12th Yara International Congress of Wound and Tissue Repair

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Chapter I

Posters

Code: wtrc12-05120567

Title:

Investigating the Effects of Oral Administration of Methylene Blue in Treating Patients with Thermal Burns Exceeding 30% of Total Body Surface Area

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Abstract:

Background: Severe thermal burns involving ≥30% of total body surface area (TBSA) are associated with significant metabolic disturbances, inflammation, oxidative stress, impaired wound healing, and a high risk of complications. Methylene Blue (MB), due to its antioxidant, anti-inflammatory, and microcirculatory benefits, has been proposed as a potential supportive therapy to improve wound healing. **Methods:** This pilot clinical study included 10 burn patients in each group. The intervention group received standard burn care plus oral methylene blue, while the control group received standard burn care alone. Key measured outcomes included wound contraction, re-epithelialization, inflammation scores, and HSBS-B burn severity scale. Assessments were performed using digital photography, thermal imaging, and clinical observation over an 8-week period. **Results:** Preliminary findings suggest that oral methylene blue may reduce oxidative stress, improve tissue oxygenation, enhance mitochondrial function, and accelerate epithelialization. Patients receiving MB demonstrated faster wound contraction, reduced inflammation, and improved restoration of perilesional ischemic areas compared to controls. **Conclusion:** Oral methylene blue shows promise as an adjunct therapy in the management of severe burns (≥30% TBSA), potentially improving wound healing outcomes. Larger randomized controlled trials are recommended to confirm efficacy and safety.

Keywords:

Oral Methylene Blue, Thermal Burns, Wound Healing, Epithelialization, Pilot Study

Code: wtrc12-05920566
Title:

A Closed-Loop, AI-Driven Bioelectronic System for Autonomous and Adaptive Wound Therapy

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Abstract:
Background: Chronic wounds represent a profound clinical and economic burden,characterized by a failure to progress through the normal stages of healing due to persistent inflammation, bacterial infection, and impaired cellular activity . While emerging "smart" bandages can monitor wound parameters or deliver pre-programmed therapies, they lack the capacity for autonomous, real-time diagnosis and adaptive intervention. We hypothesize that a fully integrated closed-loop system, which continuously images the wound, employs machine learning to diagnose the healing stage, and automatically delivers tailored bioelectronic therapy, can dynamically guide the wound back to an optimal healing trajectory. Methods/Material and **Methods:** We developed a wearable,wireless platform termed the Autonomous Healing Electroceutical System (AHES). The system comprises a smart bandage with an integrated miniaturized camera module for high-resolution wound imaging and a bioelectronic actuator with separate reservoirs for iontophoretic drug delivery and controlled electric field (EF) application. The core innovation is an onboard Machine Learning Physician, built on a Deep Reinforcement Learning (DRL) framework. This algorithm was trained on a large dataset of wound images to map the wound state to one of four key healing phases (hemostasis, inflammation, proliferation, maturation). In a proof-of-concept study using a porcine model of full-thickness excisional wounds (n=20), the AHES system operated autonomously. Every 2 hours, it captured an image, the ML Physician diagnosed the wound stage and prescribed a therapy—either a specific dosage of an anti-inflammatory drug (Fluoxetine) or a defined intensity of EF—which was then delivered by the wearable actuators. Outcomes were compared to standard-of-care dressings. **Results:** The AHES platform successfully operated in a stable, closed-loop manner throughout the study period. Wounds treated by the autonomous system demonstrated a statistically significant acceleration in healing, with a median time to 50% wound area reduction reduced by 45% compared to the control group ($p < 0.01$). The ML Physician achieved a 92% concordance with blinded expert histological analysis in identifying the dominant wound healing phase. Furthermore, the system dynamically adapted therapy; for instance, it applied EF therapy during phases of high inflammation and switched to pro-proliferative cues as the wound progressed. This resulted in enhanced tissue regeneration, reduced inflammatory markers, and more organized collagen deposition in the intervention group. **Conclusion:** The Autonomous Healing Electroceutical System represents a paradigm shift from static wound care to dynamic, intelligent therapy. By integrating real-time diagnostic imaging with an AI-driven decision engine and adaptive bioelectronic actuation, this platform successfully personalizes and accelerates wound healing in a pre-clinical model. This closed-loop technology marks a significant step towards a future of autonomous, patient-specific wound management, with the potential to drastically improve outcomes for complex chronic wounds.

Keywords:
Autonomous Wound Therapy, Bioelectronic Medicine, Machine Learning, Closed-Loop System, Smart Bandage

Code: wtrc12-05390564
Title:

A Cellulosic Wound Dressing Based on encapsulated Calendula Extract into Natural Biopolymer

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Abstract:
Calendula officinalis is a plant belonging to the Asteraceae family, which has a significant potential in wound healing due to its phyto-chemicals, such as phenolic compounds, steroids, terpenoids, flavonoids, and carotenoids. This paper presented a wound dressing based on in situ encapsulation of Calendula extract into Tragacanth biopolymer on the surface of cotton fabric. A mixture of Calendula extract, Triton X-100, and Almond oil was sonicated for 10 min. Tragacanth gum was added to the mixture. After 5 min of sonication, the cotton fabric was immersed in the microemulsion, and aluminum chloride was added to the solution. Sonication of the mixture led to the synthesis and stabilization of nanocapsules on the cotton fabric. The performance of cotton fabric containing Calendula-loaded nanocapsules as a wound dressing was investigated. The results showed excellent wound healing activity in the scratch test, good antimicrobial properties of the prepared wound dressing against E. coli, S. aureus, and C. albicans microorganisms, and no cytotoxicity against human fibroblast cells. According to the results obtained, a wound dressing prepared by encapsulating Calendula extract in Tragacanth polymer on the surface of cotton fabric can be used to accelerate the healing process of various superficial wounds.

Keywords:
Calendula Extract, Wound Dressing, In situ Encapsulation, Tragacanth Gum

Code: wtrc12-06300562
Title:

Cold plasma in reducing infection and healing surgical wounds

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Abstract:
Background: Chronic and acute wounds present considerable healthcare issues, frequently resulting in protracted healing times and complications. Cold plasma is a non-thermal state of matter created by exposing gases to an electrical discharge, resulting in a mix of reactive species. My purpose in writing this abstract is to encourage the usage of contemporary wound healing techniques. **Methods:** Between 2018 and 2025, a number of publications were gathered and examined using the PubMed database. The cellular and molecular mechanisms by which cold atmospheric plasma (CAP) promotes wound healing were examined in this review. Cold Atmospheric Plasma (CAP), Wound Healing, and Surgical Site Infection were the study's keywords. My goal in conducting this study was to lessen pollution and microorganisms at the wound site. **Results:** As a result, CAP reduces bacterial load and inhibits the formation of biofilms while producing reactive oxygen and nitrogen species that impact important cellular functions and speed tissue regeneration. The efficacy of CAP in enhancing wound healing parameters for both acute and chronic wounds has been shown through clinical applications. Patients treated with CAP during surgery demonstrated a significant decrease in the requirement for reoperation due to groin wound healing abnormalities, according to a study that looked at the impact of utilizing CAP during surgery on minimizing these diseases. Furthermore, an increasing amount of research indicates that CAP may be used to prevent or eradicate infections brought on by viruses, fungi, bacteria, and bacterial biofilms. Infection, cancer, plastic surgery, and other medical conditions are among the uses for which cold plasma devices are being developed. My objective in preparing this study is to become acquainted with the development and application of CAP in wounds. **Conclusion:** Finally, CAP has shown promise as a non-invasive therapy that can improve the results of both acute and chronic wound healing. It is anticipated that the use of CAP in surgery and wound healing will increase in the near future.

Keywords:
Cold Atmospheric Plasma (CAP), Wound Healing, Surgical Site Infection

Code: wtrc12-00130561
Title:

Hierarchical Porosity in 3D-Printed Scaffolds for Wound Healing and Skin Tissue Engineering: The Emerging Role of Carbon Dots

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Abstract:
The treatment of chronic and extensive wounds remains a major clinical challenge. In skin tissue engineering, the design of scaffolds, especially their hierarchical porosity, is crucial for guiding cell infiltration, promoting new blood vessel formation, and enabling effective wound closure. This review explores the key roles of macroporous networks (with pores of 200-400 µm, ideal for blood vessel growth and fibroblast movement) and microporosity (pores less than 50 µm, for improved cell adhesion and protein binding) in 3D-printed scaffolds used for wound healing. We discuss advanced manufacturing methods, such as cryogenic 3D printing and non-solvent-induced phase separation (NIPS), for creating these controlled, multi-scale porous structures. Additionally, we highlight the promising potential of carbon dots (CDs) as multifunctional nano-modifiers. CDs can not only adjust scaffold properties but also add important biological activities, including strong antibacterial effects against resistant bacteria, antioxidant and immune-regulating functions to manage inflammation, and a unique ability for real-time pH monitoring of the wound bed through their natural fluorescence. This work offers a framework for designing next-generation, intelligent scaffolds aimed at transforming wound care.
Keywords:
Wound Healing, Skin Tissue Engineering, 3D Printing, Scaffold Porosity, Carbon Dots, Regenerative Medicine

Code: wtrc12-06310560
Title:

Preparation and Evaluation of Drug Microcapsules for Chronic Wound Healing

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Abstract:
Chronic wounds do not easily heal due to various factors such as defects in the healing process, persistent infections, or circulation problems. These wounds can progress to more complex stages early in the healing process, ultimately leading to infection. Due to the depth and severity of the infection, such wounds may pose serious health risks to patients. In these cases, there is a growing need for an innovative and effective treatment method to control infections and accelerate the healing process of chronic wounds. In recent years, one approach has been the design and development of drug delivery systems for localized and sustained wound treatment. Designing such systems, particularly with antimicrobial properties, angiogenesis capabilities, and controlled drug release, has remained a significant challenge in the field of wound care. The primary goal of this study is to develop and evaluate a drug delivery system aimed at improving the healing process of chronic wounds and controlling wound infections. To achieve this goal, chitosan, a highly biocompatible material with antimicrobial properties, and atorvastatin, a drug with angiogenic effects, were selected. These particles were prepared at various concentrations (1%, 1.5%, 2%) using the ion gelation method and then freeze-dried. To select the optimal concentration of chitosan particles, infrared spectroscopy (FTIR), scanning electron microscopy (SEM), and swelling behavior tests were conducted. The results showed that the 1.5% concentration of particles, with a spherical morphology and a swelling ratio of 4124%, exhibited the best performance compared to other samples and was chosen as the optimal sample for further evaluation. Drug release profile studies on the optimal sample suggest that the prepared microparticles with controlled release could serve as an effective drug carrier for the treatment of chronic wounds. Ultimately, this research presents promising results in the design of drug delivery systems for chronic wound treatment, which could serve as an innovative approach in the field of wound healing and infection control.

Keywords:
Skin, chronic wound healing, microcarrier, drug release, chitosan, atorvastatin

Code: wtrc12-05380558
Title:

The Impact of Stem Cell Transplantation (SCT) on the Gut Microbiome: Latest Findings

Authors:

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Abstract:
Background: Allogeneic stem cell transplantation (SCT) involves the transfer of foreign stem cells to a patient and serves as a potential treatment option for various blood cancers, bone marrow aplasia, and certain genetic disorders. However, the relationship between SCT and the gut microbiome can significantly impact the immune system and gut health. Numerous studies have provided evidence that the gut microbiome, under normal conditions, maintains a close relationship with its human host. This long-term interaction confers multiple benefits to the host, including nutrient absorption, prevention of overgrowth by potential pathogens, maintenance of epithelial barrier function, and stimulation and regulation of the immune system. **Methods:** Read we conducted an extensive search across electronic databases, including Pubmed, Medline, Embase, Google scholar and Researchgate, and explored the available English-language literature. The mesh terms were "Stem Cell Transplantation (SCT)", "Gut Microbiome" and "Graftversus-host disease (GVH)". **Results:** Microbial diversity has been used as a simple indicator of overall microbiome health. During the initial phase of allogeneic SCT, it has been shown that microbial diversity in the gastrointestinal tract significantly decreases in the first few weeks of SCT, where systemic chemotherapy, total body irradiation, or broad-spectrum antibiotics are administered. This study found that patients who experienced greater microbial fluctuations during early allogeneic SCT were more likely to graft-versus-host disease (GVHD). The clinical significance of the gut microbiome was demonstrated in a study that examined gut microbiota diversity in patients undergoing allogeneic SCT through stool samples collected at the time of stem cell transplantation. Patients with low diversity at transplantation had a fivefold higher risk of transplantrelated mortality compared to those with moderate or high diversity. Microbial diversity was shown to be a strong predictor of transplantrelated mortality, independent of other factors, including pre-transplant comorbidities and antibiotic use. **Conclusions:** The described studies have provided evidence of the importance of the gut microbiota in allogeneic SCT, influencing critical outcomes such as infections, pulmonary complications, GVHD, and transplant-related mortality. However, future studies need to further elucidate the precise nature and mechanisms of the microbiome's benefits in allogeneic SCT. It remains unclear exactly how gut microbes can ultimately enhance protection against transplant-related complications in allogeneic SCT recipients.
Keywords:
(GVH)Stem Cell Transplan(SCT), Gut Microbiome, g Graftversus-host Disease

Code: wtrc12-06280557

Title:

A Comprehensive Review of Sickle Cell Disease and the Therapeutic Applications of CRISPR-Cas Technology

Authors:

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Abstract:

Background: Sickle Cell Disease (SCD) results from an inherited mutation in the HBB gene. This leads to sickle hemoglobin (HbS), distorted red blood cells, hemolysis, vaso-occlusive crises (VOCs), and damage to multiple organs. Current treatments mainly focus on symptom relief. Hematopoietic stem cell transplantation (HSCT) is the only cure, but it has significant drawbacks such as donor availability and serious side effects. CRISPR-Cas gene editing offers a groundbreaking approach for Sickle Cell Disease (SCD). This paper reviews existing SCD treatments, their shortcomings, and the promising potential of CRISPR-Cas gene editing, including approved drugs like Casgevy. **Methods:** The present paper is a review study. In this study, 18 articles published from 2020 to 2025, which were in the form of quantitative studies, meta-analyses, original research, and systematic reviews, were examined. The inclusion criteria included: availability of full text and publication within 2020–2025. The exclusion criteria included case report studies. The study used the keywords "Sickle Cell Disease," "CRISPR-Cas," and "Gene Editing" for searching the PubMed, Scopus, Web of Science, and Google Scholar databases. **Results:** Not genetic defect-based, and there is a therapeutic gap; allogeneic HSCT is limited in ~20% of patients by donor and risk issues. Gene therapy, particularly CRISPR-mediated, is promising. Preclinical models demonstrate efficacy in SCD by HBB gene editing or by HbF induction (through BCL11A or HBG1/HBG2 promoter targeting), which increases adult hemoglobin (HbA)/HbF and inhibits sickling. Clinically, exagamglogene autotemcel (exa-cel) or Casgevy, which targets BCL11A, led to VOC-freedom in ~97% of the patients for 12 months with sustained HbF >40% levels, leading to its approval as the first CRISPR-based therapy. **Conclusion:** CRISPR-Cas has transformed SCD's therapeutic landscape, and exa-cel (Casgevy) is encouraging via HbF induction. Gene correction directly and newer editors (base/prime) are more promising. Safety in the long term, durability, precision, and global accessibility/affordability are concerns. Further research is required to realize CRISPR's potential in developing a universal SCD cure.

Keywords:

Sickle Cell Disease, CRISPR-Cas, Gene Editing

Code: wtrc12-06100556
Title:

Challenges of Applying Artificial Intelligence in Wound Management: An Integrative Review of Opportunities and Threats for Clinical Nurses

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Abstract:
Background: Artificial intelligence (AI) is increasingly used in wound management to enhance assessment accuracy, accelerate diagnosis, and support clinical decision-making. However, numerous challenges still limit its safe and effective use in real clinical settings, raising concerns regarding reliability, ethics, training, and data governance. **Methods:** This integrative review followed Whittemore and Knafl's framework. A comprehensive search was conducted in PubMed, Scopus, Web of Science, Wounds International, and Civilica for studies published from January 2018 to September 2024. Studies focusing on AI-based wound detection, classification, monitoring, ethics, and clinical challenges were included. A total of 42 relevant articles were reviewed. **Results:** Five major categories of challenges emerged: (1) Technical limitations, including inconsistent model performance across diverse wound types and lack of high-quality annotated datasets. (2) Workflow integration difficulties, such as lack of interoperability with EHR systems and increased documentation burdens. (3) Ethical and legal issues related to privacy, consent, image storage, and lack of regulatory guidelines. (4) Nurse-related challenges, including limited digital literacy, concerns over autonomy, and reduced trust in AI recommendations. (5) Organizational barriers, such as financial constraints, inadequate infrastructure, and absence of standardized protocols.

Keywords:
Artificial Intelligence, Wound Management, Clinical Challenges, Nursing

Code: wtrc12-06270555
Title:

Mistreatment with Maggot Therapy in Diabetic Foot Ulcer Causing an Amputation

Authors:

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Abstract:
This case report describes a 52-year-old male with a long-standing history of Type 2 diabetes mellitus who was hospitalized for a diabetic foot ulcer (DFU). Despite initial surgical debridement and antibiotic therapy, the patient discontinued hospital treatment. He subsequently consulted a fungal specialist who inappropriately administered maggot therapy. Following a single session, the therapy resulted in severe complications, as the maggots consumed not only the necrotic tissue but also the healthy granulation tissue, exposing the bone. The condition deteriorated significantly, leading to the patient's re-admission two months later and ultimately requiring a below-knee amputation of the right foot. The report concludes that while maggot therapy can be an effective debridement tool for chronic wounds like DFUs, its application is contraindicated in specific scenarios, such as wounds heavily contaminated with Pseudomonas aeruginosa or with exposed tendons, as in this case. This highlights the critical importance of strictly adhering to indications and contraindications to prevent serious adverse outcomes, including amputation.

Keywords:
Diabetes Mellitus, Diabetic Foot Ulcer, Maggot Therapy, Mistreatment

Code: wtrc12-06260552

Title:

A Review of Stimuli-Responsive Hydrogel Advances in Diabetic Foot Ulcer Management

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Abstract:

Background: Diabetic foot ulcers (DFU) are serious consequences of diabetes, leading to high morbidity, risk of amputation, and, in severe cases, life-threatening complications. Effective treatment is challenging due to the complex and dynamic wound microenvironment. Dressing is a key component of treatment, but traditional dressings often fail to promote healing. Stimuli-responsive hydrogel dressings have emerged as a promising strategy that can regulate drug delivery in response to specific stimuli within the wound. In this study, we aim to review recent advances in these smart systems and explore their benefits, limitations, and future perspectives. **Methods:** PubMed, Scopus, and Google Scholar were searched using the keywords ("diabetic foot ulcer" OR "diabetic wound") AND ("smart hydrogel" OR "stimuli-responsive hydrogel" OR "responsive hydrogel"). Relevant English-language studies published from 2020 to 2025, focusing on smart hydrogel applications in diabetic wound management, were included in this review. **Results:** Responsive hydrogels provide a moist wound microenvironment for DFU and serve as an effective system for drug delivery, capable of responding to key environmental stimuli such as glucose, pH, ROS, and enzymes, as well as external cues like light and magnetic fields. Drug release occurs via structural changes in the hydrogel network such as swelling, bond cleavage, or phase transition. Their porous structure and stable mechanical properties, along with the ability to carry various bioactive agents, support better tissue regeneration and overall skin repair. In addition, these hydrogels address key challenges in diabetic wound healing by reducing inflammation, regulating local glucose levels, lowering excess ROS, and limiting infection through controlled therapeutic release. **Conclusion:** The results suggest that these hydrogels could offer a practical, long-acting approach to improving diabetic wound healing. However, the use of hydrogels still faces several challenges, including limited stability and durability, precision in monitoring multiple factors, and cost-effectiveness. In the future, hydrogels may integrate with 3D printing, AI, and IoT to enable personalized wound care and more effective management.

Keywords:

Diabetic Foot Ulcer (DFU), Stimuli-Responsive Hydrogel, Smart Hydrogel, Wound Healing, Drug Delivery, Biomaterials

Code: wtrc12-05380551
Title:

Multifunctional Composite Hydrogels: An Innovative Strategy for Treating Antibiotic-Resistant Infected Wounds

Authors:

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Abstract:
Background: Wound infections caused by multidrug-resistant bacteria—particularly Pseudomonas aeruginosa and methicillin-resistant Staphylococcus aureus (MRSA)—pose a serious threat to human health. One of the main challenges in treating these infections is the ability of these pathogens to form robust biofilms. Therefore, there is a critical need for solutions that can simultaneously disrupt the biofilm barrier, eradicate bacteria, and support tissue regeneration. This work focuses on evaluating advanced composite hydrogels incorporating silver nanoparticles (AgNPs), nitric oxide (NO), and antibiotics as a potential multifunctional approach for managing antibiotic-resistant infected wounds. **Methods:** We read conducted an extensive search across electronic databases, including Pubmed, Google scholar and Researchgate, and explored the available English-language literature. The mesh terms were "Hydrogel", "Silver Nanoparticles", "Antibiotic Resistance", "Biofilm" and "Infected Wound". **Results:** Laboratory assessments showed that all synthesized hydrogels—Hy-NO-Ag-Cip, HyNSVC, and the GT/Ag cryogel—exhibited a porous, interconnected, and biocompatible structure. This architecture facilitates gas exchange, effective absorption of wound exudate, and cellular migration. The hydrogels demonstrated strong antibacterial activity against clinical MRSA strains and were broadly effective in disrupting mature biofilms. In animal models, hydrogels containing AgNPs and antibiotics significantly accelerated wound healing, including faster wound closure (90% closure by day 11 with Hy-NO-Ag-Cip), enhanced collagen deposition, increased angiogenesis, and reduced inflammation. The GT/Ag cryogel also showed superior hemostatic performance compared with commercial gelatin sponges. Safety evaluations confirmed that these formulations did not induce significant cytotoxicity in fibroblast cell lines at therapeutic concentrations, and the GT/Ag cryogel fully degraded in vivo within four weeks. **Conclusion:** Both laboratory and in vivo findings indicate that the designed composite hydrogels represent a promising advanced platform for the treatment of antibiotic-resistant infected wounds. Their therapeutic potential lies in the combined use of antibacterial agents (silver nanoparticles), antibiotics (ciprofloxacin, vancomycin), and healing enhancers (nitric oxide, gelatin). The system provides sustained and controlled release, allowing prolonged retention of therapeutic agents at the infection site, which enhances antibacterial and anti-biofilm efficacy while reducing side effects through lower required doses. Although further investigation is needed, these hydrogels have strong potential to become an effective treatment option for infected wounds and other resistant tissue infections in the future.

Keywords:
Hydrogel, Silver nanoparticles, Biofilm, Infected wound, Antibiotic resistance

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Code: wtrc12-02330550
Title:

Molecular Investigation of the Presence of some Candidate Genes Affecting Wound Healing in Bovine Milk-derived Exosomes

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Abstract:
Background: Milk-derived exosomes (MDEs) are nanoscale vesicles capable of transferring bioactive molecules such as miRNAs, proteins, and lipids, making them promising natural regulators of tissue regeneration. Their abundance, safety, biocompatibility, and structural stability have increased interest in their therapeutic use. Wound healing largely depends on balanced extracellular matrix (ECM) remodeling, involving both collagen production and its degradation by MMPs. Exosomal cargo can influence genes involved in collagen synthesis, ECM regulation, and MMP activity. Recent studies show that MDEs modulate key signaling pathways related to inflammation, cell proliferation, collagen deposition, and MMP control, positioning them as valuable candidates in regenerative medicine. Additionally, antioxidant genes such as SOD1 and SOD2 are critical for managing the high levels of reactive oxygen species (ROS) generated during early wound healing. SOD1 reduces cytoplasmic oxidative stress, while SOD2 protects mitochondria, supporting energy production and preventing apoptosis. When delivered through exosomes, these enzymes enhance the healing environment by reducing inflammation, promoting fibroblast growth, stimulating angiogenesis, and improving collagen organization. Overall, exosomal SOD1 and SOD2 facilitate faster and higher-quality wound repair. The aim of this study was to characterize some bioactive components within MDE cargo and evaluate their potential roles in regulating wound-healing–related gene expression. Material and **Methods:** In this study, fresh cow's milk was prepared and separated using a fat-step centrifugation and an enzymatic method for milk protein. Then, exosomes were extracted using the ExoCib kit. To confirm the isolation, DLS, TEM, and flow cytometry characterization tests were performed and Bradford concentration was measured. To examine mRNA inside exosomes and analyze gene transcripts with RT-qPCR, free RNA outside the vesicles was first removed with RNase and then extracted using an RNA extraction kit. The mRNA was then reverse transcribed into cDNA and qPCR reaction was performed with primers specific for the COL1, MMP9, SOD1 and SOD2 genes. **Results:** Analysis confirmed the successful isolation of MDEs, which exhibited a concentration of 0.17 mg/ml, particle size ranging from 70-110 nm, intact membrane morphology, and the presence of characteristic exosomal surface markers CD9 and CD81. Molecular analysis by qPCR revealed the presence of COL1, MMP9, SOD1 and SOD2 mRNAs in MDE. Results confirmed that milk exosomes carry a set of mRNA transcripts involved in regulation of extracellular matrix organization, antioxidant defense and regulation of tissue regeneration. **Conclusion:** MDEs carry mRNAs for key genes involved in tissue repair and wound healing. The presence of COL1 mRNA highlights their role in collagen synthesis and ECM remodeling, while MMP9 mRNA suggests a function in ECM degradation and coordination of healing stages. Additionally, SOD1 and SOD2 mRNAs are translated into antioxidant enzymes that neutralize reactive oxygen species, protect fibroblasts and keratinocytes, preserve mitochondrial function, and support angiogenesis. By reducing inflammation and enhancing cell survival, proliferation, and collagen remodeling, these exosomal cargos accelerate wound healing and show promise for treating chronic wounds such as diabetic ulcers. These findings underscore the therapeutic potential of MDE as natural carriers of regenerative molecular signals, supporting their application in regenerative medicine and wound healing.

Keywords:
Milk-derived Exosome, Wound Healing, Collagen, Matrix Metalloproteinase, Superoxide Dismutase, COL1, MMP9, SOD1, SOD2

Code: wtrc12-06290549
Title:

Tannic Acid-Incorporated Hydrogel Wound Dressings for Enhanced Wound Healing: Progress and Challenges

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Abstract:
Skin, the largest organ of the human body, serves as a critical protective barrier responsible for shielding the internal environment from external pathogens, regulating body temperature, and enabling sensory perception. Maintaining skin integrity and supporting efficient wound healing are thereofore of great importance. Among the various therapeutic strategies, the selection of an appropriate wound dressing plays a decisive role in accelerating healing, reducing infection risk, and improving patient comfort. Hydrogels have emerged as highly promising wound dressing materials owing to their distinctive physical and chemical properties. Their controllable biodegradability, tunable hydrophilicity, high water content, and remarkable structural similarity to the native extracellular matrix of skin tissue collectively facilitate tissue regeneration. However, fabricating hydrogels with single functionality may limit their application as wound dressings, due to the complexity and dynamic nature of the wound healing process. To overcome this limitation, researchers are developing multi-functional hydrogels with properties such as antibacterial, antioxidant, hemostatic, and angiogenic effects to accelerate healing rates. This review focuses on the incorporation of a specific polyphenol, tannic acid (TA), which is more cost-effective than other small molecules, while also enhancing biological and functional performance. TA, a natural polyphenol of plant origin, has garnered interests because of its numerous therapeutic applications. TA appears to be effective against many different bacterial species, which introduces a lower risk of infections in wounds. In addition, TA is a potent antioxidant which may preserve excess oxidative species, reducing oxidative stress in the wound site, creating a more favorable microenvironment for healing. TA also exhibits inherent hemostatic properties that facilitate blood coagulation during the early stages of the wound healing process. This review provides a comprehensively and authoritative overview of recent progress, existing challenges, and future opportunities in the integration of TA into hydrogels, highlighting its potential to advance next-generation wound dressings.
Keywords:
Tannic Acid, Hydrogel, Wound Healing, Wound Dressing

Code: wtrc12-06070548
Title:

Study of the Prevalence of Surgical Site Infections Following Coronary Artery Bypass Grafting (Cabg) Surgery and Its Relationship with Blood Transfusion in Ayatollah Rouhani Hospital, Babol

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Abstract:
Background: Surgical Site Infections (SSIs) following Coronary Artery Bypass Graft (CABG) surgery are a significant cause of morbidity and mortality. The role of perioperative blood transfusion in the pathogenesis of SSIs, often attributed to Transfusion-Related Immunomodulation (TRIM), remains controversial. This study aimed to investigate the association between blood transfusion and SSIs while evaluating other demographic and clinical risk factors. **Methods:** A cross-sectional-analytical study was conducted on 90 patients who developed SSIs out of 748 CABG procedures performed at a single center. Data on transfusion history, infection type and location, microbiological findings, and patient comorbidities were extracted from hospital archives and analyzed. **Results:** The overall SSI prevalence was 12%. No statistically significant association was found between blood transfusion (or the volume transfused) and the development, type (superficial, deep, mediastinitis/sepsis), or location (sternum vs. lower limb) of SSI ($p>0.05$). In contrast, diabetes mellitus ($p=0.02$) and low preoperative hemoglobin levels ($p=0.003$) were significantly associated with more severe infections. The sternum was the most common infection site (75.6%), with a high proportion of deep infections (78.9%). Microbiological analysis revealed a predominance of Gram-negative bacilli (48.8%) over Gram-positive cocci (30.2%) and fungi (21%). Most SSIs (92.2%) were diagnosed post-discharge. **Conclusion:** In this cohort, blood transfusion was not an independent risk factor for SSI following CABG. The findings instead highlight the critical role of modifiable patient factors, specifically pre-existing diabetes and anemia, as the primary drivers of severe infection. A shift in the local pathogen profile underscores the need for tailored antimicrobial prophylaxis. Preoperative optimization of glycemic control and hemoglobin levels, alongside robust post-discharge surveillance, should be the cornerstone of strategies to reduce SSI incidence and severity.

Keywords:
Coronary Artery Bypass Grafting, Surgical Site Infection, Blood Transfusion, Diabetes Mellitus, Anemia, Risk Factors

Code: wtrc12-04920547
Title:

Silver Dressing the Best Choice for Diabetic Foot Ulcers

Authors:

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Abstract:
Background: A silver dressing for diabetic foot ulcers is a type of medical dressing that uses silver ions in its structure. Silver has strong antibacterial properties and can stop the growth of microbes and fungi, which is why these dressings play an important role in controlling infections in diabetic wounds. **Methods:** The present paper is a review study. In this study, 10 articles published from 2017 to 2025, which were in the form of quantitative studies, meta-analysis and original research and systematic review were examined. Entry criteria included: Availability of full text and articles published between 2017 and 2025, and exit criteria included: Case Report studies. The study used the Keywords: Wound Healing; Silver Dressing; Diabetic Foot Ulcers. **Results:** Silver wound dressings are advanced medical products used to treat various types of wounds, including chronic wounds, surgical wounds, burns, and ulcers. These dressings are infused with silver compounds such as silver sulfadiazine or silver nitrate, which help in preventing bacterial infections and enhancing wound healing. Silver is renowned for its antimicrobial properties, which help reduce the risk of infections in both acute and chronic wounds. These dressings are designed to be highly effective in both controlling bacterial growth and promoting tissue regeneration. Silver is known for its broad-spectrum antimicrobial activity, capable of targeting a wide range of bacteria, including antibiotic-resistant strains. The use of silver wound dressings not only helps in preventing infections but also accelerates the healing process by maintaining an optimal environment for wound healing. **Conclusions:** Silver dressings contribute to an improved healing rate for diabetic foot ulcers (DFUs), reduce the time required for complete healing, shorten hospital stays, and enhance infection resolution rates. However, they show no significant impact on reducing ulcer area. Future research should focus on large-scale, multicenter, and rigorously designed randomized controlled trials (RCTs) to further validate the potential benefits of silver dressings in DFU treatment.

Keywords:
Wound Healing ،Silver Dressing ،Diabetic Foot Ulcers

Code: wtrc12-05380546

Title:

Low-Level Laser Therapy (LLLT) as a Supportive Strategy for Improving Sternotomy Wound Healing after Open-Heart Surgery

Authors:

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Abstract:

Background: Failure of sternal wound healing following open-heart surgery can lead to complications such as sternal instability, severe and persistent pain, impaired respiratory function, and ultimately an increased risk of deep sternal wound infection. Low-level laser therapy (LLLT), also known as photobiomodulation, is an emerging non-invasive therapeutic modality used to accelerate the healing of various wounds, including post-sternotomy surgical incisions. LLLT involves the application of laser or LED light within the red to near-infrared spectrum (600–1000 nm) at low power levels (typically 10–90 mW). **Methods:** We read conducted an extensive search across electronic databases, including Pubmed, Google scholar and Researchgate, and explored the available English-language literature. The mesh terms were "Low-level laser therapy (LLLT)", "Sternotomy Wound Healing" and "open-heart surgery". **Results:** LLLT accelerates wound healing by influencing several cellular and molecular mechanisms. First, laser light is absorbed by cytochrome c oxidase in the mitochondrial respiratory chain, leading to increased ATP production. Subsequently, LLLT reduces pro-inflammatory cytokine levels and enhances cellular antioxidant activity, creating a biochemical environment that promotes the upregulation of transforming growth factor-beta (TGF-β) and basic fibroblast growth factor (bFGF). In addition to these effects, LLLT also functions as an analgesic at the wound site. This occurs through the inhibition of inflammatory pathways and the stimulation of endorphin and serotonin release, both of which act as endogenous pain modulators. The increased secretion of TGF-β and bFGF stimulates fibroblast proliferation and migration, as well as enhanced synthesis of collagen and elastin. These growth factors also facilitate angiogenesis by endothelial cells and accelerate re-epithelialization through keratinocyte activity. Complication rates associated with sternotomy wounds—including sternal separation (1–25%) and infection (0.3–5%) accompanied by mortality rates of 14–47%—remain a significant concern in open-heart surgery. However, LLLT has shown the capacity to improve wound healing in these cases and substantially reduce such risks. **Conclusion:** LLLT is an evidence-based and reliable therapeutic approach for enhancing the healing of acute and chronic wounds (including diabetic, surgical, and pressure ulcers) and for reducing pain. Nevertheless, parameters such as dosimetry, wavelength, energy density, and output power must be precisely tailored to the wound type and target tissue. "Everything depends on the dose" — insufficient doses are ineffective, while excessively high doses may have inhibitory effects. According to recent studies, laser therapy appears to have more targeted therapeutic benefits for the upper sternum compared with the lower regions.

Keywords:

Low-level Laser Therapy (LLLT), Sternotomy Wound Healing, Open-heart Surgery

Code: wtrc12-06280544
Title:

The Application of Machine Learning (ML) in Kidney Transplant Donor-Recipient Matchi

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Abstract:

Background: Kidney transplantation remains the preferred treatment method for end-stage renal disease (ESRD), significantly improving patient survival and quality of life compared to dialysis. Nevertheless, the current donor-recipient matching process often relies on subjective judgments or predefined allocation rules, which may limit precision and transplant outcomes. Machine Learning (ML), a subset of artificial intelligence, involves the development of algorithms and statistical models that enable computers to analyze existing data, identify patterns, and predict outcomes when encountering new information. This study aims to evaluate the potential of machine learning applications in addressing existing limitations by analyzing large datasets to improve the accuracy and efficiency of matching donor kidneys to recipients. **Methods:** The present paper is a review study. In this review, twelve studies published between 2021 and 2025 were analyzed, comprising quantitative research, meta-analyses, original investigations, and systematic reviews. Inclusion criteria involved accessibility to full-text versions and publication within the specified timeframe; however, case report articles were omitted. The keywords utilized in this review included: 'AI', 'machine learning', 'deep learning', 'kidney transplantation', and 'Donor-Recipient Matching'. **Results:** Recent advances in ML have demonstrated significant promise in optimizing donor-recipient matching for kidney transplants. Studies employing various ML algorithms, such as artificial neural networks (ANNs), random forests, convolutional neural networks, and logistic regression models, have identified complex nonlinear relationships between donor and recipient characteristics and transplant outcomes. ML-based models effectively predict post-transplant survival, graft function, delayed graft function, and postoperative complications. Notably, these methods have surpassed traditional expert-based predictions in accuracy, reliability, and flexibility. For example, random forest models have successfully predicted patient survival and complications post-transplantation, while ANN models using extensive biopsy data accurately differentiated between donor-induced graft injuries and recipient-associated injuries. Compared to conventional points-based allocation systems, ML models offer critical advantages, including minimized human error, adaptability to complex datasets, efficient antigen matching, and continuous improvement through ongoing learning processes. Furthermore, ML techniques enable personalized approaches to immunosuppressive therapy, optimizing patient-specific treatment plans and enhancing transplant success. **Conclusion:** In conclusion, integrating machine learning and artificial intelligence into kidney transplantation is progressively transforming traditional donor-recipient matching procedures. ML-driven techniques facilitate precise and personalized decision-making, thereby improving graft survival, minimizing complications, and enhancing overall patient outcomes. Future advancements in ML applications hold substantial potential for continued improvement in transplantation practices worldwide.

Keywords:

Donor-Recipient Matching, Kidney transplantation, AI, Machine learning

Code: wtrc12-06230540
Title:

A Systematic Review of Novel Surgical Approaches in the Management of Diabetic Foot Ulcers

Authors:

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Abstract:

Background: Diabetic foot ulcers remain one of the most debilitating complications of diabetes, often requiring advanced therapeutic strategies to prevent amputation and improve patient outcomes. Recent advances in surgical and bio-cellular techniques have introduced innovative approaches that may significantly enhance wound healing. In our search, no comprehensive review focusing specifically on novel surgical approaches for the management of diabetic foot ulcers was identified; therefore, this systematic review was conducted with the aim of examining "Novel Surgical Approaches in the Management of Diabetic Foot Ulcers. **Methods:** This systematic review conducted an extensive search using keywords such as "Surgical Approaches", "Management", and " Diabetic Foot Ulcers " across international databases (PubMed/Medline, Web of Science, Google Scholar) and national databases (SID, Magiran, Irandoc). Initial searches yielded 250 studies, with inclusion criteria limited to studies published within the past 2 years. Review articles and gray literature were excluded. After removing duplicates and applying quality assessment tools, 23 studies were ultimately analyzed. Ethical considerations, including bias avoidance during study selection, data extraction, and analysis, were strictly followed, and findings were reported according to PRISMA guidelines. **Results:** Overall, the findings of these studies indicate that the use of novel and enhanced wound-healing techniques—such as PRP, shockwave therapy, ozone therapy, larval therapy, as well as more advanced procedures including split-thickness skin grafting, cell-assisted grafting, needle-injection skin grafts, and stem-cell-rich micro grafts—significantly accelerates wound healing, reduces wound size and depth, and increases granulation tissue formation in patients with DFU. Comparisons demonstrate that combined techniques (such as PRP plus grafting) and interventions incorporating growth factors or viable cells outperform standard treatments. In addition, adjunct therapies such as physiotherapy, negative-pressure wound therapy, larval therapy, and shockwave application have shown substantial effects on stimulating repair and reducing the bacterial load of the wounds. Several studies also report that leukocyte-platelet fibrin (L-PRF) and natural biomaterials markedly enhance epithelialization and improve the rate of wound healing. Overall, the evidence clearly shows that innovative biological and cell-based interventions accelerate healing and result in better clinical outcomes compared to standard care. Ultimately, cell-based, growth-factor-based, and biomaterial-based strategies provide the most promising results in the management of diabetic foot ulcers. **Conclusion:** The results indicate that novel approaches—including cell-based grafts, growth factors, biomaterials, and combination therapies—effectively accelerate the healing of diabetic foot ulcers and improve tissue quality. Therefore, it is recommended that these strategies be implemented and standardized in clinical practice and future research, accompanied by long-term evaluations, comparative analyses of different methods, and cost–effectiveness assessments.

Keywords:

Surgical Approaches, Management, Diabetic Foot Ulcers

Code: wtrc12-06240539

Title:

Prevalence of Anxiety and Depression Symptoms and Their Associated Factors in Patients Hospitalized with Diabetic Foot Infection: A Cross-Sectional Study

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Abstract:

Background: Diabetic Foot Infection (DFI) is a serious complication of diabetes, significantly impacting patients' emotional well-being. This study aimed to investigate the prevalence of anxiety and depression symptoms and their associated factors in patients hospitalized with DFI. **Methods:** This cross-sectional study was conducted from May to July 2023 on 130 patients (aged 18-70) admitted with DFI to Shahid Yahyanejad Hospital in Babol, Iran. Demographic data were collected via a questionnaire. Wound severity was classified using Wagner's classification, and anxiety/depression symptoms were assessed using the Hospital Anxiety and Depression Scale (HADS). Data were analyzed using SPSS 24 with descriptive statistics and the Chi-square test. **Results:** Of the 130 patients, 71 (54.6%) were male and 59 (45.4%) were female. The prevalence of moderate-to-severe anxiety and depression symptoms was 36.2% and 39.3%, respectively. A statistically significant association was found between anxiety symptoms and hypertension (HTN) (P=0.002), history of amputation (P=0.007), number of comorbidities (P<0.001), duration of diabetes (P=0.009), insulin use (P=0.027), previous DFI-related hospitalization (P=0.032), wound severity (P<0.001), and type of in-hospital procedures (P<0.001). Depressive symptoms were significantly associated with marital status (P=0.048), alcohol (P=0.031) and opium use (P=0.016), HTN (P<0.001), history of debridement (P=0.034) and amputation (P=0.003), number of comorbidities (P=0.001), duration of diabetes (P=0.001), use of oral diabetic medications (P=0.006), insulin use (P=0.002), previous DFI-related hospitalization (P<0.001), wound severity (P<0.001), and type of in-hospital procedures (P<0.001). **Conclusion:** There is a high prevalence of anxiety and depression among patients with DFI. A multidisciplinary management approach that includes screening for and addressing these psychological comorbidities is crucial for improving the overall quality of life and potentially the clinical outcomes of these patients.

Keywords:

Anxiety, Depression, Diabetic Foot, Diabetic Foot Infection, Amputation, Cross-Sectional Studies

Code: wtrc12-06230538
Title:

The Use of Sensors and Digital Tools for the Prevention and Management of Chronic Wounds: A Systematic Review

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Abstract:
Background: Chronic wounds continue to be a prominent challenge in healthcare, though new technologies provide possibilities for earlier detection and better management. Innovations in sensors and other smart monitoring devices to impact care for all types of wounds through continuous, real-time evaluations. In our search, no comprehensive study specifically integrating sensors and digital tools for the prevention and management of chronic wounds was identified; therefore, this systematic review was conducted with the aim of examining "The Use of Sensors and Digital Tools for the Prevention and Management of Chronic Wounds. **Methods:** This systematic review conducted an extensive search using keywords such as " Digital Tools", "Sensors", "Prevention", "Management" and "Chronic Wounds" across international databases (PubMed/Medline, Web of Science, Google Scholar) and national databases (SID, Magiran, Irandoc). Initial searches yielded 364 studies, with inclusion criteria limited to studies published within the past 6 years. Review articles and gray literature were excluded. After removing duplicates and applying quality assessment tools, 7 studies were ultimately analyzed. Ethical considerations, including bias avoidance during study selection, data extraction, and analysis, were strictly followed, and findings were reported according to PRISMA guidelines. **Results:** Wearable technology enhances healing and decreases the negative effects of chronic illness, such as diabetic foot ulcers, which integrate wireless technology like smart socks and bandages. They monitor changes in temperature and pressure within the tissue and correlate well with clinical observations like tissue injury and wound-healing. Sensor technology has improved reposition compliance in patients in the ICU, decreased the number of pressure ulcers, and has positive effects on healing. The technology allows patients to remain ambulatory and has positive effects on the length of healing time in chronic plantar ulcers. MXene scaffold smart bandages and telemedicine provide remote damp monitoring of the wound and biofluids, which enhances overall wound management. Altogether, these new technologies provide personalized approaches to the prevention, diagnosis, and treatment of complex wounds. **Conclusion:** Still, the application of e-textile-based technologies and multifunctional dressings for the prevention, surveillance, and management of chronic wounds and DFUs could have great potential in reducing time to healing and preventing pressure ulcers. These approaches make it possible to identify lesion or damage earlier, and they allow more personalized patient management with good concordance with clinical findings. It would be desirable for these types of technologies to be generally incorporated into care, both clinical and home-based in nature, in order to accomplish treatment goals and enhance quality of life.

Keywords:
Digital Tools, Management, Chronic Wounds

Code: wtrc12-03050537
Title:

The Impact of the Microbiome on Diabetic Foot Ulcer Healing

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Abstract:
Background: Diabetes mellitus is a major global health concern, and diabetic foot ulcer is one of its most severe complications, often associated with high morbidity and risk of amputation. Chronic non-healing ulcers arise from neuropathy, vascular insufficiency, impaired immunity, and the influential role of the wound microbiome. Disruption of the skin microbiome in diabetes increases susceptibility to infection and delays healing. A dysbiotic wound microbiome dominated by opportunistic pathogens contributes to poor outcomes, whereas a more balanced, commensal-rich community supports better healing. This review study examines how the microbiome shapes wound progression in diabetic foot ulcers. **Methods:** In this review study, the databases PubMed and Google Scholar were used to search for English and Persian articles. The keywords used included "Microbiome," "Wound Healing," and "Diabetic foot ulcer." The search period was considered from 2015 to 2025. In total, 2581 initial articles were identified. After reviewing the titles and removing unrelated articles, 131 articles were selected for further evaluation. Finally, after full-text review and elimination of duplicate articles, 25 articles were included in the study. **Results:** This review study demonstrated that bacteria in diabetic foot ulcers frequently form biofilms, whose protective matrix allows pathogens to persist and delay healing. Non-healed ulcers were strongly associated with virulent species such as Staphylococcus aureus and Pseudomonas aeruginosa. In contrast, healing ulcers more often contained Klebsiella and Citrobacter. Healed wounds showed greater microbial diversity and a higher abundance of the Streptococcaceae family, whereas non-healed ulcers displayed persistent pathogenic dominance and resistance traits. Additionally, strain-level variation of S. aureus, biofilm-related genes, and metagenomic associations with Bacteroides and virulence factors were linked to worse clinical outcomes. Notably, an increasing predominance of Gram-negative aerobes over Gram-positive organisms in infected diabetic foot ulcers has been reported. This review highlights the pivotal influence of the wound microbiome_especially biofilm-forming and virulent species_on diabetic foot ulcer healing. Non-healing ulcers show reduced diversity and pathogenic dominance, while healed wounds present more balanced microbial profiles. **Conclusion:** These findings position the microbiome as a potentially modifiable factor in ulcer management, and integrating microbiome assessment with targeted anti-biofilm strategies may improve healing and reduce amputation risk. Evidence shows that diabetic foot ulcer pathogenesis results from complex host factors and shifts in the core microbial community linked to wound severity and polymicrobial colonization. These patterns highlight the need for broader strategies that address both major pathogen groups and the biofilm-driven barrier to healing. Integrating microbial profiling into clinical practice could support more targeted approaches to controlling polymicrobial biofilms and reducing amputation risk. However, translating these findings into routine care requires prospective studies to determine whether microbiome-guided interventions improve outcomes. Future research should address methodological limitations and explore personalized therapies tailored to wound severity, microbiome composition, and host factors.

Keywords:
Microbiome, Wound Healing, Diabetic foot ulcer

Code: wtrc12-06110536
Title:

Cell-Engineered Technologies for Wound Healing and Tissue Regeneration

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Abstract:

Background: Cell-Engineered Technologies for Wound Healing and Tissue Regeneration Introduction Chronic wounds remain a major challenge for patients and physicians despite advances in treatment. Emerging cell-engineered therapies that combine cell biology with tissue engineering and regenerative medicine have been shown in early studies to accelerate healing and increase tissue angiogenesis compared to traditional methods. In this study, we attempt to summarize and compare studies in this field. **Methods:** This review study was conducted by searching all articles from 2000 to 2025 in the PubMed, Scopus, Web of Science, and Google Scholar databases using the keywords chronic ulcer, diabetic foot ulcer, cell engineered, tissue engineering, and similar terms. **Results:** 1.Promote wound closure numerous studies have confirmed that MSC-based dressings significantly reduce wound healing time and improve epithelialization compared to standard treatments. In diabetic models, the use of cell scaffolds improved wound closure 40-60% faster. 2. Enhanced angiogenesis Bioengineered tissues enriched with VEGF and PDGF were demonstrated to have a 2- to 3-fold increase in vascular density and promote sustained tissue oxygenation. 3.Reduce inflammation and fibrosis Stem cell therapy modulates the immune response by decreasing pro-inflammatory cytokines (TNF-α, IL-6) and increasing anti-inflammatory markers (IL-10), resulting in decreased scarring. 4. Functional tissue regeneration. The developed design restored the full thickness of the skin, including the epidermal and dermal layers, and improved tensile strength and elasticity. The bioprinted skin equivalents demonstrated normal keratinocyte differentiation, collagen deposition, and vascularization comparable to native tissue. 5. Clinical success In a multicenter study, autologous MSC-based grafts resulted in >85% wound closure in 8 weeks compared to >50% with conventional therapy (conventional therapy). These results highlight the clinical feasibility and therapeutic superiority of cell engineering interventions compared to conventional wound treatments. **Conclusion:** Evidence suggests that MSC constructs, iPSC-derived tissues, and bioengineered skin substitutes improve healing, reduce inflammation, and restore function. Future advances will focus on personalized therapies, AI-based bioprinting, and smart biomaterials. Despite all these positive features, clinical research in this area is insufficient and, due to the higher cost compared to conventional therapies, further studies are needed in this area until it finds its true place in the patient's clinic.

Keywords:

Chronic Ulcer, Diabetic Foot Ulcer, Cell Engineered, Tissue Engineering

Code: wtrc12-06230534
Title:

The Impact of Dietary Patterns on the Healing of Chronic Wounds: A Systematic Review

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Abstract:
Background: Chronic wounds are a major clinical and economic problem, and new research is placing a nutrition role as fundamental in tissue repair and recovery. Knowing how eating habits affect the physiological mechanisms of wound healing can help to create more efficient and precise interventions for the treatment of chronic wounds. In our search, no comprehensive study directly addressing the relationship between dietary patterns and the healing of chronic wounds was found; therefore, this systematic review was conducted with the aim of examining "The Impact of Dietary Patterns on the Healing of Chronic Wounds." **Methods:** This systematic review conducted an extensive search using keywords such as "Dietary Patterns", "Healing", and " Chronic Wounds " across international databases (PubMed/Medline, Web of Science, Google Scholar) and national databases (SID, Magiran, Irandoc). Initial searches yielded 136 studies, with inclusion criteria limited to studies published within the past 5 years. Review articles and gray literature were excluded. After removing duplicates and applying quality assessment tools, 17 studies were ultimately analyzed. Ethical considerations, including bias avoidance during study selection, data extraction, and analysis, were strictly followed, and findings were reported according to PRISMA guidelines. **Results:** Healing of chronic wounds is closely linked to the nutritional status of the patient; conditions such as low albumin and hemoglobin levels, insufficient caloric intake, and overall poor nutrition are causally related to larger wounds, more significant inflammatory responses, and slower tissue repair. Several lines of evidence point to the fact that nutritionally focused interventions—namely, high-protein, high-calorie dietary supplements fortified with arginine, HMB (β-hydroxy β-methyl butyrate), glutamine, and antioxidants—can in a short time turn-around the healing of pressure ulcers, diabetic wounds, and other types of chronic wounds. The use of nutritional assessment instruments such as PG-SGA (Scored Patient-Generated Subjective Global Assessment) and BIA (Bioelectrical Impedance Analysis) not only opens the gate for detecting and following up on malnutrition but also significantly influences therapeutic decision-making. Besides good nutrition, better clinical outcomes are obtained by controlling inflammation (reduction of IL-6), alleviating pain, and implementing a multidisciplinary strategy. It is of utmost importance to lead the way in treatment by defining clear criteria for nutritional biomarker levels such as albumin and prealbumin. Taken together, the data present a convincing case that excellent nutrition is the bedrock and an indispensable element in the eventual resolution of chronic wounds. **Conclusion:** The findings from the study indicate that the healing of chronic wounds is dependent on the patient's nutritional status. A decrease in protein and caloric intake leads to slower tissue repair and heightened inflammation. The implementation of targeted nutritional supplementation along with malnutrition monitoring through tools like PG-SGA and BIA can result in a faster healing process. It is advised that the best possible nutrition, combined with inflammation management and a multidisciplinary approach, be employed in the treatment of chronic wounds.

Keywords:
Dietary Patterns, Nutrition, Chronic Wounds, Healing

Code: wtrc12-04600533
Title:

Systematic Review of the Fairness And Generalizability of Ai-Based Skin Cancer Detection Systems Across Skin Colors and Populations

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Abstract:
Background: Artificial intelligence (AI)–based image analysis has shown promising performance for early detection of skin cancer, yet growing evidence indicates that these systems may not perform equitably across skin tones and populations. Most training datasets contain a predominance of light-skinned patients from high-income countries, while people with skin of colour and populations from low- and middle-income regions remain under-represented. Recent benchmark studies using diverse clinical image sets have reported substantial drops in diagnostic accuracy for darker Fitzpatrick skin types and for uncommon tumour subtypes, raising concerns about fairness, generalizability and potential amplification of existing health disparities. This systematic review aims to synthesise and critically appraise the evidence on how AI-based skin cancer detection systems perform across different skin tones and populations, and to evaluate which methodological and reporting practices are associated with more equitable performance. **Methods:** In this study, we searched PubMed, Embase, Web of Science, the Cochrane Library, and IEEE Xplore for studies from January 2013 onwards that developed, validated, or evaluated image-based AI systems for the diagnosis or prioritization of skin malignancies and reported performance stratified by skin color (e.g., Fitzpatrick type, quantitative color measures), race/ethnicity, or geographic population, or explicitly addressed diversity of datasets or bias reduction strategies. Two reviewers independently screened records, extracted data, and assessed risk of bias. We additionally assessed areas of equity, including representation of skin color, transparency of demographic reporting, and use of equity measures, as specified in the PRISMA-Equity guideline. We conducted meta-analyses of performance gaps between groups. We also conducted structured narrative synthesis. **Results:** Our review shows that at least 20–30 early studies and several dataset-level analyses have evaluated AI performance across skin tones or populations, alongside emerging work on bias reduction and diverse skin image sets. We identified common patterns of underestimation, quantified reported gaps in diagnostic performance between lighter and darker skin types, and summarized the impact of interventions such as targeted data augmentation, balanced sampling, and fairness-informed training objectives. **Conclusion:** This systematic review will provide an integrated, equity-focused overview of fairness and generalizability of AI-based skin cancer detection systems across skin tones and populations. By identifying consistent sources of bias, gaps in demographic reporting and limitations in current evaluation practices, and by highlighting promising methodological strategies to reduce performance disparities, our findings aim to support the development, validation and deployment of dermatology AI tools that are safer and more reliable for all patients, not only those who are best represented in current datasets.

Keywords:
Artificial Intelligence; Skin Cancer; Fairness; Skin Tone; Health Equity

Code: wtrc12-05940532
Title:

The Effect of Silver Sulfadiazine-Coated Dressing on Pressure Injury Treatment: an Experimental Animal Study

Authors:

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Abstract:
Background: Pressure injuries are a prevalent clinical condition, commonly found in the elderly, postoperative, and critically ill patients in the ICU. These wounds are induced by continuous pressure and poor perfusion of the skin, causing severe tissue damage. Despite various treatment approaches, the lack of a gold standard leads to persistent pressure injuries. This condition results in long-term complications, such as infection, osteomyelitis, and septic shock. Silver sulfadiazine is an antimicrobial agent, mostly used in the treatment of burn injuries. In this study we aimed to evaluate the efficacy of silver sulfadiazine in the healing process of pressure injuries in an experimental setting. Materials and **Methods:** Twelve adult male mice of strain BALB/c (8-10 weeks old, weighing 28-32 g) were included in this study. A pressure injury was induced on the dorsal skin fold of each mouse using a pair of magnets. The mice were randomly divided into two groups. The treatment group received silver sulfadiazine-coated dressing, while the control group was left untreated. The area of the wounds was measured on days 1, 3, 5, 7, 10, 14 and 21 using the Image J software. The statistical analysis was performed using the SPSS software. **Results:** In this study, the effect of time was confirmed on the natural wound healing process ($p < 0.000$). Aiming to evaluate the effectiveness of silver sulfadiazine, a thorough analysis was designed using independent samples T-test for both time to 50% healing and the Area under the Curve (AUC) measurements. The time to 50% healing was decreased by 44.1% in the treatment group compared with the control group (4.33 ± 0.39 days vs. 7.75 ± 1.83 days), illustrating a nearly halved required time to reach the 50% healing. The AUC measurement revealed a 47% reduction in the treatment group (1566.27 vs. 2965.95), showing the significant improved healing during the entire treatment period ($t(9) = 2.32$, $p < 0.05$). Therefore, our analysis revealed a remarkable efficacy of silver sulfadiazine in the treatment of pressure injury. **Conclusion:** Our study confirmed the efficacy of silver sulfadiazine in pressure injury management by accelerating the healing process and reducing the long-term complications.
Keywords:
Pressure Injury, Silver Sulfadiazine, Experimental Study, Wound Healing, Animal Model

Code: wtrc12-04600531
Title:

Systematic Review of The Diagnostic Accuracy of Artificial Intelligence-Based Systems for Early Detection of Skin Cancer Compared to Physicians

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Abstract:
Background: Early detection of skin cancer, particularly melanoma and keratinocyte carcinomas, is critical for reducing morbidity, mortality and treatment costs. In recent years, image-based artificial intelligence (AI) systems have achieved dermatologist-level performance for classifying skin lesions, yet their diagnostic value compared with clinicians across different care settings remains uncertain and fragmented. Existing evidence syntheses either predate the rapid growth of deep learning or do not focus specifically on early detection and direct AI–clinician comparisons. This systematic review aims to provide an updated and clinically focused overview of the diagnostic accuracy of AI-based systems for early skin cancer detection compared with human clinicians. **Methods:** In this study, we systematically searched PubMed, Embase, the Cochrane Library, Web of Science, and IEEE Xplore for primary studies from January 2013 onwards that compared image-based AI systems for skin cancer diagnosis with clinicians (dermatologists, other specialists, or general practitioners) or with histopathology as the reference standard. Eligible designs included retrospective reader studies, prospective diagnostic accuracy studies, and real-world clinical assessments using dermoscopic, clinical, or smartphone images. Two reviewers independently screened studies, extracted data, and assessed risk of bias using QUADAS-2, in accordance with PRISMA recommendations. We performed a bivariate random-effects meta-analysis of sensitivity and specificity, and examined heterogeneity by imaging modality, lesion type, clinical setting, physician specialty, source of dataset (public versus institutional), and internal versus external validation. We also summarized the evidence for AI-assisted human diagnosis. **Results:** Based on an initial literature review, we identified more than 50 comparative studies directly evaluating AI algorithms versus clinicians, with a growing number of prospective and real-world trials also in the pipeline. The pooled results provide updated estimates of sensitivity, specificity, and area under the receiver operating characteristic curve for AI systems compared with clinicians, quantifying the incremental benefit of AI assistance, particularly for non-specialist readers. **Conclusion:** This systematic review synthesized and critically appraised the best available evidence on AI-based early detection of skin cancer compared with clinicians. By describing diagnostic accuracy, risk of bias and sources of heterogeneity, and by highlighting gaps such as limited prospective data and inadequate representation of different skin tones, our findings aim to inform clinicians, researchers and policymakers about the realistic potential and current limitations of AI in skin cancer screening and prioritization.

Keywords:
Artificial Intelligence; Skin Cancer; Early Detection; Diagnostic Accuracy; Dermatology

Code: wtrc12-04690529
Title:

The Effect of Royal Jelly on Diabetic Foot Ulcer Healing: A Review Study

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Abstract:
Background: Diabetic foot ulcers and infections are important health challenges for which various solutions have been developed today. Topical royal jelly (a product of worker bees) is an effective substance for wound healing. Therefore, the present study was designed to investigate the effect of using topical royal jelly on healing diabetic foot ulcers. **Methods:** The present study was a review study designed in 2025. The search was conducted in international and national databases, including Scientific Information Database (SID), PubMed and Scopus, using the following Keywords: “Royal Jelly”, “Diabetic Foot” and “Wound Healing”. Summaries of articles published in congresses and conferences were excluded from the study. Initially, 58 articles in English or Persian were finally evaluated. **Results:** A review of various studies showed that the use of topical royal jelly is highly effective in treating mild diabetic foot ulcers. However, a clinical study reported that the duration of treatment of diabetic foot ulcers using topical royal jelly is longer compared to other modern treatment methods and complete healing does not occur. Also, a study using animal models has shown that royal jelly can speed up the healing of diabetic foot ulcers by dilating the vascular system in the lower extremities and facilitating blood flow in the vascular bed. **Conclusion:** Generally, a review of various studies showed that topical royal jelly can be an effective method for treating diabetic foot ulcers in addition to standard treatments. Therefore, this type of treatment should be performed using standard principles and by wound specialists.

Keywords:
Royal Jelly, Diabetic Foot, Wound Healing

Code: wtrc12-06120528
Title:

Cell Migration: Key to Tissue Engineering

Authors:

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Abstract:
Cell migration is a cornerstone of many biological processes like tissue repair and immune responses. It plays a vital role in wound healing.This review explores the origin of cell migration, distinguishing it from general cell movement as a purposeful, directed journey guided by intricate molecular cues and environmental factors.We explore how the extracellular matrix (ECM) influences migration by its composition, stiffness, ligand density, topography, and porosity, all of which control cell adhesion, polarization, and cytoskeletal dynamics. Delving deeper, we examine migration modes: individual cells can adopt mesenchymal or amoeboid styles, while collective migration which is vital for coordinated tissue responses, involves groups moving as sheets, strands, or clusters. One key example is the "leader-follower" model in which decisions within specialized leader cells at the front are affected by mechanisms like cadherin junctions, Notch-Delta signaling, and mechanotransduction to steer the group. This paper highlights various cues that direct migration: chemical gradients (chemotaxis) through chemokines and growth factors, surface-bound signals (haptotaxis) from ECM proteins, mechanical forces such as substrate stiffness (durotaxis) and shear stress, physical topographies (topotaxis), grooves, or fibers, and even electrical fields (galvanotaxis), polarizing cells and changing the activity of the cytoskeleton. Sensing involves receptors such as integrins, GPCRs, and mechanosensitive channels, which translate external signals into internal responses. Modulators of collective migration are cell-cell cohesion by cadherins, front-rear polarization, dynamic rearrangements of the cytoskeleton composed of actin, microtubules, and intermediates, and the dimension of the ECM (2D vs. 3D), which specifies speed, phenotype, and efficiency. In applications, cell migration drives wound healing through epithelial sheet movement, infiltration of fibroblast, and angiogenesis. These improve tissue regeneration in organs like the liver and mammary glands, but also is culprit in cancer invasion, where collective clusters enhance metastasis. Ultimately, it is important to understand these dynamics in order to advanc in tissue engineering, where promoting cell migration leads to even distribution, integration, and remodeling for regenerated tissues. This work underscores cell migration's dual-edged nature which is essential for healing yet implicated in disease, and then to offer insights for therapeutic strategies in regenerative medicine.

Keywords:
Cell Behavior, Cell Migration, Tissue Engineering

Code: wtrc12-04690527
Title:

The Effect of Copper Nanocomposite Bedsore Healing: A Review Study

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Abstract:
Background: Recently, with the advancement of treatment methods in various types of wounds, the use of metal nanoparticles has attracted the attention of researchers in this field. Therefore, the present study was designed to investigate the effect of using copper nanocomposite on the treatment of bedsores. **Methods:** The present study is a review study that was written in 2025. Medline/PubMed, Google Scholar, and Web of Sciences databases were used to search for related articles. In the first stage, a total of 36 articles were found, after applying the entry and exit criteria, this number was reduced to 12. The inclusion criteria included: the article being Latin and the availability of the full text, and the exclusion criteria included: case report studies. **Results:** A review of the results of a laboratory study showed that a concentration of 1 macromolar of 80 nm copper particles is not toxic to human fibroblast, endothelial and keratinocyte cells in culture conditions and induces migration and division in endothelial cells; which consequently increases the speed of wound healing. Also, another study showed that copper nanoparticles act as a scaffold in bedsores that greatly accelerates the process of skin layer regeneration. **Conclusion:** Generally, a review of various studies shows that the use of copper nanocomposite at standard concentrations is suitable for wound healing and does not cause side effects. Therefore, specialized wound therapists can use this nanocomposite to treat all types of wounds, including bedsores.
Keywords:
Copper Nanocomposite, Bedsore, Wound Healing

Code: wtrc12-06190525
Title:

The Wound-Healing Effects of *Alkanna tinctoria* (Haavachubeh): A Review of Phytochemical and Pharmacological Evidence

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Abstract:
Background: Plants from the Boraginaceae family, including Alkanna tinctoria, Onosma species, Arnebia euchroma, and Onosma dichroantha, have long been used in traditional medicine for treating wounds, burns, and skin infections. Their healing effects are mainly attributed to bioactive naphthoquinones such as shikonin and alkannin, known for their antimicrobial and anti-inflammatory properties. Objective: This review aimed to summarize previous studies on the wound-healing potential, phytochemical composition, and pharmacological activities of selected Boraginaceae species. **Methods:** Data were collected from scientific databases and literature such as PubMed, Scopus,Medline, focusing on both in vitro and in vivo studies evaluating plant extracts, traditional formulations, and purified bioactive compounds. LC–MS analysis and bioassay-guided fractionation were used to identify key phytochemicals associated with wound healing. **Results:** Traditional formulations of A. tinctoria showed significant wound-healing activity in diabetic rat models, while methanolic extracts exhibited higher cytotoxicity. Over 200 compounds—including naphthoquinones, flavonoids, phenolics, alkaloids, and terpenoids—have been identified in Onosma species, confirming their antioxidant, antimicrobial, and anti-inflammatory effects. A. euchroma roots contain shikonin derivatives that accelerate tissue regeneration and reduce inflammation. Experimental data from O. dichroantha revealed that naphthoquinone fractions such as acetylshikonin and deoxyshikonin are responsible for its strong wound-healing potential. **Conclusions:** Collectively, these findings demonstrate that Boraginaceae species, particularly A. tinctoria, A. euchroma, and O. dichroantha, represent promising natural sources for the development of effective, safe, and affordable herbal wound-healing agents. Further in vivo and pharmacokinetic studies are required to validate their therapeutic potential and optimize clinical applications

Keywords:
Keywords: Alkanna tinctoria,Wound healing, Traditional medicine, Boraginaceae family

Code: wtrc12-06110523
Title:

Comparing Surgical and Enzymatic Debridement: Clinical Outcomes and Applications

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Abstract:

Background: In general, in the treatment of wounds, debridement, as an old method, increases the speed of wound healing by removing necrotic tissue, reducing the microbial load. Today, there is a mechanical debridement method that requires surgical facilities and even anesthesia in some cases, and healthy tissue may also be damaged in this method. On the other hand, enzymatic debridement, which is a newer method, often destroys necrotic tissue by having a local proteolytic effect. Now, in this study, we intend to compare the short-term and long-term effectiveness of each with a comprehensive review. **Methods:** This review article is a systematic review of meta-analyses of RCTs that have compared mechanical and enzymatic debridement in various wounds, including burns, diabetic wounds, and vascular wounds. We reviewed. We searched PubMed, Google Scholar, ScienceDirect, and Magiran. Data on study design, sample size, wound type, and primary outcomes such as healing rate and scar removal were collected and integrated into a comparative framework. **Results:** Evidence from reviews and meta-analyses shows that enzymatic debridement, particularly bromelain in burns, speeds up eschar removal and reduces the need for surgery. In diabetic foot ulcers, it also improves healing compared with other approaches. That said, surgical debridement can sometimes lead to faster overall healing, especially in mixed wound studies. In practice, enzymatic methods are highly valuable for burns and diabetic ulcers, while surgery remains essential when wounds are extensive or urgent. **Conclusion:** Enzymatic debridement is a preferred and better method in burn-related and chronic wounds, which is better at removing these scars and reduces the need for surgery. On the other hand, in cases where the wound is infected or requires rapid wound cleansing, surgical debridement will be a better method. Overall, the choice of method should be made individually based on the type of wound, the patient's clinical background, tolerance, and availability of resources. More randomized trials are needed for better comparison.

Keywords:

Enzymatic Debridement, Surgical Debridement, Wound Healing, Chronic Wound

Code: wtrc12-04810522
Title:

Probiotics and Wound Healing: Mechanisms and Therapeutic Potential

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Abstract:

Wound healing is a dynamic physiological process involving inflammation, proliferation, and remodeling. Chronic wounds, often sustained by bacterial colonization and biofilm formation, remain difficult to treat, especially with the global rise in antibiotic resistance. Probiotics have emerged as promising therapeutic agents due to their combined antimicrobial and regenerative properties. They inhibit pathogenic colonization by competing for adhesion sites and nutrients, producing lactic acid, and secreting bacteriocins. Probiotics also stimulate the production of antimicrobial peptides (AMPs) by skin cells, which modulate microbiota composition and enhance skin integrity. Immunologically, probiotics act as modulators by promoting cytokine and chemokine release, recruiting macrophages and polymorphonuclear leukocytes (PMN), and enhancing phagocytosis, thereby reducing bacterial burden. During the proliferative phase, probiotics facilitate angiogenesis and epithelialization by regulating macrophage polarization (M1 to M2), and by upregulating vascular endothelial growth factor (VEGF) and epidermal growth factor (EGF). Remodeling is supported through probiotic-driven collagen transition from type III to type I, strengthening dermal architecture. Experimental models demonstrate strain-specific effects: Lactobacillus plantarum, Lacticaseibacillus rhamnosus, and Streptococcus thermophilus accelerate collagen synthesis and keratinocyte migration; Saccharomyces boulardii enhances AMP expression and pathogen exclusion; bacteriocins such as nisin regulate cytokine production, including tumor necrosis factor-alpha (TNF-α), and improve wound dressings; kefir promotes fibroblast proliferation and connective tissue formation. Probiotics also modulate transforming growth factor-beta (TGF-β) and reduce C-reactive protein (CRP) levels, mitigating inflammation. Collectively, probiotics integrate antimicrobial defense, immune regulation, and tissue regeneration, offering novel strategies for managing chronic wounds

Keywords:

Probiotics, Wound Healing, Immunity, Tissue Repair

Code: wtrc12-05740521
Title:

Comprehensive Review on the Application of 3d Printing-Based Hydrogel Scaffold as an Innovative Dressing for Enhanced Personalized Wound Healing

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Abstract:

Background: The world faces a major health crisis from chronic and complex wounds which need specialized treatment methods. The manufacturing of tailored hydrogel scaffolds through 3D printing technology allows for the creation of structures which replicate natural extracellular matrix (ECM) while providing personalized support and bioactive signals for individual patient needs. The high water content of hydrogels combined with their biocompatible nature and adjustable mechanical properties and controlled drug release abilities has established them as leading materials for next-generation wound dressings. The combination of 3D printing technology enables exact control over the architectural design and bioactive element placement in the final product. The systematic review examines current evidence about 3D printing hydrogel scaffolds for wound care to evaluate their manufacturing methods and therapeutic benefits in tissue regeneration and wound healing improvement. **Methods:** A comprehensive literature search was conducted between 2010 to 2025 in the following databases: PubMed, Web of Science, Google Scholar, Scopus and Science Direct. The search strategy employed the keywords "Wound Healing", "3D Printing", "Wound Dressing", "drug-delivery system" and "hydrogel scaffold". The screening process conducted according to PRISMA checklist. The quality of the included studies was assessed using the CASP Checklist. Eligible studies included in vivo, in vitro, and preclinical investigations evaluating 3D-printed or bio-printed hydrogel scaffolds specifically designed for wound management. Exclusion criteria involved non-hydrogel scaffolds, non-additive manufacturing approaches, reviews, editorials, and studies unrelated to wound healing. Data extraction focused on hydrogel composition, printing technique, mechanical and biological performance, therapeutic outcomes, and personalization capabilities. **Results:** Thirty-six studies met inclusion criteria. The most common hydrogels utilized included alginate, gelatin methacrylate (GelMA), hyaluronic acid, chitosan, and composite blends incorporating bioactive nanoparticles, growth factors, or antimicrobial agents. The primary printing method used extrusion-based technology which handles viscous biomaterials effectively but digital light processing (DLP) and bio printing serve for precision needs. 3D-printed hydrogel scaffolds in different studies showed better porosity control and mechanical stability and tissue integration than traditional wound dressings. The tested scaffolds showed capabilities to control drug delivery while supporting new blood vessel formation and skin regeneration and infection control. The wound coverage system allowed for patient-specific wound coverage through personalized geometries which provided adjustable mechanical properties depending on wound depth and location. The combination of stem cells with antibacterial agents and signaling peptides during in vivo studies produced the most effective results for wound healing through enhanced collagen production and better granulation tissue formation and faster wound closure. **Conclusions:** The evidence indicates that 3D printing–based hydrogel scaffolds represent a promising and innovative class of personalized wound dressings capable of addressing limitations in traditional approaches. The materials enable better tissue regeneration and wound care because of their adaptable design and body compatibility and precise drug release features. Researchers still need to enhance biological structure printing precision and create uniform biomaterial standards and develop methods which support human medical treatment. Future studies need to focus on conducting long-term animal studies while creating standard testing methods and finding affordable production routes. The future of personalized wound care and regenerative medicine will experience a major transformation through 3D-printed hydrogel scaffolds.

Keywords:

3D Printing, hydrogel scaffold, Dressing, wound healing

Code: wtrc12-06050520
Title:

Electrotherapy: Skin Bio-Battery Charger to Speed up Wound Healing Process

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Abstract:
Background: Electrotherapy is a branch of physiotherapy and medicine where electricity is used in a fully controlled manner for various purposes such as reducing pain, stimulating and strengthening muscles, reducing swelling, increasing blood flow and accelerating tissue repair, where electrical stimulation of the wound is one of the specialized sub-branches of this field. Researchers are using these technologies to speed up wound healing. **Methods:** The present paper is a review study. In this study, 10 articles published from 2019 to 2025, which were in the form of quantitative studies, meta-analysis and original research and systematic review were examined. Entry criteria included: Availability of full text and articles published between 2019 and 2025, and exit criteria included: Case Report studies. The study used the Keywords: Electrotherapy, wound, healing. **Results:** The skin naturally has a transepithelial electrical potential (TEP), i.e. the inner surface of the skin epidermis has positively charged extracellular fluid due to the presence of living cells and the activity of the sodium potassium pump, while the dead cells of the outer surface of the skin are electrically insulating. Therefore, positive charges are trapped under the stratum corneum of the skin, and the outer surface will have a relative negative charge relative to the inner surface of the epidermis. Damage to the stratum corneum of the skin causes the loss of electrical insulation, and positive charges come through wound to the surface of the skin, resulting in an internal electric field whose negative pole is located in the center of the wound and its positive pole around the wound. This electric field is a molecular compass for cells through which receive signals to migrate toward the wound site. Keratinocytes react to the generated electric field due to the presence of growth factor receptors (EGFR) in the membrane so that receptors accumulate on the negative pole side and other molecules in the membrane have an asymmetrical redistribution calcium flow is also affected within the cell; these changes cause the rearrangement of the actin cytoskeleton, and eventually the cell moves directionally towards the negative pole of the electric field, the center of the wound, acting as a primary physical barrier by creating a thin cell layer. The next step of repair is through the accumulation of fibroblasts at the positive pole of the electric field. By being present at the edges and depth of the wound, they produce and secrete large amounts of collagen, elastin, and proteoglycan fibers, forming new tissue scaffolding called granulation tissue, and also by secreting growth factors, they stimulate angiogenesis and cause the wound to shrink by differentiating to myofibroblasts. If a cathode electrode is mounted directly on the wound center and an anode electrode around the wound and a direct current of microamps or milliamps is established between the two electrical poles, the internal electric field from the wound is strengthened and sends a stronger signal to the cells of the body. This is the same method of electrical stimulation of the wound, which has other benefits, including reducing bacterial load by forming the acidic environment around the anode. **Conclusion:** Electrotherapy is very effective in speeding up the healing process of wounds, especially chronic wounds that have lost their natural electric field. These technologies are quite promising in the field of tissue repair.
Keywords:
Electrotherapy, Wound, Healing

Code: wtrc12-06180517
Title:

The Supportive and Palliative Role of Nurses in Reducing Psychological Burden of Burn Patients: A Narrative Review

Authors:

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Abstract:
Background: Burn injuries represent one of the most significant public health challenges worldwide, with substantial physical, psychological and social consequences. Survivors of burn injuries frequently experience high levels of anxiety, depression, post-traumatic stress disorder (PTSD), and body image disturbances, which may persist even after hospital discharge. Such injuries impose a severe psychological burden, negatively affecting patients' quality of life. Effective nursing care is essential to reduce this burden. The aim of this study is to determine the supportive and palliative role of nurses in reducing the psychological burden of patients with burn wounds. **Methods:** A systematic search was conducted in PubMed, Scopus, and Web of Science for studies published between 2012 and 2025, including randomized controlled trials (RCTs), systematic reviews, observational studies, and qualitative research focusing on adult burn patients' psychological outcomes. Data extraction emphasized patient-reported anxiety, depression, PTSD, body image disturbance, and pain-related distress, as well as nursing interventions addressing these outcomes. **Results:** Psychological disorders are highly prevalent among burn survivors. Depression has been reported in 40–60% of patients, while post-traumatic stress disorder (PTSD) affects 20–25% of this population. Anxiety related to dressing changes and disturbances in body image, arising from scarring, disfigurement, or donor-site wounds are frequently observed and significantly exacerbate the psychological burden experienced by patients. Nurses working in burn units play a crucial supportive and palliative role in reducing these psychological challenges. Pain management, utilizing both pharmacological and non-pharmacological approaches, effectively alleviates anxiety associated with wound care procedures. Patient and family education on home care, recovery processes and coping strategies has been shown to enhance psychological outcomes and promote patient empowerment. Furthermore, therapeutic communication, encompassing active listening, empathy and reassurance, contributes to reduced anxiety and fosters a sense of safety and security throughout hospitalization. **Conclusion:** Nurses play a pivotal role in alleviating the psychological burden of burn patients. Supportive and palliative nursing interventions, particularly when delivered in a structured and patient-centered care, can reduce anxiety, enhance coping during painful dressing procedures and improve overall psychological well-being. The integration of multidisciplinary care, including psychologists, physiotherapists and other healthcare professionals, is essential to provide coordinated psychological support, education and social care.

Keywords:
Burn patients, Psychological Burden, Nursing Interventions, Supportive Care, Palliative Care, Anxiety, Depression

Code: wtrc12-06140515
Title:

Evaluation of Medical-Grade Honey in Modulating Biofilm Development and Resistance Gene Activity of Wound-Associated Klebsiella pneumoniae

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Abstract:

Background: Chronic wounds provide susceptible environments that are easily colonized by microorganisms. Once the skin barrier is compromised, opportunistic pathogens can penetrate deeper tissues, resulting in severe complications. Among opportunistic pathogens, Klebsiella pneumoniae is a significant Gram-negative bacillus frequently associated with nosocomial wound infections. Its multidrug-resistant nature, coupled with diverse resistance mechanisms, poses a serious threat to public health. A key virulence factor of K. pneumoniae is its polysaccharide capsule, which facilitates biofilm formation through capsular gene expression, enhancing persistence and tolerance to treatment. Honey has long been applied in wound management and has recently re-emerged as a medical-grade biomaterial due to its broad antimicrobial, and anti-biofilm properties. In this study, Iranian honey samples, previously characterized as medical grade in earlier studies, were evaluated for their effects on biofilm formation by regulating capsular gene in multidrug-resistant K. pneumoniae strains. The aim was to explore their potential as natural therapeutic agents in controlling wound infections. **Methods:** Two Iranian honey samples, Konar (Sidr) and Sumra, previously validated for medical-grade quality, were employed to evaluate their anti-biofilm properties against K. pneumoniae (ATCC 9997). Biofilm inhibition was assessed using the crystal violet microplate assay following bacterial exposure to different honey concentrations. To investigate the molecular effects of honey treatment, total RNA was extracted from both treated and untreated cultures. The capsular gene wcaG, a key determinant of biofilm formation, was amplified using specific primers, and cDNA was synthesized. qRT-PCR was then performed to measure changes in wcaG expression. **Results:** Biofilm inhibition assays demonstrated that Konar honey exhibited stronger antibiofilm activity than Sumra honey, particularly at higher concentrations. The inhibition rates for Konar at the final concentration of 9% and 10% v/v, were 52.41% and 49.15%, respectively. In comparison, Sumra honey at 8.5% and 9.5% v/v, reached the rates of 36.40% and 35.83%. qRT-PCR results confirmed downregulation of the wcaG gene in honey-treated Klebsiella pneumoniae strains. The $2^{(-\Delta\Delta Ct)}$ values for Konar honey at 19% and 18% v/v were 0.01, while Sumra honey at the same concentrations yielded values of 0.09 and 0.03. All values were below 1, indicating effective suppression of gene expression. **Conclusion:** This study demonstrates that Iranian medical grade honeys effectively inhibit K. pneumoniae growth, biofilm formation, and capsular gene (wcaG) expression. These findings highlight honey's dual phenotypic and genotypic effects, disrupting both biofilm integrity and molecular mechanisms of resistance. Collectively, Iranian medical grade honey shows promise as a natural therapeutic agent in resistant wound infections.

Keywords:

Antimicrobial Resistance, Biofilm Inhibition, K. Pneumoniae, Molecular Therapeutics

Code: wtrc12-06130514
Title:

Investigating the Application of Artificial Intelligence in Monitoring Burn Wound Healing

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Abstract:
Background: Burn wounds are a major global health concern, and accurate monitoring is critical for preventing complications. Traditional assessment methods, relying on visual inspection and clinical expertise, are often subjective and prone to error. Artificial intelligence (AI) offers a promising approach to enhance diagnostic precision, predict healing times, and identify potential complications. **Methods:** This Narrative review investigating the application of artificial intelligence in monitoring burn wound healing. A comprehensive literature search was conducted for articles published between 2020 and 2025 in the following databases: PubMed, Web of Science, Google Scholar, and ScienceDirect. The search strategy employed the keywords "Artificial Intelligence", "Burn Wound Healing" and "Wound Monitoring", along with their corresponding MeSH terms in both English and Persian, using the Boolean operators 'AND' and 'OR'. Editorials and inaccessible full-text articles were excluded, and only eligible studies were included for analysis. The screening process involved an initial evaluation of titles and abstracts, followed by a detailed assessment of full-text articles meeting the inclusion criteria. After applying these criteria, a total of 21 studies were included in the final review. A critical appraisal was conducted, and the relevant data were extracted and analyzed. **Results:** Recent advances in artificial intelligence have revolutionized burn wound monitoring by enabling more precise, objective, and efficient assessment methods. AI techniques such as machine learning, deep learning, and computer vision facilitate automated wound segmentation, classification, and size measurement, reducing human error and variability. Predictive AI models integrate clinical data to forecast healing outcomes and personalize treatment plans. Additionally, AI-powered telemedicine platforms provide remote, real-time monitoring, improving accessibility and patient management, especially in resource-limited settings. These applications enhance diagnostic accuracy, optimize treatment strategies, and facilitate recovery, although challenges remain regarding data standardization and ethical implementation. **Conclusion:** This review highlights the application of AI in monitoring burn wound healing, emphasizing both its potential and challenges. AI enables precise diagnosis, treatment planning, complication prediction, and resource optimization. Techniques such as multispectral imaging, machine learning, deep learning, and computer vision facilitate non-invasive assessment, early detection of tissue damage, 3D wound modeling, and personalized rehabilitation. However, limitations such as insufficient standardized datasets, privacy concerns, model interpretability, and limited clinical validation persist. Multidisciplinary collaboration among clinicians, technologists, and policymakers is essential to ensure safe, reliable, and ethical integration of AI into clinical practice.
Keywords:
Artificial Intelligence, Burn Wound Healing, Wound Monitoring

Code: wtrc12-06140513

Title:

Disrupting Biofilm Formation in Wound Infections: The Molecular Effects of Honey on Pseudomonas aeruginosa

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Abstract:

Background: Antibiotic resistance has become a critical global health challenge, particularly in chronic wound infections. Wounds such as burns, diabetic ulcers, and surgical sites are highly susceptible to colonization by opportunistic pathogens, where persistent infection delays healing and increases morbidity. Among these pathogens, Pseudomonas aeruginosa is especially significant in wound care due to its intrinsic resistance mechanisms and strong capacity for biofilm formation. Biofilms protect bacteria from host defenses and confer tolerance to conventional antibiotics, with the pslA gene playing a central role in matrix stability. Consequently, infections caused by biofilm-embedded P. aeruginosa are notoriously difficult to eradicate. Honey, historically used in wound management, has regained attention as a medical-grade biomaterial with antimicrobial, anti-biofilm, and tissue-regenerative properties. Its multifactorial mechanisms, including osmotic activity, low pH, hydrogen peroxide release, and phytochemicals, can disrupt biofilm architecture. This study aims to evaluate the impact of Iranian medical-grade honey on biofilm formation by P. aeruginosa, with a specific focus on the molecular regulation of the biofilm-associated gene pslA in resistant strains. **Methods:** Three Iranian medical-grade honey samples, Citrus (Bitter Orange), Konar (Sidr), and Sumra, were selected based on prior validation of their medical-grade quality and tested for antibacterial and anti-biofilm activity against clinical isolates of P. aeruginosa. Biofilm formation and inhibition were quantified using the crystal violet microplate assay. The presence of the pslA gene was confirmed by conventional PCR. To assess the molecular impact of honey treatment, total RNA was extracted from treated and untreated bacterial cultures, followed by cDNA synthesis. Changes in the pslA gene expression were then evaluated using qRT-PCR. This approach enabled both phenotypic and genotypic assessment of honey's anti-biofilm effects on resistant P. aeruginosa strains. **Results:** All tested Iranian medical-grade honey samples demonstrated notable anti-biofilm activity against clinical isolates of P. aeruginosa. The strongest inhibition was observed with Citrus, Konar, and Sumra honeys at a final concentration of 10% v/v, achieving biofilm reduction rates of 70.02%, 67.59%, and 62.05%, respectively. Molecular analysis using qRT-PCR confirmed downregulation of the biofilm-associated pslA gene in treated strains. The $2^{(-\Delta\Delta Ct)}$ values for all samples were below 1, indicating positive inhibitory effects. Specifically, Citrus honey at 19% v/v showed the most pronounced reduction ($2^{(-\Delta\Delta Ct)} = 0.02$), followed by Konar at 18% v/v ($2^{(-\Delta\Delta Ct)} = 0.09$) and Sumra at 19% v/v ($2^{(-\Delta\Delta Ct)} = 0.09$). These findings highlight that honey treatment not only reduces biofilm formation phenotypically but also disrupts molecular mechanisms underlying biofilm stability. **Conclusion:** This study demonstrates that Iranian medical-grade honeys (Citrus, Konar, and Sumra) exert strong anti-biofilm effects against resistant P. aeruginosa. Their ability to downregulate the pslA gene expression suggests a molecular mechanism for biofilm disruption. These results suggest that honey can interfere with critical pathways of resistance, offering a promising adjunct to conventional therapies. This study provides a foundation for further research into natural compounds for controlling antibiotic-resistant wound infections.

Keywords:

Biofilm Inhibition, Medical-Grade Honey, P. aeruginosa, Wound Infection Management

Code: wtrc12-02240510
Title:

Bioactive Nanomaterials for Accelerated Healing of Chronic Wounds: A Systematic Review of Recent Advances (2023–2025)

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Abstract:
Background: Chronic wounds—including diabetic foot ulcers, pressure ulcers, and venous leg ulcers—pose a substantial clinical and socioeconomic burden due to persistent inflammation, impaired angiogenesis, biofilm formation, and recurrent infection. Conventional dressings function mainly as passive barriers. During the past two years, bioactive nanomaterials such as MXene nanosheets, metal nanoparticle-loaded hydrogels, and stimuli-responsive nanohybrid hydrogels have emerged as multifunctional systems that integrate antibacterial activity, reactive oxygen species (ROS) scavenging, controlled drug delivery, and immunomodulation. **Methods:** This systematic review was conducted following PRISMA guidelines. PubMed, Scopus, and Web of Science were searched from January 2023 to June 2025 using predefined keywords. Three major classes of materials were examined: (1) MXene-based systems, (2) hydrogels containing silver, gold, copper, or zinc oxide nanoparticles, and (3) stimuli-responsive nanohybrid hydrogels. Eligible studies were required to report synthesis and characterization methods, in vitro biocompatibility and antibacterial performance, and in vivo evaluation in full-thickness or diabetic rodent/rabbit wound models. Non-English publications and studies lacking in vivo data were excluded. Primary outcomes included wound closure rate, re-epithelialization, collagen deposition, neovascularization markers, and macrophage polarization. **Results:** MXene-based materials exhibited strong conductivity and photothermal antibacterial effects, routinely achieving over 90% wound closure within, 10–14 days in diabetic models by promoting cell migration and angiogenesis. Metal nanoparticle-loaded hydrogels offered microenvironment-responsive therapeutic release, reducing bacterial load by 4–6 $\log_{10}$ and significantly improving granulation tissue formation and collagen organization. Advanced nanohybrid hydrogels that integrate MXene structures with metal nanoparticles within biopolymer networks accelerated healing by 30–40%, facilitated macrophage transition from M1 to M2 phenotype, and reduced scarring even in infected wounds, while maintaining favorable short-term biocompatibility. **Conclusion:** Recent advances in bioactive nanomaterials have moved from conceptual innovation to consistent, high-quality preclinical evidence, strongly supporting the initiation of early-phase clinical trials. Key challenges—including scalable GMP-compatible fabrication and comprehensive long-term biosafety evaluation—remain, but appear solvable. Although current data are largely limited to small-animal models, these platforms represent a significant opportunity to transform chronic wound care.

Keywords:
Chronic wounds, Bioactive Nanomaterials, MXene, Nanohybrid Hydrogels, Stimuli-responsive Dressings, Diabetic Wound Healing, Tissue Regeneration

Code: wtrc12-06140509
Title:

Correlation between Honey Characteristics and Antimicrobial Efficacy against Resistant Pathogens Causing Wound Infections

Authors:

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Abstract:

Background: The emergence of antibiotic-resistant bacteria, particularly Acinetobacter baumannii, Klebsiella pneumoniae, and Pseudomonas aeruginosa, poses a major challenge in the management of hospital-acquired infections. These pathogens are frequently isolated from burn wounds, surgical sites, and chronic ulcers, where they contribute to prolonged healing, recurrent infection, and increased patient morbidity. Their resistance to multiple classes of antibiotics severely limits treatment options and often leads to poor clinical outcomes. The persistence of these strains in wound environments underscores the urgent need for alternative therapeutic approaches that can overcome resistance and support effective wound care. Natural agents, including honey, have gained renewed attention for their antimicrobial properties and potential role in infection control. This study explores the antimicrobial potential of native Iranian honey samples against resistant bacterial strains and assesses their effectiveness in relation to the intrinsic characteristics of honey, including its natural therapeutic properties. **Methods:** Native Iranian honey samples (Citrus, Konar, and Sumra) were authenticated through physicochemical and phytochemical analyses, including humidity, 5-hydroxymethylfurfural (HMF), proline, diastase activity, total polyphenols, and sugar composition (sucrose, fructose, glucose, and fructose/glucose ratio), following national standards. Antimicrobial activity was assessed against resistant strains (A. baumannii, K. pneumoniae, and P. aeruginosa), using agar well diffusion, minimum inhibitory concentration (MIC), and minimum bactericidal concentration (MBC) assays. Bactericidal kinetics were evaluated by time-kill studies. Statistical analyses included two-way ANOVA to compare sample types and concentrations, and Pearson correlation to examine relationships between honey properties and antimicrobial activity, with a significance threshold of $p \leq 0.05$. **Results:** Authentication of Citrus, Konar, and Sumra honey samples was confirmed according to Iran National Standards Organization (INSO) protocols (INSO 92, ISIRI 11145, ISIRI 8986-1). All samples inhibited the growth of resistant strains. Against A. baumannii, inhibition zones were 11.5 ± 0.5 mm (Citrus), 25.0 ± 1.0 mm (Konar), and 13.0 ± 1.0 mm (Sumra). For K. pneumoniae, Citrus and Konar produced 13.0 ± 2.0 mm zones, while Sumra showed 13.0 ± 1.0 mm. Against P. aeruginosa, Citrus and Konar yielded 14.0 ± 1.0 mm zones, with Sumra slightly lower at 13.5 ± 0.5 mm. MIC ranged from 8–16% v/v, while MBC ranged from 24–40% v/v. Konar honey was most effective against A. baumannii and P. aeruginosa, whereas Citrus honey showed the strongest activity against K. pneumoniae ($p < 0.0001$). Pearson correlation analysis revealed significant positive associations between antimicrobial activity and honey's water content, proline, and polyphenols ($p \leq 0.05$). **Conclusions:** This study demonstrates the antimicrobial potential of native Iranian honey against resistant pathogens commonly associated with wound infections. While the results are promising, they also highlight the need for deeper investigation into the specific components of honey and the precise mechanisms responsible for its antimicrobial effects. Understanding these factors will be essential for developing optimized dosages, standardized formulations, and effective therapeutic products. Future studies should focus on mechanistic insights and clinical validation to fully harness honey's potential as a natural alternative in wound care.

Keywords:

Antimicrobial agents, Iranian medical-grade honey, Multidrug-resistant pathogen, Therapeutic alternatives

Code: wtrc12-03550507
Title:

Roles, Challenges, and Needs of Informal Caregivers in Chronic Wound Care: A Narrative Review

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Abstract:
Background: Chronic wounds, particularly among older adults and individuals with conditions such as diabetes, require precise, long-term, and continuous management. In many settings, a substantial part of wound care is delivered at home by informal caregivers. Considering their essential contribution to preventing complications, improving the quality of care, and reducing pressure on health systems, understanding their challenges, needs, and experiences is crucial. This review aimed to synthesize existing evidence on the roles, needs, and issues faced by informal caregivers involved in home-based chronic wound care. **Methods:** This narrative review explored various aspects of the role of home caregivers in managing chronic wounds. A literature search was conducted in PubMed, Scopus, and Google Scholar for studies published between 2015 and 2025. Keywords included chronic wounds, home caregivers, family caregivers, home care, caregiver burden, and wound management. Studies were eligible if they addressed caregivers' roles, challenges, educational needs, lived experiences, or interventions related to chronic wound care at home. After screening, 12 studies met the inclusion criteria. Extracted data were organized and synthesized into major thematic categories. **Results:** The analysis revealed that informal caregivers face a substantial caregiving burden encompassing physical, psychological, social, and time-related dimensions. Factors such as wound complexity, frequent dressing requirements, deterioration of the patient's condition, and the caregiver's lack of prior experience intensified this burden. Many caregivers reported decreased quality of life, stress, anxiety, feelings of helplessness, and reduced social engagement. Caregiving tasks included hygiene maintenance, nutrition support, repositioning, dressing changes, medication administration, and patient transport, often performed without formal education. A large proportion of caregivers received no structured training, leading to challenges such as limited knowledge of warning signs, infection management, and proper dressing techniques. Reported needs included accessible educational resources, adequate wound care supplies, financial support, and insurance coverage. Studies offering caregiver training or home-based interventions showed improvements in knowledge, self-efficacy, adherence to care, and in some cases, better wound outcomes. Effective communication between healthcare providers and caregivers emerged as a key factor in reducing anxiety and improving patient outcomes. **Conclusions:** Informal caregivers play a critical role in home-based chronic wound care yet face significant burdens, limited resources, and insufficient training. The findings emphasize that without structured education, professional support, and access to essential materials and financial resources, risks of wound complications and caregiver burnout increase. Enhancing educational programs, strengthening supportive services, improving healthcare–caregiver communication, and addressing caregivers' mental health needs may improve the quality of home wound care and reduce caregiving strain. This review underscores the need for developing multidimensional, caregiver-centered interventions in chronic wound care systems.

Keywords:
Chronic Wounds, Family Caregivers, Caregiver Burden

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زخم و ترمیم بافت یارا
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12th WTR

Code: wtrc12-03360506
Title:

A Review on the Exosomal Signaling in Diabetic Wound Regeneration: The Role of miRNAs in Modulating PI3K/Akt, MAPK, and Notch Pathways

Authors:

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Abstract:
Background: Diabetic wounds represent a persistent clinical challenge due to impaired angiogenesis, chronic inflammation, and defective cellular responses that collectively hinder normal tissue repair. Hyperglycemia-driven oxidative stress and dysregulated signaling networks further disrupt fibroblast activity, keratinocyte migration, and extracellular matrix (ECM) remodeling. Despite conventional interventions such as debridement, antibiotics, and growth factor–based therapies, healing outcomes remain suboptimal, highlighting the need for more advanced biologically targeted approaches. In recent years, stem cell–derived exosomes have emerged as promising acellular therapeutic mediators capable of delivering functional microRNAs (miRNAs), proteins, and lipids to recipient cells. These nanosized vesicles exert potent regulatory effects while offering advantages over stem cell transplantation, including enhanced safety, stability, and reduced immunogenicity. Among the diverse cargo within exosomes, miRNAs play a particularly influential role in modulating key intracellular signaling pathways. Specifically, exosomal miRNAs capable of regulating the PI3K/Akt, MAPK, and Notch pathways have drawn considerable attention for their ability to restore angiogenesis, attenuate inflammation, and promote epithelial regeneration in diabetic wounds. **Methods:** This study is areview article by surveying articles of databases and credible scientific websites include Science Direct, PubMed, Scopus, and with keywords, Exosomes, Diabetic wound healing, MicroRNAs (miRNAs), PI3K/Akt pathway, MAPK signaling, Notch signaling-Stem cell–derived exosomes Regenerative medicine conducted during 2010–2025. **Results:** Evidence from preclinical studies demonstrates that exosomes derived from mesenchymal stem cells (MSCs), adipose-derived stem cells, and endothelial progenitor cells can significantly accelerate diabetic wound healing via miRNA-mediated pathway modulation. Exosomal miR-21, miR-126, and miR-132 effectively activate the PI3K/Akt pathway, promoting endothelial proliferation, enhancing fibroblast survival, and stimulating angiogenesis through upregulation of VEGF and eNOS. This activation also reduces apoptosis and oxidative damage, both of which are prominent barriers in diabetic tissue repair. In parallel, exosomal miR-146a and miR-31 regulate MAPK/ERK signaling, mediating a shift from chronic inflammation toward controlled tissue regeneration. These miRNAs inhibit TNF-α and IL-6, facilitating the resolution of prolonged inflammatory phases commonly observed in diabetic wounds. The Notch pathway, often disrupted in hyperglycemic conditions, contributes to delayed epithelial maturation and impaired ECM organization. Exosomal miR-210 and miR-34a have been shown to restore Notch balance, resulting in improved keratinocyte differentiation and more structured collagen deposition. Animal studies consistently show that exosome-treated wounds exhibit faster closure rates, higher microvessel density, thicker epithelial layers, and more organized granulation tissue compared with untreated controls. **Conclusions:** Collectively, current findings highlight the substantial regenerative potential of exosomal miRNAs in correcting dysfunctional molecular pathways in diabetic wounds. By enhancing PI3K/Akt signaling, modulating MAPK activity, and normalizing Notch regulation, exosomal therapy improves angiogenesis, reduces inflammation, and supports ECM remodeling. Future studies should aim to identify the most effective miRNA signatures for phase-specific wound healing, engineer exosomes with optimized therapeutic cargo, and establish standardized dosing strategies. Well-designed clinical trials will be essential to evaluate long-term safety and therapeutic consistency. Exosome-based miRNA delivery may ultimately represent a transformative next-generation approach for diabetic wound management.

Keywords:
Exosomes, Diabeticwound Healing, MicroRNAs (miRNAs), PI3K/Akt pathway, MAPK signaling Stem Cell–derived Exosomes REGENERATIVE Medicine

Code: wtrc12-03360505
Title:

A Review on the Modulation of PI3K/Akt, Wnt/β-Catenin, and MAPK Signaling Networks in Diabetic Wounds Mediated by Stem Cell-Derived Exosomes: Insights into Next-Generation Regenerative Therapies

Authors:

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Abstract:
Background: Diabetic chronic wounds (DCWs) represent a major clinical challenge due to persistent inflammation, impaired angiogenesis, and defective proliferation of fibroblasts and endothelial cells. Conventional therapies often fail to achieve complete and timely healing. In recent years, exosomes derived from various mesenchymal stem cells (MSCs), including adipose-derived stem cells (ADSCs), dedifferentiated fat cells (DFATs), dental pulp stem cells (DPSCs), and other MSC sources, have emerged as a promising cell-free therapeutic approach. These nano-sized extracellular vesicles carry microRNAs, mRNAs, and proteins that modulate key signaling pathways involved in tissue regeneration. This review summarizes recent findings on the roles of MSC-derived exosomes in promoting diabetic wound healing through pathways such as PI3K/Akt, Wnt/β-catenin, and Cdc42/p38 MAPK. **Methods:** This study is areview article by surveying articles of databases and credible scientific websites include Science Direct, PubMed, Scopus, and with keywords,Diabetic wound healing; Mesenchymal stem cell-derived exosomes; PI3K/Akt; Wnt/β-catenin; Cdc42/p38 MAPK; Angiogenesis; Cell-free therapy; Regenerative medicine conducted during 2010–2025.**Results:** Exosomes derived from hypoxia-preconditioned ADSCs (HypADSCs-Exo) enhance fibroblast proliferation and migration, increase collagen type I/III synthesis, and stimulate angiogenesis through PI3K/Akt activation. DFATs-Exo embedded in GelMA hydrogel accelerate wound closure, improve epithelialization, and organize collagen fibers via activation of Wnt/β-catenin signaling. DPSC-derived exosomes (DPSC-Exo) promote endothelial cell migration, tube formation, and extracellular matrix remodeling through Cdc42/p38 MAPK, contributing to robust vascularization. In vivo studies consistently demonstrate that administration of MSC-derived exosomes accelerates wound closure, enhances epithelial thickness, increases vascular density, and reduces inflammatory cytokine levels. Combined approaches using hydrogel-based delivery systems improve exosome stability and sustained release, further enhancing therapeutic outcomes. **Conclusions:** Collectively, these findings highlight MSC-derived exosomes as versatile and effective mediators of diabetic wound repair. They modulate inflammation, promote angiogenesis, and restore extracellular matrix organization, while mitigating oxidative stress and apoptosis. The positive outcomes observed in preclinical models support the translational potential of exosome-based therapies. Challenges such as standardization of exosome isolation, dosage optimization, and long-term safety remain, but current evidence positions MSC-derived exosomes as a promising next-generation, cell-free therapeutic strategy for chronic diabetic wounds.

Keywords:
Diabetic Wound Healing; Mesenchymal Stem Cell-Derived Exosomes; Pi3k/Akt; Wnt/B-Catenin; Cdc42/P38 Mapk; Angiogenesis; Cell-Free Therapy; Regenerative Medicine

Code: wtrc12-00100503
Title:

Biological Properties of Honey-Derived Extracellular Vesicles for Wound Healing

Authors:

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Abstract:
Background: Honey has been recognized since ancient times as a natural product with properties that aid wound healing. Scientists have conducted numerous studies to identify the effective compounds in honey and their mechanisms of action. Honey is used as a medicinal substance because of its antibacterial, antioxidant, and immune system-modulating effects, which can be contribute to wound healing. Honey-derived extracellular vesicles bypass the viscosity and rapid clearance issues of raw honey, enabling targeted delivery of concentrated bioactive molecules. Their nanoscale size facilitates penetration into deeper tissue layers, enhancing efficacy. Material and **Methods:** Extracellular vesicles were extracted from diluted honey (1:20 in phosphate-buffered saline) following the protocol of the exosome isolation kit (Ana Cell Teb, Iran). Characterization was performed to analyze size and morphology using dynamic light scattering (DLS) and transmission electron microscopy (TEM). Biological properties, including cytocompatibility, wound healing ability, and antibacterial effects, were evaluated. The compatibility of L929 cells with the different concentrations of vesicles (100 ng/μl, 50 ng/μl, 25 ng/μl, 12.5 ng/μ and 6.25 ng/μl) was examined after 3 days of incubation using the MTT reagent. Additionally, a scratch assay was performed to assess the ability of honey-derived extracellular vesicles to enhance L929 fibroblast cell migration. Images of the scratched zones were taken with an inverted optical microscope at 0, 6, 24, and 48h after scratch formation using a digital camera. The antibacterial properties were investigated using 200 ng/μl of the vesicles by the well diffusion method on Mueller-Hinton agar against Gram-positive (S. aureus, ATCC 25923) and Gram-negative (E. coli, ATCC 25922). **Results:** The average size of extracellular vesicles is 220 nm with uniform dispersity and a round shape. All concentrations exhibited cell proliferation rates above 119% after 3 days. No significant differences in cell viability were observed among the different concentrations. All concentrations resulted in a significant increase in wound closure compared to the control group after 24 and 48h from initial scratching, reaching 51% for the 100ng/μl concentration after 48h. Our results showed a clear zone with diameters of 15mm and 20mm around the wells on the agar plates for E. coli and S. aureus, respectively. **Conclusion:** These results emphasize that the vesicles are non-toxic and have acceptable cytocompatibility. Due to their antibacterial effects, they may be investigated for the treatment of infected wounds.
Keywords:
Extracellular vesicles, Honey, Wound healing

Code: wtrc12-03670502
Title:

Effect of a Care Bundle-Based Educational Program on Nurses' Knowledge, Attitude, and Performance in Preventing Pressure Injuries in General Wards: A Randomized Controlled Trial

Authors:

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Abstract:
Background: Pressure injury (PI) prevalence in general wards in Iran ranges from 10–25%, with more than 95% being preventable. This study aimed to evaluate the effect of a care bundle-based educational program on nurses' knowledge, attitude, and performance in preventing PIs in general wards. **Methods:** A two-arm, parallel-group randomized controlled trial (IRCT20240901058942N2) was conducted in 2024–2025. A total of 120 nurses from internal medicine, general surgery, and orthopedic wards of 10 university hospitals in Tehran were randomly allocated (1:1) to intervention (n=60) or control (n=60) groups using stratified block randomization. The intervention consisted of six 90-minute blended sessions (three face-to-face + three online via LMS) based on the SSKIN care bundle plus a 4-hour practical workshop. The control group received routine hospital education. Outcomes were measured using the Pressure Ulcer Knowledge Assessment Tool 2.0 (PUKAT 2.0), Attitude towards Pressure Ulcer Prevention (APuP) scale, and a 30-item observational performance checklist at baseline, immediately post-intervention, and at 3-month follow-up. Data were analyzed using repeated-measures ANOVA, ANCOVA, and multiple linear regression (SPSS 27). **Results:** Mean age was 36.4 ± 6.5 years, and mean work experience was 11.2 ± 5.4 years. Post-intervention, the intervention group showed significant improvements: knowledge score increased from 11.9 ± 2.8 to 19.6 ± 2.1 (+65%, $p<0.001$), attitude from 63.8 ± 9.9 to 86.4 ± 7.2 (+35%, $p<0.001$), and performance from 57.1 ± 11.7 to 89.7 ± 5.9 (+57%, $p<0.001$). Between-group effect sizes were large (partial $\eta^2 = 0.29$–0.37). At 3-month follow-up, retention rates were 91% for knowledge and 86% for performance. Care bundle education explained 45% of the variance in performance (adjusted $R^2 = 0.45$, $p<0.001$). PI incidence in intervention wards decreased from 18% to 9% (Cohen's d = 0.92). **Conclusion:** A care bundle-based blended educational program significantly and sustainably improves nurses' knowledge, attitude, and performance in general wards. Integration of such programs into national in-service training protocols is strongly recommended.
Keywords:
Pressure injury, Care bundle, Nurse Education, Knowledge, Attitude, Performance, General wards, Randomized Controlled Trial

Code: wtrc12-03670501
Title:

Correlation between Nurses' Knowledge and the Quality of Nursing Care in Preventing Pressure Injuries in Intensive Care Units: A Systematic Review

Authors:

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Abstract:
Background: Pressure injuries (PIs) are among the most common complications in intensive care units (ICUs), with prevalence rates of 18–33%. Over 95% are preventable, yet nurses' inadequate knowledge and suboptimal care quality are primary contributors. This systematic review aimed to examine the correlation between nurses' knowledge and nursing care quality in PI prevention in ICUs. **Methods:** A systematic search was conducted in PubMed, Scopus, Web of Science, SID, MagIran, IranMedex, and Google Scholar (2010–November 2025) using keywords such as "pressure ulcer/injury," "nurse knowledge," "nursing care quality," "prevention," "ICU," and Persian equivalents. Correlational, cross-sectional, quasi-experimental, and systematic reviews in English or Persian were included. Twenty-five studies (18 English, 7 Persian) involving 4,278 ICU nurses were analyzed. Quality was assessed using JBI and Cochrane RoB checklists. **Results:** Mean knowledge score was 58.2 ± 12.4% (below desirable 60%), and care quality was 55.6 ± 13.7%. A significant positive correlation between knowledge and care quality ($r=0.32$, 95% CI: 0.18–0.46, $p<0.001$) was found in 76% of studies. Influencing factors included ongoing education, work experience (>5 years), and Braden tool use (increasing correlation to $r=0.45$). In Iranian studies, correlation was weaker ($r=0.15$) due to training gaps. Educational interventions improved care quality by 28% and reduced PI incidence by 32%. **Conclusion:** Nurses' knowledge positively correlates with PI prevention care quality, though overall knowledge is insufficient. Annual practical training programs in ICUs are recommended to strengthen this correlation and reduce PI prevalence.

Keywords:
Pressure injury, Nurses' Knowledge, Nursing care quality, Prevention, Intensive Care, Systematic Review

Code: wtrc12-05720499
Title:

Application of Three-Dimensional Scaffolds Based on Granular Hydrogel and Tilapia-Derived Chitosan for Rapid Wound Healing: A Narrative Review

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Abstract:

Background: Burns and chronic wounds represent a major global health challenge, creating a pressing need for advanced, bioactive wound dressings. This review aims to investigate the potential of composite three-dimensional scaffolds combining granular hydrogels and tilapia-derived chitosan as a novel strategy to accelerate and improve the wound healing process. **Methods:** This study was conducted as a comprehensive narrative review employing a descriptive-analytical approach. A systematic search was performed in reputable databases including PubMed, Scopus, Web of Science, and Google Scholar using specialized keywords and their Boolean combinations with a publication date filter from 2000 to 2024. Data from selected studies investigating the physicochemical properties, biocompatibility, and applications of these biomaterials were synthesized and analyzed. **Results:** Chitosan is considered an ideal biomaterial for wound dressings due to its unique properties, including biocompatibility, biodegradability, inherent antimicrobial activity, and ability to induce hemostasis. Collagen extracted from tilapia processing waste serves as a safe and effective alternative to mammalian collagen, enhancing the adhesion and proliferation of fibroblasts and keratinocytes. The integration of these materials into a granular hydrogel format enables the creation of a 3D scaffold with high, interconnected porosity, overcoming the limitations of traditional bulk hydrogels. This ECM-mimicking structure provides a moist and optimal environment for cell migration, proliferation, and angiogenesis, while also allowing for the controlled release of growth factors and drugs. **Conclusion:** Composite three-dimensional scaffolds based on granular hydrogel, chitosan, and tilapia collagen appear to be a highly promising option for accelerating the healing of both acute and chronic wounds. However, conducting extensive preclinical studies and clinical trials is essential to conclusively confirm the safety and efficacy of these systems before their clinical translation.

Keywords:
Wound Healing, Three-Dimensional Scaffold, Granular Hydrogel, Chitosan, Tilapia

Code: wtrc12-00950498
Title:

Depression and Wound Healing: A Review of Bidirectional Interaction

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Abstract:

Background: Wounds occur when the skin or underlying tissues are damaged, disrupting the body's natural barrier and initiating a complex healing process. Depression, one of the most prevalent psychiatric disorders, is marked by persistent sadness and loss of motivation. Beyond the psychological effects it has on an individual, depression also has an impact on wound healing by weakening the immune system, reducing self-care, and the side effects of antidepressants. The relationship between mental illnesses, especially depression, and chronic wounds is a two-way relationship. Depression is associated with a weakened immune system and increased inflammatory processes and hormonal effects. On the other hand, people with chronic wounds, which often occur in the context of chronic disease, are factors that trigger depression. Understanding this interplay is vital for improving medical care, since timely mental health support not only accelerates healing but also helps reduce the heavy economic costs of prolonged treatment and wound-related complications. **Methods:** To explore this relationship, we conducted a systematic review of studies published between 2000 and 2025. Searches were carried out in major databases—including Google Scholar, PubMed, SID, Magiran, and IranMedex—using keywords such as depression, wound care, inflammation, and mental health, along with their Persian equivalents.More than 50 relevant articles in both Persian and English were identified. After applying inclusion criteria—topic relevance, study quality, and the presence of clinical or imaging data—a selection of studies was analyzed. Collectively, these works span 25 years and primarily investigate the physiological effects of depression on wound healing. **Results:** Evidence shows that depression activates the hypothalamic–pituitary axis, increasing glucocorticoid secretion. Elevated glucocorticoids suppress skin growth factors and neuroimmune mediators, including anti-inflammatory cytokines, while impairing the function of immune cells such as lymphocytes and neutrophils. Patients with depression usually lack sufficient motivation to use and follow treatment, and due to poor personal hygiene, these individuals are also at greater risk of infection, creating a cycle in which both physical and psychological health are adversely affected. Pharmacological treatments add another layer of complexity. Antidepressants such as selective serotonin reuptake inhibitors (SSRIs), tricyclic antidepressants (TCAs), and benzodiazepines can both help and hinder wound healing. While they may strengthen immune responses and reduce inflammation, they can also impair platelet function, increasing bleeding risk. Side effects like drowsiness, irritability, and gastrointestinal issues may interfere with wound care routines. For this reason, antidepressant use in wound patients requires careful monitoring to balance psychological benefits with clinical safety. **Conclusion:** The relationship between chronic wounds and depression is a very complex two-way relationship, and unlike traditional wound treatments that have focused solely on dressings, this study suggests that we need to pay special attention to the chronic mental illness of the individual during the treatment process. However, research on how chronic wounds contribute to the onset of depression remains limited. More studies are needed to fully understand this two-way relationship and develop integrated treatment strategies that consider both physical and mental health.

Keywords:

Depression, Wound Healing, Mental Health, Chronic Wound

Code: wtrc12-05840496
Title:

Bioelectric Fields and Coordinated Epithelial Migration in Wound Healing

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Abstract:
In wound healing, the actions of single cells synchronize their movement toward the center of the wound to repair minor or major barrier injuries. The movement of epithelial cells as a continuous sheet is among the key processes involved in the restoration of the skin barrier. In this study, 10 articles published 2018 from to 2025, which were in the form of quantitative studies, meta analysis and original research and systematic review were examined. Entry criteria included: Availability of full text and articles published between 2018 and 2025, and exit criteria included: Case Report studies. The study used the Keywords: Bioelectric Signaling, Epithelial Migration, Wound Healing When skin is injured, the damaged epithelial barrier creates endogenous electric fields (EFs), which are generated by ion channels and sustained by cell junctions. These electrical fields are found throughout wounds, with the negative pole located at the center of the wound. Epithelial cells sense subtle EFs and move directionally in reaction to electrical signals. It has been suggested for a long time that naturally occurring EFs aid in wound healing by directing cell movement. Only recently has experimental evidence revealed that extensive sheets of keratinocytes or corneal epithelial cells react to applied electric fields by moving collectively in a directed manner. While certain mechanisms of collective cell migration resemble those employed by individual cells, distinct mechanisms regulate the synchronized movement of the cohesive sheet. Increasing evidence indicates that bioelectrical signaling in wounds plays a crucial role in the healing process. A deep understanding and effective utilization of this mechanism will be crucial for improved wound healing and regeneration
Keywords:
Bioelectric Signaling, Epithelial Migration, Wound Healing

Code: wtrc12-05840495
Title:

Early Off-loading and RANKL Inhibition in Acute Charcot Disease

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Abstract:
Charcot neuro-osteoarthropathy is one of the warning signs of diabetic complications and occurs in individuals with peripheral and/or autonomic neuropathy. The rapid progression of this condition toward foot deformity, or in more severe cases, amputation, makes early diagnosis and proper treatment selection critical for the patient. The fundamental basis of treatment is reducing weight-bearing on the feet; however, the role of the RANK/RANK-L/OPG signaling pathway may introduce a new breakthrough in modern therapeutic approaches for diabetic foot ulcers. In this study, 10 articles published 2018 from to 2025, which were in the form of quantitative studies, meta analysis and original research and systematic review were examined. Entry criteria included: Availability of full text and articles published between 2018 and 2025, and exit criteria included: Case Report studies. The study used the Keywords: Charcot Neuro-osteoarthropathy -RANKL Pathway - Wound healing In the acute phase of the disease, treatment focuses on reducing weight-bearing on the affected foot and controlling inflammation, as continued mechanical stress exacerbates bone destruction and deformity. Preventing excessive bone resorption with bisphosphonates and calcitonin helps reduce inflammation, improve soft tissue conditions, and stabilize the foot early. Hyperactivity of the RANK/RANK-L/OPG pathway plays a central role: RANK-L expressed by osteoblasts binds to RANK on pre-osteoclasts, enhancing their differentiation and survival, while OPG acts as a decoy receptor to neutralize RANK-L and prevent excessive osteoclast genesis. Given the prominent role of this pathway in bone destruction, targeting RANK-L and this signaling axis represents a novel approach to controlling the acute phase of CNO and preserving foot structure for effective wound healing. It can be concluded that current knowledge regarding the diagnosis and treatment of diabetic wounds has advanced significantly in recent years; however, accurate and timely diagnosis by the physician still plays a critical role in the healing process and can be truly life-saving for the patient.

Keywords:
Charcot Neuro-osteoarthropathy, RANKL Pathway, Wound Healing

Code: wtrc12-03670494
Title:

Impact of Education on Nurses' Knowledge and Performance in the Prevention and Control of Pressure Ulcers: A Systematic Review

Authors:

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Abstract:
Background: Pressure injuries remain one of the most common and highly preventable complications of prolonged hospitalization, with prevalence rates of 8–33% and imposing substantial financial and humanistic burdens on healthcare systems. More than 95% of pressure injuries are preventable, and inadequate nurses' knowledge and performance are the primary contributing factors. This systematic review aimed to evaluate the impact of educational interventions on nurses' knowledge and performance in the prevention and control of pressure injuries. **Methods:** A systematic search was conducted in PubMed, Scopus, Web of Science, SID, MagIran, IranMedex, and Google Scholar (2010 – December 2025) using keywords including "pressure ulcer/injury," "bed sore," "education," "nurse," "knowledge," "performance," and their Persian equivalents. Randomized controlled trials, quasi-experimental, and pre–post studies published in English or Persian were included. Thirty-two studies (23 English, 9 Persian) involving 3,846 nurses were analyzed. **Results:** All studies demonstrated significant improvements in knowledge (mean increase: 27.4 ± 11.3%) and performance scores (mean increase: 34.6 ± 14.8%) post-intervention. The most effective approaches were blended education (in-person + e-learning) combined with hands-on workshops on repositioning, Braden risk assessment, and modern dressings ($p < 0.001$). Sustained effects at 6-month follow-up were observed in 85% of studies. **Conclusion:** Evidence-based, continuous educational programs significantly enhance nurses' knowledge and performance and consequently reduce pressure injury incidence. Mandatory annual in-service training with practical assessment is strongly recommended.

Keywords:
Pressure injury, Nurse Education, Knowledge, Performance, Prevention, Systematic Review

Code: wtrc12-05970493
Title:

Living Microalgae as Therapeutic Agents for Accelerated Skin Regeneration and Chronic Wound Healing

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Abstract:

Microalgae are a diverse group of photosynthetic microorganisms that inhabit a wide range of aquatic and terrestrial environments and represent one of the most versatile biological resources in nature. They possess the ability to produce a broad spectrum of valuable bioactive compounds, including pigments, antioxidants, polysaccharides, lipids, and proteins. These characteristics make microalgae an emerging platform for applications across biotechnology and medicine. Recent advances have expanded their potential, enabling their use in innovative systems such as bioactive coatings, drug delivery platforms and oxygen-generating biomaterials. Chronic wounds are characterized by persistent hypoxia, inflammation, impaired angiogenesis, and infection. Restoring local oxygen tension and delivering antimicrobial, antioxidant, and pro-regenerative cues at the wound site are core therapeutic strategies. Within chronic wound management, several microalgal species have drawn particular attention. Chlorella spp. provide potent antioxidant and immunomodulatory compounds; Spirulina offers phycobiliproteins and bioactive peptides with antioxidant and anti-inflammatory effects; and Chlamydomonas reinhardtii contributes photosynthetic activity capable of generating oxygen locally. Together, these organisms form living, light-responsive systems that can supply sustained oxygen and therapeutic metabolites directly to wound tissue. Sustained delivery of oxygen and therapeutic molecules to the wound site. Advancing these microalgae-based strategies toward clinical translation will require integrating biological optimization with robust preclinical validation to fully realize their promise as next-generation wound therapies.

Keywords:

Microalgae, Chronic wound healing, Oxygen-generating biomaterials, Skin regeneration

Code: wtrc12-05970492
Title:

Engineered MXene Nanoplatforms for Smart Wound Dressings: Synergistic Antibacterial Activity, Biosensing, and Accelerated Tissue Regeneration

Authors:

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Abstract:
MXenes, a family of two-dimensional transition metal carides, nitrides, or carbonitrides, were first discovered in 2011 through selective etching of the A-layer from MAX phase precursors. This breakthrough marked a shift from early focuses on energy storage and catalysis to biomedical applications. Engineered MXene nanoplatforms are rapidly maturing research area, showing convincing evidence for smart wound dressings. Their unique combination of physicochemical and biological properties including- hydrophilicity that facilitates incorporation into hydrogels and loading of drugs, large surface area, photothermal/photoresponsive behaviour that allows on-demand antibacterial therapy and thermally triggered drug release, high electrical conductivity in electroactive scaffolds and wearable bioelectronics to promote cell migration and surface chemistry enabling functionalization and conjugation of antimicrobials, growth factors, polymers, or antioxidants to tune biocompatibility and function makes them highly promising for next-generation smart wound dressings. Main research interests in the area of MXene-based platforms are (1) MXene-reinforced hydrogels to produce adhesive, elastic and conductive gels. Reported benefits include NIR-triggered antibacterial action, on-demand drug release, enhanced cell adhesion/migration, and improved mechanical properties. (2) Mxene-integrated flexible/fabric wearable dressing and patches that both sense infection/temperature and provide localized therapy. (3) Aerogels, sponges and porous scaffolds provide high absorbency, breathability, and large surface area for exudative management. Mxene-based dressings also exploit multiple complementary antibacterial and antibiofilm mechanisms. From 2020 onward, MXene-based dressings have demonstrated accelerated regeneration in full-thickness, diabetic, and infected wounds by promoting hemostasis, proliferation, angiogenesis and remodeling. Major near-term need are systematic stability/toxicity stadies, standard materials characterization, and scaled manufacturing to enable clinical translation.

Keywords:
Mxene-based Nanomaterials, Smart Wound Dressings, Antibacterial Activity, Tissue Regeneration

Code: wtrc12-06030491
Title:

The Role of Macrophages in Wound Healing

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Abstract:

Background: Macrophages are key immune cells that respond to infections and regulate physiopathological conditions such as wound healing. These cells play a vital role in wound healing, including reducing inflammation, cleansing cell debris, and coordinating tissue repair. Many functional features are attributed to macrophages, including host defense and support for new tissue proliferation, to replace tissue lost from damage. **Methods:** The present paper is a review study. In this study, 10 articles published from 2019 to 2023, which were in the form of quantitative studies, meta-analysis and original research and systematic review were examined. Entry criteria included: Availability of full text and articles published between 2019 and 2023, and exit criteria included: Case Report studies. **Result:** Macrophages migrate to the wound site after injury occurs and begin the healing process in the first phase, called the inflammatory phase, by developing a strong inflammatory response. Macrophages in this phase have a pre-inflammatory phenotype (M1)and play a role in boosting inflammation by secreting factors such as inflammatory cytokine agents including tumor necrosis factor-alpha(TNF-a)interleukin 1 beta(IL-1B) and interleukin 6(IL-6) and Chemokines including CCL2 and CXCL8, which absorb more monocytes and macrophages. Macrophages at this stage produce oxygen and nitrogen active species to directly destroy pathogens as well as to clean up the remains of damaged cells in this phase through direct phagocytosis. After managing and eliminating the threat, macrophages change phenotypes and become anti-inflammatory phenotypes to advance the proliferation phase of wound healing. In this phase, macrophages inhibit inflammation by secreting anti-inflammatory cytokines such as interleukin 10(IL-10).Macrophages also cause active wound healing by secreting growth factors, including vascular endothelial growth factor(VEGF), which is the main stimulant of angiogenesis, platelet-derived growth factor(PDGF), which is the main stimulant of fibroblast proliferation and migration, fibroblast growth factor(FGF), which stimulates collagen production, and epidermal growth factor(EGF), which stimulates the proliferation of keratinocytes to cover the wound. Finally Macrophages enter the regenerative phase by changing the phenotype to M2, and by secreting key factors such as collagenases, elastases for the final regulation of the extracellular Matrix, interleukin 10(IL-10)to maintain the anti-inflammatory environment, and MMP-2 for selective matrix degradation, leading to increased restorative tissue strength, causing wound contraction and complete healing. **Conclusion:** Macrophages are cells beyond a simple immune cell, which guide the healing stages of the wound. These cells play a role in cleansing and defending, coordinating the construction of new tissue, and regenerating and modifying. It is noteworthy that wound healing directly depends on the ability of macrophages, in changing the phenotypic state at the right time. As a result, focusing on regulating the function of macrophages and understanding their activity is key to innovative and advanced treatments for complex wounds.

Keywords:

Macrophage,healing wound,Inflammation

Code: wtrc12-06040490
Title:

Effect of Different miRNAs on Wound Healing

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Abstract:
Background: in a wound healing process, all three stages of inflammation, reproduction and regeneration require the creation of proteins and changes in the expression of the RNAs gene.miRNAs are a series of small, non-coding RNAs that change the cell's response to migration and replication after scarring. It aims to increase the efficiency of wound healing and reduce the time it takes to reconstruct. **Methods:** during a review of 2015 to 2025 studies, the role of miRNAs and MSC-EXO-miRNAs for the absence of hypertrophic scars in the wound healing process shows that the combination of these two miRNA improves wound healing. Result: there are 5 key types of miRNAs that chenge gene expression. after scarring, the amount of HSA-mi21 and hsa-miR31 miRNAs increases, while hsa-miR-23B and hsa-miR-200B and hsa-let-7c decrease.Exosomal miRNAs derived from cells, especially stem cells, also play an important role in inhibiting apoptosis, induction of autophagy, open-epithelialization of granulated tissue formation, increased fibroproliferative and angiogenesis.MSC-EXO miRNAs stimulate collagen synthesis and increase the proliferation and migration of epidermal cells. **Conclusion:** miRNAs and mesenchymal exosomes are guaranteed solutions to improve the wound healing pathway and create new therapy to manage scars and facilitate the burn healing process with the aim of lesser time of healing and high aesthetic efficiency.

Keywords:
miRNA,wound healing,exosome

Code: wtrc12-06070488
Title:

Risk Factors of Recurrence of Diabetic Foot Ulcer: A Narrative Review

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Abstract:
Background: Diabetic foot ulcer (DFU) recurrence is a major challenge, leading to significant morbidity, amputation, and mortality. Understanding the risk factors for recurrence is crucial for improving preventive strategies and patient outcomes. **Methods:** This narrative review aims to provide a comprehensive overview of the diverse risk factors associated with the recurrence of diabetic foot ulcers. **Results:** A wide range of factors contribute to DFU recurrence. These can be categorized as: * Demographic and Social: Male gender, younger age, and smoking. * Comorbidities: Cardiovascular, cerebrovascular, and chronic kidney disease. * Diabetes-Related Complications:** Diabetic nephropathy, peripheral artery disease (PAD), and sensory neuropathy. * Ulcer Characteristics: Plantar location, prolonged duration, higher grade, and a history of previous ulcer recurrence or amputation. * Infectious Factors: The presence of diabetic foot osteomyelitis (DFO) is a significant risk factor. * Metabolic and Anatomical Factors: Poor glycemic control and foot deformities leading to increased plantar pressure. * Psychosocial and Laboratory Factors: Depression, anxiety, poor patient education, and elevated inflammatory markers (e.g., CRP, ESR, NLR). **Conclusion:** DFU recurrence is multifactorial. A holistic management approach that addresses not only the ulcer but also the underlying comorbidities, glycemic control, foot biomechanics, and, importantly, patient education and psychological support is essential for effective prevention and improving the quality of life for diabetic patients.

Keywords:
Diabetic Foot Ulcer, Recurrence, Risk Factors, Osteomyelitis, Amputation, Neuropathy, Peripheral Artery Disease, Prevention, Glycemic Control

Code: wtrc12-05820486
Title:

Nanotechnology-Driven Personalized Strategies for Chronic Wound Management

Authors:

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Abstract:
Background: Chronic wounds, defined as wounds that do not heal within 4 to 12 weeks of standard care, are associated with high morbidity and healthcare costs. By managing factors like wound oxygenation, pH, temperature, bacterial load, and predictors of scar formation on an individual basis, as well as using personalized methods for infection control, targeted drug delivery, and the controlled release of growth factors to modulate angiogenesis, chronic wounds can be treated more effectively. Personalized medicine (PM) aims to tailor diagnosis and treatment based on individual genetic and environmental profiles. **Methods:** In this article, we explore the potential of nanotechnology as a key enabler in the implementation of PM for chronic wound management. Search Strategy: A structured literature search was conducted in PubMed and Scopus using keywords such as "nanotechnology," "personalized medicine," and "wound healing." The search was limited to publications from 2018 to 2025, with a specific emphasis on in vivo studies. A total of 28 studies were selected, all highlighting the potential of nanotechnology in enhancing individualized wound management. **Results:** In some studies, smart wound dressings embedded with nanosensors tracked wound-specific parameters such as pH, temperature, oxygen, and bacterial load. Advanced diagnostic tools like nanoflares, spherical nucleic acid-based nanosensors, were used noninvasively by scientists to detect RNA biomarkers such as CTGF, allowing early identification of abnormal scarring risk. Based on in vitro and in vivo studies, infection control for each wound can be tailored using metal-based nanoparticles (e.g., silver, gold, and zinc oxide) whose release and dosage can be adjusted based on the microbial profile and wound conditions. Responsive delivery systems release antimicrobials only when bacterial growth is detected, reducing resistance and cytotoxicity. Personalized therapy is further enabled by nanocarriers such as liposomes and nanofibers, which protect bioactive agents from degradation and allow sustained, site-specific delivery aligned with patient biology. For impaired angiogenesis, different studies have shown targeted delivery of growth factors like VEGF or bFGF by engineered nanoparticles, which respond to wound-specific stimuli and ensure controlled release. **Conclusion:** Nanotechnology complements PM by enabling individualized and data-driven wound care. From diagnostics to therapy, it allows clinicians to align interventions with the patient's wound biology. While challenges like regulatory barriers and the need for clinical validation remain, the convergence of nanotechnology and PM represents a promising frontier in chronic wound management.

Keywords:
Personalized Medicine, Nanotechnology, Chronic Wound

Code: wtrc12-06020485
Title:

Operational Efficiency Gains from AI-Supported Tissue Assessment Systems in Nurse-Managed Chronic Wound Clinics

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Abstract:

Artificial intelligence (AI) is increasingly redefining clinical workflows in chronic wound care, particularly in settings where nurses lead tissue assessment and treatment planning. Chronic wounds—such as diabetic foot ulcers, venous leg ulcers, and pressure injuries—require continuous monitoring, precise tissue classification, and timely therapeutic decisions. Traditional assessment methods, while valuable, often introduce inter-observer variability and place a high operational burden on wound clinics. Recent advancements in AI-supported tissue assessment systems offer capabilities such as automated wound segmentation, tissue-type detection, real-time monitoring, and predictive analytics for healing trajectories. These tools have the potential to streamline decision-making, reduce delays in treatment adjustment, and enhance resource utilization. This study investigates the operational efficiency gains achieved by integrating AI-supported tissue assessment technologies into nurse-managed chronic wound clinics. Efficiency indicators include clinic throughput, average consultation time, accuracy of tissue evaluation, workload distribution, and healing-related performance metrics. The analysis draws on real clinical datasets, digital imagery repositories, and operational records from wound units currently employing AI-based evaluation platforms. By comparing workflow performance before and after the implementation of AI systems, the research identifies key improvements in assessment accuracy, standardization of documentation, reduction in redundant re-evaluations, and better prioritization of high-risk cases. Furthermore, the study analyzes how AI tools influence the clinical role of specialized wound-care nurses, emphasizing enhanced diagnostic confidence, expedited triage, and increased capability for early detection of complications. These improvements collectively contribute to better patient outcomes and more sustainable clinic operations. The research also highlights managerial impacts, including optimization of appointment scheduling, decreased variability in assessment quality, and improved allocation of human and material resources. Overall, the findings demonstrate that AI-supported tissue assessment systems can meaningfully enhance both clinical and managerial performance in chronic wound care settings. The article provides a comprehensive evaluation of these impacts, offering actionable insight for healthcare leaders, wound-care specialists, and policy planners seeking evidence-based strategies to improve operational efficiency in nurse-led wound clinics.

Keywords:

Artificial Intelligence, Chronic Wound Management, Tissue Assessment, Operational Efficiency, Nurse-Led Clinics

Code: wtrc12-04440484
Title:

Photobiomodulation in Wound Healing: From Mitochondrial Enhancement to Clinical Success in Chronic Wounds

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Abstract:

Background: Chronic wounds including diabetic foot ulcers, venous leg ulcers, and pressure ulcers affect millions globally and often fail to heal due to persistent inflammation, mitochondrial dysfunction, and impaired tissue regeneration. Photobiomodulation (PBM) using red (600-700 nm) and near-infrared (780-1100 nm) light represents a non-invasive therapeutic approach that targets multiple wound healing phases through enhancement of mitochondrial function and modulation of critical signaling pathways. **Methods:** A comprehensive narrative review was conducted using PubMed, Scopus, and Google Scholar databases covering literature from 2010-2025. Search terms included "photobiomodulation," "low-level light therapy," "chronic wound healing," "diabetic ulcers," "mitochondrial function," "cytochrome c oxidase," and "wound repair mechanisms." Studies encompassing mechanistic investigations (in vitro/in vivo), clinical trials, and comparative analyses across diabetic wounds, pressure ulcers, venous leg ulcers, burn wounds, and post-surgical wounds were evaluated. Data focused on mitochondrial enhancement, signaling pathway activation, clinical outcomes, and optimal treatment parameters. **Results:** PBM demonstrates multifaceted therapeutic mechanisms through direct interaction with cytochrome c oxidase in the mitochondrial electron transport chain, resulting in enhanced ATP production and modulated reactive oxygen species levels. Critical wound healing pathways are significantly activated: PI3K/AKT/mTOR pathway enhancing cellular repair and metabolism, TGF-β/Smad pathway promoting collagen synthesis and extracellular matrix remodeling, and JAK/STAT signaling regulating inflammation and cellular proliferation in chronic conditions. PBM effectively addresses chronic wound pathophysiology by restoring mitochondrial biogenesis, accelerating keratinocyte and fibroblast-mediated re-epithelialization, increasing type III collagen synthesis for granulation tissue formation, and stimulating VEGF-mediated angiogenesis with improved tissue oxygenation. Clinical applications demonstrate significant efficacy: diabetic ulcers show reduced healing time through resolution of chronic inflammation and enhanced vascularization, pressure ulcers and venous leg ulcers advance healing stages despite conventional therapy resistance, and burn wounds exhibit enhanced healing efficiency with reduced scar formation. Optimal therapeutic parameters include wavelengths of 600-1100 nm for deep tissue penetration, energy densities of 1-10 J/cm^2 ensuring biological stimulation without photothermal damage, and treatment protocols combining dual-wavelength approaches (810 nm pulsed with 904 nm superpulsed) showing synergistic enhancement in full-thickness wound healing. **Conclusion:** Photobiomodulation represents a transformative advancement in chronic wound management through its ability to simultaneously target mitochondrial dysfunction, modulate inflammatory responses, activate critical repair pathways (PI3K/AKT/mTOR, TGF-β/Smad, JAK/STAT), and promote angiogenesis. Despite demonstrated efficacy across diverse chronic wound types, standardization of treatment parameters and large-scale randomized controlled trials remain essential for establishing evidence-based protocols. Future integration of PBM with emerging therapies including stem cell treatments, advanced wound dressings, and innovative technologies such as triboelectric nanogenerators holds significant promise for next-generation wound care strategies.

Keywords:
Photobiomodulation, Chronic Wound Healing, Mitochondrial Enhancement, Diabetic Ulcers, Angiogenesis

Code: wtrc12-05120482
Title:

Investigation of the Effectiveness of Punch Graft in Promoting the Healing of Chronic and Treatment-Resistant Wounds: A Systematic Review

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Abstract:
Background: Chronic hard-to-heal wounds, such as venous leg ulcers, diabetic foot ulcers, and postoperative wounds, impose a significant burden on healthcare systems, affecting quality of life and incurring high costs. These wounds often fail to heal within 30 days due to disruptions in the inflammatory, proliferative, and remodeling phases. Punch grafting, a technique involving the transplantation of small split-thickness skin grafts (STSGs) to stimulate epithelialization, has been proposed as an accessible method to accelerate healing and alleviate associated pain in these wounds. **Methods:** This systematic review synthesizes evidence from PubMed, Web of Science (WOS), and Scopus databases, searching from database inception to October 2024 using terms such as "punch graft," "punch grafting," "chronic wounds," "hard-to-heal ulcers," and "wound healing." Inclusion criteria encompassed randomized controlled trials (RCTs), cohort studies, case series, and prospective studies evaluating the effectiveness of punch grafting on healing outcomes (e.g., wound closure rate, healing time, graft take percentage) in adult patients with chronic wounds (>4 weeks duration). Two independent reviewers screened titles/abstracts and full texts, with data extracted on study design, wound types, interventions, and outcomes. Quality assessment used the Newcastle-Ottawa Scale for non-randomized studies and Cochrane RoB 2 for RCTs. Narrative synthesis was performed due to heterogeneity. **Results:** Out of 1,256 unique records, 18 studies met inclusion criteria. Wound etiologies included venous leg ulcers (38%), postoperative wounds (21%), diabetic ulcers (15%), and mixed/traumatic (26%). Punch grafting demonstrated consistent benefits: complete wound closure in 54-73% of cases within 4-12 weeks, with over 70% graft take in 68% of procedures. Healing acceleration was notable in venous ulcers compared to arterial or diabetic types, reducing wound area by 40-60% at 4 weeks. Pain reduction was significant, with 54% achieving complete pain suppression and 21% experiencing over 70% pain relief post-procedure, independent of graft take. Complications were minimal (infection <5%, graft failure 10-15%), and the technique was feasible for outpatient use without donor-site morbidity. The quality of evidence was moderate; only 3 RCTs showed low bias, while observational studies (n=15) had selection biases. **Conclusions:** Punch grafting is a simple, cost-effective outpatient procedure that effectively promotes healing and reduces pain in chronic hard-to-heal wounds, particularly venous and postoperative types. While promising, larger multicenter RCTs are needed to confirm long-term outcomes, optimal graft density, and comparisons with advanced dressings or cell therapies. This technique warrants integration into wound care protocols to enhance patient-centered outcomes.
Keywords:
Punch Graft, Chronic Wounds, Treatment-Resistant Wounds and Wound Healing

Code: wtrc12-04440481
Title:

Dynamic Fascial Traction with the ABRA System: An Advancement in Open Abdomen Management

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Abstract:
Background: The open abdomen (OA) is a life-saving strategy in trauma, severe sepsis, and abdominal compartment syndrome (ACS). However, delayed primary fascial closure (DPFC) remains challenging due to loss of abdominal domain (LAD) from lateral fascial retraction. LAD occurs in up to 50% of patients with standard negative pressure wound therapy (NPWT) alone, leading to planned ventral hernias. The Abdominal Reapproximation Anchor (ABRA) system applies continuous, adjustable dynamic medial tension to fascial edges, enabling gradual reapproximation and preserving abdominal domain. **Methods:** A comprehensive narrative review (2008-2025) was conducted using PubMed, Scopus, and Google Scholar. Search terms included "ABRA system," "dynamic fascial traction," "open abdomen," "NPWT," "botulinum toxin," and "abdominal compartment syndrome." Original studies, case series, and comparative reports encompassing trauma, septic OA, burns, morbid obesity, connective tissue disorders, and large fascial defects were evaluated. Data focused on closure rates, combination therapies, technical modifications, and long-term outcomes. **Results:** ABRA demonstrated superior outcomes across challenging scenarios. Primary fascial closure rates ranged from 61% to 83-100% with optimized protocols, significantly exceeding NPWT alone (~30%) or static techniques (<50%). Septic Open Abdomen: Achieved 88% primary closure within 15 days despite severe peritonitis. Modified techniques with NPWT achieved 100% closure in septic patients with stomas. Extreme Clinical Scenarios: •Post-burn ACS following 85% TBSA burns. •Fascial defects exceeding 31 cm post-trauma. •Enteroatmospheric fistula repair in Ehlers-Danlos syndrome type IV with intact 2-year closure. •Class III obesity (BMI >40 kg/m^2) using modified internal anchor placement. Combination Therapies: •ABRA + ABThera system: High closure rates in predicted failures. •ABRA + Botulinum Toxin A (300 units): Chemical component separation in super-morbid obesity with stoma retraction enabled primary closure. Comparative Analysis: ABRA + NPWT achieved significantly better outcomes than NPWT alone regarding primary closure rates and reduced enteroatmospheric fistulae in trauma populations . Complications: Two-thirds developed manageable pressure sores at button sites. Midline hernia formation occurred in 11-28% during follow-up, substantially lower than planned ventral hernias (>70%) when primary closure fails. **Conclusion:** The ABRA system represents a major advance in OA management through controlled dynamic fascial traction, significantly increasing DPFC rates even in previously "unclosable" cases including severe burns, extreme obesity (BMI >60 kg/m^2), large defects (>30 cm), septic abdomen, and connective tissue disorders. Its versatility through synergistic combination with NPWT and botulinum toxin for chemical component separation substantially reduces planned ventral hernia burden. Future multicenter randomized trials with standardized protocols and cost-effectiveness analyses are essential to optimize patient selection and maximize clinical benefits.

Keywords:
Open Abdomen، ABRA System، Dynamic Fascial Traction، Delayed Primary Fascial Closure، Negative Pressure Wound Therapy، Abdominal Compartment Syndrome، Loss of Abdominal Domain

Code: wtrc12-06010480
Title:

Home-Based Nursing Management of Diabetic Foot Ulcers: A Narrative Review

Authors:

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Abstract:
Background: Diabetic foot ulcers (DFUs) are major complications of diabetes that significantly affect quality of life and increase healthcare costs worldwide. A substantial proportion of individuals with diabetes will develop a DFU during their lifetime, and inadequate care may result in infection, hospitalization, and amputation. As health systems shift toward community-based management, home nursing services have become essential for long-term DFU care. Nurses provide ongoing monitoring, wound care, education, and rehabilitation support to prevent complications and promote healing. This narrative review synthesizes current evidence on the role of nurses in home-based DFU management, emphasizing prevention, early detection, and patient-centered rehabilitation. **Methods:** A narrative review methodology was adopted. Literature published between 2010 and 2025 was searched in PubMed, Scopus, Web of Science, and Google Scholar using keywords such as diabetic foot ulcer, home care, community nursing, wound care, offloading, self-care education, and rehabilitation. Priority was given to clinical guidelines, systematic reviews, randomized controlled trials, and high-quality observational studies. Findings were synthesized thematically across domains of assessment, wound care, infection prevention, patient education, and rehabilitation. **Results:** Evidence shows that nurses play a critical role in delivering comprehensive home-based DFU care that integrates wound management with patient-centered rehabilitation. One of the primary responsibilities of home-care nurses is ongoing wound assessment, using standardized tools to evaluate ulcer size, depth, exudate, tissue type, and signs of infection. Early detection of deterioration enables prompt referral to specialized care and reduces the likelihood of hospitalization and amputation. Nurses also perform essential wound-care procedures, including cleansing, dressing selection, debridement where permitted by regulations, and moisture balance management. Individualized dressing plans, tailored to ulcer characteristics and comorbidities, are associated with faster healing. Offloading (reducing pressure at the ulcer site) is a cornerstone of DFU management. Home-care nurses reinforce the use of offloading devices, monitor adherence, and collaborate with podiatrists and rehabilitation specialists to optimize mobility. Evidence shows that consistent nursing supervision improves adherence and prevents ulcer recurrence. Infection prevention and monitoring are central nursing functions. By assessing wound edges, odor, systemic symptoms, and glycemic control, nurses help identify early signs of infection. They also support medication adherence, including antibiotics and diabetes therapies. Patient and family education is another essential component of home nursing care. Nurses teach foot hygiene, daily self-inspection, nutrition, blood glucose monitoring, safe physical activity, and early reporting of warning signs. Educational interventions significantly improve self-care behaviors and reduce recurrence. Telehealth-supported home care has emerged as an effective extension of nursing practice. Remote image-based monitoring, virtual education, and digital reminders enhance continuity of care and reduce unnecessary clinic visits. **Conclusion:** Home-based nursing care is fundamental to effective diabetic foot ulcer management and long-term rehabilitation. Nurses contribute to early detection, individualized wound care, offloading support, infection monitoring, and patient empowerment through education. Their presence in the home environment enables holistic and culturally sensitive care that improves healing outcomes and reduces the risk of hospitalization and amputation. Strengthening community nursing services, enhancing training in advanced wound-care techniques, and integrating telehealth tools are crucial strategies for improving DFU outcomes.
Keywords:
Diabetic Foot Ulcer, Home-Based Care, Nursing Management, Wound Care

Code: wtrc12-06010479
Title:

Psychological Well-Being in Patients with Diabetic Foot Ulcers: A Review Study

Authors:

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Abstract:

Background: Diabetic foot ulcers (DFUs) are chronic and debilitating complications of diabetes that impair mobility, independence, and social functioning while imposing significant psychological burdens. Patients with DFUs frequently experience pain, reduced physical activity, social isolation, fear of amputation, and prolonged treatment. Psychological distress can negatively affect adherence to wound care, glycemic control, offloading, and follow-up, ultimately influencing healing and rehabilitation outcomes. Nurses, as frontline providers, play a central role in assessing emotional well-being, offering psychosocial support, and implementing holistic strategies that enhance psychological health. This narrative review synthesizes current evidence on mental health challenges among patients with DFUs and highlights nursing interventions that support psychological rehabilitation. **Methods:** A narrative review methodology was employed. Literature from 2000 to 2025 was searched in PubMed, and Google Scholar using keywords including diabetic foot ulcer, mental health, depression, anxiety, quality of life, rehabilitation, and nursing care. Priority was given to clinical guidelines, systematic reviews, randomized controlled trials, and high-quality observational studies. Findings were analyzed thematically to identify the emotional burden associated with DFUs, psychosocial determinants of wound healing, and nursing-led interventions targeting psychological well-being. **Results:** DFUs impose substantial psychological strain, with depression reported in approximately 20–50% of individuals with active ulcers. Distress is intensified in patients with recurrent ulcers, severe infection, or risk of amputation. Anxiety related to healing uncertainty, disability, and body image concerns further limits coping capacity. Pain, limited mobility, and the need for long-term wound care contribute to social withdrawal and diminished independence, creating a cycle of emotional and functional decline. Psychological distress is strongly associated with reduced adherence to self-care behaviors essential for healing. Nurses play a vital role in early identification of psychological problems using validated tools such as the Hospital Anxiety and Depression Scale (HADS) and the WHO-5 Well-Being Index. Early detection enables timely referral, prevents escalation of symptoms, and improves patient engagement. Evidence supports the effectiveness of nursing interventions such as empathetic communication, individualized education, motivational interviewing, and family involvement. Psychoeducation reduces anxiety by clarifying treatment processes; while coaching and problem-solving techniques improve adherence to wound care and lifestyle recommendations. Rehabilitation-oriented nursing strategies including goal-setting, safe mobility encouragement, and structured self-management training, further support psychological and functional recovery. Telehealth-based nursing interventions, including remote counseling and virtual follow-up, have shown promise in reducing isolation and strengthening continuity of support. Studies indicate that integrating psychological care into routine wound management enhances quality of life, improves emotional resilience, and may contribute to better healing trajectories. **Conclusion:** Psychological well-being is an essential yet often overlooked component of diabetic foot ulcer management. High rates of depression, anxiety, and reduced quality of life significantly influence treatment adherence and rehabilitation. Nurses play a central role through psychological assessment, supportive communication, education, and multidisciplinary coordination. Incorporating structured psychosocial interventions and expanding access to nurse-led telehealth services can enhance emotional well-being, strengthen self-care behaviors, and promote holistic recovery in patients with DFUs. Strengthening nursing competencies in mental health and integrating psychological care into wound management protocols are crucial for improving outcomes.

Keywords:
Depression, Anxiety, Diabetes, Foot ulcer

Code: wtrc12-05950477
Title:

NPWT on DFUs

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Abstract:
Diabetic foot ulcers (DFUs) are complex chronic wounds that may lead to severe infection and limb amputation if not managed effectively. This case report describes a 60-year-old male with poorly controlled diabetes who presented with two deep ulcers on the heel and lateral foot, connected by a tunneling tract. Due to the severity of the wounds, ankle-level amputation had been recommended. A multimodal treatment plan was initiated, including mechanical and sharp debridement, Negative Pressure Wound Therapy (NPWT) over 12 sessions, ozone therapy, low-level laser therapy, advanced dressings (alginate, foam, and collagen), and complete off-loading.After approximately three months, significant improvement was observed, including marked reduction in wound depth, formation of healthy granulation tissue, over 70% reduction in wound surface area, and initiation of epithelialization. Amputation was successfully prevented. This case highlights the effectiveness of combining NPWT with comprehensive wound care strategies in managing complex DFUs.

Keywords:
Management of a DFU, NPWT, Advanced Dressings

Code: wtrc12-04700476
Title:

A Review of the Effects of Cold Atmospheric Plasma on Resistant Biofilms and Chronic Wound Healing

Authors:

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Abstract:
Backgrounf: Chronic wounds—including diabetic foot ulcers, venous leg ulcers, and pressure ulcers—pose a major clinical challenge due to persistent microbial colonization and resistant biofilm formation, which significantly impair natural healing. Conventional wound-care strategies often fail to eliminate biofilms or enhance tissue repair. Cold Atmospheric Plasma (CAP), especially CAP-jet systems, has recently emerged as a promising modality capable of both disrupting microbial biofilms and promoting wound regeneration. CAP consists of non-thermal ionized gas containing charged particles, UV photons, and reactive oxygen and nitrogen species (ROS/RNS), which together mediate antimicrobial and biological effects relevant to wound healing. **Methods:** This review was conducted by surveying peer-reviewed articles indexed in ScienceDirect, PubMed, and Scopus, using the keywords Cold Atmospheric Plasma (CAP), Chronic Wounds, Resistant Biofilms, Antimicrobial Activity, Wound Healing, ROS/RNS, CAP-jet, and MRSA. Studies focusing on CAP's mechanisms, biological effects, antimicrobial properties, and clinical or experimental applications in wound healing were included. **Results:** Findings from clinical and experimental studies demonstrate that CAP can accelerate wound healing by reducing exudate and pain, increasing granulation tissue formation, stimulating epithelialization, and decreasing overall wound size. CAP has also shown beneficial effects on burn wounds and skin graft donor and recipient sites. Its antimicrobial action is strong and broad-spectrum, effectively lowering bacterial load and disrupting biofilms formed by Gram-positive and Gram-negative species, including resistant strains such as MRSA. These effects are attributed to ROS/RNS-induced oxidative stress, electrostatic disruption of microbial membranes, and structural damage to bacterial cell walls. Nevertheless, treatment parameters are critical: inadequate exposure may limit effectiveness, while excessive dosing can trigger apoptosis or necrosis in healthy tissue. **Conclusion:** Cold Atmospheric Plasma offers a promising complementary or alternative therapeutic option for chronic wound management by reducing microbial burden, enhancing tissue regeneration, minimizing pain, decreasing antibiotic dependency, and maintaining low toxicity when properly applied. However, inappropriate dosing may lead to adverse effects, highlighting the need for standardized protocols and professional oversight. Future large-scale clinical trials and optimization of device settings are required to support the widespread integration of CAP into routine wound-care practice.

Keywords:
Cold Atmospheric Plasma (CAP), Chronic Wounds, Resistant Biofilms, Antimicrobial Activity, Wound Healing, ROS/RNS, CAP-jet, and MRSA.

Code: wtrc12-04700475
Title:

A Review on the Efficacy of Stem Cell–Derived Exosomes: A New Generation of Smart Bio-Dressings for Burn Wound Treatment

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Abstract:
Background: Wound healing is one of the most complex biological processes, and skin wounds are categorized into acute and chronic forms. Burns, as major acute wounds, remain a significant global health concern due to their associated pain, disability, infection risk, scarring, and potential for multi-organ failure. In recent years, stem cells have attracted attention for their regenerative capabilities, yet their survival in the wound microenvironment is limited by high levels of reactive oxygen species, immunogenicity, and genetic instability. Stem cell–derived exosomes provide a promising alternative, offering low immunogenicity, no tumorigenic risk, easy accessibility, and mediation of essential paracrine signaling. Exosomes (30–150 nm) are released by various cells and found in fluids such as serum, urine, and saliva. Stem cell–derived exosomes contain cytokines (IL-6, IL-10, TGF-β1, VEGF, HGF) and diverse RNAs, including non-coding RNAs such as miRNAs and lncRNAs, which actively modulate gene expression and contribute to healing processes. **Methods:** This review was conducted by surveying peer-reviewed articles indexed in ScienceDirect, PubMed, and Scopus using the keywords stem cell–derived exosomes, wound healing, burns, lncRNA, miRNA, MSC-Exos, angiogenesis, inflammation. Studies discussing the biological effects, molecular mechanisms, and therapeutic potential of exosomal RNAs in wound repair were included. **Results:** Evidence indicates that lncRNAs and miRNAs within stem cell–derived exosomes—including miR-181c, miR-21, miR-146a, and miR-29a—regulate key pathways involved in wound healing. These RNAs reduce inflammation by suppressing NF-κB activation and downregulating pro-inflammatory cytokines. They enhance angiogenesis via VEGF- and Wnt/β-catenin–related pathways, promoting endothelial cell proliferation and migration. Exosomal RNAs also stimulate fibroblast and keratinocyte proliferation through PI3K/AKT and ERK signaling, contributing to tissue formation. Additional benefits include improved extracellular matrix remodeling, reduced scar formation, and restoration of impaired healing in diabetic wounds by lowering oxidative stress and enhancing endogenous stem cell activity. **Conclusion:** Mesenchymal stem cell–derived exosomes represent a promising alternative to cell-based therapies due to their low tumorigenic risk, minimal immunogenicity, and ease of storage and application. Although most studies to date are preclinical, findings suggest that exosome therapy can accelerate wound healing, reduce scarring, and improve functional and aesthetic outcomes in burn injuries. Future research should focus on identifying the most effective lncRNAs and advancing human clinical trials to establish MSC-Exos as a safe and practical therapeutic option for wound management

Keywords:
Stem Cell–derived Exosomes; Msc-exos; Wound Healing; Lncrna; Mirna; Angiogenesis; Inflammation; Regenerative Medicine

Code: wtrc12-04500474
Title:

Management of Nonhealing Combined Burned-Diabetic Foot Ulcer with PRF Membrane: A Case Report

Authors:

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Abstract:
Background: The global prevalence of diabetes continues to rise, with over 380 million affected worldwide. Approximately 25% of these individuals develop a diabetic foot ulcer (DFU) during their lifetime. Burns are a common precipitating factor for DFUs, largely due to sensory neuropathy. Because many ulcers become refractory when early interventions fail, precise reporting of similar clinical cases is vital to improving management strategies. Material and **Methods:** The patient is a 51-year-old diabetic woman who developed a diabetic foot ulcer in the first and second toes of her right foot due to a burn. After infection and osteomyelitis developed in the affected toes, the affected toes were amputated. The patient received standard treatments for 18 months to heal the amputation site. After this period and partial treatment, the remaining wound did not heal for 6 months and standard dressings as well as NPWT(negative pressure wound therapy) were not responsive to wound healing, resulting in the patient's wound becoming an incurable wound. During this six-month period, the patient followed all diabetic foot care instructions: proper weight-bearing, wearing total cast shoes (TCC), normal blood sugar, and prophylactic antibiotics. Wound culture also confirmed the absence of infection with two consecutive tests. After referral to a wound specialist, treatment with PRF Membrane was performed for this patient in the first session. The procedure began with the wound therapist collecting 9 cc of autologous blood into a vacuum blood collection tube. The blood tube was then centrifuged for 2 minutes at a relative centrifugal force of 1900 RCF to obtain the PRF derivative. **Results:** As a result of this intervention, this patient's non healable diabetic foot ulcer was healed after 2 weeks and 2 visit sessions for dressing. Complete re-epithelialization was visible at the site of this ulcer, in a much shorter time than previous treatments. **Conclusion:** The treatment process of this case indicates that the use of modern methods such as PRF membrane instead of conventional methods and adjuvant treatments such as vacuum therapy were not effective in treating this patient, but it can accelerate the healing process of diabetic ulcers that are resistant to treatment, and it indicates the importance of timely diagnosis and correct intervention by the therapist. These findings are consistent with some studies and contradict others, because these issues are still controversial. Therefore, more research is needed to develop appropriate guidelines for its diagnosis and treatment.

Keywords:
Nonhealing Wounds, Wound Management, PRF Membrane

Code: wtrc12-04530473
Title:

From Synthetic Matrices to Wearable Sensors: A Roadmap for Advanced Technologies in Wound Care

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Abstract:
Background: The management of chronic wounds remains a formidable challenge in modern medicine, necessitating a paradigm shift from passive approaches to integrated, proactive systems. This review article delineates a roadmap for the future of wound care, where advanced technologies function not in isolation but as an interconnected continuum. Aims: This review aims to provide a unified conceptual framework for understanding the evolution and convergence of key technologies—from engineered extracellular matrix (ECM) to intelligent monitoring systems—and to outline the trajectory for future research and clinical translation. **Methods:** A systematic search of PubMed, Scopus, and Web of Science databases was conducted to identify seminal articles in the fields of intelligent synthetic matrices (including stimulus-responsive hydrogels, nano-fibrous scaffolds), wearable sensors and smart patches (for monitoring pH, moisture, temperature, and biomarkers of infection), and clinical data analytics platforms. **Results:** The findings reveal a clear roadmap: Next-Generation Synthetic Matrices: These are no longer passive coverings but function as active biological scaffolds, enabling targeted drug delivery, facilitating cell migration, and promoting tissue regeneration. Wearable Sensors: This technology bridges the critical gap in out-of-hospital care by providing continuous, real-time monitoring of wound status, allowing for early detection of complications (e.g., infection) and timely intervention. Integration and Future Directions: The apex of this roadmap is the convergence of these domains, where an integrated "smart wound dressing" will function simultaneously as a regenerative matrix and an active monitoring-and-treatment system. Preliminary clinical data from AI-powered analytics platforms demonstrate the potential to significantly reduce healing times and costs. **Conclusion:** The future of wound care lies in intelligence and personalization. This review argues that by following this roadmap—where advanced synthetic matrices provide the biological and physical foundation for repair, and wearable sensors add a digital layer of monitoring and control—we can move towards a, predictive, and data-driven paradigm in wound management. This transformation promises accelerated healing, improved patient quality of life, and a reduced burden on healthcare systems.

Keywords:
Smart Wound Dressings ،Wearable Sensors ،Bioactive Scaffolds ،Extracellular Matrix Mimetics ،Digital Health ، Chronic Wound Management ،Personalized Medicine ،Real-Time Monitoring

Code: wtrc12-04530472
Title:

Human Amniotic Membrane as a Regenerative Therapeutic Approach in Managing Resistant Wounds of Epidermolysis Bullosa: A Review Study and Clinical Experiences

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Abstract:
Background: Epidermolysis Bullosa (EB) is a rare and debilitating genetic disorder characterized by extreme skin fragility and chronic wound formation. Managing these wounds represents one of the biggest challenges in dermatology. Human Amniotic Membrane (hAM), due to its unique biological properties, has recently emerged as a promising option in regenerative medicine. This study investigates the efficacy and mechanisms of action of amniotic membrane grafting in EB wound healing. **Methods:** This study was conducted as a systematic narrative review and analysis of clinical experiences. A comprehensive search of PubMed, Scopus, and Google Scholar databases was performed using keywords including "Amniotic Membrane," "Epidermolysis Bullosa," "Wound Healing," and "Regenerative Medicine." Additionally, clinical experiences using hAM in 15 EB patients at our tertiary care center were analyzed. **Results:** The gathered evidence indicates that amniotic membrane transplantation accelerates the healing process of EB wounds. The key identified mechanisms of action include: potent anti-inflammatory properties (reducing TNF-α and IL-6), inhibition of fibrotic scar formation, induction of angiogenesis, and provision of a protective physical barrier. In the studied patients, a significant reduction in pain (78%), frequency of dressing changes (65%), and incidence of secondary infections (85%) was observed. Marked improvement in patients' quality of life, as measured by the QOLEB questionnaire, was also documented. **Conclusion:** Given its multifaceted properties and observed clinical efficacy, human amniotic membrane grafting can be considered a safe and effective therapeutic strategy in the arsenal for managing resistant EB wounds. This approach not only accelerates tissue repair but also significantly enhances the quality of life for these patients by reducing pain and complications. Conducting large-scale randomized controlled trials is recommended to standardize treatment protocols.

Keywords:
Epidermolysis Bullosa ،Amniotic Membrane ،Wound Healing ،Regenerative Medicine ،Chronic Wounds ،Anti-Inflammatory ،Angiogenesis

Code: wtrc12-04920471
Title:

Mitochondrial Regenerative Hydrogel Microneedle Patches for Chronic Wound Healing

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Abstract:

Background: Chronic wounds can be a significant source of suffering and disability for those who experience them. Chronic wounds are typically covered with a layer of hardened skin and necrotic tissue, which significantly reduces the bioavailability of drug delivery due to the presence of various enzymes in the wound environment. Microneedle patches (MPs) contain a series of dissolvable micrometer needles that enable drug delivery to the superficial layer of the skin. When placed on the skin, the needles dissolve within a short time and deliver the drug directly to the epidermal cells. This technology allows for the administration of medication in a dry, painless manner, without the need for injection equipment or medical expertise. The high thermal stability of the medication in dry form eliminates the need for storage and transportation at low temperatures and reduces the risk of contamination. Rescuing or compensating mitochondrial function represents a promising therapeutic avenue for chronic wounds. **Methods:** The present paper is a review study. In this study, 15 articles published from 2018 to 2025, which were in the form of quantitative studies, meta-analysis and original research and systematic review were examined. Entry criteria included: Availability of full text and articles published between 2018 and 2025, and exit criteria included: Case Report studies. The study used the ***Keywords:*** Chronic Wound Healing; Hydrogel Microneedle Patch; Mitochondria. **Results:** MPs can facilitate effective drug delivery by creating micron-sized channels within the skin, thereby enhancing the therapeutic effects of administered drugs or active substances. Given their advantages, including minimal invasiveness, painlessness, and ease of use, micro needle patches have been extensively studied in the field of biomedicine. This study systematically examines the wound healing process, encompassing haemostasis, inflammation, proliferation, and remodeling, along with its implications. It also explores the functionality, types (solid, coated, dissolving, hollow, and hydrogel, and benefits of MPs. Conclusions: Microneedle arrays (MNA) are considered as one of the most promising resources to achieve systemic effects by transdermal delivery of drugs. They are designed as a minimally invasive, painless system which can bypass the stratum corneum, overcoming the potential drawbacks of subcutaneous injections and other transdermal delivery systems such as chemical enhancers, nano and microparticles, or physical treatments. As a trendy field in pharmaceutical and biomedical research, its applications are constantly evolving, even though they are based on very well-established techniques. The number of molecules administered by MNA are also increasing.

Keywords:
Chronic Wound Healing; Hydrogel Microneedle Patch; Mitochondria

Code: wtrc12-02790470
Title:

A Review of NF-κB Pathway Crosstalk in Modulating Inflammation and Immune Responses in NK Cell–Stem Cell Co-Culture Systems

Authors:

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Abstract:
Background: Refractory chronic wounds, notably diabetic foot ulcers (DFUs), represent a major global health and therapeutic burden. They are pathologically defined by a prolonged stall in the inflammatory phase, which is maintained by dysregulated and excessive local immune responses rather than effective resolution. Natural Killer (NK) cells, key components of the innate immunity, although crucial for primary host defense, are implicated in the pathological chronicity of wounds. Their sustained and unchecked production of potent proinflammatory cytokines (e.g., IFN-γ and TNF-α) is largely dictated by the constitutive activation of the central inflammatory hub, the NF-κB signaling pathway, thereby exacerbating local tissue damage. Mesenchymal Stem Cells (MSCs) have emerged as a leading cell therapy candidate due to their potent, broad-spectrum immunomodulatory properties capable of reprogramming the detrimental wound microenvironment toward regeneration. However, the specific paracrine and molecular mechanisms by which MSCs exert this control, particularly in suppressing NK cell-mediated inflammation via direct downregulation of the NF-κB axis, require deeper mechanistic characterization to unlock their full therapeutic potential installed wound healing. **Methods:** This study is a systemic review article by surveying articles of databases and credible scientific websites include science direct, PubMed, Scopus, and with keywords was NF-κB Pathway, Mesenchymal Stem Cells, Natural Killer Cells, Immunomodulation, Chronic Wound Healing, Diabetic Foot Ulcers, and Paracrine Mechanisms during 2015 – 2025. **Results:** The literature consistently demonstrates that co-culture of activated NK cells with human umbilical cord-derived MSCs (hUC-MSCs) significantly attenuated activation. This suppression was molecularly characterized by a striking 60–80% reduction in the nuclear translocation of the p65 NF-κB subunit and a corresponding, dose-dependent decrease in I$\kappaB\alpha$ phosphorylation ($P<0.01$). This foundational blockade correlated directly with a marked downregulation of proinflammatory cytokine secretion (IFN-γ and TNF-α) and significantly impaired cytotoxic degranulation. Mechanistically, the immunosuppressive molecules PGE2 and IDO, actively secreted by the MSCs,were identified as the primary paracrine mediators driving the NF-κB suppression; their pharmacological blockade partially but significantly restored downstream NF-κB activity in NK cells. Furthermore, MSCs were found to critically shift the overall cytokine profile within the wound milieu from a detrimental proinflammatory (Th1-like) state to a beneficial regulatory phenotype, thereby functionally mimicking and accelerating the necessary transition from the chronic inflammatory phase to the successful proliferative phase of healing. **Conclusion:** In summary, our findings comprehensively demonstrate that MSCs potently suppress NK cell proinflammatory activity by directly and effectively blocking the NF-κB signaling cascade, primarily operating through key paracrine mechanisms involving PGE2 and IDO. This powerful immunomodulation facilitates a critical and decisive shift toward an anti-inflammatory microenvironment. The MSC-NK cell axis therefore represents an indispensable, targetable regulatory checkpoint, suggesting a highly promising and novel cell-based therapeutic strategy to resolve chronic inflammation and decisively overcome stalled healing in conditions like DFUs.

Keywords:
NF-κB Pathway, Mesenchymal Stem Cells, Natural Killer Cells, Immunomodulation, Chronic Wound Healing, Diabetic Foot Ulcers, Paracrine Mechanisms

Code: wtrc12-02790469
Title:

A Review of HIF-1α Signaling Pathways in Regulating Hypoxic Responses and Enhancing the Therapeutic Efficacy of Combined NK Cell and Stem Cell Therapy in Burn Wounds

Authors:

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Abstract:
Background: Burn wounds represent a significant global therapeutic bottleneck, primarily complicated by the persistent hypoxic microenvironment that severely compromises cellular viability, dampens effective immune surveillance, and consequently impedes subsequent tissue repair and regenerative success. Hypoxia-inducible factor-1 α (HIF-1 α), a master transcription factor, is central to the cellular adaptation to low oxygen tension. It acts as a critical nodal point in hypoxic pathways, orchestrating a complex, context-dependent response that dynamically balances early inflammation, necessary angiogenesis, and long-term tissue regeneration. The tight regulation of this factor thus presents a unique window for therapeutic intervention. **Methods:** This study is a systemic review article by surveying articles of databases and credible scientific websites include science direct, PubMed, Scopus, and with keywords was HIF-1α, hypoxia, NK cells, stem cells, burn wounds, combined therapy, Therapeutic Bottleneck, Regenerative Success during 2015 – 2025. **Results:** Findings indicate that in the harsh, hypoxic burn microenvironment, HIF-1α activation diverts NK cell energy metabolism toward increased glycolysis (Warburg effect) while sharply reducing oxidative phosphorylation. This metabolic shift, unfortunately, diminishes the critical cytotoxic potential and significantly compromises the production of key anti-inflammatory cytokines (e.g., IFN-γ and GM-CSF). This creates a paradoxical trade-off between maintaining initial antimicrobial defense and facilitating efficient wound healing. Conversely, the strategic hypoxic preconditioning of Mesenchymal Stem Cells (MSCs) leads to a beneficial HIF-1α stabilization. This activation profoundly boosts the secretion of crucial angiogenic factors (e.g., VEGF, FGF) and enhances therapeutic exosome release, which are rich in pro-regenerative cargo, thereby accelerating epithelial regeneration and significantly mitigating detrimental fibrosis. The combined NK cell + stem cell therapy, when judiciously modulated via HIF-1α stabilization (e.g., using small molecules like VHL inhibitors), exhibits powerful synergistic effects: the initial burst of NK cell activity effectively manages acute infection and inflammation, while MSCs provide the scaffolding and paracrine support for long-term repair. Data from murine burn models confirm this clinical advantage, demonstrating a reduction in wound closure time by up to 30% and a decrease in systemic infection rates by 40%. This synergy offers a superior solution over monotherapy approaches. **Conclusion:** In conclusion, the HIF-1α pathway represents a fundamental and exploitable checkpoint for optimizing the next generation of combined cellular therapies in burn wounds. The distinct, yet complementary, roles of HIF-1α in NK cells (metabolic switch) and MSCs (pro-regenerative priming) underscore the complexity of its therapeutic targeting. We recommend an immediate translational focus on Phase II clinical trials specifically evaluating HIF-1α -targeted interventions (e.g., pharmacological stabilizers) to decisively improve the long-term efficacy and patient outcomes.

Keywords:
HIF-1α, hypoxia, NK cells, stem cells, burn wounds, combined therapy, Therapeutic Bottleneck, Regenerative Success

Code: wtrc12-02790468
Title:

A Review of the Role of Cytokines (IL-15, IFN-γ, IL-10) and Exosomes in the Activation of Signaling Pathways Between Natural Killer Cells and Stem Cells for Enhancing Burn Wound Healing

Authors:

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Abstract:

Background: Deep burn injuries are characterized by a protracted inflammatory phase, delayed wound closure, and a high risk of secondary infection, ultimately leading to significant morbidity and unfavorable scar formation. In the initial stages, the innate immune system plays a pivotal role in dictating the trajectory of tissue repair. Natural Killer (NK) cells, as key effectors, are rapidly activated by the inflamed microenvironment (driven primarily by IL-15) and become potent secretors of pro-inflammatory cytokines, most notably Interferon-gamma (IFN-γ). This establishes a positive feedback loop, amplifying destructive inflammation via the JAK/STAT signaling pathway. The continued, unchecked activity of this axis significantly impairs the formation of healthy granulation tissue, perpetuating the non-healing state in severe burns and obstructing the crucial transition to the proliferative phase. Conversely, Mesenchymal Stem Cells (MSCs) possess unique therapeutic capabilities due to their multipotency and profound immunomodulatory capacity. While the suppression mediated by direct cell-to-cell contact and soluble factors (such as PGE2, IDO, and the anti-inflammatory cytokine IL-10) is well-established, recent evidence highlights a critical paradigm shift toward sophisticated cell-free mechanisms.Specifically, MSC-derived Extracellular Vesicles (EVs) and exosomes play a central role in reprogramming NK cell function from a pro-inflammatory to a pro-regenerative phenotype; an effect significantly potentiated by the IFN-γ preconditioning of MSCs, which enhances the targeted loading of immunosuppressive miRNAs and proteins within the released EVs. **Methods:** This study is a systemic review article by surveying articles of databases and credible scientific websites include science direct, PubMed, Scopus, and with keywords was NK cells, MSCs, IL-15, IFN-γ, IL-10, JAK/STAT, Extracellular Vesicles (EVs), Exosomes, Cell-Free Therapy, Immunomodulation, Wound Healing, Angiogenesis conducted during 2015 – 2025. **Results:** In-depth analysis of the selected literature consistently demonstrated that EVs derived from IFN-γ-primed MSCs (IFN-γ-EVs) exhibit significantly superior therapeutic potency compared to their conventional counterparts in suppressing the production of potent pro-inflammatory cytokines, including TNF-α and IL-1β. This enhanced efficacy is likely directly attributable to the specific alterations in EV cargo induced by the priming process. Furthermore, the paracrine signaling mediated by MSC-derived exosomes significantly inhibits the proliferation and cytotoxicity of activated NK cells, thereby reducing the lytic activity (e.g., Granzyme B and Perforin expression) that directly compromises tissue integrity and microvasculature.Collectively, this review highlights the multifaceted therapeutic role of MSC-EVs in accelerating skin wound healing through key mechanisms, including the enhancement of robust angiogenesis by promoting endothelial cell migration, robust immunomodulation of the local immune environment, a significant reduction of oxidative stress via the transfer of antioxidant enzymes, and the favorable regulation of scar formation by modulating local fibroblast behavior. Conclusions: The initial inflammatory axis driven by IL-15 and IFN-γ via JAK/STAT initiates necessary tissue debridement. However, the subsequent, timely intervention by IFN-γ preconditioned MSCs establishes a potent regulatory loop that decisively shifts the balance toward repair. This profound immune suppression and regenerative promotion involve classical soluble factors and, most critically, the paracrine transfer of immunosuppressive Extracellular Vesicles (EVs) and exosomes. The collective evidence strongly positions IFN-γ-preconditioned MSC-EVs as a novel, off-the-shelf cell-free biotherapy with immense clinical potential for effective control of chronic inflammation and marked enhancement of regeneration in acute burn management.

Keywords:

NK cells, MSCs, IL-15, IFN-γ, IL-10, JAK/STAT, Extracellular Vesicles (EVs), Exosomes, Cell-Free Biotherapy, Immunomodulation, Wound Healing, Angiogenesis

Twelfth Yara International Congress of Wound and Tissue Repair

Code: wtrc12-05980467
Title:

Superabsorbent Smart Wound Dressings Containing pH-Sensitive Material

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Abstract:

Wound dressings play a fundamental role in effective wound management and must establish an environment that actively supports the biological processes of tissue repair. chronic wounds or acute wounds that fail to progress through normal healing stages, frequent dressing replacement introduces additional performance demands. These dressings must manage exceptionally high exudate burdens; for example, venous leg ulcers can release exudate loads approaching 12 $L \cdot m^{-2}$ per day, placing severe strain on fluid-handling capacity. Within this evolving clinical landscape, pH-responsive material systems are gaining prominence as an essential advancement in dressing technology, offering the capability to adapt in real time to biochemical changes at the wound interface. Chronic and infected wounds typically exhibit alkaline pH values, often exceeding 7.4 and reaching up to 9, in contrast to healthy skin and acutely healing wounds, which maintain a mildly acidic environment. By integrating stimuli-responsive polymers, halochromic dyes, and nanostructured sensing elements that undergo measurable physicochemical transitions in response to pH fluctuations, these intelligent dressings enable real-time monitoring and on-demand therapeutic modulation. pH-triggered colorimetric indicators provide clinicians with non-invasive visual feedback for early infection detection, while pH-responsive hydrogels and fiber networks regulate critical properties such as swelling, permeability, and drug release, ensuring targeted delivery of antimicrobials only when the wound shifts toward pathogenic alkalinity. Recent advances also highlight the incorporation of conductive and electroactive pH-sensitive composites that support biofilm disruption and accelerate tissue regeneration through controlled ionic interactions. Collectively, these materials not only improve diagnostic precision but also reduce the risk of antibiotic overuse and dressing failure, aligning wound management with both personalized medicine and antimicrobial stewardship. The continued development of biocompatible, stable, and clinically translatable pH-sensitive platforms holds significant promise for enhancing wound outcomes, lowering healthcare burden, and supporting data-driven decision-making in complex wound care. pH-sensitive wound dressings derived from plant materials represent a sustainable and bioactive strategy for managing dynamic wound microenvironments. Many plant constituents—including pectin, cellulose, chitosan analogues from fungal-plant co-culture, anthocyanins, and curcumin—possess inherent or easily tunable pH-responsive behavior, enabling them to serve simultaneously as structural polymers and biochemical sensors. Phytochemical indicators such as anthocyanins extracted from Brassica oleracea, Clitoria ternatea, and berry species undergo predictable, reversible color shifts across clinically relevant pH ranges, providing visible feedback for early detection of infection-associated alkalinization. Concurrently, pH-responsive polysaccharides like pectin and hemicellulose modulate hydrogel swelling, exudate absorption, and permeability, while plant-ourced cellulose nanofibers furnish mechanical integrity and high surface area for pH-triggered delivery of encapsulated antimicrobials. The integration of these materials into composite films and fibrous scaffolds supports responsive drug-release profiles, improved moisture regulation, and intrinsic anti-inflammatory activity without reliance on synthetic additives. However, achieving clinical translation requires addressing batch variability, pigment stability, extraction scalability, and regulatory standardization. Advancing plant-based pH-sensitive systems could not only improve real-time wound diagnostics but also align wound care with principles of biodegradability, patient safety, and low-cost production, offering particular value for decentralized and resource-limited healthcare settings.

Keywords:

Superabsorbent polymer, smart wound dressings, containing pH-sensitive

Code: wtrc12-05390466

Title:

Encapsulation of Chamomile Extract in Tragacanth Nanofibers for Wound Healing Application

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Abstract:

Micro/nanoencapsulation is an effective method to fabricate controlled release systems for wound healing management. In this work, a wound healing system was prepared via encapsulating Chamomile extract in Tragacanth nanofibers using a sonochemical synthesis method. FESEM images indicated successful synthesis of the one-dimensional Tragacanth nanofibers with a thickness of about 66 nm. FT-IR spectra and UV-Vis spectra showed the existence of Chamomile extract in Tragacanth nanofibers with a loading percent of 17.8% and an encapsulation efficiency of 98%. The release behavior of Chamomile extract from Tragacanth nanofibers was studied using UV-Vis spectroscopy, indicating 93.5% release after 24 h. Wound healing performance of the prepared wound healing system studied using the scratch assay indicated a good wound healing activity with a considerable migration rate of fibroblast cells.

Keywords:

Wound Healing, Micro/Nanoencapsulation, Chamomile Extract, Tragacanth Nanofibers, Scratch Assay

Code: wtrc12-04920465
Title:

Hyiodine New Method of Diabetic Defects Treatment

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Abstract:
Background: Hyiodine is a completely new approach to the healing of complicated and chronic wounds. Indications: diabetic ulcers, bed sores (decubitus), deep wounds (sinuses, cavities), wound dehiscence after surgery, venous and arterial ulcers, undermined and infected wounds & difficult–to–heal skin defects. **Methods:** The present paper is a review study. In this study, 12 articles published from 2011 to 2025, which were in the form of quantitative studies, meta-analysis and original research and systematic review were examined. Entry criteria included: Availability of full text and articles published between 2011 and 2025, and exit criteria included: Case Report studies. The study used the Keywords: Wound Healing; Hyaluronic Acid Hyiodine; Dressing. **Results:** Hyaluronic Acid Hyiodine is a product intended for the healing of a wide range of chronic and acute wounds. Its gel-like structure makes it suitable for the healing of very deep wounds, cavities and fistulas. The effectiveness of the product is based on the synergistic effect of hyaluronic acid and iodine. In this product, hyaluronic acid is designed to create a moist wound environment that supports cell migration and survival and removes excess exudate from the wound. Iodine also protects hyaluronic acid from bacterial degradation while protecting the wound. **Conclusions:** Hyiodine is a medical device creating ideal conditions for the successful healing of any wound. The high quantity of hyaluronic acid effectively boosts the natural regeneration of damaged tissues. The iodine complex cleans the wound and protects it from infection. Hyiodine applications: burn wound treatment, post-surgical wound treatment, deep cuts and scrapes treatment, bedsore treatment, diabetic wound treatment. Change the dressing every 24 hours for infected wounds or every 48 hours for non-infected wounds, depending on the condition of the wound.

Keywords:
Wound Healing; Hyaluronic Acid Hyiodine; Dressing

Code: wtrc12-05960463
Title:

Preclinical Evaluation of Decellularized Bovine Articular Cartilage Scaffolds for Treatment of Chronic Diabetic Wounds in BABL/C Mice

Authors:

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Abstract:
Chronic diabetic wounds, such as diabetic foot ulcers, pose a significant health challenge due to their prolonged healing times and high recurrence rates. Conventional treatments are often inadequate, driving interest in advanced therapeutic approaches like biological scaffolds. Decellularized scaffolds, which replicate the extracellular matrix (ECM), have shown potential in promoting tissue regeneration and wound healing. This study evaluated the efficacy of decellularized bovine articular cartilage scaffolds in enhancing wound healing in a preclinical murine model of chronic diabetic wounds. Bovine articular cartilage was decellularized using a combination of chemical and physical processes. The scaffolds were characterized through H and E staining (to assess histomorphological characteristics), FTIR, and SEM analyses to confirm ECM preservation and effective decellularization. Twenty female diabetic BALB/c mice were divided into two groups: a control group (treated with Atrauman Ag® dressings) and an experimental group (treated with decellularized bovine articular cartilage scaffolds). This study examined the effects of decellularization on the structural and chemical properties of the cartilage scaffolds, as well as their impact on wound healing and closure rates in diabetic mice compared to the control group. Mice treated with the decellularized cartilage scaffolds demonstrated a significantly faster wound closure rate (100% closure by day 17) compared to the control group (75% closure by day 17, $P < 0.01$). Histological analysis revealed more organized epidermal regeneration, fibrin deposition, and granulation tissue formation in the scaffold-treated group. SEM and FTIR analyses confirmed the preservation and integrity of the ECM before and after the decellularization process. Decellularized bovine articular cartilage scaffolds significantly enhance wound healing in chronic diabetic wounds by promoting tissue regeneration and reducing inflammation. These findings suggest that such scaffolds represent a promising therapeutic option for the treatment of chronic diabetic wounds
Keywords:
Decellularized scaffolds, Bovine Articular Cartilage, Diabetic Wounds, Wound Healing, Extracellular Matrix, Tissue Regeneration

Code: wtrc12-05960462
Title:

The Synergistic Effects of Hypoxia and Serum Deprivation on Adipose-Derived Mesenchymal Stem Cells and Their Extracted Exosomes – Towards the Production of Purified Natural or Engineered Exosomes for Drug Delivery

Authors:

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Abstract:

Background: Exosomes from adipose-derived mesenchymal stem cells (Ad-MSCs-exosomes) are promising for targeted drug delivery due to their intrinsic properties for controlled drug loading and specific recognition. Environmental manipulation can be applied to enhance their cargo and bioactivity. We aimed to improve the quality and content of Ad-MSCs-exosomes through hypoxia and serum starvation. **Methods:** Mesenchymal stem cells (MSCs) were isolated from human adipose tissue, confirmed by flow cytometry and differentiation staining, and propagated under four conditions: control, hypoxia (H), serum-free (SF), and combined hypoxia/serum starvation (HSF). The effects of various culture conditions were evaluated on total cell count, viability, migration, differentiation potential and apoptosis of Ad-MSCs. After the extraction of exosomes from Ad-MSCs, we examined the morphological characteristics (shape, size, surface topography, distribution), structural properties (aggregation, homogeneity, colloidal particle behavior, surface charge, and stability), chemical features (functional groups and ionic interactions), and biological capacities (total protein concentration and cytotoxicity) of exosomes. **Results:** Ad-MSCs maintained their stemness, morphology, and differentiation potential in all culture conditions (H, SF, HSF, control). While hypoxia and serum starvation alone did not affect total cell count and viability rates of AD-MSCs, their combination in the HSF group significantly reduced the proliferation rate ($P \leq 0.05$). The highest migration of Ad-MSCs and the greatest expressions of CD63, CD81, and CD9 were detected in the HSF group, followed by the H and SF groups ($P \leq 0.05$). Exosomes from Ad-MSCs maintained their round morphology under all conditions but varied in size, homogeneity, aggregation, and stability. Control exosomes were uniform (150–200 nm), while hypoxia produced smaller, clustered vesicles (100–150 nm), and serum starvation yielded the smallest, highly aggregated particles (40–60 nm). The HSF conditions yielded more homogeneous exosomes (60–100 nm) with the lowest Z-average (104.6 nm), best PDI (0.18), and highest stability, as indicated by a markedly negative surface charge (−61.8 mV) ($P \leq 0.05$). FTIR analysis of exosomes under various culture conditions revealed characteristic functional groups, including O-H/N-H (proteins, hydroxylated lipids), C-H (lipids/proteins), C=O (Amide I, alpha-helices), COO^- (amino acids/lipids), C-O/C-O-C/P-O-C (carbohydrates/phospholipids/ nucleic acids), aromatic rings, and phosphate groups. Although the overall chemical profiles were similar, minor shifts in peak positions were observed under H, SF, and HSF groups, indicating subtle changes in exosome composition. **Conclusion:** Preconditioning Ad-MSCs with hypoxia and serum deprivation synergistically enhances exosome biogenesis and bioactivity. This approach facilitates the production of purified nanoparticles for use in next-generation cell-free therapies, controlled drug delivery, and targeted diagnostics and treatments.

Keywords:

Adipose-derived mesenchymal stem cells, Exosomes, Hypoxia, Serum starvation, drug delivery

Code: wtrc12-05800460
Title:

The Effect of Exosomes on Burn Wound Healing

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Abstract:
Background: Wounds are a type of tissue injury that may occur intentionally or unintentionally, affecting the skin and leading to disruption or abrasion of its surface. Among different types of wounds, burn injuries are considered one of the major clinical challenges due to extensive tissue damage, inflammation, severe infections, and the prolonged healing process; therefore, their treatment is complex and may be time-consuming. Various methods have been introduced for the treatment of burn wounds, one of which is the use of exosomes. Exosomes are nanoscale extracellular vesicles secreted by different cell types and have been proposed as a novel therapeutic approach in tissue repair. This review study was conducted with the aim of investigating the effect of exosomes on burn wound healing, in order to take an important step toward developing effective strategies for burn wound repair. **Methods:** In this review study, the databases PubMed, Google Scholar, Magiran, and SID were used to search for English and Persian articles. The keywords used included "exosome," "healing," and "burn wound." The search period was considered from 2015 to 2025. A total of 3,220 initial articles were identified. After reviewing the titles and removing unrelated studies, 204 articles were selected for further evaluation. Finally, after full-text assessment and elimination of duplicate articles, 20 studies were included in the review. **Results:** This review study showed that exosomes derived from various cell types, including mesenchymal stem cells, umbilical cord cells, keratinocyte cells, and even blood cells, have considerable ability to improve the healing of burn wounds. In addition, exosomes accelerate the healing process by reducing hyperactive burn-induced inflammation, increasing angiogenesis, increasing the proliferation of reparative cells, and improving collagen organization. The presence of active miRNAs (such as miR-762 and miR-181) plays an important role in these effects. Recent studies have also shown that the use of carriers such as hydrogels increases the effectiveness of exosomes at the wound site. **Conclusion:** Exosomes, as novel therapeutic agents, activate various mechanisms involved in the healing of burn wounds; they accelerate the recovery process by enhancing epithelialization, angiogenesis, and tissue regeneration, as well as by reducing inflammation. The use of engineered exosomes or their combination with biomaterials can further increase their therapeutic efficacy. The existing evidence showed that the use of exosomes is a new and promising therapeutic approach for burn wounds, which can reduce the limitations associated with traditional cell-based treatments. Most of this evidence is still limited to animal models, and there is a need for standard and reliable clinical studies and precise dose evaluation in humans. Therefore, it is recommended that specialists investigate the clinical application of exosomes in burn patients, as this may represent a useful step toward improving burn wound treatment and enhancing patients' quality of life.

Keywords:
Exosome, Healing, Burn wound

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Code: wtrc12-05800458
Title:

The Effect of Massage on Skin Rejuvenation and Blood Circulation

Authors:

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Abstract:
Background: The skin, as one of the most important organs of the body, plays a vital role in protecting the body against environmental factors, regulating body temperature, sensory perception, homeostasis, and maintaining the balance of water and electrolytes. With increasing age, the skin undergoes a reduction in capillary blood flow, decreased production of collagen and elastin, reduced natural moisture, and aging signs such as wrinkles, decreased radiance, and softness. There are various methods for skin rejuvenation and skin care, and one of these methods is skin massage. This review study was conducted to examine the effect of massage on rejuvenation and increase skin blood perfusion, to take an important step toward developing effective methods for skin rejuvenation and improving individuals' aesthetic appearance. **Methods:** In this review study, the databases PubMed, Google Scholar, Magiran, and SID were used to search for English and Persian articles. The keywords used included "skin," "massage," "rejuvenation," and "blood perfusion." The search period was considered from 2015 to 2025. In total, 1,600 initial articles were identified. After reviewing the titles and removing unrelated articles, 66 articles were selected for further evaluation. Finally, after full-text review and elimination of duplicate articles, 11 articles were included in the study. **Results:** This review study showed that massage, as one of the non-invasive methods, improves the delivery of oxygen and nutrients to skin cells and accelerates the removal of waste products by increasing blood perfusion and stimulating cellular regeneration, and has a significant effect on skin health and rejuvenation. In addition, these processes enhance the production of collagen and elastin, which are the main proteins of the skin, and increase skin elasticity and firmness, and reduce wrinkles. Moreover, combining massage with other complementary methods and using beneficial compounds can further increase its effect on skin rejuvenation. Numerous studies have shown that massage, by increasing blood flow and perfusion to tissues, can be highly effective in improving beauty and enhancing skin brightness and complexion. Recent research has also shown that the use of oils and moisturizing creams containing compounds such as jojoba oil, argan oil, or creams containing antioxidants can enhance the effect of massage on improving skin quality, and that combining massage with other non-invasive methods such as exfoliation, carboxytherapy, HIFU therapy, and PRP are another approach that can play a role in skin rejuvenation. **Conclusion:** The massage, as a natural, non-invasive, safe, and low-cost method, can be an effective adjunct in skin care programs and, through physiological stimulation of blood circulation, can help improve skin health and beauty. Therefore, holding workshops and training courses by specialists for personnel working in the field of skin health and beauty, to teach different massage techniques, their benefits and effects, and their combination with complementary methods for improving, preserving skin quality, and rejuvenating it, can be very beneficial. As a result, it is recommended that this method be implemented in clinics and beauty and skin care centers in combination with other methods, in order to take an effective step toward improving skin beauty and health and increasing individuals' self-confidence.

Keywords:
Keywords: Skin, Massage, Rejuvenation, Blood circulation

Code: wtrc12-05200457
Title:

Management of Refractory Ischemic Wounds in Patients with Long-Term Raynaud's Phenomenon and Systemic Scleroderma using Multimodal Regenerative Therapy: A Case Report

Authors:

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Abstract:

Background: Raynaud's phenomenon and systemic sclerosis are chronic autoimmune disorders characterized by severe vasculopathy, frequently leading to refractory ischemic ulcers of the lower extremities. These ulcers exhibit progressive tissue ischemia, vasculitis, and vasospasm and are often resistant to conventional therapies including prostaglandins, vasodilators, and antiplatelet agents. Failure of standard medical management significantly increases the risk of gangrene and major amputation. This case report aims to describe the clinical course of an extremely severe and treatment-resistant ischemic ulcer in a patient with long-standing Raynaud's phenomenon and suspected systemic sclerosis, and to evaluate the efficacy and limitations of a multimodal regenerative approach combining ozone therapy and micronized adipose-derived stem cells after failure of conventional treatments and major amputation of the contralateral limb. **Case Report:** A 70-year-old female with a 25-year history of Raynaud's phenomenon and suspected systemic sclerosis presented with chronic painful ischemic ulcers on both feet for 15 years. Despite long-term treatment with analgesics, multivitamins, aspirin, pentoxifylline, losartan, and tadalafil, the ulcers progressively worsened. Over the past three years, she required multiple hospitalizations and repeated intravenous alprostadil infusions without sustained response. Recent alprostadil administration was followed by rapid extension of necrosis from the toes to the plantar surface. Due to wet gangrene of the second toe of the right foot and extensive necrosis with severe infection, left below-knee amputation was performed. After discharge, the patient was referred to our specialized wound clinic. Examination of the remaining right foot revealed multiple ischemic ulcers with exposed tendons. A multimodal regenerative protocol was initiated, consisting of ozone therapy, collagen dressings, silver-based antimicrobials, micronized adipose-derived stem cell application, and advanced moist wound dressings. Peripheral ulcer margins demonstrated satisfactory healing, and the tendon-exposed area was successfully covered with micronized stem cells. Regular vascular and rheumatology consultations were maintained throughout treatment. **Conclusion:** This case highlights the devastating progression of ischemic ulcers in long-standing Raynaud's phenomenon and suspected systemic sclerosis despite aggressive conventional therapy, culminating in major amputation. The integration of ozone therapy and micronized adipose-derived stem cells within a multimodal regimen achieved partial but clinically meaningful wound improvement and prevented further amputation in the remaining limb. Early referral to specialized wound centers and adoption of novel regenerative modalities are essential in high-risk autoimmune vasculopathy patients. Larger case series and controlled studies are needed to establish evidence-based protocols.

Keywords:

Sclerosis, Raynaud's Phenomenon, Ischemic Ulcer

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Code: wtrc12-05200456
Title:

Effective Use of Injectable and Micronized Stem Cells in Post-Mammoplasty Wound Healing: A Report of Three Clinical Cases

Authors:

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Abstract:
Background: Wound healing complications following mammoplasty remain a significant clinical challenge, often resulting in prolonged recovery, necrosis, dehiscence, and unsatisfactory aesthetic outcomes. Conventional treatments frequently fail to achieve optimal results. Stem cells, owing to their differentiation potential and secretion of multiple growth factors, can accelerate tissue regeneration, modulate inflammation, reduce infection risk, and promote angiogenesis. This case series aimed to evaluate the clinical efficacy and safety of injectable and micronized adipose-derived stem cells in the management of complex post-mammoplasty wounds. **Case Reports:** Case 1: A 36-year-old female (BMI 28) with a history of one cesarean section underwent mammoplasty for removal of multiple bilateral breast cysts. Postoperatively, she developed significant wound dehiscence and localized necrosis with a 20-cm sinus tract in the right breast. Treatment was initiated with injectable adipose-derived stem cells administered every other day for 20 sessions. Progressive granulation tissue formation, reduced exudate, and complete wound closure were observed. The patient reported full satisfaction with the aesthetic and functional outcome. Case 2: A 48-year-old female with no chronic comorbidities underwent combined mammoplasty and subsequently developed necrosis and limited infection of the areola. She received micronized stem cell injections over 12 sessions, resulting in remarkable wound improvement and gradual restoration of normal breast contour. Case 3: A 47-year-old female developed scar formation and necrosis following reduction mammoplasty for breast ptosis correction. Micronized stem cell therapy was applied in 8 sessions, leading to satisfactory tissue regeneration and significant aesthetic improvement. **Conclusion:** Injectable and micronized adipose-derived stem cell therapy proved to be a safe and highly effective modality for managing complicated post-mammoplasty wounds. This approach significantly shortened healing time, resolved necrosis and infection, and achieved successful tissue reconstruction with excellent cosmetic results in all three cases. It can be considered a promising adjunctive treatment for refractory post-mammoplasty wounds. Larger prospective studies with long-term follow-up are recommended to confirm these findings and establish standardized protocols.

Keywords:
Stem cells, Mammoplasty, Wound Healing, Necrosis, Tissue Regeneration

Code: wtrc12-04170455
Title:

A Physiology-Guided Protocol for Ischemic Diabetic Foot Ulcers: Augmenting Perfusion through Negative Pressure Wound Therapy Followed by Bioactive Nanocellulose Closure

Authors:

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Abstract:

Background: The management of ischemic diabetic foot ulcers (DFUs) presents a therapeutic impasse. Revascularization is the cornerstone, but microvascular perfusion often remains compromised. This series evaluates a structured protocol combining revascularization, negative pressure wound therapy (NPWT) to enhance perfusion and granulation, and bacterial nanocellulose (BNC) grafting to expedite epithelialization. **Methods:** Seven patients with ischemic DFUs (University of Texas Grade 2D/3D) and successful revascularization (post-procedural $TcPO_2 \geq 30$ mmHg) were treated. Following sharp debridement, NPWT was applied at -125 mmHg with instillation for 2-3 weeks. Upon achieving robust granulation (≥90% wound bed coverage), therapy was transitioned to a BNC graft until complete epithelialization. **Results:** The protocol resulted in consistent and rapid healing. NPWT induced a mean wound area reduction of 68% ± 12% and significantly improved bed perfusion, as evidenced by increased bed color and capillary refill. Subsequent BNC grafting achieved complete epithelialization in a mean of 14.2 ± 3.1 days. The mean total healing time from post-revascularization was 45.6 ± 8.5 days. No major adverse events were recorded. **Conclusion:** For revascularized ischemic DFUs, a sequential protocol of NPWT and BNC grafting is highly effective. NPWT acts as a "perfusion amplifier" and granulation stimulus, while BNC provides an ideal scaffold for rapid epithelial closure. This synergistic approach can significantly improve outcomes in complex wound management.

Keywords:

Negative Pressure Wound Therapy, Bacterial Nanocellulose, Diabetic Foot Ulcer, Ischemic Wound, Perfusion Augmentation, Wound Healing Protocol, Regenerative Medicine, Bioactive Dressing, NPWT, BNC Grafting

Code: wtrc12-05410454
Title:

Clinical Outcomes of Bacterial Nanocellulose wound dressing in Elderly Patients with Diabetic Foot Ulcers: Case Series

Authors:

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Abstract:

Background: Diabetic foot ulcers (DFUs) remain a major therapeutic challenge, particularly in older adults who are not suitable candidates for surgical grafting because of medical comorbidities or psychosocial and financial constraints. Bacterial nanocellulose (BNC) has emerged as a promising low-invasive dressing due to its biocompatibility, moisture regulation, and structural stability. This case series reports the clinical outcomes associated with BNC application in three elderly patients with chronic or advanced DFUs who were unable or unwilling to undergo surgical graft procedures. **Methods:** Three patients aged >60 years with type 2 diabetes and poorly controlled glycemia were included. All infections had been treated prior to the initiation of BNC therapy, and complete wound-bed preparation was ensured through debridement, modern dressings, and Negative pressure wound therapy (NPWT) when indicated. A non-medicated BNC graft was applied to each wound. During the first six days, BNC was covered with foam; thereafter, only sterile gauze was used. Patients were instructed on home-based dressing changes and on the gradual removal of the graft as it dried. No additional adjunctive wound therapies were administered during follow-up. **Results:** All three wounds achieved full epithelialization. •Case 1: A 10×10 cm plantar ulcer in a patient with prior five-toe amputation healed within approximately 30 days. •Case 2: A 2×8 cm dorsum ulcer with 2 cm depth following fasciotomy and single-toe amputation healed in about 20 days. •Case 3: A chronic 5×5 cm heel ulcer with a 10-year history of nonhealing likewise achieved complete closure under the same treatment protocol. No episodes of recurrent infection or hospital readmission occurred. After the first week, all patients were able to manage wound care independently, resulting in fewer clinic visits. The regenerated tissue demonstrated early stability and visual characteristics comparable to surrounding skin. **Conclusion:** BNC grafting may represent a viable low-invasive treatment option for elderly DFU patients who are not candidates for surgical grafting. In this small cohort, BNC use was associated with timely healing (20–30 days), reduced clinical workload, and the formation of tissue with favorable early biomechanical properties. Larger controlled studies are required to assess comparative effectiveness and longer-term durability.

Keywords:

Diabetic Foot Ulcer ،Bacterial Nanocellulose ،Wound Healing

Code: wtrc12-04170453
Title:

Blister Roof Preservation with Controlled Drainage and Bacterial Nanocellulose: A Paradigm Shift in Large Burn Bullae Management

Authors:

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Abstract:
Background: Traditional management of large serous burn blisters frequently involves deroofing, despite the blister roof serving as a natural biological barrier. This study evaluates a novel protocol combining controlled drainage with bacterial nanocellulose (BNC) dressing to preserve the blister roof and optimize healing. **Methods:** Five patients with large serous burn blisters (12-25 cm²) were treated using a standardized protocol: 1) Antisepsis with 0.1% polyhexanide solution; 2) Sterile controlled drainage via single puncture with blister roof preservation; 3) Application of BNC dressing with 5-day wear time; 4) Secondary non-adherent dressing secured with bordered foam. Outcomes included healing time, pain scores (NRS), infection rates, and need for additional interventions. **Results:** The protocol demonstrated consistent success across challenging scenarios including facial burns, patients with immunosuppression, and friction-prone anatomical locations. All preserved blister roofs remained adherent and viable, with complete re-epithelialization achieved within 14-21 days (mean 16.8 days). Pain scores decreased significantly from mean 8.2 to 1.6 by day 5. No infections occurred, and 90% of cases required only single BNC application. **Conclusion:** This integrated approach of controlled drainage and BNC reinforcement represents a paradigm shift in burn blister management. By preserving the natural biological barrier while providing optimal moisture balance and microbial protection, this protocol facilitates rapid epithelialization, eliminates infection risk, and dramatically improves patient comfort. The consistent outcomes across complex cases challenge the conventional practice of routine deroofing and establish a new standard for conservative burn bullae management.

Keywords:
Burn Blisters, Blister Roof Preservation, Bacterial Nanocellulose, Controlled Drainage, Re-epithelialization, Burn Care

Code: wtrc12-04170452
Title:

The Point of No Return: How Ill-Timed Debridement Triggered a Cascade toward Amputation in a Diabetic Heel Ulcer despite Successful Revascularization

Authors:

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Abstract:
Background: The management of diabetic heel ulcers demands meticulous assessment and strategic timing of interventions. The consequences of procedural missteps in this vascularly compromised territory can be irreversible, particularly when collateral circulation is disrupted in patients with pre-existing limb loss. **Case Presentation:** A 72-year-old male with longstanding type 2 diabetes (HbA1c 9.2%), stage 4 chronic kidney disease, and a history of contralateral transmetatarsal amputation presented with a rapidly deteriorating heel ulcer. The wound had been subjected to extensive surgical debridement at an outside facility without prior vascular imaging, resulting in exposure of 60% of the calcaneal surface and rapid progression to gangrenous changes in the surrounding tissue within 96 hours. Intervention: Our multidisciplinary limb salvage team implemented a comprehensive protocol: (1) Immediate vascular imaging revealing critical tibial artery disease with compromised collateral flow; (2) Urgent endovascular revascularization achieving technical success with restored flow to the pedal arch; (3) Advanced imaging confirming extensive calcaneal osteomyelitis with necrotic involvement of the entire posterior calcaneal tuberosity; (4) Multidisciplinary assessment concluding that despite restored macrovascular flow, the structural and functional integrity of the heel was irrecoverable due to the extent of bone destruction. **Results:** Post-revascularization perfusion improved significantly (ABI increased from 0.3 to 0.85), with palpable dorsalis pedis and posterior tibial pulses. However, the heel tissue remained non-viable with progressive necrosis extending to the Achilles tendon insertion. The calcaneal destruction was so extensive that even with potential soft tissue coverage, functional weight-bearing capacity was irrevocably lost. After thorough discussion with the patient and family, elective transtibial amputation was performed. The patient achieved successful prosthetic fitting and returned to ambulatory status with a walker. **Conclusion:** This case establishes critical management principles: First, vascular assessment must be mandatory before any debridement in diabetic heel wounds, especially in patients with contralateral amputation who depend on collateral circulation. Second, the timing of debridement is as crucial as the technique—disrupting collateral vessels can create irreversible damage despite subsequent revascularization. Finally, when bone destruction reaches a critical threshold, successful revascularization alone cannot guarantee limb salvage, and well-timed amputation represents appropriate, patient-centered care that prioritizes functional recovery over biological preservation at all costs.

Keywords:
Diabetic Heel Ulcer, Critical Limb Ischemia, Surgical Debridement, Calcaneal Osteomyelitis, Contralateral Amputation, Limb Salvage, Revascularization

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Code: wtrc12-04850450
Title:

Self-Care Education and Patient Empowerment Strategies for Wound Healing: A Systematic Review of Nursing Approaches

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Abstract:
Background: Effective self-care by patients is a cornerstone of chronic wound management. Nursing-led education and empowerment interventions aim to improve adherence to dressing regimens, glycemic control, and timely reporting of complications. Therefore, in this systematic review synthesized contemporary evidence on nursing approaches that enhance patient self-care and thereby improve wound outcomes. **Methods:** In this systematic review, an extensive search was conducted with keywords related to "wound," "self-care," "patient education," "empowerment", "nursing," in international databases PubMed/Medline, Web Of Science Core Collection, Scopus, Google Scholar search engine and national databases SID, Magiran, Irandoct. The initial search yielded 1682 studies. Inclusion criteria were Articles published between 2020 and 2025 in English or Persian, full-text availability, human studies, and studies with primary data examining nursing-led education or empowerment interventions with measurable wound outcomes. Exclusion criteria included: review articles, conference abstracts, letters, editorials, grey literature, animal studies, duplicated records, and studies lacking objective wound outcomes. Ultimately, 31 studies were analyzed. Ethical considerations of non-bias were observed in the stages of selection, extraction, analysis, and classification of evidence, and the abstract was reported according to PRISMA. **Results:** A review of studies showed that most of the studies conducted were quasi-experimental. Populations included diabetic foot ulcer patients, pressure injury patients, and mixed chronic-wound cohorts. Study sizes ranged from 40 to 520 participants. Intervention components fell into three domains: (1) structured face-to-face education + printed materials; (2) multimodal education (videos, apps, tele-follow up); and (3) empowerment frameworks (motivational interviewing, self-efficacy coaching). Primary outcomes: adherence to dressing and off-loading protocols improved by 20–45% across interventions; healing time shortened (median reductions reported 10–35% in chronic wound cohorts); recurrence or unplanned readmissions decreased by 15–30% in studies with ≥6-month follow-up. Tele-delivered education (synchronous or app-based) achieved similar adherence gains as face-to-face in several studies, with improved access but greater variability in older cohorts. In quality appraisal 7 studies low risk, 5 studies some concerns (allocation or attrition). Nonrandomized studies had moderate bias chiefly from confounding. **Conclusion:** According to the findings, it seems Nursing-led education and empowerment strategies reliably improve self-care behaviors and are associated with faster healing and reduced complications. For clinical implementation, we recommend a tiered model: baseline face-to-face education at discharge, supplemented by an accessible digital follow-up (photo upload and nurse review) and targeted motivational interviewing for low-adherence patients. Future research should prioritize large multicenter RCTs measuring patient-centered outcomes and cost-effectiveness, and ensure inclusion of Persian-language validation studies for digital tools.

Keywords:
Self-care, Patient Education, Nursing, Chronic Wounds, Tele-education, Systematic Review

Code: wtrc12-05860449
Title:

Nanotechnology in Tissue Regeneration and Targeted Cancer Therapy: A Review

Authors:

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Abstract:
Nanotechnology has gained increasing importance in regenerative medicine and targeted cancer therapy, providing advanced nanoscale scaffolds and delivery systems that enhance tissue repair and improve the precision of therapeutic interventions while reducing damage to healthy tissues. This review evaluated studies published between 2018 and 2024, focusing on the use of nanoparticles, nanofibers, hydrogels, and multifunctional nanocarriers in tissue engineering and oncology. Databases such as PubMed, ScienceDirect, and SID (Scientific Information Database) were searched using terms including “nanotechnology,” “tissue regeneration,” “drug delivery,” “cancer therapy,” and “nanocarriers,” with attention to biocompatibility, targeted delivery mechanisms, and stimuli-responsive platforms. Evidence from the selected literature demonstrates that nanomaterials support tissue regeneration by mimicking extracellular matrix structures, improving cellular attachment, and enabling sustained release of growth factors essential for healing. In cancer therapy, nanoparticles contribute to both passive and active targeting strategies, increasing localized drug accumulation in tumors and reducing systemic toxicity. The development of theranostic systems-nanoparticles capable of integrating imaging and treatment-further highlights their value in guiding personalized therapeutic approaches and monitoring treatment outcomes in real time. However, challenges such as manufacturing scalability, long-term biocompatibility, and regulatory standardization continue to limit clinical translation. Overall, nanotechnology presents significant potential for developing precise, minimally invasive, and patient-specific therapeutic solutions in both regenerative medicine and oncology. Continued interdisciplinary collaboration, adherence to standardized evaluation methods, and careful ethical consideration are essential for advancing these technologies and facilitating their safe and effective integration into clinical practice.
Keywords:
Keywords: Nanotechnology, Tissue Regeneration, Cancer Therapy, Nanocarriers, Drug Delivery

Code: wtrc12-02760448
Title:

In Vivo Study of Antioxidant and Anti-Inflammatory Activity of Metabiotic Extracted from Lactobacillus Acidophilus Bf-P-064 in Ethanol-induced Peptic Ulcer

Authors:

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Abstract:
Background: Metabiotic are promising candidates for Peptic ulcer (PU) healing by regulating the expression of pro-inflammatory genes and antioxidant capacity. **Methods:** We prepared metabiotic by culturing Lactobacillus acidophilus BF-P-064 and evaluated the cytotoxicity and antioxidant properties of it by MTT and DPPH methods. To investigate the potential of PU healing, we divided 45 rats into 3 groups and induced PU by administering ethanol. The negative-control group was not treated, while the positive-control and metabiotic groups received treatment with drug and metabiotic. On different days, the wound area was determined and the histopathological characteristics were evaluated by H&E staining. The expression of pro-inflammatory cytokines (IL-6, PDGF, VEGF, EGF, TGF-β, and TNF-α) and antioxidant (SOD and GPx) genes was assayed by qRT-PCR method. **Results:** Our results showed that the metabiotic at a concentration of 60 mg/mL hadn't cytotoxic effects on the CaCo2 cell line and its antioxidant capacity was 72.49 u/mL. Metabiotic caused faster wound contraction. By accelerating the infiltration of phagocytic cells, the inflammatory phase began with greater intensity. By increasing the expression of pro-inflammatory cytokines, as well as the antioxidant property and the expression of SOD and GPx, metabiotic prevented the induction of oxidative stress in the tissue. So, the proliferation phase started faster and the healing process improved. **Conclusion:** The metabiotic extracted from L. acidophilus BF-P-064 can improve the healing process of PU by increasing the antioxidant capacity and improving the pattern of cell infiltration and the expression of pro-inflammatory cytokines.
Keywords:
Metabiotic, Lactobacillus Acidophilus, Peptic Ulcer, Antioxidant

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Code: wtrc12-02760445
Title:

Antiulcerogenic Effect of Essential Oil Extracted from Satureja Khuzestanica against Ethanol-induced Gastric Ulcer In a Rat Model

Authors:

Ghasem Farjani-kish [1], Rika Almasian [2], Parvaneh Jafari [2], Hassan Noorbazargan [3], Nima Dehdashti [1]

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Abstract:
Background: One of the most frequent and dangerous chronic disorders of the gastrointestinal tract is gastric ulcer. Carvacrol (5-isopropyl-2-methylphenol) is an anti-oxidant ingredient found in the essential oils of many aromatic plants used for treatment of gastrointestinal disorders. In the present study, we evaluated the therapeutic effects of Satureja khuzestanica essential oil (with carvacrol as its primary compound) on ethanol-induced gastric ulcer in male Wistar rats and assessed the expression of genes involved in the healing of ulcer lesions. **Methods:** Gastric ulcers were induced with ethanol (98%) treatment in rats. The rats were randomized into three groups of 15 rats per group including control, sucralfate, omeprazole, and magnesium-aluminum-treated rats, and essential oil-treated rats. The essential oil was purchased and was not extracted. The healing was assayed by histological analysis and quantitative real-time PCR was conducted to assess platlate growth factor (PDGF), superoxide dismutase (SOD), glutathione peroxidase (GPX), and epidermal growth factor (EGF) genes expression. **Results:** Carvacrol up-regulated the expression levels of fibroblast and epidermal growth factors genes as well as the mRNA expression of antioxidant enzyme genes; also, it accelerated the growth of fibroblast cells and induced accumulation of neutrophils and macrophages in the ulcer area. It also can stimulate and induce gastric ulcer healing in rats via promoting the angiogenesis process. **Conclusion:** The current investigation introduces carvacrol as a proper candidate for the treatment of gastric ulcers. Further studies are required to explore the mechanism of action of carvacrol in ulcer healing and changes in histopathological factors of gastric ulcers.

Keywords:
Gastric Ulcer, Satureja Khuzestanica, Carvacrol

Code: wtrc12-04500443
Title:

Successful Healing of a Chronic Venous Leg Ulcer in an Elderly Patient Using Combined Compression Therapy: A Case Report

Authors:

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Abstract:
Background: Venous leg ulcers are caused by venous insufficiency and impaired blood return through the leg veins in patients. The prevalence of these ulcers is higher in elderly patients due to the presence of underlying diseases and predisposing factors for ulcer development. Due to the difficulty of treating chronic venous leg ulcers and the low rate of successful treatment in these patients, accurate reporting of similar cases is essential for healthcare providers to improve management strategies. Material and **Methods:** The patient is an 84-year-old female complaining of a venous ulcer that had been present for around 2.5 years on her medial malleolous of her lower leg. The patient never had peripheral vascular disease, lipodermatosclerosis, chronic obstructive pulmonary disease, severe aortic stenosis, and chronic lymphedema of her legs for many years. Her ankle/brachial index showed normal values at 1.01 for her right side and 1.08 for her left side. After referral and examination by wound specialists, sharp debridement was performed to remove necrotic tissue from the patient's wound. Low-dose ozone therapy was performed to induce fibrinolytic activity and induce microvascularization in this patient. Due to the risk of increased cardiac afterload in this patient due to stenosis of the aorta valve, in addition to the use of conventional dressings for wound healing, the patient was treated with combined compression therapy to maintain venous flow in the leg. A 4-layer Jones bandage was used every week and a zigzag bandage every 2 weeks for this patient by the wound therapist. This treatment regimen and patient follow-up were maintained for a period of 2 months until the desired clinical outcome was achieved. **Results:** As a result of the combined compression therapy used by the wound specialist to maintain venous blood flow in this patient and the use of conventional dressings, this patient's venous ulcer, which had not progressed for 2.5 years, was effective, and this patient's venous leg ulcer was healed within a 2-month treatment process. **Conclusion:** Treatment of venous leg ulcers in the elderly, due to the presence of other underlying diseases, requires interventions that best guide the wound treatment process of patients according to their underlying problems. As observed, the use of combined compression therapy with 4-layer Jones and zigzag bandages was effective in treating this ulcer, which is consistent with the results of some studies, but more research is needed in this regard to achieve an effective treatment strategy in these patients.

Keywords:
Compression Therapy, Venous Leg Ulcer, Wound Management

Code: wtrc12-04850441
Title:

Rehabilitation-Based Functional Interventions to Enhance Wound Tissue Repair: A Systematic Review

Authors:

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Abstract:
Background: Rehabilitation strategies have emerged as essential components in the management of chronic wounds, particularly through their impact on circulation, mobility, muscular activation, and functional independence. Despite increasing evidence, a comprehensive synthesis of rehabilitation-focused interventions influencing wound tissue repair has not been fully addressed in recent years. **Methods:** This systematic review evaluates functional rehabilitation approaches used between 2020 and 2025 and their clinical effects on chronic wound healing. Methods :In this systematic review, an extensive search was conducted with keywords related to "rehabilitation," "functional exercises," "wound healing," "tissue repair," and "chronic wounds", in international databases PubMed/Medline, Web Of Science Core Collection, Scopus, Google Scholar search engine and national databases SID, Magiran, Irandoct. The initial search yielded 1432 studies. Inclusion criteria were Articles published between 2020 and 2025 in English or Persian, full-text availability, human studies, observational or interventional designs, and direct measurement of wound-healing outcomes following rehabilitation based interventions. Exclusion criteria included: review articles, conference abstracts, letters, editorials, grey literature, animal studies, duplicated records, and studies lacking defined wound outcome measures. Ultimately, 24 studies were analyzed. Ethical considerations of non-bias were observed in the stages of selection, extraction, analysis, and classification of evidence, and the abstract was reported according to PRISMA. **Results:** Patient populations included individuals with diabetic foot ulcers, venous leg ulcers, pressure injuries, and ischemic wounds. Interventions most commonly reported included: lower-limb strengthening, controlled weight-bearing activities, aerobic conditioning, ankle mobility training, neuromuscular electrical stimulation (NMES), balance exercises, and circulation-enhancing protocols. Across studies, rehabilitation significantly improved tissue oxygenation, peripheral perfusion, and limb function. NMES facilitated collagen synthesis and reduced healing time in neuropathic ulcers. Gradual functional loading improved plantar pressure distribution, reducing recurrence risk in diabetic foot ulcers. Aerobic walking programs enhanced microvascular responsiveness and decreased inflammatory markers. For pressure injuries, structured repositioning training combined with mobility restoration reduced wound depth and surface area. Studies consistently emphasized that rehabilitation was most effective when conducted alongside standardized nursing wound-care practices. **Conclusion:** Rehabilitation-based functional interventions play a clinically meaningful role in accelerating wound healing and preventing recurrence. Integrating structured exercise therapy, mobility restoration, and circulation-enhancing programs into multidisciplinary wound management can optimize healing outcomes. Large-scale randomized trials evaluating combined rehabilitation–nursing models are recommended.

Keywords:
Rehabilitation, Functional Exercises, Chronic Wounds, Tissue Repair, Mobility, Systematic Review

Code: wtrc12-04850440
Title:

Lifestyle Determinants of Chronic Wound Healing: A Systematic Review of Modifiable Behavioral Factors

Authors:

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Abstract:
Background: Chronic wounds remain a global challenge with increasing economic and clinical burden. Lifestyle behaviors—including nutrition, physical activity, sleep quality, stress management, and tobacco use—have been recognized as potentially modifiable determinants of wound repair. This systematic review aimed to synthesize recent findings regarding the role of lifestyle patterns in chronic wound healing. **Methods:** In this systematic review Databases including MEDLINE, PubMed, Scopus, Web of Science Core Collection, Google Scholar, SID, Magiran, and IranDoc were searched using controlled MeSH terms and keywords such as "lifestyle," "wound healing," "behavioral factors," and "chronic wounds." The initial search yielded 1864 studies.Inclusion criteria were Articles published between 2020 and 2025 in English or Persian, full-text availability, human studies, observational or interventional designs, direct evaluation of lifestyle components on wound-related outcomes. Exclusion criteria included: review articles, conference abstracts, letters, editorials, grey literature, animal studies, duplicated records, and studies without clear wound-healing outcomes. Ultimately, 12 studies were analyzed. This review followed PRISMA guidelines. **Results:** Most studies included adults or older adults with pressure injuries, diabetic foot ulcers, or venous leg ulcers. Across studies, improved nutrition—especially protein intake, micronutrients (zinc, vitamin C), and anti-inflammatory dietary patterns—was consistently associated with enhanced tissue repair. Moderate physical activity improved peripheral circulation and reduced time to wound closure in patients with diabetes and vascular disease. Adequate sleep duration (>7 hours/night) correlated with improved immune function and faster epithelialization. Stress reduction interventions, including mindfulness-based strategies, contributed to improved inflammatory responses. Smoking cessation was strongly linked to accelerated granulation tissue formation. Overall, lifestyle modification was most effective when combined with nursing supervision and multidisciplinary wound care. **Conclusion:** Evidence from 2020–2025 indicates that lifestyle factors play a significant modifiable role in chronic wound healing. Integrating structured lifestyle counseling into wound-care protocols—especially programs addressing nutrition, activity, sleep, smoking cessation, and stress—can meaningfully enhance healing outcomes. It is recommended Future research focus on large controlled trials evaluating combined lifestyle-nursing interventions.

Keywords:
Lifestyle, Chronic Wounds, Behavioral Modification, Nutrition, Stress, Systematic Review

Code: wtrc12-04770439
Title:

Advanced Active Drug-delivery Systems Based on Micro/nanorobots for the Treatment of Chronic Wounds

Authors:

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Abstract:
Chronic wounds, particularly diabetic ulcers, remain a major clinical challenge due to persistent infection, impaired tissue regeneration, and limited penetration of therapeutic agents. Conventional wound-care strategies rely on passive diffusion, which results in poor drug localization and reduced treatment efficiency. Recent advances in micro- and nanorobotics have introduced active delivery systems capable of navigating complex tissue environments. These miniature platforms can be actuated by magnetic, acoustic, electrical, or optical stimuli and overcome the physiological limitations associated with passive drug delivery. Magnetically or chemically driven micro/nanorobots can enhance drug penetration, disrupt bacterial biofilms, and improve delivery efficiency within chronic wound microenvironments. Their active locomotion enables the transport of therapeutic agents into deeper dermal layers, bypassing diffusion barriers and maintaining higher local concentrations. Furthermore, integrating biological components with synthetic structures has yielded biohybrid nanorobots with enhanced functional performance. This review summarizes recent progress in the design, propulsion mechanisms, and tracking technologies of micro/nanorobots for wound repair and discusses current technical and translational challenges toward their clinical application.

Keywords:
Chronic wounds ،Microrobotics ،Nanorobotics ،Drug delivery

Code: wtrc12-03830436
Title:

Improving Ulcer Management through Teledermatology and Home Care Nursing Support

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Abstract:
Background: Chronic ulcers, including pressure ulcers, leg ulcers, and diabetic foot ulcers, impose a considerable burden on patients, caregivers, and healthcare systems due to their prolonged healing periods, repeated clinic visits, and associated costs. Teledermatology, which employs audio, visual, and data technologies for remote dermatological consultations, has created new opportunities for the home-based management of such ulcers. The aim of this systematic review is to examine the existing evidence regarding the application of these technologies in improving wound management at home. **Methods:** A comprehensive search was conducted in reputable databases, including PubMed, Scopus, Web of Science, and Google Scholar. Articles published up to 2025 were retrieved using the keywords "ulcer management," "teledermatology," "home care," and "nursing support." Following the screening of article titles and abstracts, and the removal of duplicates or irrelevant studies, seven studies that examined the application of teledermatology in wound management were selected and subjected to content analysis. **Results:** Studies have demonstrated that teledermatology, when combined with home nursing, represents a practical and well-accepted approach. It can ensure the quality of transmitted images for assessment, facilitate necessary therapeutic adjustments, and reduce the need for in-person visits. Moreover, a high level of concordance has been reported between face-to-face and remote evaluations, and this method has been shown to decrease outpatient visits while achieving favorable acceptance among both patients and healthcare staff. In patients with chronic ulcers, remote monitoring has contributed to improved wound status and, in some cases, complete healing. Clinical trials have further indicated that its effectiveness is comparable to that of standard care. In addition, qualitative findings suggest that this approach enhances nurses' confidence and provides them with greater professional support, although challenges such as technology integration and workflow management remain. **Conclusion:** The integration of teledermatology with nursing support in home-based care represents an effective, safe, and acceptable strategy for enhancing the management of chronic wounds. These technologies hold considerable promise for shaping the future of wound care by alleviating the financial and organizational burden on healthcare systems, while simultaneously improving patient comfort and engagement. However, to establish conclusive evidence regarding their clinical effectiveness and cost-effectiveness, further research is required. Specifically, large-scale randomized controlled trials with adequate statistical power, the application of standardized outcome measures, comprehensive economic evaluations, and the development of strategies to facilitate seamless implementation across diverse healthcare settings are essential.
Keywords:
Ulcer management, Teledermatology, Home care, Nursing support

Code: wtrc12-05690435
Title:

Antibacterial Activity of Iranian Royal Jelly against MDR *E. coli* and *S. aureus* Across Diverse Eco-Regions

Authors:

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Abstract:

Background: Royal jelly is a bee product with notable physicochemical and antimicrobial properties. Its composition and biological activity may vary depending on the climatic region of origin. This study investigates the antimicrobial potential of royal jelly samples collected from diverse climatic regions of Iran. The alarming rise of antibiotic-resistant pathogens such as MRSA and drug-resistant Escherichia coli has intensified the need for alternative antimicrobial therapies, especially in wound care settings where skin integrity is compromised. Royal jelly, a secretion of Apis mellifera, has emerged as a promising natural agent due to its potent antibacterial, antioxidant, and immunomodulatory properties. Studies have shown that royal jelly samples collected from diverse climatic regions of Iran exhibit variable physicochemical profiles—including humidity, acidity, sugar, protein, fat, 10-HDA)trans-10-hydroxy-2-decenoic acid(, and polyphenol content—which directly influence their antimicrobial efficacy. Notably, samples from Tehran, Fars, and Mashhad demonstrated strong inhibitory effects against S. aureus, while higher concentrations were required to affect E. coli. These findings suggest that region-specific royal jelly, enriched with bioactive compounds like MRJP1 and 10-HDA, may offer targeted therapeutic potential for managing multidrug-resistant infections in burn wounds and other compromised tissues. **Methods:** Royal jelly samples were collected from diverse climatic regions of Iran. Their physicochemical properties, including humidity, acidity, sugar, protein, fat, 10-HDA, and total polyphenol content, were measured using standard methods. Their antimicrobial properties against MRSA and E. coli were evaluated using the agar well diffusion test, the minimum inhibitory concentration (MIC), and minimum bactericidal concentration (MBC). Then, statistical analysis was performed to assess the antibacterial efficacy of samples. Material and Methods Royal jelly samples were collected from diverse climatic regions of Iran and stored under controlled conditions for analysis. The physicochemical properties of these samples, including humidity, acidity, sugar, protein, fat, 10-HDA, and total polyphenol content, were measured using standard methods. Multidrug-resistant bacterial strains, Staphylococcus aureus (MRSA) and Escherichia coli were cultivated and tested against the royal jelly samples. Antimicrobial susceptibility was evaluated using agar well diffusion tests, and the minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) were determined. Statistical analysis, including two-factor ANOVA, was performed to assess the antibacterial efficacy of the royal jelly sample **Results:** •Samples from Tehran, Fars, and Mashhad showed the highest inhibition zones against S. aureus. •No inhibition was observed against E. coli in agar well diffusion. •MIC for both bacteria was 12.5% v/v; however, E. coli responded best to 50% v/v and S. aureus to 25% v/v. •MBC results showed strongest bactericidal activity in samples from Fars, Golestan, and Shahed 2. •Regression analysis confirmed that physicochemical properties influenced antibacterial efficacy. **Conclusion:** Royal jelly samples from different climatic regions of Iran exhibit variable antibacterial activity, particularly against S. aureus. The physicochemical composition, especially 10-HDA and polyphenol content, appears to correlate with antimicrobial potency. These findings support the potential of region-specific royal jelly as a natural antibacterial agent.

Keywords:

Royal Jelly, Escherichia coli, Staphylococcus aureus, Antimicrobial Resistance

Code: wtrc12-04790433
Title:

Rapid Progression of Refractory Wounds in Systemic Scleroderma despite Iranian Alprostadil Therapy: A Case Report

Authors:

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Abstract:
Background: Systemic sclerosis (SSc) is a progressive autoimmune connective tissue disease characterized by skin fibrosis, vasculopathy, and internal organ involvement. Severe peripheral ischemia and refractory digital/lower-limb ulcers are common and frequently lead to gangrene and amputation despite vasodilator therapy. Although intravenous alprostadil (prostaglandin E1) is widely used to improve microcirculation, data on the efficacy and safety of the Iranian generic formulation in advanced SSc remain limited. **Case Report:** A 70-year-old woman with long-standing systemic sclerosis and known atherosclerosis presented during a home visit with high-grade fever, malaise, and rapid progression of necrotic lesions on both lower limbs. The left foot exhibited full-thickness dry gangrene, while the right foot showed deep ulceration with extensive necrotic tissue. She had previously received multiple vasodilators and several courses of intravenous Iranian-manufactured alprostadil with inadequate clinical response. Due to imminent sepsis and irreversible gangrene, urgent referral to hospital was arranged. Bilateral below-knee amputation was performed to save her life. Post-amputation care focused on stump wound management, optimization of underlying disease control, and intensive patient/family education regarding pressure off-loading and early recognition of ischemic changes in the remaining limbs. **Conclusion:** This case highlights the aggressive and unpredictable course of ischemic ulcers in advanced systemic sclerosis and demonstrates that even repeated courses of Iranian alprostadil may fail to halt tissue necrosis in severe vasculopathy. The rapid deterioration observed after alprostadil therapy underscores the critical need for careful patient selection, close multidisciplinary monitoring, and timely surgical decision-making to prevent life-threatening complications such as gangrene and major amputation. Long-term follow-up and proactive limb-salvage strategies remain essential in this high-risk population.

Keywords:
Systemic sclerosis, Refractory ulcer, Gangrene, Alprostadil, Amputation

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Code: wtrc12-04790431

Title:

Successful Management of a Complex Post-Surgical Abdominal Wound with Extensive Undermining in a High-Risk Patient under Active Chemotherapy: A Case Report

Authors:

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Abstract:

Background: Complex deep wounds with heavy exudate and extensive undermining represent a major challenge in wound care, particularly when multiple comorbidities (diabetes mellitus, hypertension, hypothyroidism) and immunosuppressive treatments such as active chemotherapy are present. These factors significantly increase the risk of infection, delayed healing, and wound dehiscence. In such high-risk patients, combined use of negative-pressure wound therapy (NPWT) and advanced dressings can effectively control exudate, reduce bacterial load, and promote granulation and epithelialization. Reports of successful closure of large undermined wounds in patients receiving concurrent chemotherapy remain scarce. **Case Report:** A 53-year-old female presented to the wound clinic with severe pain, profuse purulent discharge, and foul odor from an abdominal surgical site. Her past medical history included diabetes mellitus, hypertension, hypothyroidism (on losartan, levothyroxine, and insulin), multiple previous abdominal surgeries (two caesarean sections, ovarian cystectomy), and recent partial colectomy for colon cancer. She was actively receiving chemotherapy at the time of referral. Following the most recent surgery, the incision had been surgically reopened by the operating surgeon due to purulent collection. However, progressive wound dehiscence and undermining occurred. Clinical examination revealed a large abdominal wound with two communicating undermined pockets; the superior pocket measured approximately 6 cm in depth. Over one liter of purulent exudate was evacuated during the first NPWT session. Negative-pressure wound therapy was initiated to control exudate and prepare the wound bed. Subsequent dressings included alginate, hydrofiber, collagen matrix, and stem-cell-containing advanced products to accelerate granulation and epithelialization. Despite ongoing chemotherapy and multiple comorbidities, healing progressed favorably. Complete wound closure was achieved within three months without recurrence of infection or further dehiscence. **Conclusion:** This case demonstrates that accurate assessment, timely intervention, and combined use of NPWT and modern advanced dressings can achieve rapid and successful healing of complex post-surgical abdominal wounds with extensive undermining, even in high-risk patients undergoing active chemotherapy. Particular attention to adequate drainage of undermined areas and meticulous wound-bed preparation plays a decisive role in preventing infection spread and optimizing outcomes. The findings highlight the value of a structured, multidisciplinary, staged approach in managing postoperative wounds in patients with multiple comorbidities and provide a practical model for clinical decision-making in similar challenging scenarios.

Keywords:

Postoperative wound, Surgical site infection, Negative-pressure wound therapy (NPWT), Advanced dressings, Chemotherapy

Code: wtrc12-04880429
Title:

First Pedicled TRAM Flap Breast Reconstruction in Golestan Province in an Obese Patient with Prior Radiotherapy

Authors:

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Abstract:

Background: Breast reconstruction after mastectomy and radiotherapy is technically demanding due to radiation-induced fibrosis, impaired microcirculation, and increased risk of flap complications. Autologous pedicled transverse rectus abdominis myocutaneous (TRAM) flap remains a reliable option in irradiated fields, particularly in obese patients. **Case Report:** A 33-year-old woman (BMI 34 kg/m^2) with left invasive breast carcinoma underwent total mastectomy in May 2022 followed by eight cycles of chemotherapy and 29 sessions of radiotherapy. Severe radiation dermatitis and tissue breakdown necessitated delayed reconstruction. Two months after radiotherapy completion, she underwent the first pedicled TRAM flap breast reconstruction ever performed in Golestan Province, Iran. Two weeks postoperatively, partial necrosis of the superior flap zone with purulent discharge developed. Immediate debridement and broad-spectrum intravenous antibiotics (cefepime 2 g q12h, vancomycin 1 g q12h, clindamycin 600 mg q8h) for two weeks were administered. Intensive staged wound care with initial four-times-daily normal saline irrigation and topical mupirocin, silver sulfadiazine, and collagenase dressings, gradually reduced to alternate days, achieved complete epithelialization within six weeks with full flap survival and excellent donor-site healing. At six-month follow-up, the reconstructed breast showed natural contour, symmetry, and soft consistency, with high patient satisfaction and restored quality of life. Nipple-areola reconstruction is planned. **Conclusion:** Pedicled TRAM flap breast reconstruction can yield durable and aesthetic outcomes in high-risk, irradiated, obese patients when complications such as partial flap necrosis are promptly recognized and managed with immediate debridement, appropriate antibiotics, and staged multidisciplinary wound care. This first reported case from Golestan Province confirms that complex autologous reconstruction is feasible outside major referral centers and provides a practical model for regional surgical teams.

Keywords:
Pedicled TRAM Flap, Post-radiotherapy Reconstruction, Partial Flap Necrosis

Code: wtrc12-00950428
Title:

"Applications and Challenges of Artificial Intelligence in Wound Care and Healing Prediction"

Authors:

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Abstract:
Background: Artificial intelligence (AI) comprises systems and algorithms capable of performing tasks that traditionally require human intelligence, such as learning, decision-making, and problem-solving, with abilities that improve through experience and data. AI is clinically important in wound care because traditional treatment methods impose significant economic burdens on therapists and patients and can lead to complications due to medical errors. Furthermore, the shortage of wound therapists and limited universal access make traditional methods less viable. Additional limitations include hygiene concerns, varied opinions on wound management, patients' lack of awareness about their wound status, and limited patient participation in their care. Given the rapid global expansion of AI and its potential to overcome these challenges, its application in wound care is increasingly necessary. **Methods:** This narrative review examined AI applications in wound care and healing prediction by searching reputable databases (Google Scholar, PubMed, SID, Magiran, IranMedex) for articles from 2000 to 2025 using keywords such as "artificial intelligence," "wound care," "wound images," and "wound healing prediction." And their Persian equivalents. Over 50 relevant Persian and English articles were selected and analyzed based on focus, study quality, and clinical or imaging data relevance. The majority of studies reflect recent advances in AI over the past decade. **Results:** AI employs sensors embedded in smart dressings or placed on the skin to measure real-time wound parameters such as pressure, pH, and moisture. By integrating these data with clinical information (age, sex, BMI, etc.) and using machine learning, AI provides a comprehensive wound assessment, estimates healing time, and offers tailored recommendations to patients and therapists. This technology enables remote monitoring, enhances understanding of wound tissue and shape through images, videos, or audio explanations, and suggests appropriate dressings and medications based on wound discharge and clinical signs. Compared to conventional methods, AI improves accuracy, reduces infection risks from frequent checkups, and collects detailed information through machine imaging. However, challenges include the need for large high-quality datasets, limited infrastructure, privacy and security concerns, high costs, restricted access, and resistance from therapists and patients. **Conclusion:** AI is transforming wound care by enabling more precise assessment and prediction of healing times. Machine learning and clinical image analysis facilitate early infection detection and improve treatment outcomes. These technologies increase the speed and accuracy of clinical decision-making while reducing complications from delayed treatment. Despite challenges such as data requirements and standardization issues, AI's potential to enhance patient care quality promises broader future applications. Given the limitations mentioned, future studies should focus on designing uniform standards for AI interpretation of wound images and on collecting larger, more diverse patient databases with different skin characteristics to reduce AI errors. Continued investment in intelligent model development and multimodal data integration can improve public health and reduce treatment costs.
Keywords:
Artificial Intelligence, Wound Care, Wound Images, Wound Healing Prediction

Code: wtrc12-05650427
Title:

A Review of Artificial Intelligence Applications for Monitoring and Preventing Pressure Ulcers in Patients Undergoing Hip Surgery

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Abstract:
Background: Hip surgeries are among the most common orthopedic interventions, and patients in this field, particularly older adults, are at high risk of developing pressure ulcers. This complication increases hospital stay, healthcare costs, infection risk, and delays rehabilitation. Limitations of traditional preventive methods—such as human error and the lack of continuous monitoring—highlight the importance of employing novel technologies. In recent years, artificial intelligence (AI) and smart monitoring systems have offered new perspectives for early detection and prevention of pressure ulcers. This study aimed to review the existing evidence on the role of AI-based technologies in monitoring and preventing pressure ulcers in patients undergoing hip surgery. Materials and **Methods:** This review was conducted following the PRISMA guidelines. A systematic search was performed in SID, Magiran, Google Scholar, PubMed, Scopus, and Web of Science using MeSH terms related to artificial intelligence, hip surgery, wearable sensors, and pressure ulcers, for studies published between 2018 and 2025. Inclusion criteria comprised clinical trials and quasi-experimental studies relevant to the application of AI in patient monitoring and pressure ulcer prevention. Titles, abstracts, and full texts were screened, and data were extracted according to the established protocol. **Results:** Out of 93 identified articles, 17 studies met the eligibility criteria and were included in the review. Qualitative synthesis indicated that integrating smart sensors, the Internet of Things (IoT), and machine learning algorithms plays a key role in identifying risk patterns and preventing pressure ulcers. Sub-mattress pressure sensors combined with algorithms such as Random Forest and neural networks detected body position and pressure patterns with 85–95% accuracy. IoT-based smart beds provided automated alerts for repositioning and reduced sustained contact with high-risk areas. Prediction models based on clinical data showed 80–87% accuracy. Multi-modal wireless sensors detected microclimatic skin changes before clinical signs appeared, and wearable devices increased adherence to repositioning protocols by 30%. **Conclusion:** Findings suggest that AI technologies, by enabling continuous monitoring, automated data analysis, and precise alerting, can significantly enhance the effectiveness of preventive interventions in hip surgery patients. Implementing these technologies represents an important step toward improving orthopedic care and reducing the nursing care burden.

Keywords:
Artificial Intelligence, Hip Surgery, Wearable Sensors, Pressure Ulcers, Patient Monitoring

Code: wtrc12-03460426
Title:

Copper Nanoparticle-Infused Polyvinyl Alcohol-Hyaluronic acid Mats for Enhanced Diabetic Foot Ulcer Therapy

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Abstract:
Diabetic foot ulcers (DFU), a common complication of diabetes, require effective management. Conventional wound dressings often fail to provide adequate infection control and sustained therapeutic release, which are critical challenges in the effective treatment of diabetic foot ulcers. One innovative approach to managing DFU involves the use of wound dressings fabricated through electrospinning. The incorporation of metal nanoparticles such as copper into nanofibers enhances their biological properties. This study investigates the synthesis and characterization of electrospun bilayer polymeric nanofibers combined with copper nanoparticles (CuNPs), to evaluate their potential in DFU. CuNPs were synthesized using a green synthesis method. The bilayer nanofibers were constructed with the first layer consisting of PVA and HA polymers, and the second layer composed of PVA and CuNPs and thermally treated. The size of the CuNPs were analyzed using dynamic light scattering, while the dimensions of the nanofibers were examined using scanning electron microscopy. Additionally, degradation and swelling tests of the nanofibers, as well as loading and release rates, were measured. The synthesized CuNPs exhibited an average size of 70 ± 9 nm. These fibers demonstrated drug loading and release capabilities, exhibiting adequate stability over a 24 hours period. Thermal analysis indicated a loading capacity of 14.58%, with a controlled release pattern. The degradation rate of the final fibers was 35 ± 3% after 24 hours, while the swelling rate was 603 ± 7%. The bilayer nanofibers composed of hyaluronic acid/PVA and CuNPs demonstrated potential as wound dressings for DFU
Keywords:
Wound dressing, Hyaluronic acid, Polyvinyl alcohol, Copper, Diabetic wound

Code: wtrc12-04800424
Title:

Application of Iranian Complementary Medicine in Wound Healing: A Scoping Review

Authors:

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Abstract:

Background: Wound healing is a complex process that can be disrupted by various factors such as persistent inflammation, infection, and impaired angiogenesis, potentially leading to chronic wounds. Limitations of conventional treatments, including antibiotic resistance, high costs, and limited efficacy, have increased attention to complementary therapies and traditional medicine. Iranian traditional medicine, with its long history and extensive collection of medicinal plants and topical formulations, has significant potential to enhance wound healing. The aim of this study was to identify and analyze scientific evidence related to complementary therapies and traditional Iranian medicine products in wound healing. **Methods:** This scoping review was conducted based on the Arksey and O'Malley framework and in accordance with the PRISMA-ScR guidelines. A comprehensive search was performed in PubMed, Scopus, Web of Science, Google Scholar, SID, Magiran, and IranDoc without time restrictions. Classical Iranian medicine sources such as Qanun, Makhzan al-Advia, and Tohfat al-Hekma were also manually reviewed. Inclusion criteria comprised experimental studies, clinical trials, ethnobotanical studies, reviews, and reports addressing the use of medicinal plants or traditional Iranian medicine products in wound healing. Titles, abstracts, and full texts were screened independently by two reviewers, and data were extracted using a standardized form including type of intervention, plant species, mechanisms of action, wound type, and clinical/laboratory outcomes. Due to the nature of a scoping review, risk of bias assessment or quantitative meta-analysis was not performed. **Results:** The systematic review identified over 60 medicinal plants and several traditional products effective in wound healing. Quince (Cydonia oblonga), Persian shallot (Allium stipitatum), pomegranate (Punica granatum), mallow (Malva sylvestris), Otostegia persica, Scrophularia striata, saffron (Crocus sativus), Fumaria vaillantii, Persian walnut (Juglans regia), Prangos ferulacea, Pistacia atlantica, and Albizia julibressin have the most extensive use and the strongest scientific evidence. Additionally, in Iranian traditional medicine, polyherbal preparations containing plants such as Aloe vera, Commiphora myrrha (myrrh), Boswellia carteri (frankincense), and plants from the Fabaceae family are. Their pharmacological effects include anti-inflammatory, antioxidant, and antibacterial activities; acceleration of wound contraction; increased collagen synthesis; stimulation of fibroblast proliferation and migration; enhanced angiogenesis; and regulation of growth factors such as TGF-β1, bFGF, and PDGF. Among traditional formulations, ointments, pastes, and zaroorha—particularly Ral and Oshaq ointments—showed the highest usage and best outcomes in chronic wounds, burns, diabetic foot ulcers, and infected wounds. Some local methods, such as Dood Anbarnesa, were also reported to be effective against resistant infections. These therapies demonstrated significant effects across various wound types, including burns, diabetic wounds, pressure ulcers, surgical wounds, inflammatory lesions, and even autoimmune lesions such as pemphigus. **Conclusion:** Existing evidence suggests that complementary therapies and Iranian traditional medicine products have significant potential to accelerate wound healing and control infections, serving as low-adverse options alongside standard treatments. However, the lack of high-quality clinical trials, absence of standardization in herbal formulations, and limited safety data highlight the need for advanced research and the development of standardized formulations. Integrating traditional and modern medical approaches can pave the way for effective, evidence-based natural therapies in wound management.

Keywords:

Wound healing, Iranian traditional medicine, Medicinal plants, Topical formulations, Chronic wounds, Anti-inflammatory, Angiogenesis

Code: wtrc12-04800423
Title:

Prescriptive Authority for Wound Care Specialist Nurses: A Global Narrative Review of Models, Scope, and Challenges

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Abstract:
Background: Global changes in health systems, including the rising prevalence of chronic diseases and shortages of specialized healthcare personnel, have expanded the role of advanced practice nurses. Wound, ostomy, and continence (WOC) nurses—or advanced practice nurses specialized in wound management—play a critical role as key members of the healthcare team, providing comprehensive assessment, diagnosis, treatment, and patient education for individuals with chronic wounds. Objective: The aim of this article is to present a narrative review of the status of prescriptive authority for wound care specialist nurses across different countries, examining and comparing existing models, scope of practice, and challenges associated with nurse prescribing in wound care internationally. **Methods:** A global narrative review approach was used to synthesize available evidence regarding prescriptive authority for wound care specialist nurses, highlighting variations in practice, legal frameworks, and implementation challenges across countries. **Results:** Findings indicate that in Anglo-Saxon countries such as the United States, the United Kingdom, and Australia, advanced practice nurses possess broad and independent prescribing rights, including the ability to prescribe medications and advanced wound care products. Conversely, in many Asian countries and emerging European systems, such as China, Japan, and Spain, prescribing authority remains limited, protocol-based, or dependent on physician oversight due to legal, structural, and cultural constraints. Major global challenges include interprofessional resistance (particularly from physicians), insufficient legal and educational infrastructures, and concerns regarding clinical competency. Successful experiences show that nurse prescribing can increase patient satisfaction, reduce physicians' workload, and improve the efficiency of healthcare systems. **Conclusion:** Establishing clear legislation, strengthening specialized education, and promoting interprofessional support can facilitate the development of prescribing roles in nursing, especially in wound management. In Iran, expanding this role requires addressing legal barriers and providing structured training programs. Drawing on the experiences of leading countries may assist in developing standardized protocols and reinforcing the health system's capacity to manage chronic wounds.
Keywords:
Wound Care Specialist Nurses, Nurse Prescribing, Advanced Practice Nursing, Task Shifting, Prescriptive Authority, Wound Management, Chronic Wound Care, Interprofessional Challenges, Scope Of Practice, Health System Policy

Twelfth Yara International Congress of Wound and Tissue Repair

Code: wtrc12-05720421
Title:

Severe Opium Intoxication Following Topical Application on a Third-Degree Burn in an Infant: A Case Report

Authors:

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Abstract:
Background: Burn injuries are among the leading causes of morbidity and mortality in children worldwide. The World Health Organization (WHO) reports nearly 180,000 burn-related deaths annually, with young children being disproportionately affected, especially in low- and middle-income countries where mortality rates are significantly higher. Children under five years of age are particularly vulnerable due to thinner skin, limited awareness of danger, and dependence on caregivers for safety. Severe burn injuries can trigger systemic responses such as capillary leakage, fluid loss, and shock, often occurring when total body surface area (TBSA) exceeds 15–20%. In many communities, traditional remedies—including honey, toothpaste, herbal materials, and even opium—are commonly used for burn care despite lacking scientific support. Such practices may increase the risk of infection, delayed healing, and in severe cases, systemic toxicity. Opioid intoxication in children remains a major health concern in Iran, with many cases linked to accidental exposure due to cultural beliefs and easy access to opium. Topical application of opium on burn wounds is extremely rare but can lead to dangerous transdermal absorption. This report presents a rare case of severe opioid intoxication in an infant following topical exposure of opium applied to a third-degree burn wound. **Case Report:** An 11-month-old male infant (11 kg), living in a socioeconomically deprived area, presented to the emergency department with reduced consciousness, poor respiratory effort, and pallor. Upon arrival, he had ineffective spontaneous breathing and required immediate cardiopulmonary resuscitation (CPR). Continuous naloxone infusion followed by scheduled QID dosing was initiated, confirming opioid intoxication based on clinical response and laboratory findings. The child had sustained a hot-water burn to the hand three days earlier. Initially, the family applied toothpaste and raw potato as home remedies. On the third day, they washed the wound with diluted opium, believing it to relieve pain and disinfect the area—a cultural practice reported in certain low-resource communities. Shortly thereafter, the infant developed bradypnea, hypotension, and loss of consciousness. Physical examination revealed deep partial- to full-thickness burns (2–3% TBSA) involving the dorsal and palmar aspects of the hand, including digits 1, 4, and 5. After stabilization, the burn areas were irrigated with sterile saline. SilverMed dressings were applied to moist, exudative regions, while Atrauman Ag was used on areas with less exudate. During two treatment sessions, progressive improvement in granulation tissue and reduced exudate was observed, without signs of infection. Despite favorable wound healing, the family discontinued treatment due to financial limitations and insufficient awareness of potential complications. **Conclusion:** This case demonstrates a rare but life-threatening instance of severe opioid intoxication following topical application of opium on a burn wound in an infant. Damaged skin significantly increases transdermal absorption, posing substantial risks even with small amounts of opium. The case highlights the urgent need for community education regarding safe burn management and the dangers of traditional remedies. Strengthening parental awareness, improving accessibility of burn-care services, and addressing cultural misconceptions are essential to prevent similar events. Further research is warranted to evaluate the prevalence of opioid-related topical poisonings in pediatric burn patients and to develop targeted educational and public-health interventions for high-risk regions.

Keywords:
Pediatric Toxicology; Burn Wound; Opium Application

Code: wtrc12-05760420
Title:

Theranostic Smart Dressings: Multi-Stimuli Infection Monitoring and Targeted Antibiotic Delivery for Diabetic Foot Ulcers

Authors:

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Abstract:
Background: Diabetic ulcers, especially diabetic foot ulcers, have significant clinical and economic consequences due to wound healing complications, high risk of infection, and the possibility of disease recurrence. Moreover wound microenvironment in these patients is often dysregulated, highlighted with elevated pH, oxidative stress, and persistent inflammation contributing to delayed healing. Monitoring wound pH is a valuable biomarker for chronic or infected wounds frequently exhibit a more alkaline pH compared to healthy skin, which correlates with bacterial colonization and impaired tissue repair. However, traditional dressings are passive and do not have much effectiveness for biochemical changes in the wound **Methods:** This review examines literature published over the past 20 years ago. Studies were selected based on association with photobiomodulation therapy and its mechanistic, preclinical and clinical effects on cutaneous wound healing. The search was conducted in PubMed with these Keywords: "photobiomodulation," "low-level light therapy," "cutaneous wound healing "skin repair," and "gene expression in wound healing." Additional evidence was identified through reference lists of key studies to ensure inclusion of important mechanistic and .translational findings **Results:** Multi-stimuli responsive dressings showed better performance than conventional modalities. PH-sensitive hydrogels accurately detected early infection and enabled controlled antibiotic release under acidic conditions. These hydrogels may include chemical motifs that respond to acidic or alkaline environments, enabling on-demand release of active agents. Some advanced dressings are dual-responsive, reacting to both pH and glucose levels, which is particularly relevant for diabetic wounds. Such systems provide a theranostic strategy integrating sensing and therapy, potentially reducing unnecessary antibiotic use while promoting wound healing. ROS-responsive hydrogels delivered antibacterial and anti-inflammatory agents with controlled timing and localization, resulting in bacterial clearance acceleration and granulation tissue formation. NIR-responsive nanofiber systems demonstrated strong photothermal eradication of multidrug-resistant bacteria with supported re-epithelialization and neovascularization. Theranostic hydrogels that combine monitoring with therapy showed potential to reduce overtreatment, minimize systemic toxicity, and provide .personalized wound care **Conclusion:** Theranostic smart dressings integrate multi-stimuli infection monitoring with controlled antibiotic delivery, and offer a major advancement in DFU care. These dressings dynamically respond to patient-specific wound signals and enable more precise, adaptive, and patient-centered therapy. Limitations involve variability of chronic wound environments material instability, and manufacturing complexity. Despite these limitations, current evidence shows that smart dressings may improve infection control, reduce unnecessary antibiotic usage .and antibiotic resistance, and transform DFU management toward personalized, infectionadaptive strategies

Keywords:
Antibiotic Delivery, Chronic Wounds, Diabetic Wounds, Infection Monitoring, Phsensitive Dressings, Smart Dressings, Wound Healing

Code: wtrc12-05740419
Title:

Explain Experiences of Physicians and Nurses' Perspectives on Burn Injury Care Priorities

Authors:

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Abstract:

Background: Doctors and nurses are in frequent contact with burn patients, therefore, the best sources for receiving care information are to design a comprehensive program to improve the quality of care. For this purpose, this study was conducted to explain the experiences of physicians and nurses of burn wound care priorities. **Methods:** This study was qualitative research based on content analysis that was conducted in 2020 in 1 teaching hospital and 1 military hospital in Isfahan. Participants included 7 nurses and physicians with at least 5 years of experience in burn wound care who were selected by purposive sampling. Data were collected using in-depth semi-structured individual interviews and sampling was continued until data saturation. Data were analyzed by conventional content analysis. **Results:** After data analysis, 3 main classes and 10 subclasses were extracted. Class of burn wound assessment with two subclasses of patient evaluation and first aid and assessment of burn surface and depth, burn wound management class with four subclasses of cleaning and exfoliation, burn wound dressing, pain management, and patient education, follow-up care class were divided into four subcategories: general health care, skincare, multidisciplinary support, and malformation prevention. **Conclusion:** According to the experiences of nurses and physicians, patients with burn wounds have various care needs in physical and psychological fields, which make care priorities different from each other, and it is necessary to pay attention to this issue in patient-centered care

Keywords:

Burn injury, Physician, Nurses, Care

Code: wtrc12-05740418
Title:

Systematic Review on the Application of Novel Advanced Dressing in Burn Wound Healing

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Abstract:
Background: Burn wounds are complex injuries characterized by tissue damage, inflammation, and risk of infection. New and advanced wound dressings have been developed to maintain optimal moisture, support cellular repair, reduce pain, and deliver therapeutic agents to the wound bed. In this Study, we review novel and advanced wound dressings in burn wound healing. **Methods:** This systematic review examines the use of novel advanced wound dressings in burn wound healing. A comprehensive literature search was conducted for articles published between 2020 and 2025 in the following databases using the keywords Advanced Dressing, Burn Injuries, Novel Dressing, Wound Care, Wound Healing: PubMed, Web of Science, Google Scholar, and ScienceDirect. Studies were screened based on the PRISMA checklist. The literature search was conducted using a combination of keywords and their corresponding MeSH terms in English. After the search, the quality of the included studies was assessed using the EPHPP (Effective Public Health Performance Project) checklist. Editorial articles and inaccessible full-text articles were excluded, and only eligible studies were considered for analysis. The screening process included an initial assessment of titles and abstracts, followed by a detailed assessment of full-text articles that met the inclusion criteria. A critical appraisal was performed, and relevant data were systematically extracted and analyzed. **Results:** Initially, 478 studies were identified, of which 30 met the inclusion criteria. The findings of this study suggest that advanced burn dressings have revolutionized wound management, transforming from passive dressings to active, intelligent systems that intervene in the healing process. Hydrogel dressings provide an optimal environment for healing by absorbing excess exudate and allowing for controlled drug release, while biological dressings such as chitosan and bacterial cellulose accelerate healing and inhibit infection through their inherent antimicrobial and hemostatic properties. Nanosilver dressings, known for their superior anti-infective capabilities, reduce healing time and reduce complications. In addition, biological scaffolds are three-dimensional structures that can be integrated with various drugs, including epidermal and fibroblast growth factors - not only reducing the risk of infection and relieving pain, but also accelerating healing. They enable the highest degree of tissue regeneration. Among these, nanosilver and chitosan dressings are the most common dressings in clinical practice due to their unique combination of high efficacy, availability and cost-effectiveness. Collectively, these developments represent a transition from traditional dressings to smart and active systems that simultaneously protect the wound, accelerate healing, reduce infection and pain, and enable better cosmetic outcomes. **Conclusion:** Current evidence shows that advanced dressings provide advantages in burn wound management by maintaining an optimal healing environment, reducing microbial load, and enhancing tissue regeneration. Clinical studies report accelerated healing, improved patient comfort, and lower complication rates compared with conventional dressings. Despite promising outcomes, variations in study design and limited long-term data highlight the need for more standardized, high-quality clinical trials. Overall, advanced dressings represent a promising and increasingly validated component of advanced burn care

Keywords:
Advanced Dressing, Burn Injuries, Novel Dressing, Wound Care, Wound Healing

Code: wtrc12-05730416
Title:

Protective Isolation for Severe Combined Immunodeficiency (SCID) Patients after Hematopoietic Cell Transplantation (HCT): A Systematic Review

Authors:

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Abstract:

Background: Severe combined immunodeficiency (SCID) is a genetic condition marked by significant impairment of both cellular and humoral immunity due to faulty development or functioning of T cells and B cells. Hematopoietic stem cell transplantation (HSCT) is potentially curative for all patients with SCID. In the early post-HSCT phase, multiple factors lead to a significant state of immunodeficiency such as bacterial, viral, fungal, and parasitic infections. Also, other conditions like Graft versus Host Disease (GVHD) may occur. After the procedure; Infection prevention and standard isolation of patients is vital. In this review we summarized different protective isolation protocols for SCID patients post-HSCT. **Methods:** The literature search encompassed three databases—PubMed, Scopus, and Web of Science —and was limited to English written papers from 2020 to 2025. Review articles, letters and conference papers were excluded. search strategy was conducted using Medical Subject Headings (MeSH) including subsequent Keywords: SCID, HSCT, Isolation, and “Infection prevention”. The eligibility criteria were defined using the PICO framework. Two independent researchers reviewed the titles and abstracts of the identified articles. Disagreement was solved by discussion and reaching consensus. Data were extracted from the selected studies using a standard data extraction form including the following information: title, article type, publishing date, region, sample size and results. **Results:** A total of 10 articles included in qualitative analyze. Main protective isolation methods against infections were reducing exposure (through separating the patient from potential sources of infection), disinfecting the environment (via filtering air, sterilizing surfaces, and managing food and water sources), decreasing Transmission (by enforcing strict hygiene protocols for all of the visitors), use of personal protective equipment and using Protective Environment Rooms (HEPA Filtration, Positive Pressure and Anteroom). Other protective procedures include following strategies: aseptic procedures, limited visitors, screening the visitors, strict food diet and consuming sterilized water. **Conclusion:** More studies are needed to refine isolation plans, looking at how long they last and how strict they are. It is important to find better ways to lessen the social and mental health problems isolation causes. There should also be set rules for isolation after hematopoietic stem cell transplant in severe combined immunodeficiency patients.

Keywords:

Severe Combined Immunodeficiency (SCID); Hematopoietic Cell Transplantation (HCT); Protective Isolation; Infection Prevention.

Code: wtrc12-05720414

Title:

Severe Opium Intoxication Following Topical Application on a Third-Degree Burn in an Infant: A Case Report

Authors:

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Abstract:

Background: Burn injuries are a major cause of morbidity and mortality among children, particularly in low-income regions where burn-related deaths are significantly higher. Infants are especially vulnerable due to their thin and sensitive skin, higher fluid loss, and increased risk of shock, requiring rapid and specialized medical care. Despite advances in burn management, traditional and non-scientific self-treatments—such as the topical application of opium—remain common in some communities. This case highlights the severe risk of opioid toxicity following topical exposure to opium on a burn wound in an infant. **Case Report:** This case report describes an 11-month-old infant weighing 11 kg who sustained a 2–3% TBSA third-degree burn on the hand caused by boiling water. After two days of inappropriate home treatments, including toothpaste and potato, the family applied diluted opium directly onto the burn wound. The patient developed signs of acute opioid poisoning, including hypotension, bradypnea, and reduced consciousness, requiring immediate cardiopulmonary resuscitation (CPR). Opioid toxicity was confirmed and treated with intravenous naloxone. Standard burn care protocols using modern dressings were subsequently applied. **Results:** After administration of naloxone, the patient's hemodynamic status stabilized, respiratory function improved, and consciousness returned. The burn wound responded satisfactorily to advanced wound-care management, showing proper granulation and healing progression. The infant was discharged in good condition after several days of inpatient care. However, due to financial concerns and lack of awareness, the family discontinued specialized follow-up after two sessions despite clinical recommendations. **Conclusion:** This case demonstrates the rapid and critical systemic absorption of opium through a third-degree burn wound in an 11-month-old infant, leading to severe opioid intoxication requiring CPR. It underscores the urgent need for community education on appropriate burn management and the potentially fatal consequences of traditional, unsupervised treatments involving opioid substances. Raising awareness can prevent secondary complications, reduce morbidity, and improve outcomes in pediatric burn cases.

Keywords:

Burn, Wound, Opium

Code: wtrc12-03910412
Title:

The Skin Microbiome as a Missing Link in Chronic Diabetic Wound Healing

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Abstract:
Diabetic foot ulcers (DFUs) are among the most common and costly complications of diabetes. Despite treatment advances, DFUs continue to have poor healing rates and a high risk of amputation. While neuropathy, ischemia, persistent inflammation, and polymicrobial infections are recognized contributors, these factors do not fully explain why many wounds persist or resist treatment, even in the absence of a clear clinical infection. Recent evidence suggests that persistent dysbiosis of the skin microbiome may be a missing link in the development of diabetic foot ulcers. This imbalance is characterized by reduced microbial diversity, increased pathobionts such as Staphylococcus aureus and Pseudomonas aeruginosa, and decreased protective commensal bacteria, including Staphylococcus epidermidis and bacteriocin-producing species. Mechanistic studies have identified several pathways by which a disrupted microbiome impairs wound healing. These include the formation of antibiotic-resistant biofilms, persistent activation of inflammatory responses through TLRs and increased proinflammatory cytokines such as IL-1β, TNF-α, and IL-17, altered keratinocyte and fibroblast migration due to bacterial metabolites, and inhibition of angiogenesis and tissue regeneration caused by reduced growth factors and increased MMPs. Metagenomic analyses using 16S rRNA and shotgun sequencing have shown that the microbial composition of non-healing wounds differs significantly from that of healing wounds. These microbial patterns can be detected before clinical signs of infection develop. Interventions such as topical probiotics, microbiome modification, phage therapy, and targeted antibiotics based on microbial profiles have shown promise in accelerating wound healing in preclinical and early clinical studies. It suggests that assessing the wound microbiome and using interventions to modulate it should become part of standard treatment protocols.
Keywords:
Diabetic Foot Ulcers, Skin Microbiome Dysbiosis, Biofilm, Chronic Wound Healing

Code: wtrc12-05700411
Title:

Induction of Osteomyelitis by *Staphylococcus aureus* (SA) in a Rat Model with Calvaria Defect

Authors:

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Abstract:
Background: Osteomyelitis as a common disease, presents significant clinical challenges, particularly when caused by Staphylococcus aureus (SA). Utilizing a rat model with calvaria defects offers a valuable platform for studying the pathophysiology of osteomyelitis. **Methods:** The rats were randomly assigned to three groups based on different inoculation dose levels, which included 1× 103 (G1), 5× 103 (G2), and 1× 104 (G3) CFU/μL (using 10 μL for each rat). Fever and weight of rats monitored for 2 weeks post-surgery. Furthermore, bone tissues and blood were collected from all rats involved in the study and analyzed through histological and hematological methods to evaluate the correlation between the inoculation dose and the level of infection. **Results:** The weight and fever of the rats in group G1 were within the normal limits, but in groups G2 and G3, there was an increase in body temperature and a slight weight loss. Due to the persistent local infection, blood factors such as CBC and ESR remained within the normal ranges. However, in histological results, high levels of inflammatory responses (Neutrophil cells were observed.), bone necrosis, and bacteria were observed in the studied groups. Our results indicated that an inoculating dose of 1 × 104 CFU/ μL was sufficient to induce the development of osteomyelitis in rat models. **Conclusion:** This study indicates that the dose of 1 × 104 CFU/ μL is capable of inducing osteomyelitis. This finding provides valuable insights to more accurately model osteomyelitis, as well as to simulate the challenges associated with its treatment.

Keywords:
Animal Model, Calvaria Bone Defect, Osteomyelitis, *Staphylococcus aureus*

Code: wtrc12-05640409
Title:

Treatment of Traumatic Wounds Based on the TIME Approach

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Abstract:
Wound healing is one of the challenges facing therapists. Especially when it becomes chronic, issues such as infection, increased length of stay in hospital, increased costs, decreased quality of life, deformities in the form or function of the limb, or in some cases, amputation, lead researchers to find effective treatments, and the use of modern dressings and stem cells in line with the time frame is the therapeutic approach to managing the wound challenge. The aim of this study is to investigate new treatment methods and their effect on the healing of chronic wounds.

Keywords:
TIME ،stem cell ،Amputation ،Wound healing ،Infection ،Advanced wound dressing

Code: wtrc12-04600408
Title:

Fairness and Generalizability of Artificial Intelligence-Based Skin Cancer Detection Systems across Skin Tones and Populations: A Systematic Review

Authors:

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Abstract:
Background: Artificial intelligence (AI)–based image analysis has shown promising performance for early detection of skin cancer, yet growing evidence indicates that these systems may not perform equitably across skin tones and populations. Most training datasets contain a predominance of light-skinned patients from high-income countries, while people with skin of colour and populations from low- and middle-income regions remain under-represented. Recent benchmark studies using diverse clinical image sets have reported substantial drops in diagnostic accuracy for darker Fitzpatrick skin types and for uncommon tumour subtypes, raising concerns about fairness, generalizability and potential amplification of existing health disparities. This systematic review aims to synthesise and critically appraise the evidence on how AI-based skin cancer detection systems perform across different skin tones and populations, and to evaluate which methodological and reporting practices are associated with more equitable performance. Material and **Methods:** We will search PubMed, Embase, Web of Science, the Cochrane Library and IEEE Xplore for studies from January 2013 onwards that develop, validate or evaluate image-based AI systems for diagnosis or triage of cutaneous malignancies and report performance stratified by skin tone (e.g. Fitzpatrick type, quantitative colour metrics), race/ethnicity or geographic population, or explicitly address dataset diversity or bias-mitigation strategies. Two reviewers will independently screen records, extract data and assess risk of bias. We will additionally evaluate equity-relevant domains, including representation of skin tones, transparency of demographic reporting and use of fairness metrics, informed by the PRISMA-Equity guidance. Where data permit, we will conduct meta-analysis of performance gaps between groups; otherwise, we will perform structured narrative synthesis. **Results:** Preliminary scoping suggests that at least 20–30 primary studies and several dataset-level analyses have evaluated AI performance across skin tones or populations, alongside emerging work on bias mitigation and diverse dermatology image collections. We expect to characterise typical patterns of under-representation, quantify diagnostic performance gaps between lighter and darker skin types where reported, and summarise the impact of interventions such as targeted data augmentation, balanced sampling and fairness-aware training objectives. **Conclusion:** This systematic review will provide an integrated, equity-focused overview of fairness and generalizability of AI-based skin cancer detection systems across skin tones and populations. By identifying consistent sources of bias, gaps in demographic reporting and limitations in current evaluation practices, and by highlighting promising methodological strategies to reduce performance disparities, our findings aim to support the development, validation and deployment of dermatology AI tools that are safer and more reliable for all patients, not only those who are best represented in current datasets.
Keywords:
Artificial intelligence, Skin cancer, Fairness, Skin tone, Health equity

Code: wtrc12-04600407
Title:

Diagnostic Accuracy of Artificial Intelligence-Based Systems for Early Detection of Skin Cancer Compared with Clinicians: A Systematic Review

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Abstract:
Background: Early detection of skin cancer, particularly melanoma and keratinocyte carcinomas, is critical for reducing morbidity, mortality and treatment costs. In recent years, image-based artificial intelligence (AI) systems have achieved dermatologist-level performance for classifying skin lesions, yet their diagnostic value compared with clinicians across different care settings remains uncertain and fragmented. Existing evidence syntheses either predate the rapid growth of deep learning or do not focus specifically on early detection and direct AI–clinician comparisons. This systematic review aims to provide an updated and clinically focused overview of the diagnostic accuracy of AI-based systems for early skin cancer detection compared with human clinicians. **Methods:** We will systematically search PubMed, Embase, the Cochrane Library, Web of Science and IEEE Xplore for primary studies from January 2013 onwards that compare image-based AI systems for skin cancer detection with clinicians (dermatologists, other specialists or generalists) or with histopathology as reference standard. Eligible designs will include retrospective reader studies, prospective diagnostic-accuracy studies and real-world clinical evaluations using dermoscopic, clinical or smartphone images. Two reviewers will independently screen studies, extract data and assess risk of bias using QUADAS-2, following PRISMA recommendations. Where appropriate, we will perform a bivariate random-effects meta-analysis of sensitivity and specificity, and explore heterogeneity by image modality, lesion type, clinical setting, clinician expertise, dataset source (public vs institutional) and internal versus external validation. We will also summarise evidence on AI-assisted human diagnosis. **Results:** Based on preliminary scoping of the literature, we expect to identify more than 50 comparative studies directly evaluating AI algorithms against clinicians, with a growing number of prospective and real-world trials. Pooled results will provide updated estimates of sensitivity, specificity and area under the receiver operating characteristic curve for AI systems compared with clinicians, and will quantify the incremental benefit of AI assistance, particularly for non-expert readers. **Conclusion:** This systematic review will synthesise and critically appraise the best available evidence on AI-based early detection of skin cancer compared with clinicians. By characterising diagnostic accuracy, risk of bias and sources of heterogeneity, and by highlighting gaps such as limited prospective data and under-representation of diverse skin tones, our findings aim to inform clinicians, researchers and policymakers about the realistic potential and current limitations of AI in dermatologic cancer screening and triage.

Keywords:
Artificial intelligence, Skin cancer, Early detection, Diagnostic accuracy, Dermatology

Code: wtrc12-05620406
Title:

Differential Expression of EGF, TGF-β and PDGF in Early and Late Stages of Cutaneous Leishmaniasis and their Association with Wound Healing.

Authors:

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Abstract:
Background: Leishmaniasis is a protozoan disease transmitted through sand fly bites. Cutaneous leishmaniasis is a tropical disease. In Iran, cutaneous leishmaniasis predominantly occurs in arid and desert areas. There is no specific drug or vaccine that can guarantee remission or prevent infection so far. However, recent studies demonstrated that growth factors play crucial roles in regulating inflammation, tissue repair, and lesion evolution in cutaneous leishmaniasis. Evidence from experimental models and clinical studies suggests that platelet-derived growth factors (PDGF), epidermal growth factors (EGF), and transforming growth factor-β1 (TGF-β1) contribute differently to wound-healing outcomes during Leishmania-induced skin damage. PDGF: Clinical trials using autologous platelet gel enriched with PDGF have demonstrated accelerated wound contraction, enhanced granulation tissue formation, and improved epithelialization when administered alongside antimonial therapy. These findings indicate that PDGF provides strong pro-repair activity by stimulating fibroblast proliferation and collagen remodeling. EGF: Studies in BALB/c mice and hamsters show that topical or injected EGF significantly reduces lesion size, promotes keratinocyte proliferation, and shortens healing time. EGF acts predominantly during the early reparative phase, where rapid epithelial recovery is essential for controlling tissue destruction caused by Leishmania parasites. TGF-β1: Multiple human and animal studies consistently report elevated TGF-β1 expression in chronic or non-healing CL lesions. While TGF-β1 supports early wound stabilization, its persistent upregulation contributes to pathological inflammation, delayed epithelialization, and fibrosis. It also interacts with IL-10, creating an immunosuppressive environment that may favor parasite persistence. **Methods:** Data were synthesized from experimental and clinical studies involving Leishmania major and L. braziliensis infections. Methodologies included real-time PCR–based quantification of growth-factor expression in lesion biopsies, histopathological evaluation of inflammatory stages, and therapeutic interventions such as autologous platelet gel (APG) enriched with PDGF, exogenous EGF application, and analysis of endogenous TGF-β1 expression in both human and animal models. Lesions were classified as early-stage (≤4 weeks, inflammatory phase) and late-stage (>4–8 weeks, chronic/ulcerative phase). Growth-factor expression levels were compared across these stages. **Results:** Evidence indicates that PDGF is markedly and significantly elevated during the early stages of cutaneous leishmaniasis, while its levels remain relatively stable with no significant changes in the late stages. Similarly, EGF shows an increase in early lesions but decreases considerably during the late stages of infection. Research findings further demonstrate that TGF-β1 initially acts as an immunosuppressive factor, exhibiting only a slight elevation at the onset of infection, but increases sharply in the late or chronic stages. These temporal patterns highlight the differential roles of growth factors in wound healing and immune regulation during the progression of cutaneous leishmaniasis. **Conclusion:** Growth-factor expression in cutaneous leishmaniasis is dynamic and stage-dependent. PDGF peaks during early stages and remains stable rather than declining in the late phase; EGF increases in early lesions but decreases substantially during late epithelial remodeling; and TGF-β1 shows progressive and pronounced elevation in chronic stages with context-dependent effects. These findings suggest that targeted modulation of growth factors may enhance therapeutic strategies for CL, and that distinguishing early versus late expression patterns is essential for optimizing wound-healing outcomes.

Keywords:
Leishmaniasis, PDGF, EGF, wound healing

Code: wtrc12-02890405
Title:

Evaluation of the Effect of Human Umbilical Vein Endothelial Cell Conditioned Media on the Healing of Second-Degree Burn Wounds in an Animal Model

Authors:

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Abstract:
Background: The healing of deep second-degree burn wounds presents a significant challenge due to the substantial therapeutic burden and associated adverse effects. The prevailing standard of care, silver sulfadiazine cream (SSD), while possessing antimicrobial properties, has been shown to impede the epithelialization process owing to its cytotoxic effects. Recent methodologies have concentrated on the application of growth factors and cytokines as a means to enhance the healing process. Conditioned media derived from human umbilical vein endothelial cells (HUVEC-CM) represents a plentiful, accessible, and low-risk reservoir of angiogenic and inflammatory-modulating agents. Consequently, the objective of this investigation was to assess the therapeutic efficacy of HUVEC-CM within an animal model of second-degree burns. **Methods:** In this experimental investigation, full-thickness second-degree burn wounds were induced in a murine model (n=24). The subjects were randomly allocated into four distinct treatment cohorts: 1) control group (no treatment administered), 2) vehicle group, 3) standard treatment group (1% silver sulfadiazine cream), and 4) intervention group (cream composed of HUVEC conditioned media). The wound healing progression was evaluated macroscopically (via photographic documentation and quantification of wound closure percentage) on days 0, 7, 14, and 21. Upon completion of the study, tissue specimens were procured for histopathological analysis (H&E staining). **Results:** The macroscopic observations indicated that the application of HUVEC-CM cream significantly expedited the closure of burn wounds. After a period of 14 days, the cohort treated with HUVEC-CM exhibited a notable decrease in wound surface area relative to the control groups (no treatment and vehicle). Histopathological assessments (H&E staining) corroborated these observations; thus, in the HUVEC-CM cohort, a more comprehensive re-epithelialization and enhanced angiogenesis, accompanied by a reduction in inflammatory cell infiltration, were documented in comparison to the other treatment groups. **Conclusion:** These preliminary findings suggest that HUVEC-derived conditioned media possesses considerable potential for the acceleration of second-degree burn wound healing. This effect appears to be mediated through enhanced re-epithelialization and the promotion of angiogenesis. The outcomes of this study advocate for HUVEC-CM as a promising therapeutic candidate warranting further exploration.

Keywords:
Burn Wound Healing, Conditioned Media, Human Umbilical Vein Endothelial Cells (HUVEC), Angiogenesis

Twelfth Yara International Congress of Wound and Tissue Repair

Code: wtrc12-05610404
Title:

Artificial Intelligence (AI)-Driven Personalized Wound Care: Integrating Multi-Modal Data for Precision Diagnosis, Treatment Response Prediction, and Automated Healing Monitoring

Authors:

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Abstract:

Chronic and hard-to-heal wounds pose a major clinical burden; diagnosis and treatment response are highly variable across individuals due to the presence of heterogeneous biological, physiological, and behavioral factors. Traditional assessment is imprecise and has high inter-clinician variability. Recent progress in multi-modal AI allows the integration of imaging, clinical data, molecular biomarkers, and patient-specific characteristics into a potentially powerful pathway for personalized wound management. This systematic abstract summarizes and synthesizes recent evidence on AI-enabled personalized wound care, focusing on: (1) precision diagnosis using multi-modal AI models; (2) prediction of individualized treatment response; and (3) automated monitoring of wound healing trajectories. Our goal in this article and various studies is to examine the different aspects of artificial intelligence and help it heal wounds. We conducted an extensive search across electronic databases, including PubMed, MEDLINE, Embase, Google Scholar, and ResearchGate, and explored the available English-language literature. The MeSH terms were" Personalized Wound Care " OR " Automated Healing Monitoring "; " Artificial Intelligence(AI)";"Personalized Medicine ". The articles included in this review adhere to the following criteria: they encompass studies solely focused on progress in comprehending and novel treatment approaches, and they are studies conducted in the English language within the last decades. We have used Ryan's AI in this review to screen articles, where it was done with the help of colleagues to visually separate articles using their reading as well as keyword readers. Findings consistently demonstrate that multi-modal AI models outperform conventional single-source approaches. Deep convolutional neural networks and vision-language models improved diagnostic accuracy of wound type, severity, and tissue composition by up to 20-35%, especially when complemented with clinical, biochemical, and perfusion data. Personalized predictive models that incorporated genomics, inflammatory biomarkers, glycemic control, and comorbidity patterns exhibited significant benefits in predicting the treatment outcomes of diabetic foot ulcers and venous leg ulcers. Generative AI and temporal machine learning architectures also allowed for dependable automated monitoring of wound healing, thereby achieving predictive performance comparable to expert clinicians. Throughout the studies, personalized approaches led to more accurate predictions of healing time, reduced overtreatment, and improved selection of therapy. AI-driven personalized wound care empowered by multi-modal data integration represents a transformative approach toward precision medicine in wound management. Integrating imaging, clinical indicators, molecular signatures, and patient-specific risk factors, next-generation AI systems can offer personalized diagnosis, decision support to optimize treatment selection, and automation of real-time monitoring. Future research needs to focus on large-scale, longitudinally acquired datasets, clinical validation through randomized trials, and explainable AI frameworks to support safe deployment in practice.
Keywords:

Personalized Wound Care, Automated Healing Monitoring, Artificial Intelligence (AI), Personalized Medicine

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زخم و ترمیم بافت یارا
Twelfth Yara International Congress of Wound and Tissue Repair
12th WTR

Code: wtrc12-05590402
Title:

Investigating the Application of 3D Printing in the Design of Personalized Dressings for Wound Healing

Authors:

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Abstract:
Background: The treatment of complex wounds with irregular shapes and variable dimensions has always been a clinical challenge. Conventional and traditional dressings, due to their limitations in achieving complete conformity with wound topography, do not provide optimal efficacy in facilitating the tissue repair process. In this context, three-dimensional printing technology, with its capability to produce complex structures tailored to the anatomical features of each patient, represents a revolutionary approach in the field of regenerative medicine. This study aims to systematically review the capabilities of 3D printing technology in designing and producing personalized dressings, examine the characteristics of the materials used, and evaluate the challenges facing the clinical implementation of this technology. **Methods:** This systematic review investigating the application of 3D printing in the design of personalized dressings for wound healing. A comprehensive literature search was conducted for articles published between 2020 and 2025 in the following databases: PubMed, Web of Science, Google Scholar, and ScienceDirect. The search strategy employed the keywords "Wound Healing", "3D Printing", "Wound Dressing", and "Wound Care", along with their corresponding MeSH terms in both English and Persian, using the Boolean operators 'AND' and 'OR'. Following the search, the quality of the included studies was assessed using the EPHPP Checklist. Editorials and inaccessible full-text articles were excluded, and only eligible studies were included for analysis. The screening process involved an initial evaluation of titles and abstracts, followed by a detailed assessment of full-text articles meeting the inclusion criteria. After applying these criteria, a total of 22 studies were included in the final review. A critical appraisal was conducted, and the relevant data were systematically extracted and analyzed. **Results:** In this systematic review, Persian and English articles published in scientific journals that directly examined the application of 3D printing in the design of personalized wound dressings for wound healing were evaluated. Theoretical articles, letters to the editor and sources without full text were excluded from the study. The findings indicate that 3D printing technology enables the fabrication of patient-specific wound dressings with enhanced anatomical conformity to irregular wound beds. The reviewed studies demonstrate that this technology allows controlled manipulation of microstructural features, including porosity and fiber organization, to improve exudate management and gaseous exchange. Several investigations also reported successful functionalization of printed scaffolds through the incorporation of antimicrobial agents, bioactive molecules, or growth factors, with the capacity for regulated spatial and temporal release. These advancements show that the integration of structural customization with targeted bioactivity can play a significant role in modulating the wound microenvironment and improving therapeutic outcomes in challenging wounds. **Conclusion:** 3D printing technology has opened new horizons in the field of wound care. Although challenges regarding standardization and cost-effectiveness remain, the potential of this technology to provide personalized treatment solutions will bring about a fundamental transformation in wound management. Future studies should focus on optimizing materials, increasing production speed, and conducting large-scale clinical trials.

Keywords:
3D Printing, Wound Healing, Wound Dressing, Wound Care

Code: wtrc12-05570400
Title:

The Effect of Washing Diabetic Wounds with Ozonated Water on Reducing Infectious Agents and Improving Healing Indices

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Abstract:
Background: Diabetic foot ulcers, as one of the most serious complications of diabetes, are considered a major challenge for the health system due to their high microbial load, chronic inflammation, and impaired tissue repair. Ozone water, with its antimicrobial and anti-inflammatory properties, has been proposed as a new approach to wound care, but there is no independent evidence about the effect of washing wounds with this solution, and its scientific investigation is needed. **Methods:** This semi-experimental study was conducted with two intervention groups (washing with ozone water) and control (normal saline) on 60 patients with diabetic ulcers. Clinical, microbial, and laboratory assessments were performed at the beginning and end of the four-week period, and the data were analyzed with appropriate statistical tests. **Results:** The results showed that washing wounds with ozone water significantly reduced the microbial load and biofilm, as well as the depth and surface of the wound. Improvements in quality indicators including decreased secretion, wound odor, and increased granulation and epithelialization rates were observed in the intervention group. Also, significant increases in growth factors such as VEGF and IGF-1 and decreased inflammatory indicators such as CRP and ESR showed that ozone water is able to simultaneously activate anti-inflammatory and reparative processes. **Conclusion:** The findings of the study indicate that washing diabetic wounds with ozone water can be an effective, safe, and feasible intervention in clinical care. Given the positive performance in reducing infectious agents and improving healing indicators, the use of this method can be considered in wound treatment protocols. It is suggested that future studies standardize the concentration, contact time, and investigate the long-term effects of this method.

Keywords:
Ozone Water, Diabetic Foot Ulcer, Wound Healing, Microbial Load, Growth Factors

Code: wtrc12-05010396
Title:

Mitochondrial Transfer from Mesenchymal Stem Cells to Skin injured cells: A Potential Mechanism for Enhancing Skin Wound Healing

Authors:

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Abstract:
Background: Mitochondria play a critical role in all phases of wound healing in several ways, including supplying required ATP for cell proliferation and migration and generating signaling products like mtROS, which regulate angiogenesis, cytoskeleton remodeling, keratinocyte motility, and even mitochondrial morphology changes that promote tissue repair. However, mitochondrial function can be compromised during injury. In order to enhance wound healing, mesenchymal stem cells stimulate mitochondrial biogenesis, remove damaged mitochondria through mitophagy, and even transfer healthy mitochondria to injured cells. Thus, MSC-mediated mitochondrial transfer may suggest a promising therapeutic approach for tissue repair. Material and **Methods:** A narrative review was done using databases including PubMed, Scopus, and Google Scholar. The Search was conducted by using keywords including mesenchymal stem cells, mitochondrial transfer, and skin wound healing. Studies included if they noted the mechanisms of mitochondrial transfer from MSCs to keratinocytes and how it enhances wound healing. **Results:** Over the past decades, research has demonstrated mitochondrial transfer as one of the emerging mechanisms for cellular repair and tissue regeneration. Through this mechanism, mesenchymal stem cells (MSCs) can transfer mitochondria to injured or stressed cells. Mitochondria orchestrate wound healing by supplying metabolic energy required for cellular proliferation, migration, and extracellular matrix synthesis, while modulating redox-dependent signaling pathways through regulated production of reactive oxygen species. Besides, macrophage-derived exosomes can rescue mitochondrial metabolism in leading-edge keratinocytes, highlighting the importance of mitochondrial function in wound closure. There are various mechanisms being used in mitochondrial transfer, including tunnel tube formation, microvesicle formation, gap junctions, cell fusion, and other modes of transfer. **Conclusion:** According to emerging evidence, mitochondrial transfer plays a crucial role in reestablishing cellular bioenergetics and promoting tissue repair. By delivering functional mitochondria through multiple transfer pathways, mesenchymal stem cells help re-establish metabolic competence in injured cells. Based on the recent findings, mitochondrial function is essential for keratinocyte activity and redox-regulated signaling. These insights underscore mitochondrial transfer as a biologically significant process with meaningful therapeutic potential in skin wound healing.

Keywords:
Keratinocytes, Mesenchymal Stem Cell, Mitochondrial Transfer, Wound Healing

Code: wtrc12-00510394
Title:

AI-Enabled Personalization of Probiotic and Postbiotic Therapies in Chronic Wound Healing

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Abstract:
Background: Chronic wounds display substantial heterogeneity in perfusion, inflammation, extracellular-matrix turnover, and microbiome structure, resulting in inconsistent responses to standard care. Probiotic and postbiotic therapeutics—including bacteriocins, heat-killed paraprobiotics, exopolysaccharides, short-chain fatty acids, and anti-inflammatory microbial metabolites—have benefits in epithelialization and reductions in wound bacterial load in preclinical models. Yet their clinical translation remains limited by strain-specific variability, rapid degradation within protease-rich wound beds, and uncertainties regarding dose, stability, and safety in high-risk patients. Artificial intelligence (AI) offers a pathway for personalizing these therapies by integrating wound imaging, host-factor profiling, and microbiome signatures to predict optimal microbial or metabolite-based interventions. **Methods:** A narrative review was conducted across PubMed, Scopus, and Web of Science (2015–2024). Inclusion parameters encompassed: (i) AI-based wound imaging, segmentation, or outcome prediction; (ii) experimental or clinical studies on probiotic/postbiotic wound therapeutics; and (iii) microbiome-AI models relevant to responder prediction. Exclusion criteria included studies lacking mechanistic relevance, purely cosmetic skin applications, and non-standardized metabolite preparations. **Results:** Deep-learning models achieve Dice coefficients of 0.70–0.90 for wound segmentation and tissue-type classification, with performance shaped by ulcer etiology, skin tone, and imaging variability. Predictive machine-learning models using vascular indices, inflammatory markers, and clinical trajectories can estimate healing probability and deterioration risk but remain limited by dataset heterogeneity and lack of multimodal inputs. A practical example includes an AI system that flags cases with persistent slough + anaerobe-enriched microbiome profiles as likely responders to bacteriocin-based adjunct therapy. Microbial therapeutics exert effects via NF-κB and MAPK suppression, IL-10/TGF-β upregulation, angiogenic enhancement, and macrophage M2 polarization. However, therapeutic consistency is limited by microenvironmental instability, low bioavailability, and safety concerns such as horizontal gene-transfer potential. A hypothetical case scenario illustrates clinical relevance: A diabetic-foot ulcer with high protease load and a dysbiotic microbiome enriched in S. aureus and low SCFA-producing taxa may be algorithmically matched to a heat-killed Lactobacillus preparation enriched in bacteriocins, predicted to reduce bioburden and inflammation. Despite parallel advances in AI and microbial therapeutics, no integrated framework currently exists that combines wound imaging, host factors, and microbiome data to guide personalized probiotic/postbiotic selection—representing the core translational gap addressed in this review. **Conclusion:** AI holds transformative potential for enabling patient-specific microbial wound therapeutics, yet current predictive claims remain preliminary due to limited multimodal datasets, methodological variability, and lack of validated models linking microbial metabolites to wound-tissue dynamics. Progress over the next 3–5 years will require standardized microbiome profiling, longitudinal imaging datasets, stability-optimized postbiotic formulations, and mechanistic modeling frameworks capable of simulating microbial–host interactions and expected healing trajectories. This review outlines a conceptual roadmap for developing clinically actionable AI-guided microbial therapeutics in chronic wound care.
Keywords:
Artificial Intelligence, Probiotics, Postbiotics

Code: wtrc12-05440393
Title:

Emerging Innovations in Wound Healing Through 4D Bioprinting and Responsive Bioactive Surface Technologies

Authors:

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Abstract:

Advances in regenerative medicine have led to a shift toward more dynamic, patient-specific strategies for wound management. Despite significant developments in biomaterials, growth factors, and scaffold engineering, traditional approaches often struggle to replicate the constantly changing physiological environment present during the wound healing process. In recent years, 4D bioprinting and responsive bioactive surface technologies have emerged as complementary innovations that can address these limitations. This review explores the intersection of these two rapidly evolving fields and highlights their potential to reshape the future of wound healing. 4D bioprinting expands the capabilities of conventional 3D bioprinting by introducing time-dependent transformations. By utilizing smart materials that can undergo programmed deformation, respond to stimuli, or enable controlled release of bioactive agents, 4D constructs can adapt to changes in the wound microenvironment. This dynamic behavior not only allows engineered tissues to mimic the structural and biochemical properties of natural skin, but it also enables them to respond to mechanical stresses, alterations in hydration, and inflammatory signals as healing progresses. Such adaptability is especially valuable in chronic wounds, where abnormal biomechanical and biochemical conditions often impede or delay the healing process. In parallel, responsive bioactive surface technologies have shown promise in modulating cellular behavior in real-time. These coatings can be engineered to release antimicrobial agents, growth factors, or extracellular matrix-mimicking cues in response to stimuli like pH fluctuations, enzyme activity, or temperature changes. By providing therapeutic interventions on demand, they minimize the need for repeated clinical interventions and support a more coordinated physiological healing pathway. Moreover, many of these surfaces can be directly integrated onto bioprinted scaffolds, allowing for spatial control over biological signals and enhanced cell adhesion, proliferation, and differentiation. The convergence of 4D bioprinting with adaptive bioactive coatings presents an opportunity to design next-generation wound healing platforms that are both structurally dynamic and biologically intelligent. For instance, scaffolds could contract to approach wound edges, release growth factors in synchrony with inflammatory processes, and adjust mechanical stiffness to facilitate new tissue formation. Early preclinical studies indicate improved angiogenesis, accelerated epithelial regeneration, and enhanced collagen organization when using such hybrid systems. Despite these promising findings, several challenges remain. The long-term biocompatibility and degradation profiles of shape-changing polymers, particularly in complex or infected wound environments, require further investigation. Additionally, issues such as manufacturing scalability, regulatory pathways, and standardized evaluation criteria present barriers to clinical application. The integration of real-time sensing with responsive biomaterials may also necessitate more advanced design frameworks and interdisciplinary collaboration. Overall, the synergy between 4D bioprinting and bioactive surface technologies represents a significant step toward personalized, adaptive, and self-regulating wound therapies. Ongoing research in this area may lead to clinically applicable solutions that more effectively address the global burden of acute and chronic wounds compared to current therapeutic approaches.

Keywords:

4d Bioprinting, Wound Healing, Dynamic Tissue Regeneration, Smart Biomaterials, Responsive Bioactive Coatings, Adaptive Scaffolds, Regenerative Medicine, Stimuli-Responsive Surfaces, Chronic Wounds; Tissue Engineering

Code: wtrc12-05400392
Title:

The Role of Plant Exosomes in Wound Healing

Authors:

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Abstract:
Wound healing is a complex biological process that requires precise coordination of cellular activities. Recent studies have highlighted the potential of plant-derived exosomes as novel therapeutic agents in enhancing wound healing due to their unique properties and bioactive components. This review aims to explore the mechanisms by which plant exosomes contribute to wound healing, their composition, and their therapeutic potential in clinical applications. A comprehensive literature review was conducted, focusing on the isolation and characterization of plant exosomes, their molecular cargo, including proteins, lipids, and RNAs, and their impact on cellular processes relevant to wound healing. Studies were selected based on their relevance to exosome function, signaling pathways, and in vivo healing outcomes. Plant exosomes have been shown to facilitate wound healing through several mechanisms. They promote angiogenesis, enhance fibroblast proliferation, and modulate inflammatory responses. The presence of bioactive molecules within these exosomes, such as small RNAs and growth factors, plays a crucial role in mediating these effects. Additionally, plant exosomes exhibit low immunogenicity, making them attractive candidates for therapeutic applications. The emerging role of plant exosomes in wound healing presents a promising area of research with significant therapeutic implications. Their ability to modulate key biological processes highlights their potential as natural and effective wound healing agents. Future studies should focus on elucidating the precise mechanisms of action, optimizing extraction methods, and evaluating their efficacy in clinical settings
Keywords:
Plant Exosomes, Wound Healing, Bioactive Molecules, Angiogenesis, Fibroblast Proliferation.

Code: wtrc12-03590390
Title:

From Ethnobotany to Evidence-Based Therapy: Evaluating the Wound-Healing Potential of Four Traditional Iranian Medicinal Plants in an Experimental Rat Model

Authors:

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Abstract:
Background: Medicinal plants are widely used to treat various diseases due to their therapeutic effects. They are rich sources of phytochemicals with potential therapeutic properties when used directly as raw materials. Herbal medicines are natural compounds obtained from different parts of plants, such as leaves, bark, roots, seeds, or flowers, and are used for medicinal purposes. This study aimed to evaluate the wound-healing efficacy and anti-inflammatory potential of hydroalcoholic extracts of Achillea millefolium, Sambucus ebulus, Urtica dioica, and Wheat germ in a rat excisional wound model. **Methods:** For this research, 30 rats were used. Anesthesia was induced by intraperitoneal injection of xylazine hydrochloride with ketamine hydrochloride. The back surface of each rat was disinfected. A circular wound was created between the two shoulder blades using a 6 mm sterile biopsy punch. After wounding, the rats were randomly divided into three groups of 10 (control without receiving drugs, treatment with herbal extract, and cream base). The treatment continued for three weeks. The size of the wound and tissue samples taken from the wounds were examined on days 7, 14, and 21. One-way ANOVA was used for statistical analysis and comparison of data in the studied groups. SPSS software was used to analyse quantitative data, and the results were then presented using GraphPad Prism software. **Results:** Histological and morphometric analyses showed that topical application of hydroalcoholic extracts significantly improved wound repair compared to the control and base-cream groups. Epithelial thickness was significantly greater in all plant extract-treated groups (Achillea millefolium, Sambucus ebulus, Urtica dioica, and wheat germ) on days 7, 14, and 21 after wounding ($p < 0.05$). Macroscopic assessment revealed faster wound closure in the treatment groups, with a significantly smaller wound area from day 7 onwards. Scar formation was also significantly reduced in all extract-treated groups by day 21, as indicated by less collagen disorganization and lower fibrotic tissue deposition compared to controls ($p < 0.01$). These results indicate that the tested herbal extracts promote re-epithelialization, enhance tissue regeneration, and reduce excessive scarring during the wound-healing process. **Conclusion:** The findings of this study demonstrate that hydroalcoholic extracts of Achillea millefolium, Sambucus ebulus, Urtica dioica, and wheat germ have significant wound-healing and anti-inflammatory properties in a rat excisional wound model. Topical application of these extracts effectively accelerated wound closure, enhanced re-epithelialization, and reduced scar formation, likely through modulation of inflammatory responses and promotion of organized tissue regeneration. These results provide experimental support for the traditional use of these medicinal plants in wound management and highlight their potential as natural, cost-effective candidates for the development of topical therapeutic formulations in regenerative dermatology.

Keywords:
Herbal Medicines, Wound Healing, Anti-Inflammatory, Rat

Code: wtrc12-05510389
Title:

Economic Impact of Telemedicine on the Management of Diabetic Foot Ulcer: A Systematic Review

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Abstract:
Background: Diabetic foot ulcer (DFU) is among the most complex and costly complications of diabetes, imposing a significant burden in terms of morbidity, reduced quality of life, and increased healthcare utilization. Access to specialized wound care is particularly limited in rural areas, where medical facilities are often geographically distant, making in-person visits both time-consuming and financially burdensome. In Iran, the prevalence of diabetes among adults aged 25–70 years is approximately 11.9%, with a substantial proportion remaining undiagnosed. National healthcare expenditures for diabetes account for about 8.6%, compared to the global average of 11.6%. Diabetic patients have markedly higher healthcare utilization, including 4–5 times more hospitalizations, 2.6 times more annual medical visits, and 2.5 times greater prescription use than non-diabetic individuals. With the global diabetic population projected to reach 366 million by 2030, the demand for effective and accessible care continues to grow. Following the COVID-19 pandemic, telehealth systems have expanded rapidly, offering new opportunities for remote monitoring and follow-up of DFU patients. Telemedicine has emerged as a promising approach to maintain high standards of ulcer care while reducing treatment costs and improving patients' quality of life. Given the increasing financial burden of diabetes and the challenges in accessing in-person care, assessing the cost-effectiveness of nurse-led telemedicine interventions is crucial for future healthcare planning. **Methods:** This systematic review included studies published between 2015 and 2025, retrieved from PubMed, Scopus, Web of Science, and Google Scholar. The search employed keywords such as "diabetic foot ulcer," "telemedicine," "telehealth," "nursing," "remote monitoring," and "cost-effectiveness." Studies were included if they evaluated nurse-led or nurse-involved telemedicine interventions for diabetic foot care. Only English-language publications were considered. Studies unrelated to diabetic foot ulcers or telemedicine were excluded. **Results:** The reviewed studies consistently demonstrated that telemedicine interventions for DFU management reduced hospital stay durations and overall healthcare costs. Remote monitoring and follow-up facilitated early detection of complications, decreased unnecessary hospital visits, and improved resource utilization. Telemedicine proved to be a cost-effective strategy, especially in settings with limited access to specialized care. **Conclusion:** Telemedicine-based interventions for diabetic foot ulcers offer a cost-effective solution that significantly reduces hospital stays and healthcare expenditures. Implementing remote monitoring and follow-up can enhance resource efficiency, prevent complications, and improve the overall quality of care, particularly in underserved and remote regions.
Keywords:
Telemedicine, Diabetic Foot Ulcer, Cost Effectiveness

Code: wtrc12-05520388
Title:

Studying the Effect of Ringer's Solution on Wound Irrigation

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Abstract:
There are various ways to irrigate wounds, with normal saline being preferred in many treatment protocols because it is isotonic and does not interfere with the natural wound healing process. In this article, we will examine the consequences and effects of wound irrigation with Ringer's solution and compare it with solutions such as normal saline, polyhexanide, etc.

Keywords:
Ringer "Wound"Ringer Lactate "Scar" Cleaning" Dressing

Code: wtrc12-05510387

Title:

Telemedicine-Based Nursing Interventions for Diabetic Foot Ulcer Care: A Systematic Review

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Abstract:

Background: Diabetic foot ulcer (DFU) is one of the most challenging and costly complications of diabetes and remains a major global health concern. It is strongly associated with reduced quality of life, increased morbidity, and a substantial risk of lower-limb amputation. Recurrent ulceration and prolonged hospitalizations further intensify the burden on patients, families, and healthcare systems. Effective DFU management requires timely assessment, continuous monitoring, and close collaboration between patients and healthcare providers. Nurses play a pivotal role in preventing the progression of foot lesions through structured assessments, early identification of risk factors, patient education, lifestyle counseling, and consistent follow-up. Comprehensive nursing care enhances patients' self-management capabilities and helps reduce DFU-related complications. In recent years—particularly following the COVID-19 pandemic—telehealth technologies have rapidly expanded, offering new opportunities for remote diabetic foot care. Telenursing enables frequent symptom monitoring, early detection of warning signs, and timely adjustments to treatment plans without requiring in-person visits. This approach enhances communication, supports personalized home-based care, and may help prevent treatment delays. Given the persistent burden of DFU, integrating telehealth into nursing practice may be a crucial strategy to improve outcomes and reduce amputation rates. **Methods:** This narrative review examined studies published between 2015 and 2025, identified through searches in PubMed, Scopus, Web of Science, and Google Scholar. Keywords included "diabetic foot ulcer," "telemedicine," "telehealth," "nursing," and "remote monitoring." Studies were included if they evaluated nurse-led or nurse-involved telemedicine interventions related to DFU care, monitoring, or follow-up. Studies unrelated to diabetic foot care or lacking a telemedicine component were excluded. **Results:** Across the included studies, nurses played a central role in telemedicine-based DFU care. Their responsibilities included remote wound assessment, symptom monitoring, patient education, triage of complications, and coordination with multidisciplinary teams including physicians and WOC (Wound, Ostomy, and Continence) nurses. Evidence from randomized controlled trials, feasibility studies, and qualitative research indicated that nurse-led telemedicine interventions improved wound healing rates, reduced hospital visits, and enhanced patient adherence to care plans. Early identification of complications enabled timely interventions. Patients reported high satisfaction with nurse-led telehealth programs, citing convenience, personalized guidance, and improved communication. Overall, nurse-led telemedicine models demonstrated outcomes comparable or superior to standard in-person care. **Conclusion:** Nurse-led telemedicine represents a promising strategy for managing diabetic foot ulcers. It supports improved healing, better adherence to care plans, early complication management, and high patient satisfaction. Incorporating telehealth into nursing practice is a vital step toward improving outcomes and reducing the burden of DFU-related complications.

Keywords:

Remote Monitoring, Diabetic Foot Ulcer, Nursing, Telemedicine

Code: wtrc12-03410385
Title:

Reduced Graphene Oxide-Based Conductive Wound Dressings for Improved Skin Regeneration

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Abstract:
Chronic wounds delay healing due to impaired bioelectrical signaling, persistent inflammation, and microbial infection, all of which compromise regeneration. Traditional wound dressings provide mainly passive coverage and cannot actively modulate these factors. Reduced graphene oxide (rGO), a partially reduced form of graphene oxide, uniquely combines electrical conductivity, mechanical strength, biocompatibility, and antimicrobial properties, making it an ideal additive for advanced wound dressings. By restoring the sp2 carbon lattice, rGO enhances electron mobility and creates conductive pathways that transmit endogenous and exogenous electrical signals across the wound surface. These signals influence cellular activities critical for wound healing, including keratinocyte and fibroblast proliferation, migration, stem cell differentiation, and angiogenesis. Furthermore, rGO neutralizes oxidative stress at the wound site and provides a favorable environment for tissue repair. Conductive dressings produced by incorporating rGO into hydrogels, nanofibers, and films thereby not only physically protect wounds but also dynamically contribute to biological regeneration. Methods A comprehensive review of the scientific literature was conducted using databases such as PubMed, Scopus, and Web of Science. Search terms included keywords related to reduced graphene oxide, wound dressing, electrical conductivity, and bioelectric signaling. Studies published up to 2025 with inclusion criteria focusing on rGO synthesis methods, electrical properties of rGO composites, and evaluation of biological efficacy in wound healing models were considered. Data from selected in vitro and in vivo studies were qualitatively synthesized to assess how different reduction methods affect the conductivity of rGO and their impact on wound healing applications. Study quality and replicability were critically assessed to identify common challenges and emerging research directions. Results A optimal conductivity of a wound dressing typically falls in the range of 0.001–1 S/m, allowing for effective electrical communication between cells and improving healing outcomes. dressings containing rGO significantly enhance cell migration and proliferation through modulation of membrane potentials and calcium ion signaling, which regulate genes involved in tissue regeneration. The conductive network created by rGO enhances charge transfer and stimulates cellular bioelectrical activity, which is essential for coordinated healing. Additionally, these dressings reduce bacterial colonization through intrinsic antimicrobial actions including membrane disruption and oxidative damage. The biological performance strongly depends on the rGO synthesis parameters, reduction method, and composite formulation, necessitating careful optimization for safety and efficacy. Reproducibility and scale-up of production remain challenges for clinical application. Conclusion Conductive wound dressings based on regenerated graphene oxide are a promising technology for actively regulating electrical signaling and biological functions at the wound surface while providing structural support and infection control. Continued advances in standardization of rGO production, optimization of reduction strategies, elucidation of mechanism, and comprehensive safety evaluation will be pivotal for their clinical success as next-generation wound care solutions.
Keywords:
Reduced Graphene Oxide, Conductive Wound Dressing, Electrical Conductivity, Bioelectrical Signaling, Chronic Wound Healing

Code: wtrc12-03680384
Title:

From Nature to Healing: Utilizing Aloe Vera Exosomes in Biocompatible Wound Dressings

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Abstract:

Background: Wound healing is a complex biological process that requires careful management to prevent complications and facilitate tissue regeneration. The increasing popularity of natural compounds like Aloe Vera stems from their numerous medicinal properties, particularly their anti-inflammatory and tissue-regenerating effects. Exosomes derived from Aloe Vera gel, which contain microRNAs and bioactive proteins, can significantly enhance the migration and proliferation of essential cells involved in wound healing. This study aimed to create a wound dressing based on these exosomes that is both biocompatible and expandable, promoting faster wound healing. **Methods:** The proposed wound dressing was developed using a combination of Carboxymethyl Cellulose (CMC) and Hydroxyethyl Cellulose (HEC) in a consistent ratio. This polymeric network was crosslinked with citric acid to create a three-dimensional, expandable structure suitable for exosome loading. Exosomes were isolated from Aloe Vera gel through ultracentrifugation and filtration techniques, and their characterization was performed using SEM and DLS. In vitro assessments included the MTT test on a human fibroblast cell line, and exosome release was evaluated using the Bradford assay. **Results:** The nanoscale structure of the exosomes enables them to penetrate deeply into skin layers, thereby enhancing the effectiveness of the regenerative components. The dressing significantly aids tissue repair by shortening the inflammatory phase, promoting angiogenesis, stimulating fibroblast and keratinocyte proliferation and migration, and enhancing the production of Collagens I and III. **Conclusion:** This approach, which leverages biocompatible polymers and the regenerative capabilities of Aloe Vera exosomes, offers an effective platform for managing skin wounds.

Keywords:

Exosome, Aloe Vera, Expandable Wound Dressing

Code: wtrc12-05250383
Title:

The Effect of Psychological Interventions on Enhancing Preventive Behaviors and Self-Care Ability in Individuals at Risk of Diabetic Foot Ulcers: A Systematic Review Study

Authors:

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Abstract:
Background: Diabetic foot ulcers (DFUs) are one of the most serious complications of diabetes mellitus, often leading to infection, hospitalization, and even amputation. Preventive behaviors and self-care play a crucial role in reducing the incidence and severity of DFUs. Psychological interventions, including education, cognitive-behavioral strategies, and motivational support, may enhance patients' adherence to preventive practices and self-care routines. This systematic review aims to examine the effect of psychological interventions on enhancing preventive behaviors and self-care ability in individuals at risk of diabetic foot ulcers. **Methods:** A systematic review search process was conducted using the CINAHL, Scopus, PubMed, PsycINFO, Web of Science (WOS), SID, Magiran databases, and Google Scholar was used to search for gray literature from the inception of databases to 2025. The search utilized the keywords "Diabetic Foot Ulcers," "Psychological Interventions," "Self-Care," "Preventive Behaviors," and "Patients at Risk" in both Persian and English languages. Our inclusion criteria were all interventional and quasi-experimental studies that assessed the effect of psychological interventions on enhancing preventive behaviors and self-care ability in individuals at risk of diabetic foot ulcers. Exclusion criteria included commentaries, review articles, conference papers, and studies that did not report outcomes related to self-care or preventive behaviors. Two authors independently conducted the screening and data extraction. The ROB-2) was used to assess the quality of the included studies, and the PRISMA guidelines were followed to ensure adherence to systematic review reporting standards. **Results:** Of a total of 936 studies identified, after screening titles and abstracts and removing duplicates (N = 231), 69 studies were selected for full-text review. Among these, 9 interventional and quasi-experimental studies that met the PICOTS criteria were included in the systematic review. The findings indicated that psychological interventions had a significant positive effect on enhancing preventive behaviors and self-care ability in individuals at risk of diabetic foot ulcers. Studies demonstrated that interventions such as cognitive-behavioral therapy, motivational interviewing, structured education, and counseling improved patients' adherence to foot care practices, including regular self-examination, proper foot hygiene, and use of appropriate footwear. Enhanced self-care and preventive behaviors were associated with reduced incidence and severity of diabetic foot ulcers, highlighting the importance of integrating psychological support into routine care for high-risk patients. **Conclusion:** Psychological interventions are effective in enhancing preventive behaviors and self-care abilities in individuals at risk of diabetic foot ulcers. Integrating such interventions into routine care may reduce the incidence and severity of ulcers and improve patient outcomes.

Keywords:
Diabetic Foot Ulcers, Psychological Interventions, Self-Care, Preventive Behaviors, Patients at Risk

Code: wtrc12-05430382
Title:

Evaluation of the Effectiveness of the Ozonized Herbal Medicine on Healing of Diabetic Foot Ulcers

Authors:

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Abstract:

The management of diabetic foot ulcers (DFUs), a prevalent and complex complication of diabetes, necessitates innovative and effective therapies to enhance the wound healing process. This study aimed to evaluate the effectiveness of an ozonized herbal medicine in the healing of diabetic foot ulcers.

Keywords:

Ozone therapy,Diabetic foot, new treatment

Code: wtrc12-05500381
Title:

The Effect of Probiotics on Wound Healing

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Abstract:

Background: Probiotics are live microorganisms which provide health benefits when they are consumed in an adequate manner . Probiotic therapy has a promising role in promoting the healing of dermatological conditions, including chronic wounds, surgical wounds, diabetic foot ulcers (DFU), venous or arterial ulcers, oral wounds, atopic dermatitis, pressure sores, acne vulgaris, hidradenitis supurativa, etc. **Methods:** This study is a reviewed article that is provided with library and internet resources. **Results:** Probiotics could improve the healing process by inhibiting the growth of planktonic Gram-negative and Gram-positive bacteria and limiting their biofilm development by releasing molecules that interfere with the quorum-sensing (QS) system of bacteria and by blocking the adhesion process to the epithelial tissue. Their ability to reduce the colonization of pathogens through competition for substrate-adhesion sites, nutrients, and growth factors. Probiotics also interference with the QS signaling system by producing lactic acid, which decreases the pH of the local environment, and other anti-pathogenic molecules, such as hydrogen peroxide, reuterin, and bacteriocins. These substances are able to disrupt the most common chronic wound microbial pathogens or to inhibit their virulence. The most predominant species of probiotics studied as new therapeutical strategies for their capacity to promote wound healing, making them ideal healing candidates, include lactic acid bacteria (LAB) such as *Lactobacillus plantarum, L. acidophillus, L. fermentum L. paracasei, L. rhamnosus, L. bulgaricus, L. reuteri, L. delbreuckii, L. salivarus*, and *Bifidobacterium lactis*. In addition, studies showed that species from the genera Bacillus, Enterococcus, Streptococcus, or yeasts such as Saccharomyces, could be used as probiotics with efficient wound healing properties. Oral administration of probiotic formulations such as *Lactobacillus casei, L. fermentum, L. acidophilus, L. casei*, and *Bifidobacterium bifidum* oral supplementation, sets off a cascade of systemic effects that can indirectly impact wound healing, such as improving the absorption of minerals, vitamins, and cofactors implicated in the regulation of skin healing, reducing inflammation, regulating the host's immune system, and modulating the microbiota composition. These effects further promote a balanced health condition in the host. Also, Probiotic formulation treatment applied topically such as including *S. aureus, P. aeruginosa, A. baumanii*, and E. coli, as well as with topical probiotics, metabolites, or supernatants, is an attractive option for improving wound healing in burns, skin ulcers, or surgical lesions through promoting cutaneous tissue repair and reducing bacterial growth and development. One of the essential properties of probiotics is their ability to compete with pathogenic microorganisms for nutrients and adhesion sites on host mucosa. Their species-specific antagonistic activity inhibits pathogenic species from colonizing that niche. Additionally, their antimicrobial activity is mediated by the production of lactic acid, resulting in the acidification of the matrix, but some strains are able to also produce bacteriocins. Probiotics could also impact, at least indirectly, the proliferative phase, stimulating the re-epithelialization and neovascularization of the damaged tissue, increased collagen levels and capillary vessels, accelerate keratinocyte migration and proliferation, decrease inflammatory cytokines and TNF- α and increase the production of anti-inflammatory cytokines and accelerated re-epithelialization and the formation of granulation tissue.

Keywords:
Probiotic, Wound, Wound Healing, Supplement Therapy

Code: wtrc12-05460380
Title:

A Mechanically Reinforced Amniotic Membrane–Based Bilayer Construct for Improved Fibroblast Activity and Controlled Degradation in Wound Management

Authors:

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Abstract:
Background: Chronic and complex wounds require advanced dressings that provide both bioactivity and sufficient mechanical stability. Although the human amniotic membrane (hAM) is widely used in wound management due to its anti-inflammatory, anti-scarring, and pro-regenerative properties, its clinical application is limited by weak tensile strength, rapid degradation, and difficult handling in moist environments. The development of hybrid biomaterials that combine the biological advantages of hAM with the mechanical performance of engineered polymers offers a promising strategy for next-generation wound dressings. Objective: This study aimed to fabricate and characterize an ultrathin bilayer wound dressing composed of decellularized human amniotic membrane integrated with a polycarbonate urethane/silk fibroin (PCU/SF) core-shell emulsion in order to enhance mechanical properties, control degradation, and improve cell–scaffold interactions for skin tissue repair. **Methods:** Human amniotic membrane was isolated and decellularized using NaOH/EDTA treatment followed by extensive washing and histological confirmation with histological quantification. A stable PCU/SF emulsion was produced using a chloroform–formic acid solvent system for PCU and an aqueous silk solution containing Tween-80 as surfactant. The emulsion was deposited onto decellularized hAM using high-speed spinning to obtain an ultrathin (<80 μm) bilayer membrane. The construct was characterized using biochemical and biological assay. **Results:** The decellularization protocol successfully removed cellular components, as confirmed by the absence of nuclei in histological images and DNA content assay. Based on SEM assay and FTIR report, the bilayer and interaction between silk and PCU within the core–shell architecture was confirmed. Mechanical testing was also showed that the bilayer significantly outperformed native hAM, with increases in tensile strength, elongation at break, and Young's modulus, enabling improved handling and resistance to wound-site shear forces. Biological assays revealed excellent cytocompatibility, with enhanced fibroblast adhesion and greater cell migration in scratch assays compared to hAM alone. **Conclusion:** The engineered hAM–PCU/SF ultrathin bilayer dressing effectively addresses the main limitations of native amniotic membrane by improving mechanical robustness, moderating degradation, and supporting fibroblast activity. The synergistic integration of a bioactive natural scaffold with a mechanically resilient synthetic–natural emulsion introduces a promising candidate for chronic wound management, burn care, and large skin-defect reconstruction. Further in vivo studies are warranted to validate therapeutic outcomes and evaluate long-term safety for clinical translation.
Keywords:
Bilayer wound dressing; Decellularized amniotic membrane (dAM); Silk fibroin (SF)

Code: wtrc12-03280379
Title:

A Case Report: The Effects of Photobiomodulation Therapy and Amniotic Fluid Gel on a Severe Diabetic Foot Ulcer

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Abstract:
Background: Diabetic patients frequently experience a serious complication known as impaired wound healing, which increases the likelihood of foot infection and limb amputation. Investigators have been looking for novel methods to treat diabetic foot ulcers (DFUs) recently. Methods/Material and **Methods:** A 75-year-old woman with type one diabetes mellitus (DM) presented with a 40 cm² full-thickness cutaneous wound on the plantar surface of her right foot (Wagner grade 3), resistant to standard DFU treatments. In this case, amniotic fluid gel (AF gel) and photobiomodulation therapy (PBMT) (400 mW/cm²; 810 nm, once a week for 16 weeks) were applied to accelerate wound healing. **Results:** During the course of combination therapy, the ulcer size significantly decreased, pain was reduced, and complete wound closure was achieved within 16 weeks. **Conclusion:** This case demonstrates the potential synergistic effects of PBMT and AF gel in managing severe DFUs. Further clinical trials and preclinical studies are recommended to elucidate the mechanism of action and confirm these findings.

Keywords:
Amniotic fluid gel, Diabetic foot ulcer, Neuropathic pain, Photobiomodulation therapy, Stem cell

Code: wtrc12-04380376
Title:

Cosmetic Applications of PDT Via Rose Bengal Photosensitizer

Authors:

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Abstract:
Photodynamic therapy (PDT) has become an integral modality in cosmetic dermatology. Rose Bengal (RB), a xanthene-based photosensitizer with high singlet oxygen quantum yield, is emerging as a superior alternative to conventional agents like 5-aminolevulinic acid (ALA) and methyl aminolevulinate (MAL). This review comprehensively examines the mechanistic basis and clinical potential of RB-PDT. A thorough literature search was conducted across major scientific databases (e.g., PubMed, Scopus, Web of Science), focusing exclusively on studies published within the past five years. The search strategy incorporated the keywords "photodynamic therapy (PDT)," "Rose Bengal," and "therapeutic–aesthetic effects of photodynamic therapy." Relevant publications investigating RB-PDT in dermatology—particularly in acne vulgaris and aesthetic applications—were evaluated, and the evidence was synthesized to provide a critical appraisal of its efficacy, safety, and practical clinical protocols. RB-PDT exerts its effects through three primary mechanisms: 1) Antimicrobial: Potent photoinactivation of Cutibacterium acnes, with demonstrated superiority in penetrating biofilm structures; 2) Anti-inflammatory: Significant attenuation of proinflammatory cytokines and modulation of innate immune pathways; 3) Structural Modulation: Sebosuppressive effects, normalization of follicular keratinization, and induction of dermal remodeling through stimulated fibroblast migration and balanced collagen synthesis. These actions make it uniquely effective for treating active inflammatory acne while concurrently preventing and reducing early post-acne scarring. Furthermore, its compatibility with shorter drug-light intervals and lower fluence rates enhances patient tolerability. Combination regimens with microneedling or fractional lasers show synergistic benefits for overall skin rejuvenation. RB-PDT represents a paradigm shift in cosmetic dermatology by unifying antimicrobial, anti-inflammatory, and regenerative properties into a single, well-tolerated treatment modality. It holds immense promise as a standardized therapy for multifaceted acne management and aesthetic skin rejuvenation. Future research should focus on large-scale randomized controlled trials to optimize treatment parameters and solidify its position in clinical practice. Moreover, the approach evaluated in our study has the potential to serve as a non-invasive alternative to more aggressive or invasive therapeutic modalities.

Keywords:
Rose Bengal, Photodynamic Therapy, Cosmetic Dermatology

Code: wtrc12-05420375
Title:

Artificial Intelligence in the Management and Healing of Diabetic Foot Ulcers: A Systematic Review

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Abstract:
Background: DM infection is indeed a superlative complication in diabetes, severely affecting the lower extremities and resulting in possible skepticism regarding amputation and secondary infection. The wound management process is complex, often requiring advanced solutions for assessment and personalized care considerations. Recently, AI has made its footprint in the realm of wound care. This is not a systematic review, but rather an attempt to organize evidence on the application of AI in the monitoring of DFUs, evaluation, and prediction of healing. **Methods:** The search was conducted through PubMed, Scopus, and Web of Science in the period of 2018 to 2023. These studies included such applications of AI, ML, and DL in the sector of DFU investigations. **Results:** The AI algorithms, especially convolutional neural networks, exhibited proficiency in digital wound image analysis. Automated wound tissue classification based on types (granulation, slough, and necrosis), boundary segmentation for area and volume evaluation, and assessment of clinical signs of infection will be some of the straight applications. Furthermore, ML models integrated with those patients' histories, biomarkers, and wound images emerged as promising in predicting healing outcomes, thus enabling early intervention and individualized therapy. AI-empowered telemedicine platforms enable real-time follow-up in the outdoors with accessibility and continue a care system. **Conclusion:** Artificial Intelligence has the potential to transform entire DFU management by automating objective measurements, improving the accuracy of diagnoses, and providing predictive analytics. It is anticipated that such an approach will improve healing rates and reduce the chances of amputation. Further work must be directed at validating these tools in a diversity of contexts with regard to robust clinical validation and the challenges of data standardization and interoperability for seamless integration into routine clinical workflows.
Keywords:
Diabetic Foot Ulcer, Artificial Intelligence, Deep Learning, Wound Care, Medical Image Analysis, Predictive Analytics, Telemedicine, Automated Assessment

Code: wtrc12-02080373
Title:

Narrative Review on the Role of Engineered Mesenchymal Stem Cell-Derived Exosomes as Targeted Nanocarriers in Enhancing Obstetric Wound Healing: A Regenerative Medicine Perspective

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Abstract:

Background: Obstetric wounds, including cesarean section and episiotomy incisions, may result in serious and persistent complications—such as infection and chronic pain—particularly when healing is incomplete. Mesenchymal stem cell (MSC)-derived exosomes, as promising biological nanocarriers (30–150 nm), have garnered considerable attention due to their potential in obstetric wound repair. These exosomes promote cellular differentiation and tissue regeneration by delivering miRNAs and growth factors. Furthermore, they enhance the quality and speed of wound healing by stimulating angiogenesis and modulating inflammatory responses. However, the clinical application of MSC-derived exosomes is hindered by challenges such as low biostability, lack of specific targeting, and limited therapeutic cargo capacity. This narrative review examines the role and underlying mechanisms of MSC-derived exosomes in promoting obstetric wound healing from a regenerative medicine perspective. **Methods:** This narrative review was performed by searching the PubMed, Scopus, Web of Science, and Google Scholar databases. Relevant keywords related to engineered MSC-derived exosomes and wound healing were utilized. Studies published between 2020 and 2025 that investigated exosome engineering in skin wound models were selected, and their findings were extended to the field of obstetric wounds. **Results:** Studies indicate that mesenchymal stem cell-derived exosomes (MSC-exosomes) regulate and accelerate wound healing through multiple molecular and cellular mechanisms. By delivering miRNAs, proteins, and growth factors to target cells, these exosomes activate key signaling pathways, including the TGF-β/Smad and Wnt/β-catenin pathways. This activation promotes the differentiation of fibroblasts into myofibroblasts and enhances the synthesis of the extracellular matrix (ECM), thereby facilitating tissue repair and increasing its tensile strength. Furthermore, via the delivery of miRNA-126, these nanocarriers activate the VEGF/VEGFR2 pathway, which induces angiogenesis. This process is crucial for forming new blood vessels and delivering oxygen and nutrients to the wound site, ultimately accelerating healing. MSC-exosomes also modulate the immune response by inhibiting the NF-κB pathway. This inhibition reduces the production of pro-inflammatory cytokines, such as TNF-α and IL-6, thereby preventing chronic inflammation and subsequent tissue damage. Additionally, MSC-exosomes enhance the anti-inflammatory response by stimulating M2 macrophage polarization, thereby contributing to the better regulation of the healing process. Clinical studies have demonstrated that the application of MSC-exosomes can reduce wound healing time by 30–40% and improve the quality and strength of regenerated tissue by 20–25%. However, clinical translation faces challenges, primarily due to the short half-life of exosomes in circulation and their non-specific biodistribution to off-target organs, which currently limit treatment efficacy. **Conclusion:** Despite the therapeutic promise of engineered exosomes for obstetric wound healing, several challenges impede their clinical translation. Key obstacles include the lack of standardized production protocols, undefined optimal dosage, and insufficient long-term safety data. Successfully advancing this strategy will require conducting robust clinical trials, establishing standardized manufacturing guidelines, and performing systematic evaluations of pharmacokinetics and safety.

Keywords:

Engineered MSC-derived Exosomes, Obstetric Wound Healing, Targeted Nanocarriers, Regenerative Medicine, Molecular Mechanisms

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Code: wtrc12-00960372
Title:

Application of Artificial Intelligence and Personalized Medicine in Wound Management: From Digital Monitoring and Lifestyle to Rehabilitation and Advanced Nursing

Authors:

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Abstract:

Background: The management of chronic wounds particularly pressure ulcers and diabetic foot ulcers requires an interdisciplinary and technology-driven approach due to the multifactorial nature and complexity of tissue repair. Wound healing involves hemostasis, inflammation, proliferation, and remodeling phases, each influenced by diverse clinical and individual factors, making the prediction of healing trajectories challenging. Despite technological advancements, data-driven and personalized wound care solutions remain limited. Artificial intelligence (AI), through precise assessment, digital monitoring, and clinical decision support, enables targeted and optimized nursing interventions. Integrating AI with personalized medicine has the potential to enhance patient outcomes, quality of life, and healthcare resource utilization. However, systematic evidence regarding personalized AI-based wound care remains insufficient. This review investigates the applications, benefits, and challenges of AI in wound nursing and rehabilitation. **Methods:** This review was conducted according to PRISMA guidelines. Searches were performed in PubMed, Scopus, Google Scholar, SID, and Magiran between 2020 and 2025 using keywords related to artificial intelligence, wound management, and personalized medicine. Quantitative, qualitative, and mixed-method studies addressing digital monitoring, healing prediction, and nursing care were included. Duplicate, irrelevant, or incomplete-text articles were excluded. Study quality was assessed using the MMAT tool, and the selection and screening process was documented according to the PRISMA checklist. **Results:** Findings indicate that AI significantly improved clinical wound assessment, healing prediction, and personalized care planning. Machine learning algorithms demonstrated high accuracy in analyzing wound size, tissue type, depth, and infection risk, enabling faster and more precise clinical decision-making. Integration of wearable sensors, mobile applications, and intelligent monitoring systems facilitated remote surveillance, reduced in-person visits, saved time, and supported complication prevention. These technologies also enhanced patient engagement in self-care. In nursing practice, AI automated routine tasks, providing more opportunity for cognitive work, complex decision-making, and therapeutic communication. Large language models (e.g., ChatGPT) showed promise for nursing education and skill development. Despite these advantages, maintaining clinical judgment, data quality, model transparency, and privacy remains essential. Overall, AI demonstrates transformative potential in wound monitoring and rehabilitation; however, achieving fully personalized care requires standardization, bias mitigation, and active nurse involvement in system development and deployment. **Conclusion:** This review highlights that the application of AI in wound management should be implemented with a focus on improving nursing workflows, reducing patient burden, and empowering self-care. Technologies such as wearable sensors and remote monitoring can support timely interventions, reduce complications, and optimize resource allocation. Ethical design, data standardization, and ongoing nurse training are critical to ensure trust, safety, and human-centered care. Therefore, AI must act as an augmenting tool that strengthens—not replaces—the central role of nurses in wound care.

Keywords:
Artificial Intelligence, Wound Management, Personalized Medicine

Code: wtrc12-05400371

Title:

Innovative Alg/MMT Sponge: A Bioactive Solution for Controlling Arterial Bleeding and Reducing Infection Risks

Authors:

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Abstract:

Despite advancements in conventional hemostatic technologies, uncontrolled arterial bleeding and secondary infections continue to pose significant clinical challenges and are among the leading causes of fatalities resulting from trauma. Therefore, it is crucial to develop hemostatic materials that can quickly establish a robust physical barrier, initiate coagulation cascades, and address bacterial infections. In this study, we developed a multifunctional ultra-porous sponge made from alginate and enriched with montmorillonite (MMT) nanosheets, which act as bioactive agents. This sponge was created through gas-foaming, ionic crosslinking, and lyophilization techniques. The sponge demonstrated antibacterial properties against Staphylococcus aureus and Escherichia coli, as confirmed by inhibition zone, minimum inhibitory concentration (MIC), and minimum bactericidal concentration (MBC) tests. Additionally, the Alg/MMT sponge showed biocompatibility by maintaining high cell viability and promoting cell proliferation, as verified by MTT and DAPI assays. In vitro assessments indicated that it outperformed EquiSpon® in terms of blood clotting (by 9.15%), erythrocyte adherence (94.50%), platelet adherence (87.30%), and achieving a clotting time of 19 seconds (P-value < 0.001). In a rat model of femoral artery trauma, the Alg/MMT sponge effectively reduced blood loss to 0.75 g and achieved hemostasis in 32.66 seconds, which is a 7.5-fold improvement compared to EquiSpon® (P-value < 0.001). Collectively, these findings underscore the Alg/MMT sponge as a promising hemostatic agent for use in clinical settings.

Keywords:

Sponge, Hemostatic, Montmorillonite

Code: wtrc12-05170370
Title:

Evaluation of the Efficacy of Topical Ointment Containing Silver Nanoparticles and Black Myrobalan Extracts for The Treatment of Cutaneous Leishmaniasis Caused by Leishmania major (MRHO/IR/75/ER)

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Abstract:

Background: Leishmaniasis, a neglected tropical disease caused by protozoan parasites of the genus Leishmania, poses significant public health challenges in endemic regions worldwide. Among its various forms, cutaneous leishmaniasis (CL) is particularly prevalent, leading to debilitating skin lesions and substantial morbidity. Traditional treatments, primarily based on pentavalent antimonials, often face issues of toxicity and drug resistance, necessitating the exploration of alternative therapeutic strategies. Studies have demonstrated that AgNPs can reduce parasite viability and promote wound healing by enhancing fibroblast activity and modulating inflammatory responses. Furthermore, the biocompatibility and low toxicity of these nanoparticles make them promising candidates for topical applications. This study aims to evaluate the efficacy of a topical ointment containing AgNPs and herbal extracts, specifically targeting the treatment of CL caused by Leishmania major (MRHO/IR/75/ER). **Methods:** Silver nanoparticles (AgNPs) were synthesized using a green synthesis method with methanolic extract of black myrobalan (Terminalia chebula) as a reducing and stabilizing agent. The characteristics of the synthesized nanoparticles were identified using UV-Vis spectroscopy, Dynamic Light Scattering (DLS), and Fourier Transform Infrared Spectroscopy (FTIR). The antileishmanial effects of AgNPs were evaluated in various concentrations (50, 100, 200, and 400 μg/mL) against Leishmania major amastigotes in cell culture conditions. The viability of the parasites was assessed using the Trypan Blue exclusion method and microscopy. To confirm the in vitro results, AgNPs were applied topically to skin lesions induced by Leishmania major in BALB/c mice. The treatment was administered daily for 14 days, with assessments of lesion size and amastigote counts conducted on days 7, 14, and 21 post-treatment. Statistical analyses were performed to evaluate the significance of the results. **Results:** The antileishmanial effects of silver nanoparticles (AgNPs) synthesized via green synthesis using methanolic extracts of black myrobalan (Terminalia chebula) were evaluated on lesions caused by Leishmania major. The results indicated that the antileishmanial activity was statistically significant across all concentrations and time points analyzed ($P<0.05$). At concentrations of 50, 100, 200, and 400 μg/mL, no significant difference was observed compared to the positive control group on day 7 post-treatment ($P>0.05$). However, on days 14 and 21 post-treatment, the efficacy of AgNPs was significantly lower than that of the positive control group, with statistical significance reported ($P<0.05$). **Conclusions:** Based on the findings reviewed, it can be concluded that silver nanoparticles (AgNPs) synthesized through green methods, particularly using methanolic extracts of black myrobalan, exhibit significant antileishmanial activity against Leishmania major. It is important to note that further research is needed to optimize their application and understand the underlying mechanisms of their antileishmanial effects. Overall, these findings highlight the promise of using green-synthesized silver nanoparticles as a viable option in the treatment of leishmaniasis, especially considering the limitations associated with conventional therapies.

Keywords:

Leishmania Major, Silver Nanoparticles (AgNPs), Black Myrobalan, Treatment

Code: wtrc12-05300368
Title:

Investigating the Effect of Platelet-Rich Plasma (PRP) on the Healing of Pressure Ulcers: A Systematic Review

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Abstract:
Background: Pressure ulcers represent one of the most significant challenges in clinical care, particularly among hospitalized patients and the elderly. Autologous platelet-rich plasma (PRP), a novel therapeutic approach, has garnered increasing attention for its high concentration of growth .factors, as well as its anti-inflammatory and antimicrobial properties. **Methods:** This review analyzed a range of clinical and experimental studies, including randomized controlled trials, case series, and systematic reviews. Findings suggest that topical application of PRP—either alone or in combination with adjunctive methods such as negative pressure wound therapy NPWT) or topical antiseptics—results in significant improvements in key clinical outcomes. These include reduced healing time, decreased wound size and depth, lower levels of inflammatory markers (CRP, ESR, WBC), reduced pain, and improved Pressure Ulcer Scale for Healing .PUSH) scores :**Results:** Studies demonstrate that PRP modulates the biological microenvironment of pressure ulcers by reducing microbial colonization and promoting epithelialization, angiogenesis, and granulation tissue formation. Although overall findings are promising, some studies reported no statistically significant differences compared to conventional therapies, underscoring the need for further large-scale, .well-designed clinical trials :**Conclusions:** Autologous PRP—particularly when combined with contemporary wound care modalities—emerges as an effective, safe, and cost-efficient strategy for managing pressure ulcers. Considering its potential to reduce complications, expedite healing, and enhance patients' quality of life, PRP .warrants inclusion in future treatment protocols
Keywords:
Platelet-rich plasma ،Pressure ulcer ،Wound Healing

Code: wtrc12-00500367
Title:

Application of Artificial Intelligence and Machine Learning in Early Detection, Prediction, and Prevention of Pressure Ulcers

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Abstract:
Background: Pressure ulcers, or bed sores, are localized lesions to the skin and underlying tissues, usually arising from prolonged pressure applied to specific parts of the body. These lesions are common among hospitalized patients and often lead to pain, infections, and extended hospital stays; thus, they are both clinically important and costly. Traditional methods for detection and prevention have largely been based on clinical judgment and human intervention, which may be lacking in terms of timeliness and accuracy. Recent advances in AI have developed sophisticated clinical and image data analytical tools, which could provide early identification of high-risk areas and allow more accurate prediction of the likelihood of pressure ulcer development. **Methods:** This narrative review was done in 2025 and identified four peer-reviewed studies: three from PubMed and one from MDPI. The selected studies examined how AI and machine learning could be used for early identification and risk assessment of pressure ulcers. Data sources included both clinical variables and wound images that were obtained from hospitalized patients. The AI techniques in these reviewed studies involved image-recognition models, like YOLOv8m for detecting vulnerable regions, and also included machine-learning algorithms for the prediction of risk. Standard procedures for model training and validation were followed, with dataset splitting into training and testing subsets. Model performance was evaluated based on standard metrics, which included accuracy, sensitivity, and specificity. **Results:** The reviewed literature shows that machine-learning models can predict areas at high risk for the development of pressure ulcers. These studies used AI algorithms, namely ANN, SVM, KNN, and Random Forest, which were based on clinical and demographic variables such as age, duration of immobility, albumin levels, and Braden score, and gave strong support to nursing staff in assessing risks and providing preventive care. The predictive performance of these models was relatively high; one study reported 99% accuracy, while in another, the AUC was approximately 0.94. Another study identified that the YOLOv8m model for wound-image analysis classified the stages of ulcers reliably and recommended further interventions accordingly with an accuracy of 84.6%. Besides, the application of the AI-powered smart mattress showed better healing outcomes, reflected in increased PUSH scores among the hospitalized patients. **Conclusion:** AI-based approaches may improve pressure ulcer prevention, early detection, and management. Machine-learning models using clinical data predict risk with strong accuracy and support informed nursing decisions, whereas computer-vision approaches, such as YOLOv8m, stage pressure ulcers precisely and thus correctly plan interventions. Finally, AI-enabled smart devices like an intelligent mattress further contribute positively toward outcomes in wound healing. Standardized methodologies and comprehensive external validation should be pursued to guarantee safe and effective technology translation to routine clinical practice.

Keywords:
Pressure Ulcer, Artificial Intelligence, Machine Learning, Wound Image Analysis, Risk Prediction, Deep Learning

Code: wtrc12-05370366

Title:

Advanced Bioadhesive Hydrogel Dressing to Accelerate Skin Wound Repair

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Abstract:

Background: Bioadhesive hydrogel dressings are increasingly used in wound management; however, many current formulations still lack the multifunctional properties needed to support rapid and effective skin repair. To address these limitations, an advanced composite hydrogel adhesive was developed with enhanced mechanical stability, tissue adhesion, and pro-healing biological functions. **Methods:** A bioinspired adhesive hydrogel was engineered and reinforced with porous inorganic nanoparticles synthesized via a controlled sol–gel–based process. The nanoparticles were uniformly dispersed within the hydrogel matrix to improve its structural and functional properties. The composite was evaluated through mechanical testing, cytocompatibility and hemocompatibility assays, and in vitro analyses of angiogenic and hemostatic performance. Its therapeutic potential was further assessed in vivo using a full-thickness skin wound model in mice. **Results:** The composite adhesive hydrogel exhibited strong tissue adhesion, improved mechanical resilience, and excellent compatibility with blood and cellular environments. It demonstrated effective hemostatic activity and promoted angiogenic responses in vitro. In vivo, the dressing enhanced wound closure, accelerated re-epithelialization, increased collagen formation, and supported higher blood vessel density compared to untreated wounds, indicating robust regeneration. **Conclusions:** The developed bioadhesive composite hydrogel shows significant potential as an advanced wound dressing capable of accelerating healing in acute skin injuries. Its combined adhesive, structural, and pro-regenerative features highlight its applicability as an effective next-generation solution for clinical wound care.

Keywords:

Wound healing, composite hydrogel, Gelatin methacrylate

Code: wtrc12-04900365
Title:

The Effect of Vacuum Therapy and Hydrocolloid Dressing on the Management and Treatment of Pressure Ulcers

Authors:

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Abstract:
Background: Pressure ulcers are a significant concern in elderly and bedridden patients, resulting from prolonged pressure on tissues. Various wound management strategies, including Negative Pressure Wound Therapy (NPWT or VAC therapy) and hydrocolloid dressings, have been used to promote healing. NPWT enhances wound recovery by removing excess exudate, improving perfusion, and stimulating granulation tissue, particularly in deep ulcers. Hydrocolloid dressings maintain a moist environment, prevent infection, and support tissue repair. Evidence suggests that treatment choice depends on ulcer severity and patient condition, while combined use of NPWT and hydrocolloid dressings may offer superior outcomes in complex cases. Continuous monitoring and individualized care are essential to optimize healing and improve patient comfort. This review summarizes current findings on the effectiveness of these therapies in pressure ulcer management. **Methods:** A comprehensive literature search was performed in PubMed, Scopus, Web of Science, Google Scholar, and SID for articles published between 2010 and 2025, using the keywords “pressure ulcer,” “elderly,” “VAC therapy,” and “hydrocolloid dressing.” Studies were included if they reported clinical or experimental data on pressure ulcer management in elderly patients and excluded if they were duplicates or lacked treatment-related information. Data extracted encompassed dressing types, mechanisms of tissue repair, clinical outcomes, and safety profiles. Wound healing was evaluated using the PUSH (Pressure Ulcer Scale for Healing) tool. Findings were organized according to treatment efficacy, recovery time reduction, and clinical challenges. Selection of therapy was guided by accurate wound assessment and patients’ individual needs. **Results:** The reviewed studies indicated that both NPWT (VAC therapy) and hydrocolloid dressings are effective in promoting pressure ulcer healing, with distinct mechanisms and strengths. NPWT accelerated granulation and wound closure, partly by modulating inflammatory pathways such as NOD1, RIP2, and IL-1β, and was especially beneficial for deep wounds and diabetic patients. Hydrocolloid dressings enhanced tissue repair and pain management by maintaining a moist environment and protecting the skin, and were particularly effective in preventing new pressure injuries. Overall, NPWT demonstrated a higher rate of wound healing, while hydrocolloid dressings were more advantageous for superficial wounds and prevention. **Conclusion:** Treatment selection should consider wound depth, severity, exudate, and the patient’s overall condition. NPWT is most effective for deep, exudative ulcers, whereas hydrocolloid dressings are suitable for superficial wounds and prevention. No single therapy is universally effective; individualized assessment and continuous monitoring are essential for optimal outcomes. Combining the appropriate therapy with consistent nursing care promotes healing and enhances quality of life in patients with pressure ulcers.

Keywords:
Negative Pressure Wound Therapy (NPWT), Hydrocolloid Dressing, Pressure Ulcer, Wound Management, Treatment

Code: wtrc12-03760363
Title:

Advancements in Hemostatic Hydrogels for Trauma and Surgical

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Abstract:
Background: Uncontrolled bleeding is a leading cause of death in trauma, surgery, and emergency medicine, with traditional hemostatic agents like gauzes and sponges often ineffective for deep or irregular wounds. Hemostatic hydrogels have emerged as a promising solution due to their ability to rapidly absorb fluids, adhere to tissues, and promote clot formation while being biocompatible and structurally tunable. These hydrogels mimic the extracellular matrix (ECM) and can be engineered to enhance clotting, physically close wounds, release bioactive molecules, and prevent infection. (1–4). Materials and **Methods:** Hemostatic hydrogels are made from natural polymers (such as chitosan, alginate, gelatin, collagen, cellulose, and pectin), synthetic polymers (including polyvinyl alcohol (PVA), polyethylene glycol (PEG), and polyacrylamide), and hybrid nanocomposite systems. Natural polymers offer excellent biocompatibility and intrinsic bioactivity, with their hemostatic function derived from interactions with blood cells, ion-induced gelation, and activation of coagulation pathways. Synthetic polymers provide controlled mechanical strength, adhesion, and degradability. Hybrid formulations incorporate metal oxide nanoparticles (like ZnO, TiO_2, CuO, CeO_2), carbon nanotubes, or keratin-based organic nanoparticles, enhancing antibacterial activity, ROS modulation, conductivity, and mechanical performance. Several fabrication techniques are used to create biodegradable and smart hydrogels, including freeze-drying (lyophilization), microfluidics, emulsion techniques, 3D printing, and in situ gelation. These techniques allow for the creation of highly porous sponges, microspheres with controlled drug release, complex scaffolds tailored to irregular wound shapes, and injectable cryogels that form a structure at the wound site. **Results:** In multiple in vitro and in vivo models, hemostatic hydrogels consistently demonstrated superior performance. They accelerated coagulation, reduced blood loss, and improved healing in skin defects, arterial punctures, liver hemorrhages, and diabetic wounds. For example, chitosan-alginate microspheres concentrated clotting factors and released Ca^{2+} ions, achieving effective hemostasis in irregular wounds. GelMA-based hydrogels and PEG sealants activated coagulation cascades and exhibited strong adhesion for sealing surgical incisions. Nanocomposite hydrogels with CeO_2 or MnO_2 nanoparticles enhanced hemostasis while providing antibacterial effects, ROS scavenging, and promoting angiogenesis, which benefits chronic and diabetic wounds. Hybrid cryogels showed shape-memory properties, enabling easy insertion into deep wounds and rapid swelling to seal and support thrombus formation. Photocurable ECM-inspired adhesives withstood high arterial pressures and effectively repaired large vascular defects. **Conclusion:** Hemostatic hydrogels represent a significant advancement over traditional wound dressings, combining rapid clot formation, tissue adhesion, antibacterial protection, and wound healing support. The use of natural, synthetic, and hybrid materials offers unique advantages, and modern fabrication techniques allow for precise structural control. Despite challenges related to mechanical robustness, wet tissue adhesion, scalable manufacturing, and degradation kinetics, these multifunctional hydrogels are promising candidates for next-generation clinical wound care and trauma management (1–4).

Keywords:
Hemostatic hydrogels, Wound healing, Biocompatibility, Nanocomposites

Code: wtrc12-03110362
Title:

Controlled Release of Growth Factors Using Nanoparticles in Tissue Regeneration

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Abstract:
In regenerative medicine, controlled release of growth factors through nanoparticles enables precise, stable, and efficient control of biological signals vital for tissue repair. The use of free growth factors creates problems such as rapid degradation, movement to non-target areas, and the need of high doses that could lead to side effects. Delivery systems based on nanoparticles solve all these problems by making the growth factors resistant to enzymatic degradation, retaining them at the site of injury, and allowing the release profiles to be tailored according to the healing requirements of tissues. Not only does this technology increase the efficacy of the treatment but it also diminishes the side effects because it allows the bioactive molecules to be at the specified areas for longer periods. Different biomaterials can serve as the basis for nanoparticles, such as polymers, lipids, and inorganic materials, with each of them having their own advantages in biocompatibility, drug loading, and release properties. For example, polymeric nanoparticles are often selected for controlled and prolonged release of drugs through carrier degradation, lipids on the other hand, are used to enhance stability and uptake of the protein faster. Inorganic silica or hydroxyapatite nanoparticles are strong, bioactive materials that have been successfully used in bone tissue engineering. By using hybrid and bio-inspired nanoparticles, natural extracellular vesicles are mimicked, leading to improved cellular uptake and biological activity. The methods for the controlled release vary from diffusion to environmentally responsive systems. These methods imitate the dynamic signaling patterns that are necessary for successful tissue regeneration. Administering single or multiple growth factors with nanoparticles can mirror natural healing processes and simultaneously enhance safety and regenerate outcomes. In this area, the accomplishments have found their way into various medical applications. Nanoparticles in bone regeneration double the osteogenic effect of BMP-2 and BMP-7, while at the same time greatly reducing the occurrence of side effects. In the case of cartilage repair, the use of TGF-β and IGF-1 through controlled release has significantly increased chondrocyte activity. With wound healing, the application of nanoparticles containing VEGF or PDGF has resulted in an increased blood vessel formation. However, there are still challenges to such approaches, including rapid release, production scale, and immunogenicity. One of the possible future innovations may involve stem cells and gene-activated systems together as a way to obtain customized regenerative therapies. With the help of researchers' efforts, complex nanoparticle designs and multi-disciplinary collaboration will be the way to faster clinical translation.
Keywords:
Nanoparticle, Growth factor, Controlled release

Code: wtrc12-04820360
Title:

The Impact of Stem Cell-Based Dressings on Pressure Ulcers in Elderly Patients: Challenges and Management

Authors:

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Abstract:

Background: Pressure ulcers among the elderly are prevalent and debilitating, primarily due to reduced mobility, impaired tissue perfusion, and diminished regenerative capacity. Delayed healing increases risks of infection, hospitalization, and prolonged disability. Advances in regenerative medicine demonstrate that stem cell-based dressings can enhance angiogenesis, modulate inflammation, and facilitate tissue repair. However, barriers such as varied cell sources, lack of standardized clinical protocols, scarcity of geriatric-focused studies, and concerns regarding cost, safety, and feasibility have hindered clinical adoption. Given the rising elderly population and prevalence of pressure ulcers, focused evaluation of the effectiveness and challenges of cellular dressings in elderly patients is imperative. **Methods:** A systematic review was conducted through a comprehensive search in PubMed, Scopus, Web of Science, Google Scholar, and SID for articles published between 2010 and 2025. Keywords included "pressure ulcer", "elderly", "stem-cell-based dressing", "regenerative wound care", and "advanced wound therapy". Included studies reported clinical or experimental data on stem cell-based or regenerative therapies for pressure ulcers in elderly patients. Case reports, duplicates, and studies lacking relevant therapeutic data were excluded. Extracted data encompassed cell types used, proposed repair mechanisms, clinical outcomes, safety profiles, and implementation challenges. Qualitative synthesis categorized themes related to efficacy and clinical barriers. **Results:** Recent evidence suggests mesenchymal stem cells, especially those derived from umbilical cord and adipose tissue, significantly accelerate and improve pressure ulcer healing. Despite promising clinical evidence, no standard protocol exists. Highest efficacy is observed in early-stage ulcers and when combined with advanced dressings and supportive factors such as PRP. Smart hydrogels offer controlled protection and growth factor release, crucial for elderly patients. Nonetheless, high costs, need for protocol standardization, and factors like malnutrition or reduced tissue perfusion impact outcomes. Long-term safety and efficacy require further investigation. **Conclusion:** Pressure ulcers represent a serious threat to elderly patients necessitating multifaceted approaches beyond monotherapies. Early identification of at-risk elderly and delivery of foundational and reparative interventions may prevent ulcer progression. Investment in specialist training, national registries for pressure ulcer incidence, and counseling services for families enhance patient quality of life and economic savings at a national scale. Promotion of multifunctional dressings or gels in clinical settings is recommended to synergistically optimize pharmacokinetics and therapeutic effects with minimal risks.

Keywords:

Pressure Ulcer, Stem Cell-Based Dressing, Advanced Wound Therapy, Elderly, Regenerative Wound Care, Challenges

Code: wtrc12-04120359
Title:

Treatment Approaches for Cervicitis (Comprehensive Review)

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Abstract:
Background: This review provides an overview of treatment approaches for cervical wound (cervicitis). Cervical wound, defined as inflammation of the cervix, can develop due to various infectious and non-infectious factors. If left untreated, it may lead to pelvic pain, abnormal discharge, bleeding, and chronic discomfort. Chronic cases can also result in the ascending spread of infection to the uterus and fallopian tubes, increased risk of infertility, long-term pelvic pain, and even heightened susceptibility to certain sexually transmitted infections. Therefore, its treatment is of high importance. The aim of this study is to review treatment approaches for cervical wound (cervicitis). **Methods:** In this study, available articles indexed in PubMed and SID were reviewed using the keywords cervical wound (cervicitis) and treatment approaches for the years 2021–2025. **Results:** One of the less known treatment methods for cervical wound (cervicitis) is the Chinese herbal medicine Kang Gong Yan. After evaluation, it was shown that this plant may assist in reducing cervical inflammation by modulating metabolites and improving gut microbiota. Although it has demonstrated effects, its clinical application is still very limited and not well-studied. Another traditional approach is the use of vaginal suppositories containing henna oil along with an antibiotic regimen, which has shown beneficial clinical effects regardless of the underlying pathology of cervical wound (cervicitis). Another treatment method includes the use of vaginal creams containing honey, olive oil, and propolis. According to findings, honey has antibacterial, anti-inflammatory, and specific tissue-healing properties; olive oil has moisturizing and anti-inflammatory properties; and propolis demonstrates antimicrobial and anti-inflammatory effects that can help improve cervical wound symptoms. Comparative Methods Azithromycin and doxycycline are medications used in the treatment of cervical wound (cervicitis). In one study, the rate of improvement with single-dose azithromycin was lower compared to a 7-day doxycycline regimen. Although patient acceptance was similar, gastrointestinal side effects were more common with azithromycin. Overall, doxycycline was considered preferable for the treatment of chlamydial cervical wound (cervicitis), and clinical improvement was noted during the first week of follow-up. **Conclusion:** Based on general evidence, targeted infection treatment, simultaneous treatment of sexual partners, regular condom use, reduction of high-risk behaviors, avoidance of vaginal douching and irritants, use of probiotics, smoking cessation, and regular follow-ups are among the best strategies for the prevention and treatment of cervical wound (cervicitis).

Keywords:
Cervical Wound (Cervicitis), Treatment

Code: wtrc12-04720358
Title:

AI Driven Behavioral Interventions and Foot Care Education for Diabetic Ulcer Prevention: A Systematic Review

Authors:

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Abstract:

Background: Diabetic foot ulcers (DFUs) constitute one of the most disabling and costly complications of diabetes mellitus, contributing to increased morbidity, infection, and amputation risk. Preventive foot care education and behavioral modification remain cornerstone strategies in reducing DFU incidence, yet adherence among patients is often inconsistent. In recent years, artificial intelligence (AI) driven behavioral interventions have been introduced to optimize education delivery, monitor adherence patterns, and promote risk aware foot care behaviors through predictive analytics and personalized feedback. These digital frameworks combining AI algorithms with behavioral theories enable tailored lifestyle coaching, automated risk stratification, and dynamic reinforcement of self-care routines. This systematic review aimed to evaluate the effectiveness of AI based behavioral and educational interventions in preventing diabetic foot ulcer occurrence among adults with diabetes. **Methods:** Following the PRISMA 2020 guidelines, a comprehensive literature search was conducted across PubMed, Scopus, Web of Science, Embase, IEEE Xplore, and Google Scholar databases for studies published from January 2015 to June 2025. Search terms included "artificial intelligence", "behavioral intervention", "foot care education", "diabetic foot ulcer prevention", and "digital health coaching". Inclusion criteria encompassed randomized, quasi experimental, or observational studies testing AI driven educational or behavioral programs targeting DFU prevention. Studies involving non AI or purely manual educational approaches were excluded. Two independent reviewers conducted screening, data extraction, and methodological appraisal using the Joanna Briggs Institute critical appraisal tools. Extracted data were synthesized narratively, with meta-analytic pooling of adherence and ulcer incidence outcomes where applicable. **Results:** Out of 1,496 retrieved records, 29 studies met eligibility criteria representing a combined cohort of 6,832 participants with type 1 or type 2 diabetes. Twenty studies (69%) employed machine learning or mobile AI coaching platforms to personalize risk alerts and self-care feedback. Pooled analysis revealed that AI driven behavioral systems increased adherence to daily foot inspection and hygiene compliance by 31–47% (95% CI: 0.28–0.50) and reduced ulcer incidence by 22–36% compared with conventional education. Nine studies (31%) integrated AI supported text or sensor based reminders within digital foot care applications, demonstrating significant improvement in self-efficacy and early symptom reporting. Overall methodological quality attained a mean JBI score of 78%, indicating moderate to high reliability. Limitations included short follow up durations and heterogeneity in AI frameworks, hindering universal comparative analysis. **Conclusion:** AI driven behavioral interventions effectively promote sustainable lifestyle adherence and improve outcomes in diabetic foot ulcer prevention. Integrating intelligent feedback loops into educational programs enhances risk awareness and encourages proactive foot care habits among diabetic individuals. These findings suggest that combining behavioral science with predictive AI coaching can bridge the adherence gap in DFU prevention. Further multicenter randomized trials with standardized outcome metrics are warranted to validate algorithmic robustness, ensure cultural adaptability, and establish ethical guidelines for digital behavioral monitoring.

Keywords:

Artificial Intelligence, Behavioral Interventions, Foot Care Education, Diabetic Foot Ulcer Prevention, Digital Health, Predictive Analytics

Code: wtrc12-01860357
Title:

The Effect of Gamification on Learning Clinical Skills in Pressure Ulcer Care: A Systematic Review

Authors:

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Abstract:

Background: Wound care is one of the essential competencies in nursing education, requiring integration of theoretical knowledge with practical skills and clinical decision-making in complex healthcare environments. Traditional methods based on lectures and clinical observation often result in superficial learning and limited improvement in learners' functional confidence. Gamification, as an innovative approach using elements such as scoring, competition, real-time feedback, and stepwise challenges, has been proposed to enhance motivation, engagement, and active learning. Considering the importance of effective education in pressure ulcer assessment and management, this systematic review aimed to evaluate the impact of gamification on learning clinical skills related to pressure ulcer care among nursing students and nurses in training. Despite the increasing use of gamification, evidence on its effect on clinical skill acquisition in wound care remains limited. **Methods:** A systematic review was conducted following PRISMA 2020 guidelines. A comprehensive search was performed in PubMed, Scopus, Web of Science, ScienceDirect, ProQuest, and Google Scholar using the keywords "Gamification," "Clinical Skills," "Pressure Ulcer," and "Nursing Student" for the period 2017–2025. Inclusion criteria were studies that used gamification in wound care education, with participants being nursing students or nurses in training, and measuring at least one outcome of theoretical knowledge, practical performance, confidence, or critical thinking. Exclusion criteria included non-English studies, narrative reviews, articles without full text, research outside wound care, and other reviews such as meta-analyses or scoping reviews. Out of 542 identified studies, 78 full-text articles were assessed, and 32 studies were included in the final analysis. Study designs included quasi-experimental, randomized controlled trials, and cross-sectional interventional studies, with sample sizes ranging from 24 to 120 participants. Study quality was evaluated using JBI and CASP tools. Gamified interventions included Kahoot, Classcraft, vSim, educational escape rooms, and serious computer games. **Results:** Gamification significantly increased theoretical knowledge and practical skills in pressure ulcer assessment and management. Improvements included accurate wound classification, appropriate dressing selection, consistency in dressing procedures, and reduced technical errors. Gamification also reduced performance anxiety, increased confidence and self-efficacy, and enhanced critical thinking. Challenges included instructors' technological proficiency requirements, time-consuming scenario design, and variations in learners' digital literacy. Discussion and **Conclusion:** This review demonstrates that gamification is an effective tool for enhancing clinical skill learning in pressure ulcer care. By increasing active participation, providing continuous feedback, and strengthening motivation, gamification improves clinical decision-making and practical performance, facilitating the transfer of skills from simulated to real clinical settings. Nursing education programs should be designed according to real clinical needs, and future studies should investigate the long-term effects and sustainability of this approach.

Keywords:

Gamification ،Education Nursing ،Pressure Ulcer ،Clinical Competence ،Health Education

Code: wtrc12-03920356
Title:

Comparative Study Between Apigenin, Hypericum Perforatum, Luteolin, and Acetyl-11-Keto-Beta-Boswellic Acid on MMP-9 in Wound Healing (Molecular Docking)

Authors:

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Abstract:
Background: Regeneration of skin and its damages is one of the important issues in tissue engineering. Matrix metalloproteinases also known as matrixins, (especially MMP-9), are important proteins in wound healing and tissue regeneration through breaking down of extracellular matrix. This study evaluates the molecular interaction between the MMP-9 (due to its significant role in wound healing, tissue remodeling, and development) and four natural compounds which may be effective on wound healing. Also, these compounds could suppress MMP-9 or reduce its activity. **Methods:** a) Protein Structure Retrieval and Preparation: The 3D structure of the MMP-9 retrieved from the UniProt and Protein Data Bank databases. Using UCSF Chimera, the structure was pre-processed by removing excess chains, water molecules, and ions. b) Ligand Preparation and Docking Simulation: The 3D structures of Apigenin, Hypericum perforatum, Luteolin, and Acetyl-11-keto-beta-boswellic acid (AKBA), were prepared and docked to the MMP-9 protein using PyRx virtual screening software. **Results:** The docking simulations yielded the flowing binding affinities: Apigenin: -8.8 (kcal/mol), Hypericum perforatum: -10.6 (kcal/mol), Luteolin: -9.9 (kcal/mol), and AKBA: -8.7 (kcal/mol). **Conclusion:** As more negative affinity indicates more stable interaction between the drug and the target protein, according to results Hypericum perforatum showed higher affinity towards the MMP-9 protein than others, indicating its superior efficacy in targeting this key protein. More interestingly, based on early results AKBA may introduced as a new compound on skin regeneration which required more studies to confirm.

Keywords:
Apigenin, Hypericum perforatum, Luteolin, and Acetyl-11-keto-beta-boswellic acid

Code: wtrc12-05330355
Title:

From Platform to Prototype: Multifunctional Electrospun Polyvinyl Alcohol/Hyaluronic acid Scaffolds for Acute, Chronic, and Specialized Wound Healing

Authors:

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Abstract:

Background: The development of a single wound-dressing platform capable of meeting the diverse therapeutic needs of acute infected wounds, chronic wounds, and specialized tissue environments remains a major challenge in regenerative medicine. To address this gap, we designed an electrospun hyaluronic acid/polyvinyl alcohol (HA/PVA) nanofibrous scaffold as a modular base platform with tunable physicochemical properties. A systematic investigation of thermal and solvent-mediated crosslinking strategies established the scaffold's core architecture by defining its physicochemical properties. Building on this platform, we functionalized the HA/PVA matrix through three distinct strategies to create targeted wound-healing prototypes for antibacterial, anti-inflammatory, and pro-regenerative applications. **Methods:** The base HA/PVA nanofibrous scaffold was fabricated via electrospinning and optimized through controlled thermal or solvent crosslinking. Fiber morphology, network density, swelling, degradation, and release kinetics were evaluated using scanning electron microscopy, Fourier transform infrared spectroscopy (FTIR), gravimetric analysis, and multi-model kinetic fitting. A comparative functionalization study was then conducted across three independent strategies: probiotic functionalization by electrospraying viable M. luteus onto crosslinked scaffolds to enable sustained probiotic delivery and biological antimicrobial action, metallic functionalization by development of a bilayer HA/PVA scaffold containing copper nanoparticles for, targeting chronic wounds, curcumin/postbiotic functionalization by incorporation of curcumin and Micrococcus luteus supernatant to create a dual-action antimicrobial/anti-inflammatory dressing. All functional prototypes were comparatively assessed for antimicrobial activity, swelling capacity, degradation behavior, and morphological changes. **Results:** Crosslinking analysis identified thermally treated scaffolds as the most balanced structure, exhibiting controlled swelling, predictable release behavior, and morphological integrity. The probiotic-functionalized scaffold provided the most sustained biological activity, maintaining viable M. luteus for 28 days, completely inhibiting Staphylococcus aureus and P. aeruginosa, and enhancing fibroblast migration with no cytotoxicity, positioning it as the strongest long-term antimicrobial and pro-regenerative system. The CuNP-integrated bilayer dressing exhibited the highest hydration and structural responsiveness, with 603% swelling, 35% degradation at 24 h, and controlled copper release. The curcumin/postbiotic prototype showed a biphasic release pattern with an extended therapeutic window and achieved >99.99% suppression of Pseudomonas aeruginosa, outperforming other groups in rapid-onset antimicrobial action. Together, the comparative results highlight that each functionalization route confers a unique therapeutic profile including rapid antimicrobial and sustained probiotic defense demonstrating the modular adaptability of the HA/PVA platform. **Conclusion:** This integrated research establishes HA/PVA electrospun nanofibrous scaffold as a highly adaptable platform that can be modularly functionalized with phytochemicals, postbiotics/probiotics, or metal nanoparticles to address distinct clinical challenges. The "platform-to-prototype" approach provides a coherent scientific trajectory offering a scalable route toward next-generation antimicrobial, anti-inflammatory, and pro-regenerative wound dressings tailored to specific wound types.

Keywords:

Electrospun HA/PVA platform, optimization, Controlled release kinetics, Functionalized wound dressings, Antimicrobial nanoscaffold

Code: wtrc12-04170353
Title:

Bacterial Nanocellulose in Wound Management: From Biomaterial Innovation to Clinical Therapeutic Efficacy

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Abstract:

Background: Chronic wounds including diabetic foot ulcers (DFUs), venous leg ulcers (VLUs) and pressure ulcers (PUs) do not follow orderly and timely reparative processes, leading to severe morbidity for the afflicted patients as well as extremely high cost for society. The wound healing process in these patients is frequently characterised by a vicious cycle of inflammation, bacterial colonisation and damaged tissue regeneration. Typical wound healing dressing commonly fail to regulate this abnormal microenvironment. Bacterial nanocellulose (BNC) has attracted extensive attentions as a novel generation of wound dressing material. The three-dimensional nanofibrillar network more accurately recapitulates the native ECM, which is conducive to cell migration and proliferation. In addition, because of its excellent hydrophilicity a high moisture content is maintained and the effect of blocking foreign pathogenic agents occurring from outside is brought about due to nano-porous structure so that it becomes an outstanding barrier layer against not only exogenous pathogens. Toward this as well, one additional study also indicates that BNC dressings could have an active role of action on the wound bed in a model of oxidative stressed environment by reducing oxidative stress and enhancing crucial growth factor expression. The objective of this systematic review is to systematically evaluate and summarize pre-clinical and clinical evidence created over the last decade (2015-2025) on the therapeutic effects and mechanisms of action of BNC-based dressings as wound treatment in refractory chronic wounds. **Methods:** This review was carried out under the guidance of PRISMA. A systematic literature search was conducted using PubMed/MEDLINE, Scopus, ScienceDirect and Google Scholar databases until November 2025. A total of 256 records were found using predefined key words for BNC and chronic wounds. After removing duplicates and two-step screening (title/abstract, full text), 40 studies were included according to PICOS: (P) patients with DFU, VLU or PU; (I) BNC-based dressings; (C) conventional or other advanced dressings utilized; (O) wound closure, infection control granulation tissue; S: RCTs cohort studies in-vivo study. **Results:** The analysis consistently demonstrated the superior efficacy of BNC dressings in chronic wound management. Studies showed significantly accelerated wound closure rates, enhanced granulation tissue formation, and improved exudate management compared to conventional dressings. A key finding was BNC's exceptional capacity as a drug-delivery platform. The nanofibrous network effectively incorporates bioactive agents including antimicrobials (silver nanoparticles, gentamicin), growth factors, and anti-inflammatory compounds. This enables targeted, sustained release at the wound site, resulting in substantial bacterial bioburden reduction, inflammation modulation, and markedly improved tissue regeneration. Consequently, drug-loaded BNC dressings outperformed non-loaded counterparts in managing infected, complex chronic wounds. **Conclusion:** This review has the effect of that BNC is a wound dressing which promotes healing and reduces infection to a large extent. Of fundamental importance is the extended capacity of BNC, when used as a personalized drug- delivery platform for antimicrobials and growth factors, to allow the directed therapy of complicated wounds. To facilitate clinical translation, large-scale randomized studies and standardization of the procedure for the development of such an advanced, bioactive BNC is still required.

Keywords:
Bacterial Nanocellulose; Chronic Wound Healing; BNC Dressing; Advanced Wound Care

Code: wtrc12-03530352
Title:

Role of Multi-Dimensional Care of Necrotizing Fasciitis in a Diabetic Leg Ulcer Patient with High Risk of Amputation: A Case Report

Authors:

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Abstract:
Background: Necrotizing fasciitis is a progressive soft-tissue infection characterized by skin and underlying tissue necrosis. It is most commonly caused by Group A Streptococcus and occurs frequently in patients with diabetic patients due to impaired circulation and weakened immune response. This study aims to reveal the role of multi-dimensional care of necrotizing fasciitis in a diabetic leg ulcer patient. **Methods:** A 60-year-old female patient with a medical history of type 2 diabetes mellitus presented with a left diabetic leg ulcer assessed Wagner class 5. The wound culture revealed infection with Pseudomonas aeruginosa. She was admitted with a diagnosis of necrotizing fasciitis to hospital, Initial surgical debridement with wound irrigation was performed, and above-knee amputation was considered her cindition. The patient was then referred to our wound care center, where antiseptic irrigation and debridement according to the TIME (Tissue, Infection or Inflammation, Moisture balance and Edges) framework were carried out. Adjunctive biophysical therapies and negative pressure wound therapy, monitoring exudate quantity and quality, were used to promote healing. The wound was then managed with antimicrobial (bio-synthetic and biologic) dressings. **Results:** Infection, exudate, and odor were controlled during the treatment sessions, and slough tissue was reduced while we observed more granulation tissue appearing. Wound closure occurred after 20 treatment sessions without amputation. **Conclusion:** This case showed the value of multi-dimensional Care of necrotizing fasciitis in diabetic leg ulcers by combining surgical intervention with advanced wound care techniques, thus preventing major amputation and improving patient outcomes.

Keywords:
Diabetic leg ulcer, necrotizing fasciitis, NPWT, multi-dimensional Care

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Code: wtrc12-05180351
Title:

Management of a Grade III Extravasation Injury in a Preterm Neonate: A Case Report

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Abstract:
Background: Extravasation of intravenous (IV) is a well-recognized complication in neonatal intensive care units, especially among preterm infants with fragile veins and immature skin. Irritant solutions such as total parenteral nutrition (TPN) and certain antibiotics can cause significant tissue injury when infused outside the vascular space. Research suggests that up to 11% of pediatric patients and 70% of infants receiving intravenous therapy will experience intravenous extravasation. Prompt recognition and appropriate management are essential to prevent progression to necrosis and long-term morbidity. Introduction Preterm neonates frequently require prolonged IV therapy, which places them at increased risk for infiltration and extravasation. Hyperosmolar TPN solutions and certain medications may trigger inflammatory and chemical reactions when they leak into surrounding tissue. Timely intervention can significantly reduce complications. This report describes a Grade III extravasation injury caused by TPN and cefotaxime in a 32-week-and-8-day male neonate admitted for respiratory distress syndrome highlights the healing process documented through nine serial photographs. The clinical course, management approach, and outcome are summarized to contribute to existing knowledge on neonatal wound care. **Case Presentation**: At 15:00, the bedside nurse detected signs of drug extravasation at the dorsum of the right hand. The infusion was immediately stopped, and the yellow peripheral IV cannula was removed. Photograph 1 documented the initial presentation of the lesion at the time of discovery. After ensuring adequate pain control, the clinical team proceeded under sterile conditions using a multi-puncture technique, gently fenestrating the affected area with a fine needle to facilitate drainage and dispersion of irritant fluids. This was followed by irrigation with 50 mL of sterile normal saline over the course of one hour. Photograph 2 illustrated the wound at the completion of irrigation. Hyaluronidase was administered within the optimal therapeutic window. A total of 30 units was injected subcutaneously at five points surrounding the lesion using a 25-gauge needle. The area was then lightly covered with sterile gauze, and the affected limb was elevated. Hourly assessments were performed. Photograph 3 depicted the wound condition five hours after the event. A second identical dose of hyaluronidase was administered. Photograph 4 captured the wound 18 hours later. At 24 hours, topical mupirocin was started, and nitroglycerin ointment was applied every eight hours to enhance perfusion. A small tense blister developed and was left intact. It gradually reabsorbed without rupture or need for debridement. No additional dressings or advanced therapies were required. By the end of the week, the wound had stabilized with clear epithelial advancement. Photograph 9 showed complete re-epithelialization without tissue destruction or complications. **Results:** The infant showed progressive improvement with reduced swelling, improved perfusion, and absence of necrosis. Blisters resolved spontaneously, and neurovascular assessments remained normal. By day 18, near-complete epithelialization was observed, and follow-up revealed normal hand function without scarring. **Conclusion:** This case demonstrates that early recognition and structured conservative management can effectively treat Grade III extravasation injuries in preterm neonates. Timely irrigation, hyaluronidase administration, and appropriate topical therapy contributed to full recovery without complications.

Keywords:
Extravasation Injury, Neonatal Intensive Care Units, Preterm Neonates

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Code: wtrc12-05360350
Title:

Microbiome-Targeted Probiotics for Enhancing Chronic Wound Repair in Elderly Patients

Authors:

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Abstract:
Background: Millions of elderly people around the world suffer from chronic wounds (such as pressure ulcers and venous leg ulcers). Such wounds are caused by age-related health problems, a weakened immune system, and dysbiotic microbiomes that can develop inflammation and biofilm formation. Meanwhile, conventional therapies often yield suboptimal healing because of antibiotic resistance and failure to restore microbial equilibrium. In this regard, emerging evidence highlights the skin/wound microbiome's pivotal role in modulating repair cascades. As a matter of fact, the purpose of the study is to introduce microbiome-targeted probiotics (e.g., engineered strains delivering antimicrobial peptides, quorum-sensing inhibitors, and immunomodulatory metabolites) as a precision strategy to rebalance dysbiosis, suppress pathogens, and accelerate granulation and re-epithelialization. Methods/Materials and **Methods:** A narrative synthesis was undertaken, which draws from multidisciplinary sources since 2015. Literature was selected from PubMed, Scopus, and Web of Science using search terms such as “aged,” “probiotics,” and “skin microbiome.” Additionally, studies were selected based on relevance to structured or informal interactions. **Results:** Reviewed studies from 2015 to 2025 proved that microbiome-targeted probiotics considerably prevented biofilm formation by up to 95% and completely eradicated preformed mature Pseudomonas aeruginosa and Staphylococcus aureus biofilms in vitro and ex-vivo in porcine skin models primarily through lactic acid secretion and cell-free supernatants, without inducing antibiotic resistance. A Lactobacillus-based microneedle patch achieved 85% complete wound closure within one week in S. aureus-infected murine models, surpassing standard topical antibiotics. In addition, topical Lactiplantibacillus plantarum application decreased wound area by 42% by day 7 compared to controls ($p < 0.01$), significantly decreased neutrophil infiltration, prevented NLRP3 inflammasome activation and proptosis pathways induced by advanced glycation end-products, and increased TGF-β1 and VEGF expression, thereby accelerating re-epithelialization, collagen deposition, and angiogenesis in diabetic rat models. Limosilactobacillus fermentum diminished burn-wound healing time by 21% compared to silver sulfadiazine and reduced local pro-inflammatory cytokines IL-6 and TNF-α. Furthermore, across animal and human studies, topical Lactobacillus strains consistently enhanced re-epithelialization, lowered pathogenic bacterial colonization, restored microbial diversity, and exhibited no adverse immune reactions in over 90% of cases, confirming high safety and superior efficacy for chronic and elderly wound repair. **Conclusion:** Microbiome-targeted probiotics restore eubiosis, suppress biofilm-forming pathogens, and amplify repair in elderly chronic wounds via precision metabolites and quorum disruption. In addition, they can minimize resistance better than antibiotics while augmenting angiogenesis and collagen deposition tailored to immunosenescence. Furthermore, rigorous Phase III trials with strain-specific sequencing are imperative. In this context, this geriatric-focused strategy heralds accelerated, recurrence-free healing that alleviates the burden on aging populations afflicted by recalcitrant ulcers.

Keywords:
Elderly, Microbiota, Probiotics, Skin Microbiome, Wound Healing

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Title:

Full Thickness Skin Wound Repair by Mesenchymal Stem Cell Sheets as an Improved Therapeutic Cell-Based Therapy

Authors:

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Abstract:
Full-thickness wound healing, especially in diabetic patients, consider as a challenge due to impaired angiogenesis, chronic inflammation, and insufficient extracellular matrix deposition. Cell-based therapies using mesenchymal stem cells (MSCs) showed great potential for tissue regeneration; however, the low retention and poor survival of transplanted cells are major limitations. Cell sheet technology provides a promising strategy to overcome these issues by preserving cell–cell junctions and ECM, facilitating direct graft adhesion and improved cellular communication with the host tissue. Developed multi-layer MSC sheets (including two main sources of MSC bone marrow and adipose) for full-thickness wound repair. The sheets were fabricated using temperature-responsive culture surfaces to achieve enzyme-free detachment. Also, co-culture of MSCs with endothelial progenitor cells that led to pre-vascularization, markedly enhanced neovascularization and tissue integration in-vivo. Furthermore, based on Jiashing Yu et al., Meghan McLaughlin et al., and Yen-Chih Lin et al., it is confirmed that adipose-derived MSC sheets (particularly in multilayer constructs), accelerated epithelialization, collagen maturation, and reduced scar formation compared with conventional MSC suspensions. In diabetic wound models, based on Yuka Kato et al. and Maryam Habibi et al., MSC sheet made up of bone marrow and adipose MSCs demonstrated improved capillary density, enhanced angiogenic factor secretion (VEGF, FGF-2), and restored epidermal structure. As a conclusion, recent findings suggest that multilayer and pre-vascularized MSC sheets constitute an advanced therapeutic approach for full-thickness skin wound healing, enabling superior graft survival, vascular regeneration, and scarless healing.
Keywords:
Mesenchymal Stem Cells, Cell Sheet, Pre-Vascularization, Tissue Regeneration

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Title:

Effect of Cold Plasma in Skin Cancer Therapy: In Vitro Study

Authors:

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Abstract:
Background: the ionized gas composition of cold atmospheric plasma (CAP) includes electrons and ions and radicals and photons. The operation of CAP at temperatures near room temperature makes it suitable for medical applications. The production of ROS and RNS by CAP leads to cancer cell death through oxidative stress and DNA damage and mitochondrial dysfunction and apoptosis. The apoptotic effects of CAP become more evident through increased expression of BAX and CASP3 and TP53 genes. Cutaneous Squamous Cell Carcinoma (cSCC) represents the second most common type of skin cancer, which incidence is continuously increasing worldwide. Given its high frequency, cSCC represents a major public health problem. Therefore, to provide the best patients' care, it is necessary having a detailed understanding of the molecular processes underlying cSCC development, progression, and invasion. **Methods:** In this study**,** the A431 skin cancer cell line was used, which cultures in DMEM with 10% FBS. The plasma treatment process used three different voltage levels of 3 V and 5 V and 7 V while exposing cells to plasma for 1 to 400 seconds. The MTTT assay served as a method to measure cell viability and proliferation after plasma treatment. 3. **Results:** A431 cancer cells experienced substantial viability decrease after receiving CAP treatment. The highest level of cell death occurred when cells received plasma treatment at 5 V and 7 V during extended exposure times. The same treatment conditions failed to affect HDF normal cells but successfully killed cancer cells. 4. **Conclusion:** Cold atmospheric plasma shows therapeutic potential as a new treatment method for skin cancer patients. The treatment method uses oxidative stress to kill cancer cells while preserving healthy cells through gene expression modulation for non-invasive localized therapy. Scientists need to conduct more research to develop successful treatments and prove CAP treatment effectiveness in human medical situations.

Keywords:
Skin Cancer, Scc Cell Line, Cold Plasma

Code: wtrc12-04430347

Title:

Integrating Skin-on-a-Chip Systems for Predictive Drug Screening and Personalized Diagnostics

Authors:

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Abstract:

Background: Diabetic Foot Ulcers (DFUs) are a major complication in patients with diabetes due to their chronic and non-healing nature and severe morbidities. The ulcers create a complex microenvironment that impedes healing processes. Thereby, the correlation with several factors including hyperglycemia, hypoxia, chronic inflammation, infection, and vascular and cellular dysfunction, exacerbates the healing process. Given the complex microenvironment and extensive cellular dysfunction of keratinocytes as a key factor in DFUs healing, comprehensive therapeutic options should address each component of the microenvironment. Thus, engineered keratinocytes hold promise in wound healing and regeneration based on multidimensional effects on the DFUs microenvironment. Such keratinocytes refer to modified cells based on the wound microenvironment that are cultured in specific ways to enhance therapeutic capacity, particularly in skin regeneration and wound healing. Material and **Methods:** A structured review is performed to explain current evidence on engineered keratinocyte therapies for diabetic foot ulcers. Preclinical and clinical studies from the PubMed, Embase, and Scopus databases from 2009 are chosen to investigate genetically modified or otherwise engineered keratinocytes applied to diabetic cutaneous wounds and reported at least one relevant outcome (wound closure, re-epithelialization, angiogenesis, inflammation, or infection control). **Results:** while DFU keratinocytes exhibit impaired migration, reduced proliferation, abnormal differentiation, persistent inflammation, and high oxidative stress, engineered keratinocytes can modulate the re-epithelialization process and reverse cellular dysfunctions. In particular, DICER1-engineered and FTO/m6A-modulated keratinocytes show significant abilities in migration, proliferation, and survival in the DFUs microenvironment . Moreover, engineered keratinocytes show enhanced resistance to oxidative stress through Nrf2 upregulation . In addition, immunomodulatory reprogramming of the DFU microenvironment through engineered keratinocytes, which are considered one of the most powerful immune regulators, has significant effects on wound healing. Immune modulation reduces chronic M1 polarization and shifts the wound toward a pro-healing status . Furthermore, engineered keratinocytes facilitate angiogenesis by increasing microvascular density and delivering proangiogenic cytokines to mitigate the wound from hypoxia and ischemia. Although engineered keratinocytes may enhance antimicrobial peptide (AMP) production and show potential in reducing infection risk, there is currently no direct evidence that genetically engineered keratinocytes designed for antimicrobial gene expression have been applied specifically in DFUs. Therapeutic strategies in applying engineered keratinocytes are cell-based dressings of allogenic cells, tissue-engineered models incorporating fibroblasts and endothelial cells, and integration with advanced biomaterials . **Conclusion:** engineered keratinocytes show promising effects on DFUs healing through reversing cellular dysfunctions, enhancing resistance through oxidative stress, immure reprogramming, facilitating angiogenesis, and preventing infections. However, complexities in the wound environment and cellular dysfunction of fibroblasts can impair the therapeutic process. In addition, standardization and ensuring the safety of the approach require further investigations. Thus, advanced biomaterials and novel genetic modification and tissue engineering strategies may improve engineered keratinocytes in the future.

Keywords:

Drug Screening, Microfluidic Skin, Personalized Medicine, Skin-On-A-Chip, Wound Healing

Code: wtrc12-05350345
Title:

Jellein-I conjugated Gold Nanoparticles: Enhanced Antibacterial, Antibiofilm, and Wound Healing efficacy Against MRSA

Authors:

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Abstract:
Background: Natural wound healing involves inflammation, proliferation, and remodeling phases, typically resolving acute wounds (e.g., surgical injuries) within 8-12 weeks. Chronic wounds, such as ulcers, fail to heal within 3 months, are prone to infection, and resist traditional treatments. Antimicrobial peptides (AMPs) and their conjugation with nanoparticles hold promise for targeting MRSA. Jellein-I peptide was conjugated to gold nanoparticles (GNPs) to enhance its antibacterial and antibiofilm activities, and increase wound healing. **Methods:** The Jellein-I, with a C-terminal cysteine, was attached to 5.5 nm GNPs, forming Jellein-I-Cys-GNPs, with peptide concentration (1500 μM) confirmed via characterization. This study evaluated the in vivo efficacy of Jellein-I-Cys-GNPs on wound healing and microbial load reduction in a full-thickness wound model. 55 male Wistar rats (250 g) were anesthetized with ketamine (3 mg/kg) and xylazine (30 mg/kg), and a 2 cm wound was created on their backs, inoculated with 10^8 CFU MRSA after 24 hours. Rats were divided into five groups (n=9) and treated daily for 21 days with Jellein-I-Cys-GNPs (94 μM), GNPs (630 μM), Jellein-I (512 μM), vancomycin (68 μM), or distilled water. Wound size was monitored using ImageJ software on days 1, 3, 7, 14, and 21, while histopathological analysis (H&E and Masson's trichrome) assessed tissue response. **Results:** By day 14, Jellein-I-Cys-GNPs and vancomycin groups showed significant reduction in wound size, microbial load, inflammation, and necrotic tissue, with complete wound closure by day 21, unlike other groups where infection persisted. Histopathology revealed increased angiogenesis, epithelialization, and mature collagen in Jellein-I-Cys-GNPs and vancomycin groups, resembling normal skin. Wound contraction and collagen synthesis were highest in these groups, with negligible bacterial load by day 14. **Conclusion:** Jellein-I-Cys-GNPs matched vancomycin's efficacy, suggesting a promising therapeutic formulation for MRSA-related wound infections.

Keywords:
Wound healing, Jellein-I, Gold nanoparticle, Biofilm, Antimicrobial Peptide

Code: wtrc12-04760344
Title:

The Effect of Electrical Stimulation on Pressure Ulcer Healing in Critically Ill Patients Admitted to Intensive Care Units: As an Adjunctive Therapy; a Systematic Review

Authors:

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Abstract:

Background: Pressure injuries are among the most common and costly complications in critically ill patients and are associated with increased risk of infection, prolonged hospitalization, and higher treatment expenditures, and reduced quality of life. In ICU patients, prolonged immobility, dependence on life-support measures, and impaired tissue perfusion markedly increase the likelihood of developing and worsening pressure injuries. Although standard interventions such as pressure redistribution and advanced dressings are essential, wound healing remains insufficient in many cases. Electrical stimulation (ES) has been proposed as a non-invasive adjunct therapy capable of enhancing blood flow, promoting cell migration, and accelerating tissue repair. Despite growing evidence, data related specifically to ICU populations remain scattered and heterogeneous. Therefore, a systematic review is warranted. The present study aimed to evaluate the effects of ES on pressure injury healing in ICU patients. **Methods:** This systematic review was conducted according to PRISMA 2020 guidelines. A comprehensive search was performed in PubMed, Scopus, Web of Science, ISI, and Google Scholar from 2017 to 2025 using Boolean combinations of the keywords “pressure injury,” “pressure ulcer,” “electrical stimulation,” “wound healing,” and “ICU.” Inclusion criteria were randomized controlled trials, quasi-experimental studies, and controlled clinical studies examining the effects of ES on pressure injuries in ICU patients. Exclusion criteria included animal studies, articles without quantitative outcomes, reports lacking details on stimulation parameters, and studies without a control group. Two independent reviewers performed study screening, data extraction, and quality assessment. Methodological quality was evaluated using the Cochrane RoB and JBI tools. Primary outcomes included wound area reduction, healing rate, changes in PUSH scores, and reported adverse events. Due to heterogeneity in stimulation type, intensity, session duration, and study design, data synthesis was conducted narratively. **Results:** Of the 367 identified records, 34 studies met the inclusion criteria. Most studies utilized high-voltage pulsed current or microcurrent stimulation. The findings indicated that ES resulted in a significantly greater reduction in wound area compared with standard care, and in some studies, the rate of healing increased up to twofold. Substantial improvements in PUSH scores and related healing indicators were also reported. None of the studies documented serious ES-related adverse events, and patient tolerance was rated as favorable. However, heterogeneity in stimulation parameters, intervention duration, and sample sizes limited the ability to conduct a meta-analysis. **Conclusion:** The evidence suggests that ES can serve as a safe and effective adjunctive therapy to accelerate pressure injury healing in ICU patients. Integrating ES with standard care may lead to reduced wound size, improved healing metrics, and potentially shorter treatment duration. Despite these promising results, standardization of ES protocols, precise definition of stimulation parameters, and large, well-designed clinical trials are necessary. Overall, ES appears to be a promising intervention with the potential to play a significant role in managing pressure injuries in high-risk ICU populations.

Keywords:

Wound Healing،Electrical Stimulation،Pressure Injury،Pressure Ulcer،ICU

Code: wtrc12-05290343
Title:

Synergistic Effects of Photobiomodulation and Growth Factor-Loaded Scaffolds on Tissue Repair 20:12

Authors:

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Abstract:

Background: The importance of tissue engineering in the creation of functional bioreplacements consisting of biological molecules, cells, and scaffolds is significant. One of the problems of natural tissue repair that affects millions of people worldwide every year is incomplete repair of the damaged site after injury or surgery, which is the result of the misregulation of the natural tissue repair response such as inflammation and cell adhesion. One of the most important reasons that make growth factors vital for stimulating cells to repair tissue is their multiple activities. One of the functions of growth factors is to attract cells to the site of injury and stimulate their proliferation to repair the damaged site. Three-dimensional scaffolds are one of the goals of tissue engineering. Scaffolds act as a template for connecting cells and simulate the extracellular matrix. In this context, Photobiomodulation (PBM) refers to the use of light penetrating the tissue at the site of injury to interact with intracellular chromophores, which is used to regulate the developmental trajectory of cells and tissues. One of the most important advantages of this method is that it is non-invasive. Therefore, this study aims to investigate the synergistic effects of photobiomodulation and growth factor-loaded scaffolds on tissue repair Materials and **Methods:** A narrative synthesis was undertaken, which draw from multidisciplinary sources since 2003. Literature was selected from PubMed, Scopus, and Scholar using search terms like “photobiomodulation,” “low-level laser therapy,” “growth factor,” “scaffold,” “tissue engineering,” and “synergistic.” In vitro, ex vivo, and in vivo (rodent and large-animal) studies combining PBM (parameters 1–50 J/cm^2, 635–904 nm) with natural or synthetic scaffolds releasing one or more growth factors were included. Outcomes assessed included cell viability, migration, angiogenesis, collagen synthesis, biomechanical properties, and histological repair quality. **Results:** Combined therapy consistently demonstrated synergy. In this regard, in dermal models, PBM (660 nm, 5 J/cm^2) with VEGF/PDGF-loaded collagen or gelatin methacrylate scaffolds increased fibroblast migration 2.2-fold and angiogenesis markers (CD31, α-SMA) compared to either treatment alone. Additionally, in bone regeneration, PBM (808 nm) enhanced BMP-2 release from PLGA/silk fibroin scaffolds, raising osteocalcin expression 3-fold and bone volume fraction by 45–60% in critical-size calvarial defects. Furthermore, Cartilage studies showed PBM with TGF-β3-loaded hydrogel scaffolds improvs chondrocyte proliferation and GAG deposition while reduces fibrotic markers. As a matter of fact, mechanisms include PBM-induced upregulation of growth factor receptors (VEGFR-2, PDGFR), enhanced sustained release kinetics, and reduced scaffold degradation rate. **Conclusion:** Photobiomodulation and growth factor-loaded scaffolds act synergistically in order to accelerate and improve the quality of tissue repair across skin, bone, and cartilage. The combination amplifies cellular signaling, vascularization, and matrix synthesis beyond additive effects. Clinical translation is promising but requires standardized PBM protocols and scaffold designs. Large-animal and first-in-human trials are now warranted to confirm efficacy and establish optimal combinatorial parameters.

Keywords:

Keywords Photobiomodulation, growth factor scaffolds, synergistic therapy, tissue engineering, wound healing, bone regeneration

Code: wtrc12-03570342
Title:

The Role of Advanced Fat-based Products in Wound Management: A Systematic Review

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Abstract:
Background: Chronic wounds pose a significant health issue due to their complications, prolonged healing process, and socioeconomic burden. As conventional strategies often fall short, developing more effective and cost-efficient wound treatments remains an urgent task. The benefits of fat products in wound healing promotion have been revealed recently that it leads to extensive application of these products on chronic, acute, and complicated wounds. Regarding no article summarizes the clinical and microscopic effects of fat-products and their advances in nonhealing wound management to provide treatment strategies, this study aims to do that through reviewing updated evidence. **Methods:** An electronic-based literature search was conducted in the databases EMBASE, PubMed, Web of Science, and SID besides Google Scholar search engine. Literature about the subject were searched with proper terms/keywords in both English and Persian languages for period between January 2020 and January 2025. This review included all abstract-available articles which used any fat-derived products in patients with refractory wounds and evaluate any wound healing outcomes and non-experimental studies, letter, conference abstract, case reports, and in-vitro experiments were omitted. Then screening and data extraction with resolving the discrepancies was conducted. The Preferred Reporting Items for Systematic Reviews and Meta-analyses 2020 (PRISMA) guidelines were followed in this study. **Results:** Based on our criteria, 25 suitable articles were entered in study. Totally, human fat products are categorized in AGF, SVF, and ADSC that used as bioactive material through lipofilling, micro/nano-fat, and lipo-structure techniques. The commonly-used methods are enzymatic SVF isolation and nano-fat. According to this investigation, the positive outcomes of these methods in wound management are higher and faster healing rate, enhancing epithelialization, promoting collagen generation and deposition, alleviating inflammatory reactions, decreasing pain level, and displaying no major side-effects. On the other hand, no differences were shown between these methods and conventional treatments in terms of neovascularization. **Conclusion:** Although fat-products have all above-mentioned benefits in wound healing, existing various methodology in treatment, reporting bias due to lack of blind methods create some constraints. Thus, this report suggests conducting further large-scale randomized trials to confirm this efficacy.
Keywords:
Fat Product, Fat Tissue Engineering, Wound Healing

Code: wtrc12-05260341
Title:

Engineered MSC-derived Exosomes Loaded in Injectable Smart Hydrogels for Diabetic Foot Ulcer Healing

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Abstract:
Background: Diabetic foot ulcers are a common complication in patients who suffer from diabetes that cause significant disability and distress. If the wound is not healed, it can lead to widespread infection, and in the final stages, the organ may have to be amputated. Currently, there is a lack of effective treatment for diabetic wounds, given their complex pathology, which includes chronic inflammation, immune dysfunction, impaired angiogenesis, and bacterial proliferation. Recent studies have shown that Engineered Mesenchymal Stem Cell (MSC)-derived exosomes can be helpful in wound healing, due to their ability for multidirectional differentiation, immunomodulation, anti-inflammatory effects, promotion of angiogenesis, endothelial cell proliferation, and collagen remodeling**. Methods:** A literature review was conducted to investigate the therapeutic application of MSC-derived exosomes and their integration with hydrogel scaffolds for the treatment of diabetic foot ulcers using PubMed, Scopus, and Web of Science databases from 2020 to 2025. **Result:** Despite their high therapeutic potential, exosomes face limitations such as short half-life, low stability, and uncontrolled release. These challenges can be mitigated by covering them with scaffolds, which are three-dimensional structures that lead to the controlled release of exosomes at the wound site by physicochemical changes, such as temperature and pH changes. Among scaffolds, smart injectable hydrogels offer a dependable solution. These hydrogels not only act as a passive carrier, but due to the hydrophilicity they create, they can protect exosomes from rapid degradation and increase their half-life, preventing them from being washed away by wound exudate. Consequently, they ensure the sustained release of exosomes into the wound bed, along with scarless healing. The smart nature of hydrogels has given them the ability to interact with environmental factors, such as acidic pH, matrix metalloproteinases, which are important in the wound healing process. Also, temperature plays a significant role in accelerating wound healing. In addition, due to their own characteristics, such as cell migration, scarless skin healing ، biocompatibility, antibacterial, anti-inflammatory, anti-oxidant, and pore structure, they can promote wound healing. **Conclusion:** Studies demonstrated that by loading exosomes in a smart hydrogel, due to the synergistic effect, they show a promising potential for an ideal dressing. Sustained release of exosomes can be helpful to promote angiogenesis, reduce inflammation by localizing to the wound area, accelerate collagen deposition, cell proliferation, and migration. Furthermore, they act as an effective physical barrier for a variety of irregular wound profiles. However, there are currently numerous challenges, such as the difficulty of optimizing the formulation, the potential for fibrosis, and possible damage to exosomes during the manufacturing process. Further studies should focus on overcoming these limitations and enhancing the properties of these exosomes.

Keywords:
Diabetic foot, Exosome, Hydrogel, Scaffold

Code: wtrc12-03860339
Title:

Self-powered Bioelectric Wound Dressing: Engineering Endogenous Electric Fields for Accelerated Healing

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Abstract:
Background: Wound dressing is defined as a wound management method with roles in infection control, moisture balance, protection, and cell migration facilitation. Dressing has different types, and bioelectric is one that improves angiogenesis and has antibacterial effects due to its microcurrent generation. Endogenous electric fields are generated by transepithelial potential gradients, guide fibroblast migration, and lead to wound healing. Endogenous electric fields impairment leads to delayed wound healing and may be related to collagen alignment and, as a result, scar size. Considering the key role of endogenous electric fields, the combination with wound dressing focused on a self-powered system can lead to a more reliable therapeutic method. **Methods:** A systematic search was conducted using databases such as PubMed and Scopus. Studies published between 2015 and 2025 were included, with a focus on self-powered bioelectric wound healing. **Results:** Recent studies illustrate that self-powered dressings can successfully convert natural body motions, such as breathing, into useful electric pulses to accelerate recovery. A motion-harvesting bandage, for instance, was able to fully close open wounds within 3 days in animal subjects, while normal healing took 12 days. These devices work by aiding skin cells in aligning properly and differentiating into the cell types that are needed to repair tissue. Similarly, generators made from flexible materials like zinc oxide create electricity when they are bent or pressed, which increases the production of natural growth factors that help form new blood vessels. In addition to motion-powered devices, "bioelectric plasters" use enzymatic reactions of fructose within a hydrogel to produce a steady electric ionic current, which promotes a "moist healing" environment, resulting in smoother skin regrowth and less scarring compared to traditional dry treatments. On the cellular level, the exogenous fields activate intracellular signaling pathways that are essential for cell proliferation and directed migration. Furthermore, there are considerable antibacterial effects in this method, minimizing infection risks by preventing biofilm formation without the toxicity associated with high-voltage external devices. **Conclusion:** The transition from passive dressings to active, self-powered bioelectric systems is a revolutionary step in wound management. Discussed technologies offer a flexible, low-cost, and biocompatible solution to accelerate both acute and chronic wounds healing, by engineering devices that restore or enhance the endogenous electric field. Besides improving the rate of wound closure, the mentioned methods also enhance the quality of the healed tissue by modulating inflammation and collagen deposition. Future research needs to be directed at optimizing device durability against physiological fluids and integrating sensing capacities to realize fully personalized therapeutic systems.

Keywords:
Bioelectric wound dressing, endogenous electric fields, wound healing.

Code: wtrc12-02630338

Title:

Green Synthesis of Zinc Oxide Nanoparticles using Aloe vera Extract with Potential for Use in Wound Dressing

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Abstract:

Background: Wound healing is a complex, multistage physiological process involving hemostasis, inflammation, proliferation, and remodeling. Disruptions at any stage, particularly in patients with underlying conditions such as diabetes or immune disorders, can delay healing and increase the risk of bacterial and fungal infections. Conventional wound dressings often incorporate antibiotics or antimicrobial agents; however, challenges such as antibiotic resistance, hypersensitivity reactions, and potential toxicity have prompted the search for safer, more effective alternatives. Zinc oxide nanoparticles (ZnO NPs) have attracted significant attention due to their broad spectrum of biological activities, including antibacterial, antifungal, anti-inflammatory, antioxidant, and wound-healing properties. Moreover, ZnO NPs are effective against multidrug-resistant pathogens. However, the main challenges in synthesizing ZnO NPs by chemical methods are the toxicity of the chemicals used and the difficulty in controlling particle size and shape. Green synthesis offers multiple advantages: it eliminates the use of toxic chemicals, occurs at ambient temperature, is cost-effective, and produces biocompatible nanoparticles. **Methods:** In this study, ZnO NPs were synthesized using a green approach with Aloe vera leaf extract. The extract contains phytochemicals, including polyphenols, vitamins, polysaccharides, amino acids, alkaloids, and terpenoids, which act as natural reducing and capping agents. Synthesis was conducted under alkaline conditions (pH=12), resulting in the precipitation of ZnO NPs, followed by washing, vacuum oven drying, and calcination at 400 °C. **Results:** The successful formation of ZnO NPs was confirmed by UV–Vis spectroscopy, revealing an absorption peak at 273 nm, and FTIR spectroscopy, with Zn–O bond peaks at 418.50 cm^{-1} and 574.88 cm^{-1}. The FTIR peak at 3422.62 cm^{-1} corresponds to the O–H stretching vibrations, which are characteristic of the flavonoids and polyphenols present in the Aloe vera extract. The peak at 1512.13 cm^{-1} is associated with the amines involved in the reduction process of zinc ions. X-ray diffraction (XRD) analysis displayed sharp peaks corresponding to the hexagonal wurtzite phase, indicating high crystallinity. Dynamic light scattering (DLS) measured an average hydrodynamic size of 676 nm in aqueous suspension with a zeta potential of −30 mV, indicating good colloidal stability, while scanning electron microscopy (SEM) of dried nanoparticles showed rod-shaped particles averaging 180 nm. The discrepancy between DLS and SEM measurements is attributed to the hydrated state and potential particle aggregation in solution compared to their dry-state dimensions. **Conclusion:** The successful synthesis of ZnO NPs with Aloe vera extract suggests that this method could be a promising candidate for incorporating ZnO NPs into wound dressings. The use of toxic chemicals in the chemical synthesis of these nanoparticles and the retention of chemicals on their surfaces increase cytotoxicity and limit their application in biomedicine, especially in direct contact with damaged tissue, such as wounds. The biological functional groups derived from Aloe vera extract remain associated with the nanoparticles, enhancing antioxidant capacity and potentially supporting wound healing. The proposed mechanisms underlying ZnO NPs' antimicrobial activity include the production of reactive oxygen species (ROS), disruption of the microbial cell wall leading to leakage of intracellular contents, and interference with microbial DNA and protein functions. Their eco-friendly, low-cost synthesis and multifunctional therapeutic potential suggest that ZnO NPs can serve as safe and effective alternatives to conventional antimicrobial agents, supporting rapid and reliable wound healing.

Keywords:

ZnO NPs, Green synthesis, Wound healing, Antibacterial

Code: wtrc12-05220337
Title:

Artificial Intelligence in Wound Care

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Abstract:
Background: As healthcare continues evolving in the age of digital technology, the integration of artificial intelligence has emerged as a powerful force, particularly in wound care. The purpose of this review is to explore the scope of application of artificial intelligence in wound care. **Methods:** A literature search was conducted in databases including Pubmed, Medline, Scopus, and Web of Science, covering studies from 2013 to 2023 **Results :** The results of the studies demonstrate the role of artificial intelligence(AI) in classifying injury type, measuring wounds (including area and depth), classifying wound tissue type, monitoring and predicting wounds personalized treatment**,** prediction of wound etiology, risk indicators, healing potential and wound care education. Thus, AI-driven tools, including machine learning models and large language models (LLMs), enhance the precision of wound assessments**,** facilitated early infection and streamline clinical workflows. AI in education includes intelligent tutoring systems, chat bots, robots, and automated assessment tools integrated into digitized materials that improve education. The integration of AI in wound care education, marks a pivotal shift towards enhancing clinical decision support and e-learning platforms. Despite the advances, challenges such as time-consuming processes related to collecting, classifying, and interpreting wound images, lack of robust and efficient data analysis systems, limited access to data, and privacy protection in wound management by artificial intelligence are worth considering. **Conclusion:** AI shows substantial promise in revolutionizing wound care and management, thus enhancing the treatment of hospitalized patients and enabling healthcare workers to allocate their time more effectively

Keywords:
Artificial Intelligence, Wound Care, Wound Diagnosis, Wound Repair

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Code: wtrc12-05240333
Title:

Targeting Cellular Senescence in Chronic Wound Healing Using Senolytics: Emerging Therapeutic Insights

Authors:

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Abstract:

Background: Cellular senescence is a complex process defined by stable cell cycle arrest. Senescence can be induced by several factors in the context of injury and subsequently affect multiple mechanisms in the wound healing process. In the early stages of wound healing, senescent cells promote inflammatory responses and limit fibrosis through the secretion of senescence-associated secretory phenotype, all of which accelerate wound closure. However, regardless of their beneficial effects, ablation of senescent cells by the immune system in the late stages of the process is crucial for normal homeostasis. Therefore, conditions that compromise the ablation of senescent cells can lead to the development of chronic wounds. Accordingly, senolytics, drugs that selectively eliminate senescent cells, exhibit a significant potential in the treatment of chronic wounds. This review investigates the mechanisms by which senolytics facilitate chronic wound healing. **Methods:** A structured review was conducted on recent data from 2020 about the role of senolytics in chronic wound healing. Studies from the PubMed, Embase, and Scopus databases are chosen based on the keywords cellular senescence, chronic wound, senolytics, collagen synthesis, and gene modulation. The literature is critically reviewed to investigate senolytics in chronic wound healing comprehensively. **Results:** In animal models, administration of senolytics effectively eliminated senescent fibroblasts, which are implicated in compromised re-epithelialization owing to their resistance to apoptosis. Additionally, treatment with senolytic agents downregulated senescence-associated secretory phenotype by mediating NF-κB signaling, therefore modulating the inflammatory profile. Moreover, it promoted the functional capacity of dermal fibroblasts and vascular endothelial cells, while increasing collagen synthesis, enhancing extracellular matrix organization, and strengthening epidermal barrier integrity. Extracellular matrix components have a crucial role in the normal wound healing process due to their ability to regulate cell proliferation, differentiation, and migration; thus, disruption in the extracellular matrix can lead to the development of chronic wounds. Senolytics also upregulated the genes responsible for cellular proliferation and angiogenesis, all of which contribute to accelerated wound healing. **Conclusion:** Senolytics can improve chronic wound healing through eliminating senescent fibroblasts, modulating the inflammatory profile, improving the function of tissue repair cells, and upregulating proliferation and angiogenic genes. However, heterogeneity of senescent cells and off-target effects based on potential toxicities limited the applications. Advances in senescence profiling and engineered immune therapies can make the approach more effective in the future. Furthermore, integrating innovative delivery systems as well as multi-omics approaches as novel precision medicine-based approaches is considered a future perspective in this field.

Keywords:
Cellular Senescence, Chronic Wound Healing, Senolytics

Code: wtrc12-05230332
Title:

Immunohistochemical Analysis of Nanofat Membrane, Solid PRF, and Stromal Vascular Fraction Gel

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Abstract:
Background: Platelet-rich fibrin (PRF) and nanofat have emerged as promising autologous biomaterials in tissue regeneration and facial rejuvenation. Both serve as vehicles for cellular growth factors that promote wound healing and tissue remodeling. This study aims to investigate the presence of endothelial and stem cell markers in nanofat membranes through immunohistochemical analysis. **Methods:** Eleven patients (nine women, two men) with a mean age of 36.82 ± 5.79 were included in this case-series study. Tissue samples were obtained using a mixture of nanofat and injectable PRF, with two different concentration ratios (2:1 and 1:1), in addition to solid PRF and stromal vascular fraction (SVF) gel membrane for comparison. The samples were fixed in 10% formaldehyde, processed into paraffin blocks, and sectioned (2–5 μm). Immunohistochemical staining was performed using markers CD31 (endothelial cells), CD34 (hematopoietic and adipose-derived stem cells, and endothelial cells), CD163 (macrophages), ERG (endothelial marker), S100 (adipocyte marker), and CD10 (adipose-derived stem cells). Histopathologic examination evaluated endothelial and stem cell presence as well as macrophage infiltration. **Results:** Histopathological analysis revealed fragmented adipose tissue with vascular proliferation, as well as platelet and fibrin deposition. Immunohistochemical staining showed the presence of endothelial markers (CD31: 36.82%, CD34: 22.73%, ERG: 19.09%) in the nanofat membrane, indicating vascularization. CD163 staining highlighted macrophages, although they were sparse in the nanofat membrane (<1% of cells). The SVF gel membrane exhibited substantial platelet aggregation but lacked evidence of cellular differentiation. CD34 staining confirmed the presence of adipose-derived stem cells (ADSCs), though in lower-than-expected quantities. **Conclusions:** This study demonstrates the presence of endothelial cells and limited macrophages within the nanofat membranes, suggesting potential for vascular neoformation and tissue remodeling. However, the lack of detection of significant adipose-derived stem cells highlights the need for more advanced immunohistochemical markers to fully evaluate regenerative potential. The nanofat membrane provides a viable scaffold for tissue regeneration, with further research needed to optimize protocols for enhanced clinical outcomes.

Keywords:
Nanofat Membrane, Tissue Engineering, SVF, PRF, Immunohistochemical Analysis

Code: wtrc12-05190330
Title:

Nanorobots in Microsurgery: A Frontier in Minimally Invasive Medicine

Authors:

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Abstract:
Background: Artificial nanorobots represent emerging, promising tools for a variety of biomedical applications. Their unique ability to navigate confined spaces and be controlled precisely enables operations at cellular and even subcellular scales. Micro/nanorobots are defined as nano- to micron-sized structures (300 nm to 300 μm) that convert power sources into kinetic energy. The application of microrobots in vivo has penetrated several aspects, including drug delivery, stem cell transport for tissue regeneration, wound healing, biopsy, and minimally invasive surgery. Different in vitro platforms have been developed for precision micro/nanoscale surgery; however, they have remained unapproved in in vivo models. **Methods:** This review was conducted by searching PubMed and Google Scholar and using keywords including Micro/nanorobots, Microsurgery. Studies were included if they focused on the surgical application of nanorobots and reported outcomes from 2018 to 2024. **Results:** The distinctive dimensions of micro/nanorobots enable them to enhance the accuracy and quality of medical treatments. For example, scientists have created Fe_3O_4@SiO_2 core-shell nanorods that were altered by attaching particular antibodies. The external magnetic fields can be used to direct these nanorobots, and they can also agitate liquids, which is one way they can greatly enhance the efficiency of analyte detection. Moreover, conventional methods such as endoscopy are considered a well-established clinical practice for direct intestinal observation and biopsy, but they can face several challenges, such as access to deep tissues without leading to patient discomfort or trauma. In contrast, the remarkable scale of micro/nanorobots offers a more efficient and precise alternative intervention. Besides this, the advanced properties of these in tissue penetration have led to the development of a `surgical knife` with remote control capabilities. The `surgical knife` is made of two-dimensional nanomaterials with extremely sharp tips that can be controlled by the modulation frequency of the external magnetic field. **Conclusion:** Advancements in nanorobots indicate that this technology is both more precise and therapeutically effective than traditional approaches. Ensuring the safety and wide accessibility of nanorobot systems, especially in microsurgery, is a priority in current research. In in vivo applications, nanorobots face several challenges, such as precise navigation through body organs and real-time guidance, which require high frame rate imaging at high magnification. Additionally, it is important to evaluate the economic, social, and ethical impacts of applying them in treatments. However, the use of nanorobots in microsurgery is expected to grow rapidly in future studies. Nanorobotics has great potential to improve medical diagnosis and treatment. Therefore, greater attention to the design and development of advanced techniques in this field can revolutionize medical treatments.

Keywords:
Micro/nanorobots, Microsurgery, Nanotechnology, Precision surgery

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Title:

The Role and Significance of Curcumin in the Wound Healing Process: Effects on Hematological Parameters

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Abstract:

Background: The skin, as the largest organ of the body and a vital barrier against external factors, plays a crucial role in maintaining homeostasis and facilitating tissue repair. Skin wounds can disrupt hematological balance, and delays in healing may lead to infections and irreversible complications. Such disturbances are often accompanied by changes in complete blood count (CBC) parameters, particularly increased white blood cell (WBC) levels, which can adversely affect the healing process. Hematological indices are considered key indicators of wound recovery, reflecting the immune response, inflammatory activity, and overall physiological condition of the organism. Curcumin, the active compound extracted from the rhizome of Curcuma longa (turmeric), is a natural substance with immunomodulatory and anti-inflammatory properties. Previous studies have shown that curcumin can reduce inflammatory cytokines such as TNF-α and IL-6 and modulate immune responses, thereby potentially influencing blood parameters. However, the direct effect of curcumin on CBC during the wound healing process has received limited attention, which the present study aims to address. This research investigated the effect of curcumin on hematological parameters during the healing of skin wounds in an albino rat model. Methods/Material and **Methods:** Twenty-four adult male albino rats (average weight: 30 g) were maintained for 21 days under standardized environmental (temperature, humidity, light) and nutritional (diet and feeding frequency) conditions. The animals were randomly divided into two groups (n = 12): (A) control and (B) curcumin + wound. General anesthesia was induced by intraperitoneal injection of ketamine (10%) and xylazine (2%). After disinfecting the dorsal area, a 5-mm circular wound was created on each scapular region using a sterile biopsy punch. The control group received daily treatment with distilled water, while the curcumin group was treated daily with a 2% curcumin solution. Blood samples were collected on days 7, 14, and 21 post-wounding and analyzed using standard hematological techniques. **Results:** The results showed a significant reduction ($p < 0.05$) in WBC count in the curcumin-treated group on day 21 compared to the control group, indicating decreased systemic inflammation. Other hematological parameters, including red blood cell count (RBC), hemoglobin (HGB), hematocrit (HCT), platelets (PLT), and erythrocyte indices (MCV, MCH, MCHC), exhibited moderate improvement in the curcumin group, suggesting enhanced blood supply and oxygenation to the wound area. In contrast, the control group displayed minimal changes in CBC values. **Conclusion:** In conclusion, curcumin improved the wound healing process by modulating hematological parameters—particularly through significant WBC reduction and mild enhancement of RBC and HGB levels—demonstrating its beneficial role in promoting systemic and local recovery.

Keywords:
Curcumin, Wound healing, Blood cell count, Hematology, Albino rat

Code: wtrc12-04990327
Title:

The Potential of Mitochondria-Targeted Antioxidants in Enhancing Wound Healing

Authors:

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Abstract:

Background: Oxidative damage which resulted in elevated reactive oxygen species (ROS) is the main cause of chronic and non-healing wounds. In fact, chronic wounds are stuck in the inflammatory phase, which prevents them from healing. At this point, studies have shown that using antioxidants and anti-inflammatories can be beneficial. Moreover, current treatments are debridement of necrotic tissue, advanced dressings, negative-pressure wound therapy (NPWT), oxygen therapy, and the application of growth factors. However, they cannot completely combat oxidative stress and long-term inflammation. Although general antioxidants such as vitamin C, vitamin E, and N-acetylcysteine (NAC) have been used in order to reduce oxidative stress, they were insufficient in targeting mitochondrial sources of ROS. Additionally, using antioxidants that target mitochondria is an interesting approach. Furthermore, recent studies are exploring these agents in modulating mitochondrial ROS and enhancing wound repair. **Methods:** In this narrative review, a comprehensive search was conducted across multiple electronic databases, such as Google Scholar, PubMed, and Scopus, by using search terms including "mitochondria-targeted antioxidants," "wound healing," "mitochondrial ROS," "oxidative stress," "diabetic wounds," and "angiogenesis." In addition, related terms to mitochondria-targeted antioxidants (e.g., MitoQ, SkQ1, and SS-31) were searched. It should be mentioned that all studies were selected based on their relevant topics. **Results:** Recent studies on mitochondria-targeted antioxidants have shown a promising improvement in wound healing outcomes. Treating diabetic mice with SkQ1 (plastoquinonyl-decyl-triphenylphosphonium) accelerated wound closure and promoted epithelialization, granulation tissue formation, and angiogenesis. In fact, phases of wound healing in diabetic mice were normalized. Applying SkQ1 in old mice showed similar results; facilitating tissue regeneration, epithelialization, and collagen production. Transforming growth factor-beta (TGF-β), an angiogenic factor, was produced by fibroblasts, the excessive inflammatory response of the endothelium was reduced, and differentiation of fibroblasts to myofibroblast was induced in vitro. Application of SS-31 (Elamipretide) reduced mitochondrial ROS levels, promoted M2 macrophage polarization, and increased fibroblast migration, proliferation, neovascularization, and collagen deposition in chronic wound models. Furthermore, MitoQ (mitoquinone mesylate), a mitochondria-targeted antioxidant, has been demonstrated to preserve mitochondrial membrane potential and attenuate oxidative damage in both fibroblasts and keratinocytes. In essence, these actions help maintain the efficient function of the cellular energy-producing organelles while shielding cells from oxidative injury that impairs the healing process. In this context, mitochondria-targeted antioxidants can mitigate oxidative stress, enhance cellular bioenergetics, and accelerate wound closure, which underscores their considerable therapeutic potential for the management of chronic wounds and delayed healing associated with aging. **Conclusion:** Mitochondria-targeted antioxidants revolutionize wound healing by selectively neutralizing mitochondrial ROS, preserving bioenergetics, and mitigating oxidative damage in stressed fibroblasts and keratinocytes. Moreover, they enhance ATP-driven migration, proliferation, and matrix remodeling better than systemic antioxidants while countering inflammation and apoptosis in chronic milieus. In addition, preclinical success in diabetic and aging models underscores translational promise. In this regard, rigorous clinical trials with standardized dosing and mitochondrial biomarkers are essential. Furthermore, the mentioned precision strategy accelerates closure, reduces scarring, and improves outcomes in recalcitrant wounds, which offers a transformative therapeutic paradigm for patients burdened by delayed repair.

Keywords:

Wound healing, Mitochondrial ROS, Oxidative stress, Diabetic wounds, MitoQ

Code: wtrc12-05140326
Title:

Mesenchymal Stem Cell-Based Regenerative Therapy: A Cell-Engineered Approach for the Treatment of Pressure Ulcers

Authors:

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Abstract:

Background: Pressure ulcers are characterized as a localized injury to skin and underlying tissue driven by sustained mechanical pressure from a bony prominence or a medical device. Despite the implementation of several prevention strategies, their growing prevalence in recent years is expected to continue as the population ages. Currently, several treatment options are utilized for pressure ulcers, ranging from conservative management to surgical interventions. However, many chronic ulcers exhibit resistance to these therapies. Therefore, innovative treatment modalities have been developed. Among such novel strategies, the application of Mesenchymal stem cells (MSC) due to their impact on immunomodulatory, pro-angiogenic, and extracellular matrix remodeling has garnered considerable interest as an alternative therapy. **Methods:** This review was conducted by searching PubMed and Google Scholar. Studies were included if they focused on the application of mesenchymal stem cell–based and cell-engineered therapies for pressure ulcers and reported relevant outcomes. **Results:** Recent evidence shows that mesenchymal stem cell–based therapies produce significant regenerative effects on pressure ulcers through multiple integrated mechanisms. Preclinical studies consistently show reductions in inflammatory cytokines and oxidative and endoplasmic-reticulum stress pathways, alongside enhanced angiogenesis, improved microvascular integrity, and accelerated extracellular matrix remodeling. Engineered platforms for MSC delivery —including extracellular matrix remodeling -derived hydrogels, MSC-loaded tissue-engineered patches, and platelet-rich plasma -augmented MSC constructs—have achieved superior cell retention and more robust granulation and epithelialization compared with MSC therapy alone. Early clinical use, particularly treatments based on Wharton's Jelly–derived MSC and stromal vascular fraction, reports meaningful reductions in wound size and faster healing in stage III–IV ulcers, although variability in study design and treatment parameters still limits cross-study comparison. **Conclusion:** Based on current findings, "MSC-centered regenerative strategies appear to provide a promising alternative for the management of pressure ulcers that respond poorly to standard care. Their ability to influence inflammation, vascular repair, and matrix reconstruction makes them particularly appropriate to the complex biology of chronic pressure injuries. Engineered delivery systems appear to further enhance these benefits by supporting cell survival and prolonged activity at the base of the ulcer Still, the field lacks unified treatment protocols and adequately powered clinical trials. Establishing clear guidelines for cell source, dosage, and optimizing the delivery method will be essential before MSC-based therapies can move from promising experimental tools to widely accepted clinical interventions.

Keywords:

Mesenchymal Stem Cells (MSCs), Pressure Ulcers, Regenerative Therapy, Tissue Engineering, Cell-Engineered Constructs, Chronic Wound Healing

Code: wtrc12-03940325
Title:

Cerebral Organoids: A Paradigm Shift in Modeling and Treating Neurological Disorders

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Abstract:
The profound complexity of the human brain has historically limited our ability to accurately model its development and disease pathogenesis. Conventional animal models and 2D cell culture systems fail to recapitulate human-specific neural processes, creating a significant translational gap in neuroscience research. The emergence of brain organoids—three-dimensional, self-organizing structures derived from human pluripotent stem cells—represents a paradigm shift in neurological disease modeling. This systematic review synthesizes evidence from multiple databases, including PubMed, Scopus, Web of Science, and EMBASE, covering publications from 2015 to 2024. We analysed 127 peer-reviewed articles that met our inclusion criteria, focusing on original research studies utilising brain organoids for disease modelling and therapeutic applications. Key findings demonstrate that brain organoids successfully mimic critical stages of human cortical development, providing an unprecedented ethical window into previously inaccessible prenatal events. Studies have shown their particular utility in modelling neurodevelopmental disorders, including autism spectrum disorder and microcephaly, neurodegenerative conditions such as Alzheimer's and Parkinson's disease, and viral infections including the Zika virus. Patient-derived organoids have revealed novel disease mechanisms and enabled high-throughput drug screening platforms, significantly advancing personalized therapeutic strategies. Recent technological advances discussed include the generation of region-specific organoids (cortical, hippocampal, thalamic), vascularized models, and the integration of functional neural activity monitoring through multi-electrode arrays. While challenges remain in standardization, maturation, and scalability, the evidence consistently positions brain organoids as a transformative tool for decoding human brain mysteries and accelerating drug discovery. The future of neurology and personalized medicine is being fundamentally reshaped by these innovative in vitro models, though further work is needed to enhance their clinical predictive validity and integration with other neural cell types.

Keywords:
Brain Organoids, Neurodevelopment, Neurological Disorders, Personalized Medicine, Stem Cells, Disease Modeling, Drug Screening

Code: wtrc12-05160323
Title:

Targeted Bacteriophage Therapy in Drug-Resistant Surgical Site Infections

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Abstract:

Background: Surgical site infection (SSI) is one of the most common post-surgical complications. Considerably, about 2.5% of surgical procedures lead to postoperative SSIs worldwide. The increasing incidence of antibacterial resistance makes SSI management more challenging. In low-income countries, up to 36% of SSIs are caused by antibiotic resistance. Targeted bacteriophage therapy is a promising approach in which viruses infect bacterial microbes. Bacteriophage therapy as a novel treatment could overcome the barriers of antibacterial resistance and enhance the safety and efficacy of biofilm-associated wound infection. **Methods:** A literature review was conducted in PubMed, Scopus, and Google Scholar databases, using keywords such as Bacteriophage therapy, Drug-resistant, Phage, Surgical site infection, Wound healing. Data extracted based on articles published from 2018 to 2025. **Results:** Both human and animal studies have shown that most drug-resistant wounds were successfully healed by targeted bacteriophage. Especially, it has demonstrated significant benefits in drug resistant surgical site infections caused by Staphylococcus aureus, Staphylococcus epidermidis, Klebsiella pneumoniae, and Pseudomonas aeruginosa. Pain relief, suppurative discharge reduction, and improvement of range of motion in periprosthetic joint infection were seen in the results. it also decreased the necessity for additional surgical procedures. No serious adverse events were reported; mild and transient symptoms such as fever or nausea were mainly attributed to endotoxin contamination rather than the phages themselves. Moreover, the bacteria showed no signs of developing phage resistance. **Conclusion:** All things considered, targeted bacteriophage therapy can substantially reduce bacterial load and enhance wound healing in antibiotic-resistant surgical site infections. However, the limited number of clinical studies remains a major challenge. Therefore, to ensure the safety and efficacy of this method more clinical trials are needed. Current evidence suggests that targeted bacteriophage therapy is an alternative or combinative therapeutic option for managing antibiotic-resistant infections.

Keywords:

Bacteriophage therapy, Drug-resistant, Phage, Surgical site infection, Wound healing.

Code: wtrc12-04680322
Title:

Carbon Quantum Dots as Multifunctional Nanoagents in Advanced Wound Healing: Mechanisms, Biomaterial Integration, and Translational Prospects

Authors:

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Abstract:

Wound healing represents an intricate and dynamic biological process that encompasses four stages, including hemostasis, inflammation, proliferation, and remodeling. Disruptions within any one of these biological processes can sometimes lead to either delayed wound healing, chronic wounds, and/or pathological scarring. Recent breakthroughs in nanomedicine have recently brought into limelight carbon quantum dots (CQDs), which belong to the third generation of carbon nanomaterials, and possess outstanding physicochemical characteristics, such as flexible photoluminescence, excellent aqueous solubility, high surface functional groups, and biocompatibility, making them uniquely suited candidates in high-performance wound healing. Recent findings suggest that CQDs possess potential biological functions that can control various aspects of tissue repair (1). One of the main difficulties faced in the pathology of chronic wounds is oxidative stress and the subsequent inflammation. The high free radical scavenging potential of CQDs can reduce intracellular ROS significantly, thereby protecting against oxidative damage. The surface modification of CQDs can be harnessed to control inflammation by suppressing pro-inflammatory mediators such as TNF-α, IL-1β, and IL-6. This anti-inflammatory and antioxidant property can help accelerate the transition from inflammation to tissue regeneration. Another critical aspect of wound care is microbial infection control. Different research works have shown that CQDs have comprehensive antibacterial action, either by disrupting cell membrane integrity, photo-activated ROS production, or interfering with microbial metabolism. The effectiveness of CQDs against either Gram-positive or Gram-negative bacteria makes them potential antibacterial materials, especially in view of antibiotic resistance, which is an emerging problem in wound treatments (2, 3). Apart from their inherent biological functions, CQDs can be efficiently combined with advanced biomaterial platforms, including hydrogels, electrospun nanofibers, biodegradable scaffolds, and composite dressings. The addition of CQDs has been found to promote mechanical strength, water retention, swelling property, and exudate management, besides controlling drug release. The first and foremost advantage of CQDs, and perhaps unique to them, is their optical characteristics and bioluminescent properties, which enable real-time visualization, non-invasive tracking of wound environments, and designing theranostic wound patches that can enable diagnostic and therapeutic functions simultaneously. Bioluminescent CQDs can be incorporated into scaffolds to monitor cell infiltration, degradation, and drug release rates(2). Taken together, existing preclinical information suggests that CQDs are proving to be an extremely promising new class of multi-modal nano-carriers that can be seamlessly utilized to combat all conceivable limitations in wound healing, such as oxidative stress, microbial infections, and dysfunctional cellular functions. The present review attempts to compile all new mechanistic understanding, material science approaches, and translation efforts using CQDs in wound-healing therapeutics and discusses emerging avenues and difficulties in their clinical translation.

Keywords:

Carbon Quantum Dots, Wound Healing, ROS Scavenging, Antibacterial, Bioluminescent

Code: wtrc12-01570321
Title:

Explanation of Pathological Alterations in Skin Wounds Based on the Effects of Curcumin

Authors:

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Abstract:

Background: Anthropological evidence suggests that humans have long sought effective remedies for optimal wound healing, experimenting with a wide range of natural substances throughout history. A wound is defined as any disruption or discontinuity in the integrity of the skin layers that impairs its protective and physiological functions. Curcumin, the principal bioactive component of turmeric rhizome, is known for its anti-inflammatory, antioxidant, antibacterial, and anticancer properties. The present study aimed to investigate the effect of curcumin on accelerating the healing process of skin wounds in albino rats. Methods/Material and **Methods:** Twenty-four adult male albino rats, with an average body weight of 30 g and similar age, were used. The animals were maintained for 21 days under standardized and identical environmental and nutritional conditions. Subsequently, the rats were randomly divided into two groups: (A) control and (B) curcumin + wound. General anesthesia was induced via intraperitoneal injection of ketamine and xylazine. After cleaning the dorsal area, a 5-mm circular wound was created on each scapular region of every rat using a sterile biopsy punch. Group A rats were treated daily with distilled water (without the active substance), whereas Group B received topical curcumin treatment every day. **Results:** The findings, considering wound healing rate and duration of recovery, revealed a statistically significant difference ($p < 0.05$) between the control and curcumin-treated groups in terms of pathological improvement. The curcumin-treated group exhibited enhanced fibroblast and fibrocyte proliferation, denser collagen deposition, and overall improved histopathological conditions. **Conclusion:** In conclusion, curcumin can be introduced as an effective agent in improving pathological parameters that facilitate the wound healing process.

Keywords:
Wound Healing, Curcumin, Pathological Alterations, Albino Rat

Twelfth Yara International Congress of Wound and Tissue Repair
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Code: wtrc12-05150320
Title:

Predictive Value of Pentraxin-3 as an Early Biomarker for Infected Diabetic Foot Ulcer Susceptibility

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Abstract:
Background: A diabetic foot ulcer is a severe complication of diabetes mellitus, affecting nearly 15% to 20% of patients with diabetes during their lifetime. More than one-half of the diabetic foot ulcers become infected, and propagation of the infection to the underlying bone is associated with lower-limb amputation and postoperative mortality. For effective management, reducing hospitalization and chances of mortality, early detection of infected diabetic foot ulcer is essential. Pentraxin-3 is an inflammatory biomarker with potential for detecting infected diabetic foot ulcer early. Therefore, evaluation of the predictive value of Pentraxin-3 is needed to identify the susceptibility of infected diabetic foot ulcer. **Methods:** A narrative review was performed using literature since 2019 from databases such as Google Scholar, PubMed, and Scopus. Search terms included diabetic foot ulcer, early biomarker, infected diabetic foot ulcer, Penetraxin-3, and predictive value. Studies focusing on evaluating Pentraxin-3 levels, diagnostic and prognostic accuracy, were included. **Results:** Patients with moderate to severe infections had higher Pentraxin-3 levels than those with mild infection, and Pentraxin-3 levels increased progressively with the seriousness of infected diabetic foot ulcers. Patients who received an amputation had a greater level of Pentraxin-3 (4.1 ng/mL) compared with those who did not require amputation (1 ng/mL). However, Pentraxin-3 had limited diagnostic value in distinguishing between infected and non-infected ulcers and performed less effectively than conventional inflammatory markers such as Procalcitonin, C-reactive protein, fibrinogen, and Erythrocyte sedimentation rate. Patients with higher baseline PTX-3 levels had a greater risk of mortality and other serious complications during the 6-month follow-up period ($p = 0.047$). **Conclusion:** Pentraxin-3 shows potential as an early biomarker for predicting the development and progression of infected diabetic foot ulcers. Evaluating the severity of the condition and supporting clinical judgments, such as the necessity of amputation, could be guided by higher Pentraxin-3 levels in patients with infected diabetic foot ulcers. The function of Pentraxin-3 as a prognostic tool rather than a diagnostic one is supported by the association between its level and 6-month mortality. Early measurement of Pentraxin-3 might improve the identification of high-risk diabetic patients, potentially reducing hospitalization, disability, and mortality. Further research is needed to confirm these findings and create standardized clinical guidelines for their applications.

Keywords:
Infected Diabetic Foot Ulcer, Pentraxin-3, Early Biomarker

Code: wtrc12-05090319
Title:

CRISPR/Cas9-Engineered Mesenchymal Stem Cells as a Targeted Therapy for Skin Fibrosis in Chronic Graft-versus-Host Disease

Authors:

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Abstract:
Background: Chronic graft-versus-host disease (cGVHD) is a complication of allogeneic hematopoietic stem cell transplantation that can present a wide spectrum of skin manifestations, including severe skin fibrosis. Despite the significant immune system dysfunction, the skin fibrosis is refractory to conventional immunosuppression. Therefore, a novel and enhanced regenerative medicine-based approach, such as CRISPR/Cas9 gene editing technology, can be utilized as a more effective treatment that improves mesenchymal stem cells (MSCs) anti-fibrotic potential for managing skin fibrosis in cGVHD patients. **Methods:** A narrative review was conducted using literature from databases such as PubMed and Scopus, spanning from 2020 to 2025. Search terms included mesenchymal stem cell(s), CRISPR/Cas9, skin fibrosis, chronic graft-versus-host disease, and graft-versus-host disease. Studies focusing on the influence of regeneration medicine on skin fibrosis were included. **Results:** Preclinical reports indicate that MSCs and their extracellular vesicles reduce dermal fibrosis in cGVHD models. MSCs apply their therapeutic effects by suppressing fibroblast activation and shifting macrophage polarization toward an M2 reparative phenotype. The M2 macrophages are known for their anti-inflammatory role in tissue repair and regeneration. CRISPR/Cas9-engineered MSCs have even lower expression of pro-fibrotic mediators, such as transforming growth factor-beta (TGF-β). In addition, engineered MSCs are also more resistant to apoptosis and oxidative stress, which are involved in the pathogenesis of cGVHD skin lesions. Therefore, modified MSCs accelerate wound repair in fibrotic models. **Conclusion:** CRISPR/Cas9-engineered MSCs are promising next-generation cell therapy approaches to counteract skin fibrosis in cGVHD. Current evidence from animal models and engineering studies supports the need for further work on early-phase trials. However, several challenges regarding efficacy and genomic safety must be addressed. Long-term safety and stability of CRISPR/Cas9 gene modifications must be approved in order to avoid posing risks to patients. Future directions should focus on clinical trials that consider these challenges and explore combination therapies that might enhance the therapeutic effects of CRISPR/Cas9-engineered MSCs.

Keywords:
Cell Engineering, Chronic Graft-versus-host Disease, CRISPR/Cas9, Mesenchymal Stem Cells, Regenerative Medicine, Skin Fibrosis

Code: wtrc12-01570318
Title:

Analysis of the Restorative Effects of Curcumin on Oxidative Stress in Skin Wounds

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Abstract:
Background: The skin, as the largest organ of the body, plays a crucial role in maintaining immune homeostasis and defending against oxidative agents. Skin injuries can significantly intensify oxidative stress, which is one of the main factors delaying the wound healing process. Controlling oxidative stress can therefore play a key role in accelerating tissue repair and regeneration. Chronic and treatment-resistant skin wounds are considered a major global health challenge, emphasizing the necessity of investigating natural antioxidant compounds. Curcumin, the principal bioactive component of turmeric rhizome, is a plant-derived compound well known for its potent antioxidant and anti-inflammatory properties. By scavenging free radicals and modulating oxidative markers, curcumin helps restore the balance between reactive oxygen species production and antioxidant capacity, thereby creating favorable conditions for wound healing. This study aimed to evaluate the effects of curcumin on oxidative stress markers during the healing of skin wounds in an albino rat model. Methods/Material and **Methods:** A total of 24 adult male albino rats with an average weight of 30 g were used. The animals were maintained for three weeks under uniform environmental (temperature, humidity, light) and nutritional (diet type and feeding frequency) conditions. Subsequently, the rats were randomly divided into two groups: (A) control and (B) curcumin + wound. General anesthesia was induced via intraperitoneal injection of ketamine and xylazine. After disinfecting the dorsal area, a 5-mm circular full-thickness wound was created on each scapular region using a sterile biopsy punch. Group A rats were treated daily with distilled water (without active compound), whereas Group B received a 2% curcumin solution topically each day. Oxidative stress parameters, including malondialdehyde (MDA) and total antioxidant capacity (TAC), were extracted from skin tissues and analyzed using standard biochemical assays. **Results:** The results demonstrated a significant reduction in MDA levels ($p < 0.05$) and a marked increase in TAC in the curcumin-treated group compared with the control group. **Conclusion:** In conclusion, the findings of this study indicate that curcumin, as a potent and effective antioxidant, promotes wound healing by reducing lipid peroxidation and enhancing total antioxidant capacity, thereby efficiently mitigating oxidative stress in skin tissue.

Keywords:
Curcumin, Oxidative Markers, Malondialdehyde (MDA), Total antioxidant Capacity (TAC), Wound Healing, Skin

Code: wtrc12-05020316
Title:

A Novel Curcumin-Loaded Polymeric Dressing with Controlled Release, Cytocompatibility, and Antibacterial Performance

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Abstract:
Chronic wounds remain a major clinical concern due to prolonged inflammation, microbial infection, and delayed tissue regeneration. To address these challenges, a curcumin-loaded biopolymer dressing was developed using a composite matrix of polyvinyl alcohol (PVA), polyacrylic acid (PAA), and natural starch. Curcumin was incorporated to provide antibacterial, antioxidant, and anti-inflammatory activity, while glycerin and NaOH were utilized to enhance flexibility, moisture retention, and polymer cross-linking. Structural and morphological characteristics were examined through FESEM, and biological performance was evaluated using MTT cytotoxicity assays, drug-release studies, and Kirby–Bauer disk diffusion tests. The dressing demonstrated a controlled and time-dependent release profile of curcumin, along with strong cytocompatibility in Hela and HDF cell lines, particularly at higher curcumin concentrations. Antibacterial assessment revealed clear inhibition zones against E. coli and Staphylococcus aureus, with activity comparable to standard antibiotics in the case of E. coli. These findings indicate that the PVA/PAA/starch composite provides an effective platform for sustained drug delivery, biocompatibility, and antibacterial protection. Overall, the developed dressing offers a promising and cost-effective solution for chronic wound management, integrating structural stability with therapeutic functionality. Future studies should explore in-vivo evaluation and incorporation of additional bioactive compounds to further enhance clinical outcomes.

Keywords:
Wound, Wound dressings, Skin, Drug Delivery Systems, Polymeric Dressing, Poly Acrylic Acid, Polyvinyl Alcohol, Starch, Curcumin, Wound Healing

دوازدهمین کنگره بین‌المللی زخم و ترمیم بافت یارا
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Code: wtrc12-02870314
Title:

hsa-miR-200b-3p Regulates Epithelial-Mesenchymal Transition and Angiogenesis in Ovarian Wound Healing in PCOS: A Protein Interaction Network Analysis

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Abstract:
Background: Laparoscopic ovarian drilling (LOD) is a therapeutic procedure for polycystic ovary syndrome that induces thermal injuries to ovarian tissue requiring efficient wound healing. Impaired wound healing in PCOS is associated with dysregulated microRNA expression, including miR-200b-3p. This microRNA regulates epithelial-mesenchymal transition (EMT), angiogenesis, and cell proliferation— all of which are critical processes for ovarian tissue repair. **Methods:** Target genes of hsa-miR-200b-3p were identified through TargetScan and miRDB databases and validated by published luciferase assays and functional studies. Protein-protein interaction (PPI) networks were constructed using STRING database. Pathway enrichment analysis was performed on wound healing-related biological processes. **Results:** Nineteen validated miR-200b-3p targets were identified: ZEB1, ZEB2, RAC1, PTEN, VEGFA, FLT1, KDR, GATA2, ERG, CDH1, VIM, ERRFI1, CFL2, SNAI1, PLAU, TWIST1, AKT1, TP53, and SNAI2. The PPI network contained 19 nodes with 85 edges (average degree 8.9; density 0.47), indicating a highly interconnected regulatory system. Hub genes KDR, PTEN, and AKT1 participated in 17, 16, and 15 wound healing pathways respectively. Seventeen significantly enriched wound healing pathways were identified. The most significant pathways included: regulation of epithelial cell proliferation ($p=2.31\times10^{-11}$, 9 genes), cell migration ($p=1.07\times10^{-10}$, 11 genes), circulatory system development ($p=1.05\times10^{-10}$, 11 genes), regulation of cell motility ($p=2.78\times10^{-10}$, 11 genes), tissue development ($p=2.99\times10^{-10}$, 13 genes), anatomical structure morphogenesis ($p=3.90\times10^{-10}$, 14 genes), and epithelial cell migration ($p=4.77\times10^{-10}$, 6 genes). Additional significant pathways included regulation of cell adhesion (5.37×10^{-6}), angiogenesis (4.83×10^{-7}), and tube development (4.54×10^{-8}). Network analysis revealed three functionally distinct clusters: EMT regulation centered on ZEB1/ZEB2 coordinating with CDH1, VIM, and SNAI factors; angiogenic signaling anchored by VEGFA-FLT1-KDR-GATA2 axis; and PI3K/AKT proliferation pathway with PTEN and AKT1 as critical hubs. **Conclusion:** hsa-miR-200b-3p functions as a master regulator of wound healing through orchestration of EMT suppression, angiogenesis control, and cell proliferation. The highly interconnected network with 85 edges and convergence of 17 statistically significant wound healing pathways demonstrates the critical importance of miR-200b-3p in ovarian tissue repair. These findings provide molecular rationale for miRNA replacement therapy to enhance wound healing following LOD in PCOS patients.

Keywords:
miR-200b-3p, Wound Healing, Protein-Protein Interaction Network, Pathway Enrichment, EMT, Angiogenesis

Code: wtrc12-05080313
Title:

AI-Driven Biosensing in Tissue Regeneration and Wound Healing

Authors:

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Abstract:
Background: Conventional monitoring approaches for tissue regeneration and wound healing, as dynamic processes influenced by multiple factors, are often limited to either visual inspection or invasive sampling, which may lead to delayed detection of wound complications, such as infection. Wearable biosensors are designed to address the mentioned limitations by measuring biomarkers such as pH, temperature, and oxygenation levels. The biosensors provide a real-time and more accurate assessment of the healing process by monitoring the wound simultaneously. The integration of artificial intelligence (AI) with the biosensing process enables more advanced continuous monitoring by approaches such as predictive healing trajectories and providing therapeutic feedback, overall leading to better wound management. **Methods:** A literature review was performed on AI-driven wearable biosensing for wound healing and tissue regeneration. Relevant studies were retrieved from PubMed and Google Scholar using keywords such as "AI," "machine learning," "wearable biosensors," and "wound healing." **Results:** In the wound healing process, the real-time monitoring of biomarkers such as pH, temperature, moisture, uric acid, cytokines, and oxygenation levels with multimodal biosensors requires a large amount of data to be analyzed. In this regard, machine learning algorithms pave the way for simultaneously processing the data obtained from biomarkers and providing feedback regarding the change patterns. AI-assisted biosensing platforms also enable the prediction of healing trajectories and comparing the current outcomes with what was predicted. Moreover, some platforms integrate on-demand drug delivery with biosensors, minimizing the delay. Altogether, by the integration of AI, closed-loop wound repair systems using AI-feedback, such as a-Heal, have been developed, being able to monitor the tissue regeneration process and adjust the intervention as needed, thus enhancing wound management. **Conclusion:** AI-driven biosensing is becoming a rapidly evolving method for wound management. Integrating multimodal sensors with AI enables the processing of the large data obtained from the wound, leading to healing trajectories prediction, early detection of deteriorations such as infection, and on-demand drug delivery. AI-assisted biosensing has the potential to enhance the quality of care and clinical outcomes as it enables timely wound evaluation, hence ensuring appropriate wound care. The AI-integrated biosensing platforms sound promising; however, clinical translation will require overcoming challenges such as the need for large datasets, clinical validation, and ethical considerations, to name a few.

Keywords:
AI, Machine Learning, Wearable Biosensors, Wound Healing

Code: wtrc12-05050312
Title:

Inhibition of YAP and Engrailed-1: Pharmacological Synergies for Scarless Skin Regeneration

Authors:

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Abstract:
Background: Scar formation resulting from wound healing has become a major issue, influencing patients' social lives and psychological status. Impaired wound healing and dysregulation of local immune system can cause chronic inflammatory wounds, which are highly susceptible to pathological scarring. The principal mediators of scar formation are fibroblasts that proliferate inordinately and produce excessive extracellular matrix. The fibrotic process is mediated through mechano-transduction pathways such as yes-associated protein (YAP) activation. YAP stimulates tissue regeneration and cell proliferation through regulating gene expression. Activation of YAP's target genes, including Engrailed-1, is associated with wound healing and leads to scar tissue deposition. Thus, YAP inhibition has been proposed as a potential strategy to regulate Engrailed-1 pathway and reduce scarring in adult skin as a result. Furthermore, combining the suggested strategy with supportive therapies may enhance scarless wound healing. **Methods:** A narrative review of available studies from 2021 to 2025 was carried out. Terms such as "YAP inhibition", "Engrailed-1 protein", and "Scarless wound healing" were searched across databases containing PubMed, Google Scholar, and Scopus. **Results:** Recent preclinical studies have demonstrated that blocking Engrailed-1 by YAP inhibition leads to wound regeneration. An animal study showed that wounds treated with pharmacological YAP inhibitor, verteporfin, recovered in 30 days. Verteporfin-treated wounds had considerable hair growth and, by 90 days, resembled normal skin, while untreated scars missed secondary appendages. In mouse models, YAP knockdown augmented proliferation and migration of fibroblasts. Additionally, autophagy in fibroblasts was diminished, suggesting that Mammalian target of rapamycin (mTOR) pathway was activated via YAP knockdown. Delivering verteporfin via microneedles or injectable hydrogels promoted more striking results compared with monotherapy. Core-shell structured microneedle loaded with verteporfin was utilized to facilitate the recovery of chronic wounds. The recommended tool degraded under oxidative stress during the inflammation stage to release verteporfin for bacterial inhibition and wound remodeling. Furthermore, in another study, verteporfin-enriched hydrogel co-formulated with adipose-derived mesenchymal stem cells was injected into rats. The presence of adipose-derived mesenchymal stem cells resulted in angiogenesis and improved wound closure, besides the mentioned effects of verteporfin. **Conclusion:** YAP-Engrailed-1 pathway modulating prevents fibroblasts transition into scar-forming lineage and results in regenerative changes. Moreover, combining YAP inhibitors with specific delivery strategies and cell therapies develops synergistic effects. Therefore, targeting YAP-Engrailed-1 signaling pathway and pharmacologic synergies indicate promising strategies to achieve scarless healing. However, further preclinical studies are essential to demonstrate safety, assess optimal dosage and explore long-term effects.

Keywords:
EN1 Protein, Engrailed-1 Protein, Pharmaceutical Preparations, YAP Inhibition, Yes-Associated Proteins, Verteporfin, Scarless Wound Healing

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Code: wtrc12-04680311
Title:

Bioactive Moringa oleifera–Loaded Scaffolds in Advanced Wound Care: Current Evidence, Mechanisms, and Therapeutic Prospects

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Abstract:

Wound healing is a complex and multi-stage biological process, which engages various cellular, humoral, and molecular phenomena, sequentially including hemostasis, inflammation, proliferation, and remolding. Any disruption in such proceedings can lead to irregular scarring and/or chronic diseases, causing severe limitations to one's life quality. Thus, it has ever been a top priority to build effective therapeutic approaches accelerating wound healing. Currently, there has been an ever-growth in interest concerning acellular biopolymer matrices as innovative systems in wound care. Among bioactive materials explored and combined with biopolymer matrices, Moringa oleifera has recently acquired wonderful interest due to its high richness in vitamins A and C, proteins, glucosinolate, isothiocyanates, terpenes, anthocyanins, phenolic acids, and essential minerals. The present review highlights current scientific findings regarding therapeutic application of Moringa matrices to wound healing based upon in vitro and animal research. Engineered bioactive scaffolds with Moringa extracts have been demonstrated to successfully mimic significant aspects of the wound environment with an emphasis on biological events involved in wound healing. To act as an inductive matrix with potential to induce infiltration and neovascularization, among other biological responses, and eventually enhance wound healing, aspects such as biodegradability, biocompatibility, and matric structure are vital. The integration of phytochemicals into scaffold structures not only enables better stability of phytochemicals than in their isolated forms but also utilizes the benefits offered by porous scaffold structure. The interconnected porosity offers better cell infiltration, oxygen transfer, nutrient exchange, and angiogenesis, thereby accelerating granulation tissue formation and re-epithelialization. The water absorption property of such scaffolds also works towards preventing infections by controlling exudation and accelerating wound closure by providing optimal conditions for healing. Moringa's phytochemistry has diverse therapeutic properties, such as antibacterial, antioxidant, and anti-inflammatory actions. The therapeutic property brought by phytochemistry has accelerated wound contraction, promoted fast re-epithelialization, and protected tissue from oxidation. Moringa phytochemistry has already shown its potential to manage inflammation by minimizing oxidative stress and downregulating vital pro-inflammatory cytokines such as TNF-α, IL-1β, and IL-6, thereby protecting tissue against potential damage due to inflammation. Additionally, its potential antibacterial property against Gram-positive and Gram-negative bacteria works towards controlling infections. During proliferation, Moringa phytochemistry can accelerate fibroblast proliferation and support keratinocyte migration. This process is crucial and pivotal towards robust granulation tissue formation and re-epithelialization. Enhanced collagen synthesis and better extracellular matrix structure and strength, finally providing stronger and restored tissue with better functions. Furthermore, Moringa has shown excellent compatibility with advanced biomaterials intended for wound healing. Its integration into hydrogels, biodegradable scaffolds, and electrospun nanofibers has improved its physio-chemistry and enhanced its performance concerning water holding capacity and regeneration potential. Overall, evidence suggests that Moringa-loaded scaffolds present very encouraging materials with high potential as advanced wound dressing biomaterials. This review aims to herald and present the significant therapeutic potential of Moringa oleifera in wound treatment and demonstrate its need and potential in biomedical utilization at clinical stages.

Keywords:
Moringa oleifera, Wound healing, Scaffold, Antioxidant, Anti-inflammatory, Antibacterial

Code: wtrc12-04370310
Title:

Differential Expression of egf, tgf-β and pdgf in Early and Late Stages of Cutaneous Leishmaniasis and their Association with Wound Healing

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Abstract:

Background: Leishmaniasis is a protozoan disease transmitted through sand fly bites. Cutaneous leishmaniasis is a tropical disease. In Iran, cutaneous leishmaniasis predominantly occurs in arid and desert areas. There is no specific drug or vaccine that can guarantee remission or prevent infection so far. However, recent studies demonstrated that growth factors play crucial roles in regulating inflammation, tissue repair, and lesion evolution in cutaneous leishmaniasis. Evidence from experimental models and clinical studies suggests that platelet-derived growth factors (PDGF), epidermal growth factors (EGF), and transforming growth factor-β1 (TGF-β1) contribute differently to wound-healing outcomes during Leishmania-induced skin damage. PDGF: Clinical trials using autologous platelet gel enriched with PDGF have demonstrated accelerated wound contraction, enhanced granulation tissue formation, and improved epithelialization when administered alongside antimonial therapy. These findings indicate that PDGF provides strong pro-repair activity by stimulating fibroblast proliferation and collagen remodeling. EGF: Studies in BALB/c mice and hamsters show that topical or injected EGF significantly reduces lesion size, promotes keratinocyte proliferation, and shortens healing time. EGF acts predominantly during the early reparative phase, where rapid epithelial recovery is essential for controlling tissue destruction caused by Leishmania parasites. TGF-β1: Multiple human and animal studies consistently report elevated TGF-β1 expression in chronic or non-healing CL lesions. While TGF-β1 supports early wound stabilization, its persistent upregulation contributes to pathological inflammation, delayed epithelialization, and fibrosis. It also interacts with IL-10, creating an immunosuppressive environment that may favor parasite persistence. **Methods:** Data were synthesized from experimental and clinical studies involving Leishmania major and L. braziliensis infections. Methodologies included real-time PCR–based quantification of growth- factor expression in lesion biopsies, histopathological evaluation of inflammatory stages, and therapeutic interventions such as autologous platelet gel (APG) enriched with PDGF, exogenous EGF application, and analysis of endogenous TGF-β1 expression in both human and animal models. Lesions were classified as early-stage (≤4 weeks, inflammatory phase) and late-stage (>4–8 weeks, chronic/ulcerative phase). Growth-factor expression levels were compared across these stages. **Results:** Evidence indicates that PDGF is markedly and significantly elevated during the early stages of cutaneous leishmaniasis, while its levels remain relatively stable with no significant changes in the late stages. Similarly, EGF shows an increase in early lesions but decreases considerably during the late stages of infection. Research findings further demonstrate that TGF-β1 initially acts as an immunosuppressive factor, exhibiting only a slight elevation at the onset of infection, but increases sharply in the late or chronic stages. These temporal patterns highlight the differential roles of growth factors in wound healing and immune regulation during the progression of cutaneous leishmaniasis. **Conclusion:** Growth-factor expression in cutaneous leishmaniasis is dynamic and stage-dependent. PDGF peaks during early stages and remains stable rather than declining in the late phase; EGF increases in early lesions but decreases substantially during late epithelial remodeling; and TGF-β1 shows progressive and pronounced elevation in chronic stages with context-dependent effects. These findings suggest that targeted modulation of growth factors may enhance therapeutic strategies for CL, and that distinguishing early versus late expression patterns is essential for optimizing wound-healing outcomes.

Keywords:
Leishmaniasis, PDGF, EGF, Wound Healing

Code: wtrc12-05060309
Title:

Healing in Hushed Tones: The Impact of lipidocolloid Technology with a Nano-oligosaccharide Factor (TLC-NOSF) Dressings on Chronic Wounds

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Abstract:
Background: Chronic wounds are defined as wounds that do not progress through the normal process of healing in an expected time frame. The most common chronic wounds include diabetic, vascular, and pressure ulcers. The prevalence has increased due to the ageing of the population and increased comorbidities such as diabetes, resulting in serious complications such as amputation and a great burden on the healthcare system. Despite advances in wound care, very few novel approaches have received FDA approval due to insufficient efficacy, highlighting the need for novel approaches. Lipidocolloid technology with a nano-oligosaccharide factor (TLC-NOSF) dressings has emerged as a novel approach that acts by modulating the wound micro-environment, providing a favorable condition for healing. In this regard, the impact of TLC-NOSF dressings on chronic wound healing is highlighted. **Methods:** A literature search using PubMed, Scopus, and Scholar (2005–present) yielded studies on TLC-NOSF in chronic wound healing. Search terms included "TLC-NOSF," "lipidocolloid dressing," "matrix metalloproteinase inhibition," and "chronic wounds." Peer-reviewed and cohort study articles were synthesized to reveal trends and gaps. Findings were compiled through a comprehensive review of dressing structure, biochemical mechanisms, and clinical outcomes to identify emerging therapeutic patterns, translational barriers, and underexplored areas in regenerative wound care. **Results:** TLC-NOSF dressings work not by force, but by finesse. These dressings are designed to recalibrate the microenvironment of the wound where conventional dressings fail. Regarding the molecular level, the NOSF acts as a selective inhibitor of matrix metalloproteinases. Otherwise, these matrix metalloproteinases can degrade the extracellular matrix and stop the healing process. The NOSFs are paired with a lipidocolloid scaffold that maintains moisture, which can protect peri-wound tissue and support cellular migration. The intelligence used in the structure of TLC-NOSF set it apart: the dressing is harmonized with the wound bed and can minimize the trauma during its removal, and last but not least, it integrates seamlessly with fragile skin. The underlying mechanism is due to faster granulation, earlier epithelialization, and visibly healthier wound beds. Furthermore, TLC-NOSF acts as a protective interface that enhances granulation without disrupting the wound bed, which results in compatibility with negative pressure wound therapy and it is another factor for broadening its therapeutic scope. Patients report quieter healing: less pain, fewer dressing changes, and a sense of progress that feels both tangible and sustainable. These outcomes, while supported by clinical trials, are best understood: wounds that once resisted care begin to respond, not with noise, but with nuance. **Conclusion:** Chronic wounds remain a challenge for healthcare systems despite the advances in care. TLC-NOSF dressings demonstrate a novel approach in wound care by modulating the wound microenvironment through inhibiting matrix metalloproteinases, maintaining moisture, and protecting peri-wound tissue resulting in faster granulation and earlier epithelialization. Studies suggest that TLC-NOSF is effective in chronic wound healing enhancement and it also can be combined with other therapies. Further clinical studies are essential to define their role in reducing the burden of chronic wound and improving the patients' quality of life.

Keywords:
Chronic Wounds, TLC-NOSF, Lipidocolloid Technology, Nano-oligosaccharide Factor, Wound Healing

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Title:

Photobiomodulation Therapy for Enhanced Cutaneous Wound Healing: Mechanistic Insights and Clinical Applications

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Abstract:
Background: Approximately 2.21 out of every 1,000 people worldwide suffer from chronic cutaneous wounds, which are linked to high morbidity and healthcare costs. In this regard, healing time can be affected by several factors, e.g., prolonged inflammation, reduced angiogenesis, and mitochondrial dysfunction. Conventional treatments such as growth factors often fail to fully restore tissue function, which brings us to use new emerging treatments. Photobiomodulation therapy (PBM), also called low-level laser therapy (LLLT), is a non-invasive light-based therapy that uses low-energy red or near-infrared wavelengths to control cellular activity and accelerate wound healing through photochemical effects. This non-invasive method improves tissue regeneration, cellular metabolism, and proliferation through special pathways. Preclinical and clinical studies suggest it can accelerate wound closure by improving extracellular matrix organization and modulating inflammation. In this context, the evidence indicates its potential as an effective therapy for cutaneous wounds. **Methods:** A literature search was conducted in PubMed, Scopus, and Google Scholar using keywords such as “Photobiomodulation,” “Low-level laser therapy,” “Cutaneous wound healing,” “Fibroblasts,” and “Keratinocytes.” Data were extracted from both preclinical and clinical articles published between 2005 and 2025. **Results:** PBM therapy has significantly enhanced the proliferation of cutaneous progenitor cells. There were several studies that showed PBM plays important roles in enhancing pathways that induce NG2 activation through dermal adipocyte-mediated lipolysis. Current evidence about diabetic wound healing investigated the use of PBM as a preventive treatment for foot ulcers. In addition, PBM promotes angiogenesis, collagen deposition, and keratinocyte migration. Recent research also highlights the significant role of photobiomodulation (PBM) in dampening inflammatory signaling. It achieves this primarily by reducing levels of key pro-inflammatory cytokines—e.g., IL-1β, IL-6, and TNF-α—with multiple studies documenting reductions of 50–75% in treated wound tissue. These effects are thought to result from increased mitochondrial activity, ATP production, and controlled reactive oxygen species signaling that collectively increase cellular proliferation. PBM has been demonstrated to reduce inflammation, decrease healing time, and improve the quality of the repaired tissue, which highlights its potential as a non-invasive therapy for cutaneous wounds. **Conclusion:** In the realm of tissue repair, PBM shows potential in cutaneous wound healing acceleration, particularly in clinical cases where conventional treatment strategies provide limited benefit. Moreover, PBM seems to accelerate tissue repair by stimulating fibroblast and keratinocyte proliferation. In addition, improving extracellular matrix organization, modulating inflammation, and promoting angiogenesis can reduce the healing time of the wounds, which becomes important in special ulcers. Although most current evidence comes from preclinical studies and small clinical trials, the observed regenerative effects indicate PBM’s therapeutic potential in managing acute and chronic wounds. However, more controlled clinical studies are needed in order to evaluate long-term efficacy and establish standardized protocols for the integration of PBM into routine wound care practice.

Keywords:
Photobiomodulation, Cutaneous Wound, Cellular Regeneration

Code: wtrc12-05000307
Title:

From Web to Wound: Advances in Spidroin-Based Biomaterials as a Scaffold for the Growth, Proliferation, and Differentiation

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Abstract:

Background: Chronic wounds affect over 300 million people globally, and the prevalence is still rising in aging, diabetic, and low-resource populations. For instance, in South Asia alone, millions of people suffer from non-healing ulcers, surgical wounds, and burns that are often exacerbated by poor access to regenerative therapies. Bear in mind the failure of Conventional wound dressings in replicating the extracellular matrix environment for healing, a promising scaffold for tissue regeneration has recently emerged, Spider silk proteins. These proteins, also known as spidroins, are recognized for their exceptional mechanical strength, biocompatibility, and also elasticity. Although natural silk harvesting is impractical, recent developments of recombinant spidroins through heterologous systems (such as E. coli, yeast, and transgenic organisms) have paved the way for scalable production and molecular customization, positioning spidroins as next-generation biomaterials for wound healing and cell-based therapies. **Methods:** A literature search using PubMed, Scopus, and Scholar (2003–present) yielded studies on Advances in Spidroin-Based Biomaterials. Search terms included "Spidroins", "gene expression", "protein modifications", "biomaterials", and "tissue engineering." Peer-reviewed and cohort studies articles were synthesized to reveal trends and gaps. **Results:** Recombinant spidroins possess a modular architecture: 1. a central repetitive domain rich in glycine and alanine that is flanked by conserved N- and C-terminal regions, and these regions facilitate self-assembly. 2. Structural motifs such as polyalanine β-sheets confer tensile strength, while glycine-rich amorphous regions enhance elasticity. Newly provoked findings underscore the versatility of spidroins through different modifications. For instance, Genetic modifications (such as insertion of RGD (Arg-Gly-Asp) and IKVAV (Ile-Lys-Val-Ala-Val) motifs) have significantly improved cell adhesion, proliferation, and lineage-specific differentiation. Moreover, enhanced fibroblast and keratinocyte attachment on spidroin films was reported as a surprising finding in in vitro studies and in vivo models demonstrate accelerated wound closure, reduced inflammation, and improved angiogenesis. For supporting granulation tissue formation and epithelialization, Spidroin hydrogels are generated that mimic ECM hydration and porosity. Furthermore, Antibacterial spidroin films incorporating hepcidin and HNP1 peptides inhibit microbial colonization without impairing human cell growth. Also, in the field of controlled drug release and localized delivery of growth factors field, spidroin-based microcapsules and nanoparticles have been engineered. It is worth noting that modified spidroins with hydroxyapatite-binding domains promote biomineralization, making them suitable for skin-bone interface healing. Recent fusion constructs combining spidroin domains with silaffin-derived peptides enable silica deposition; notably, this mechanism could enhance scaffold roughness and osteoinductive potential. **Conclusion:** Recombinant spidroins are considered as a transformative leap in biomaterial science. Their structure, biocompatibility, and ability to support cell growth and differentiation make them ideal scaffolds for wound healing. Not just as passive dressings but as active regenerative platforms, spidroin-based materials are poised to enter clinical practice. Their integration into wound care could improve healing outcomes, especially in populations where chronic wounds remain a silent epidemic. All in all, Spidroins have already proven their value in multifunctional wound healing, and with future innovations in molecular design, their future applications look transformative.

Keywords:
Biomaterials, Biomedical Applications, Gene Expression, Protein Modifications, Spidroins, Tissue Engineering

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Title:

Artificial Intelligence and Quantitative Imaging in Dermatologic Wound Management: Advances in Assessment and Predictive Analytics

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Abstract:

Background: Management of chronic dermatologic wounds, such as diabetic foot ulcers, venous leg ulcers, and pressure injuries keeps persistently challenging. One of the main factors of this mishandling is the lack of standardized wound monitoring protocols. Now, the existence of quantitative imaging modalities, such as digital photography, multi-spectral or high-spectral imaging, thermal mapping, and three-dimensional photogrammetry, enables us to acquire wound metrics, including area, perfusion, tissue composition, and temporal evaluation. Otherwise, artificial intelligence, particularly deep learning and machine learning prove that they have a capacity to build an actionable method in order to facilitate wound segmentation, tissue characterization, and prediction of healing process via spatial, spectral, and temporal analysis. Material and **Methods:** A structured review was conducted based on articles from PubMed, Scopus, and Google Scholar focusing on artificial intelligence-based applications coupled with quantitative imaging in wound management. Key research domains evaluated including, multi modal imaging fusion with clinical data models, utilization of artificial intelligence applications, and imaging biomarkers to biological correlation studies. **Results:** Current evidence indicates that deep learning modals, particularly encoder-decoder architectures, achieve a high-quality performance in wound segmentation and tissue classification, which frequently attaining more accurate metrics comparable to clinical benchmarks. Due to variable imaging protocols, and insufficient datasets, clinical adoption remains limited. The integration of multimodal systems, for instance with red-green-blue imaging or thermal imaging, with clinical metadata will enhance the precise prediction of some common complications, like infection risk or even intervention requirements. Portable devices equipped with artificial intelligence have demonstrated utility in automated wound metrics and real-time risk stratification, thereby diminishing inter-observer variability. Yet, the prospective evidence proving artificial intelligence-driven agents in enhancing some patient-centered outcomes like time to complete closure, rates of limb salvage, and quality of life persist rare. **Conclusion:** Artificial agents-driven imaging methods are potentially able to standardize wound assessment protocols and early risk stratification. Realizing this fact and convert it into clinical protocols requires concreted and multidisciplinary efforts focused on four imperatives: (1) establishment of large-scale and diverse repository of wound annotation (2) developing international union in order to create benchmark datasets for algorithm validation (3) conducting robust prospective trials with clinical endpoints and also investigation of health-economic outcomes (4) implementing ethical frameworks addressing data security, algorithm transparency, and interoperability with electronic health records and some the telemedicine platforms. In conclusion, multidisciplinary collaboration among clinicians, data scientists, imaging scientists or even presence of healthcare governors is essential for achieving scalable, equitable implementation, global standardization and improved healing outcomes among heterogenous populations.

Keywords:
Chronic Wound, Artificial Intelligence, Quantitative Imaging

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Title:

The Role of Smart Dressings, Wearable Sensors, and IoT in Advanced Wound Management: A Systematic Review on Real-Time Monitoring Technologies

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Abstract:
Background: Chronic wounds challenge global healthcare systems. Traditional treatment requires intermittent visual evaluations, which may make complication detection harder. Innovative dressings, wearable sensors, and IoT platforms signal a shift toward real-time physiological monitoring. This systematic review examined these technologies' diagnosis, clinical efficacy, and implementation readiness in monitoring wound status and predicting healing trajectories. Materials and **Methods:** This review followed PRISMA. For studies from inception to April 2024, MEDLINE, Embase, Web of Science, IEEE Xplore, and Scopus were systematically reviewed. Search terms included "smart dressing," "biosensor," "wearable electronic device," "IoT," "connected health," "wound monitoring," and "wound healing." The study examined a real-time wound biomarker detection technology that measures temperature, pH, moisture, and infection. Exclusions included non-English, in vitro, ex vivo, and simulation studies. Diagnostic studies used QUADAS-2, while randomized controlled trials used Cochrane RoB 2 to assess bias. We did a narrative synthesis and meta-analysis when needed. **Results:** 42 studies with 2,153 patients and 1,852 wounds were selected from 2,517 records. Technology primarily measured temperature (19 studies), pH (15 studies), and moisture (22 studies). Innovative technologies had a pooled sensitivity of 0.92 (95% CI: 0.85–0.96) and specificity of 0.89 (95% CI: 0.82–0.94) for infection detection compared to clinical diagnosis in a meta-analysis of 12 diagnostic studies (n= 845 wound Five randomized controlled trials (n=588 patients) comparing IoT-guided care to standard care showed that the intervention group had significantly lower healing time (Mean Difference -4.2 days, 95% CI [-6.1, -2.3]) and unplanned consultations (Risk Ratio 0.56, 95% [0.42, 0.75]). **Conclusion:** Smart wound technologies improve clinical outcomes, including faster healing and lower healthcare utilization, by accurately diagnosing issues. This helps them transform wound care from reactive to proactive and predictive. Small, short-term studies provide most of the evidence. Larger, long-term randomized controlled trials, sensor system standardization, and rigorous economic evaluations to assess cost-effectiveness and facilitate clinical implementation and reimbursement policies are important.

Keywords:
Smart Dressing, Biosensor, Wearable Electronic Device, IoT

Code: wtrc12-00800304
Title:

Personalizing Wound Care with Artificial Intelligence: A Systematic Review on the Efficacy of Clinical Decision Support Systems (CDSS) in Optimizing Nursing Protocols: A Systematic Review

Authors:

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Abstract:
Background: In wound care, a challenging nursing specialty, protocol-guided decisions speed healing and prevent complications. AI helps ACDSs customize suggestions, standardize nursing procedures, and follow evidence-based standards. To improve nurses' protocol adherence and wound outcomes, including healing length and complications, researchers evaluated AI-driven CDSS. We addressed methodology, model validity, and implementation issues. Materials and **Methods:** In January 2018–June 2025, we searched PubMed/MEDLINE, Embase, CINAHL, Web of Science, and IEEE Xplore for "clinical decision support," "artificial intelligence," "machine learning," "wound care," "pressure injury," "ulcer," "nursing protocol," and "decision support system." Eligible studies were RCTs, quasi-experimental studies, and cohort studies on AI-enabled clinical decision support systems and adult wound care protocol adherence or clinical outcomes. Incomplete conference abstracts, children, and non-AI decision-making tools were excluded. Nonrandomized studies were assessed by ROBINS-I, while randomized controlled trials were graded by RoB 2. PROBAST evaluates model development research bias. Narrative synthesis and random-effects meta-analyses addressed three study results. Studies employed risk ratios (RR) or standardized mean differences (SMD), 95% confidence intervals, and heterogeneity (I^2). **Results:** 22 trials had 9,842 patients and 1,540 nurses. Eight cohort studies, six QETs, and eight RCTs were done. Nursing workflows included picture-based wound categorization and treatment. AI-CDSS enhanced nursing protocol adherence (RR 1.32; 95% CI 1.18–1.48; I^2=46%) compared to standard care in a meta-analysis of 12 studies (n=5,430). Nine studies (n=3,210) indicated a small favoring for CDSS for healing length (SMD −0.28; 95% CI −0.45 to −0.11). Analysis of ten studies (n≈4,000) revealed a decrease in wound complications (RR 0.78; 95% CI 0.65–0.94). Clinical workflow integration, variable outcome definitions, and a lack of external validation created mild bias. **Conclusion:** Moderate evidence suggests AI-enabled Clinical Decision Support Systems increase nursing adherence, wound healing, and complication management. For predictive performance standardization, research should focus on large-scale prospective validation, standardized outcome measurements, transparent reporting, clinician-centered implementation studies, and cost-effectiveness evaluations.

Keywords:
Artificial Intelligence, Machine Learning, Wound Care, Nursing Protocol

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Title:

Artificial Intelligence in Personalized Regenerative Medicine: Predicting Healing Dynamics from Patient-Specific Data

Authors:

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Abstract:

Background: The expanding regenerative medicine toolkit is reaching a record number of lives saved. However, healing after tissue injury varies widely from one patient to another, even when the same regenerative treatment is used. Some factors cause differences in healing response, such as age, genetic makeup, and personal health history, make it difficult for physicians to predict how well or how quickly a patient will recover. To achieve reliable outcomes, there is a pressing need to enhance the precision, efficiency, and effectiveness of regenerative approaches. To address this challenge, an artificial intelligence (AI) approach was developed that combines several forms of patient-specific data, including clinical information, laboratory markers, imaging features, and medical history. **Methods:** The study provides a review of recent studies on AI predicting healing dynamics from patient-specific data. Studies from the PubMed, Embase, and Scopus databases from 2018-2025 are chosen based on the keywords artificial intelligence and personalized healing, and regenerative medicine, and reviewed to solve the problem and report results. **Result:** While regenerative medicine has relied on an empiric paradigm, the availability of big data along with advances in informatics and AI offers the opportunity to inform the next generation of regenerative medicine along the discovery, translation, and application pathway. By learning from the patterns across these different data sources, AI estimates individual healing speed, regeneration potential, and the likelihood of delayed recovery. In the evaluations carried out, it consistently performed better than traditional clinical prediction methods, was a more cost-effective innovation, and was able to detect subtle relationships that are usually overlooked or missed by human researchers. Also, personalized healing curves were produced by AI, giving a clearer picture of how each patient might respond to regenerative therapy. **Conclusion:** AI can be a useful support tool in personalized regenerative medicine, helping physicians plan and tailor treatments with a more informed understanding of patient-specific healing dynamics. Nevertheless,. Therefore, AI has enormous potential to transform and accelerate the advancement of regenerative medicine treatments.

Keywords:

Artificial Intelligence, Personalized Healing, Regenerative Medicine

Code: wtrc12-00800302
Title:

From Prediction to Prevention: The Role of Artificial Intelligence Models in Identifying High-Risk Patients for Post-Surgical Pressure Ulcers – A Systematic Review

Authors:

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Abstract:

Background: Preventable surgery complications like pressure ulcers are standard. They lengthen hospital stays, increase morbidity, and raise healthcare costs. Latest AI advances enable predictive modeling of high-risk patients. We could change our disease prevention plan. The accuracy, clinical utility, and usability of these models are unclear. Artificial intelligence-based pressure ulcer prediction tools after surgery were reviewed in this systematic review. Methodology quality, forecast accuracy, and clinical instrument utility were stressed. Materials and **Methods:** We searched PubMed, Embase, Web of Science, IEEE Xplore, and the Scopus for studies about "artificial intelligence," "machine learning," "prediction," "pressure ulcer," "decubitus ulcer," "surgery," and "risk assessment" from January 2018 to March 2025 Original AI or machine learning research predicting pressure ulcers in adults post-surgery is eligible. Child-only studies, conference abstracts without full texts, non-English studies, and model performance metrics were excluded. We assessed bias with PROBAST. Where possible, pooled predictive accuracy estimates (AUC) were calculated from narrative and tabulated data. **Results:** We examined 27 surgical studies with 42,315 patients. Most studies used logistic regression, random forest, SVMs, and deep learning. Predictive performance was 0.72–0.93 (pooled estimate: AUC 0.84; 95% CI 0.80–0.88). Models using hemodynamic parameters, operative duration, and comorbidities outperformed demographic or static risk factors. Insufficient external validation and model overfitting caused moderate bias in 63% of studies. AI-driven tools predicted outcomes better than the Braden and Norton risk assessment scales. **Conclusion:** AI models can predict postoperative pressure ulcer risk for early prevention. However, inconsistent outcome definitions, lack of external validation, and limited clinical workflow integration limit generalizability. For predictive performance to become preventive, future research must emphasize prospective validation, transparent reporting, and real-world applicability.

Keywords:
Artificial Intelligence, Machine Learning, Prediction, Pressure Ulcer, Decubitus Ulcer

Code: wtrc12-05030301
Title:

Artificial Intelligence in Wound Assessment and Healing: Deep Learning Advancements and Their Clinical–Nursing Integration

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Abstract:
Background: Subjectivity in wound assessment remains a primary clinical challenge, leading to diagnostic variability. While broad AI reviews exist (Wang et al., 2024), this narrative review charts the specific 2020–2025 evolution from traditional Convolutional Neural Networks (CNNs) to advanced Vision Transformers (ViT) and multimodal systems that enable objective, data-driven analysis. **Methods:** A narrative review of literature from January 2020–June 2025 (PubMed, Scopus, IEEE Xplore, ScienceDirect) was conducted using terms such as "wound assessment," "artificial intelligence," and "Vision Transformer." Studies describing novel AI architectures, model validation, or explainability (XAI) were prioritized, and thematic analysis was applied to map architectural evolution. **Results:** We identified a clear trajectory from general-purpose CNNs, dominant in early 2020s literature for basic classification, toward specialized architectures. Since 2022, Vision Transformers (ViT) and multimodal frameworks (e.g., DeBERTa) have become prevalent. These models integrate diverse data — thermal imaging, clinical notes, microbiome data — to achieve higher accuracy in predicting healing outcomes. Critically, explainability methods (e.g., Grad-CAM) now demystify model predictions, enhancing clinician trust and offering granular insights that exceed conventional manual evaluation. **Conclusion:** The 2020–2025 period represents a pivotal transition from simple pattern recognition to holistic, predictive analytics in wound care. Recent investigations highlight the potential of Deep Learning-based wound image assessment tools that, upon image capture, automatically analyze lesions and suggest AI-generated treatment plans. Such integrated applications hold particular promise for nursing practice, serving as real-time decision-support systems during bedside wound management. The adoption of ViT and multimodal systems, combined with XAI, is establishing a new standard for objective wound assessment. Future research must emphasize their integration into Internet of Medical Things (IoMT) platforms to translate model precision into measurable clinical outcomes.

Keywords:
Wound Healing, Artificial Intelligence,Deep Learning, Vision Transformer,Explainable AI (XAI),Multimodal Dat a Analytics

Code: wtrc12-03690300
Title:

Smart Electrospun Nanofibrous Platforms Integrated with Dual Biosensors for Advanced Real-Time Management of Diabetic Foot Ulcers

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Abstract:

Background: Diabetic foot ulcers (DFUs) remain one of the most challenging complications of diabetes due to persistent inflammation and recurrent infections that progressively weaken healthy tissue. The chronic nature of these ulcers highlights the need for advanced therapeutic strategies capable of improving healing outcomes. Electrospun nanofiber systems have gained considerable attention for their ability to mimic the extracellular matrix, support cellular activity, and promote tissue regeneration by replicating key structural elements of the skin. Alongside these materials, the development of smart, stimulus-responsive technologies has enabled real-time monitoring of ulcer conditions, offering clinicians more accurate insights for managing DFUs. Newly designed biosensors can detect changes in glucose levels and infection progression—both essential indicators in diabetic wound care. This review summarizes recent advancements in integrating electronic components into electrospun nanofibrous dressings and outlines architectural strategies that contribute to more efficient DFU management. These approaches support a data-driven method for wound care that benefits from improved materials and monitoring capabilities. Despite progress, several technological and clinical challenges remain before fully intelligent wound-care systems can be realized, and this review identifies key gaps and limitations that must be addressed to advance systems capable of supporting real-time data integration and improved chronic ulcer management. **Methods:** A systematic literature review covering the years 2019 to 2025 was conducted using PubMed, Scopus, and ScienceDirect. Search terms included smart wound dressing, electrospun nanofiber, biosensor, diabetic foot ulcer, pH, glucose, wearable, artificial intelligence, and internet of things. Twenty studies presenting innovative combinations of biosensors and electrospun nanofiber scaffolds were selected and evaluated based on methodological quality, detection limits, stability, and response time. Both in vitro and in vivo studies were included, with preference given to research meeting biocompatibility and electrical safety requirements defined by ISO 10993 and IEC 60601 standards. **Results:** Recent innovations emphasize the advantages of conductive and photothermal nanomaterials—particularly MXene and silver nanowires—which enhance electrical conductivity, moisture balance, antibacterial performance, and sensor durability. Janus and multilayer electrospun architectures have improved moisture retention and enabled more controlled therapeutic drug release. Advances in biosensing, including enhanced sensitivity in wound exudate and the incorporation of self-calibration algorithms, have increased the long-term accuracy of pH and glucose monitoring. Wearable platforms now provide more reliable closed-loop functionalities, enabling controlled drug release and localized stimulation, while remote monitoring allows continuous real-time data logging. Intelligent electrospun dressings equipped with dual pH/glucose biosensors mark a transition toward more personalized and digitally supported DFU care. However, challenges such as long-term sensor stability, biofouling, power demands, and the need for flexible low-power circuit designs still limit broader clinical translation. Continued progress in biocomposites, improved biosensor interfaces, and machine-learning applications is expected to shape the next generation of responsive, intelligent wound-care systems. **Conclusion:** Smart electrospun nanofiber dressings integrated with biosensors show strong potential for improving DFU management by providing real-time physiological insights and enabling more adaptive therapeutic strategies. While important technical barriers persist, advancements in material science, intelligent monitoring technologies, and data-driven system designs point toward a more personalized, efficient, and clinically impactful future for wound care.

Keywords:

Electrospun Nanofibers, Diabetic Foot Ulcers, Smart Wound Dressings, Biosensors (pH/Glucose), Real-Time Monitoring

Code: wtrc12-03840298
Title:

Therapeutic Management of Pseudomonas Biofilm in Burn Wounds: Current state and Challenges

Authors:

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Abstract:
Background: Burn injuries are one of the leading causes of disability-adjusted life-years, causing 180,000 deaths worldwide annually. Besides mortality, burns cause lifelong complications and disabilities. As one of these complications, infections are considered the primary reason for morbidity and mortality in burn patients. One of the most common causes of burn wound infections is Pseudomonas aeruginosa. In fact, management of Pseudomonas is challenging mostly because of biofilm formation and antibiotic resistance. Additionally, failure of treatment can lead to sepsis and systemic consequences. Material and **Methods:** A literature search based on the keywords “Pseudomonas”, “burn wound”, and “biofilm” has been performed on Google Scholar, PubMed, and Scopus. Articles from 2020 have been obtained. **Results:** Based on the culture results, the type of antibiotic therapy is determined. As a consequence, higher exposure to antibiotics increases the risk of antibiotic resistance in Pseudomonas. For this reason, numerous studies have been done to explore novel treatments. Preclinical studies have identified new methods. For instance, anti-biofilm enzyme-assisted antibiotic therapy demonstrated no obvious cytotoxicity along with accelerated wound healing, both histopathological and microscopic aspects, and decreased biofilm formation in the rat model. In cell studies, silver nanoparticles combined with colistin showed a strong synergistic effect on biofilm inhibition and reduced biofilm integrity. Also, a combination of carbon dots with ciprofloxacin resulted in reduced bacterial growth and biofilm formation compared to exposure to each one alone. **Conclusion:** Although new approaches are emerging, there is still inadequate evidence to be considered as a therapeutic strategy, whether methods are cost-effective or the sample size of studies is adequate remains a challenge. Therefore clinical trials need to be designed to be incorporated into the guidelines.

Keywords:
"Pseudomonas"،"Burn Wound"،"Biofilm"،"Antibiotic Resistance"

Code: wtrc12-04470297
Title:

Engineered Keratinocytes for Diabetic Foot Ulcers: Resolving a Complex Microenvironment through Multi-Targeted Action

Authors:

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Abstract:

Background: Diabetic Foot Ulcers (DFUs) are a major complication in patients with diabetes due to their chronic and non-healing nature and severe morbidities. The ulcers create a complex microenvironment that impedes healing processes. Thereby, the correlation with several factors including hyperglycemia, hypoxia, chronic inflammation, infection, and vascular and cellular dysfunction, exacerbates the healing process. Given the complex microenvironment and extensive cellular dysfunction of keratinocytes as a key factor in DFUs healing, comprehensive therapeutic options should address each component of the microenvironment. Thus, engineered keratinocytes hold promise in wound healing and regeneration based on multidimensional effects on the DFUs microenvironment. Such keratinocytes refer to modified cells based on the wound microenvironment that are cultured in specific ways to enhance therapeutic capacity, particularly in skin regeneration and wound healing. Material and **Methods:** A structured review is performed to explain current evidence on engineered keratinocyte therapies for diabetic foot ulcers. Preclinical and clinical studies from the PubMed, Embase, and Scopus databases from 2009 are chosen to investigate genetically modified or otherwise engineered keratinocytes applied to diabetic cutaneous wounds and reported at least one relevant outcome (wound closure, re-epithelialization, angiogenesis, inflammation, or infection control). **Results:** while DFU keratinocytes exhibit impaired migration, reduced proliferation, abnormal differentiation, persistent inflammation, and high oxidative stress, engineered keratinocytes can modulate the re-epithelialization process and reverse cellular dysfunctions. In particular, DICER1-engineered and FTO/m6A-modulated keratinocytes show significant abilities in migration, proliferation, and survival in the DFUs microenvironment. Moreover, engineered keratinocytes show enhanced resistance to oxidative stress through Nrf2 upregulation. In addition, immunomodulatory reprogramming of the DFU microenvironment through engineered keratinocytes, which are considered one of the most powerful immune regulators, has significant effects on wound healing. Immune modulation reduces chronic M1 polarization and shifts the wound toward a pro-healing status. Furthermore, engineered keratinocytes facilitate angiogenesis by increasing microvascular density and delivering proangiogenic cytokines to mitigate the wound from hypoxia and ischemia. Although engineered keratinocytes may enhance antimicrobial peptide (AMP) production and show potential in reducing infection risk, there is currently no direct evidence that genetically engineered keratinocytes designed for antimicrobial gene expression have been applied specifically in DFUs. Therapeutic strategies in applying engineered keratinocytes are cell-based dressings of allogenic cells, tissue-engineered models incorporating fibroblasts and endothelial cells, and integration with advanced biomaterials. **Conclusion:** engineered keratinocytes show promising effects on DFUs healing through reversing cellular dysfunctions, enhancing resistance through oxidative stress, immure reprogramming, facilitating angiogenesis, and preventing infections. However, complexities in the wound environment and cellular dysfunction of fibroblasts can impair the therapeutic process. In addition, standardization and ensuring the safety of the approach require further investigations. Thus, advanced biomaterials and novel genetic modification and tissue engineering strategies may improve engineered keratinocytes in the future.

Keywords:

Angiogenesis, DfUs, Engineered Keratinocytes, Immune Modulation, Wound Healing

Code: wtrc12-04910296
Title:

A Mini-Review and Structural Evaluation of Aloe vera–Mediated Silver Nanoparticles with Focus on Morphology, Crystallinity, and Antibacterial Performance

Authors:

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Abstract:
Green synthesis of silver nanoparticles has become an emerging strategy in wound care, with numerous studies reporting variable structural and biological outcomes depending on plant-derived reducing agents. In this mini-review–based study, recent literature on Aloe vera–mediated silver nanoparticles is briefly analyzed to highlight common trends in morphology, crystallinity, and antimicrobial behavior. Building on these insights, we synthesized AgNPs using Aloe vera extract and evaluated their key properties through FESEM and XRD analyses, which revealed well-defined crystalline nanoparticles with uniform morphology. The antibacterial assessment demonstrated effective inhibition of both Gram-positive and Gram-negative bacteria, aligning with and extending the patterns observed in previous studies. This combined review-and-analysis approach underscores the relevance of structural characteristics in determining antimicrobial performance and supports the potential application of green-synthesized AgNPs as bioactive nanomaterials for wound-related biomedical uses
Keywords:
Green Synthesis, Silver Nanoparticles (AgNPs), Aloe vera Extract, Antibacterial Activity

Code: wtrc12-02280295
Title:

An Analytical-Descriptive Study of the Relationship between Metacognitive Beliefs and Stress in Patients with Diabetic Foot Ulcers

Authors:

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Abstract:

Background: Diabetic foot ulcer (DFU) is recognized as one of the most prevalent and challenging complications of diabetes, causing significant physical, psychological, and functional impairment. DFU increases the risk of infection, hospitalization, and lower-limb amputation, and it also imposes substantial emotional strain on affected individuals. Psychological stress is common among these patients and can interfere with wound healing, treatment adherence, and overall disease management. Metacognitive beliefs, which refer to individuals' beliefs about their own thinking processes, influence how people appraise stress, regulate emotions, and cope with chronic illness. Understanding the relationship between metacognitive beliefs and perceived stress in patients with DFU may offer valuable insight for developing supportive psychological interventions aimed at improving both clinical outcomes and quality of life. Accordingly, this study aimed to examine the association between metacognitive beliefs and perceived stress in a clinical sample of patients with diabetic foot ulcers. **Methods:** This descriptive–analytical study was conducted on fifty-seven patients diagnosed with diabetic foot ulcers. A snowball sampling technique was used, allowing each participant to refer additional eligible individuals until the intended sample size was reached. Data were collected through in-person visits to outpatient clinics and specialized hospital-based wound care units. Demographic information, including age, gender, marital status, smoking status, duration of diabetes, and wound grade, was recorded for each participant. Metacognitive beliefs were assessed using the Metacognitions Questionnaire-30, and perceived stress was measured using the four-item Perceived Stress Scale. All data were entered into SPSS version 26, and descriptive statistics were used to summarize variables, while Pearson's correlation coefficient was applied to examine the association between metacognitive beliefs and perceived stress. **Results:** Among the fifty-seven patients included in the final analysis, the mean age was 69.1 years, and the majority were married. The mean perceived stress score was 3.33, and the average metacognitive belief score was 32.92. Statistical analysis performed using SPSS 26 demonstrated that the correlation between metacognitive beliefs and perceived stress was weak and not statistically significant ($r = 0.07$, $p = 0.40$). These findings indicate that variations in perceived stress were not meaningfully associated with differences in metacognitive beliefs in this clinical sample. The absence of a significant relationship suggests that additional psychological, clinical, or social factors may exert a stronger influence on patients' stress levels than metacognitive patterns alone. **Conclusion:** Overall, the findings of this study indicate that metacognitive beliefs are not significantly associated with perceived stress in patients with diabetic foot ulcers. Although theoretical perspectives suggest that dysfunctional metacognition may heighten vulnerability to stress, the present results did not confirm this assumption in the studied population. Nevertheless, integrating psychological interventions that focus on cognitive awareness, stress-management strategies, and supportive counseling into routine wound care may still contribute to improved emotional well-being and treatment adherence. Such approaches have the potential to complement medical management by addressing factors that influence patient behavior and emotional responses. Future research using larger sample sizes, more diverse populations, and longitudinal designs is recommended to clarify how cognitive, emotional, and contextual variables interact to shape stress in individuals with diabetic foot ulcers.

Keywords:
Diabetic Foot Ulcer, Metacognitive Beliefs, Perceived Stress, Psychological Factors, Nursing Care

Code: wtrc12-04980294
Title:

Platelet-Derived Exosomes: Orchestrating Tissue Repair and Wound Healing in Modern Regenerative Medicine

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Abstract:
Background: Regenerative medicine aims to restore tissue integrity by endogenous repair mechanisms. As a matter of fact, beyond their established hemostatic function, platelets secrete nanoscale extracellular vesicles—exosomes—enriched with bioactive cargo, e.g., growth factors, cytokines, and microRNAs. In this regard, platelet-derived exosomes are increasingly recognized as pivotal mediators of intercellular communication in tissue regeneration. In this context, this narrative review evaluates their therapeutic potential across cutaneous, musculoskeletal, and cardiovascular repair paradigms. **Methods:** A narrative synthesis was undertaken, which drew from multidisciplinary sources since 2003. Literature was selected from PubMed, Scopus, and Scholar using search terms like "platelet exosomes," "exosome contents," "tissue healing," and "regeneration therapy." Studies that mapped what's inside Platelet-derived exosomes, followed where they go in the body, or tested them in animal models of wounds, arthritis, bone breaks, or heart attacks—plus the few human trials starting to appear -were focused. **Results:** Platelet-derived exosomes contain more than 500 proteins and >200 microRNAs, which modulate key regenerative cascades. In the context of dermal repair, they accelerate re-epithelialization, enhance angiogenesis, and weaken fibrosis, which remodels via fibroblast and endothelial recruitment. Moreover, in osteoarthritic cartilage, they suppress proinflammatory cytokines while increasing chondrocyte anabolic activity and matrix deposition. Additionally, in osseous defects, they augment osteoblast differentiation and vascular infiltration, expediting callus maturation. In addition, in ischemic myocardium, they mitigate apoptosis, reduce scar burden, and preserve contractile function. Furthermore, compared with platelet-rich plasma, platelet-derived exosomes exhibit superior immunogenicity profiles and shelf stability. Critical barriers include batch-to-batch variability, scalable GMP-compliant isolation, and longitudinal safety validation in expanded cohorts. **Conclusion:** Platelet-derived exosomes function as precision-engineered, autologous orchestrators of tissue regeneration; by refining a ubiquitous blood product into a defined vesicular therapeutic, they circumvent immunogenicity and scalability limitations inherent to cellular interventions. As a matter of fact, with advancing standardization and accruing clinical evidence, platelet-derived exosomes are positioned to emerge as foundational modalities in contemporary regenerative medicine.

Keywords:
Growth Factors, Joint Regeneration, Regenerative Medicine, Tissue Repair, Wound Healing

Code: wtrc12-04070293
Title:

Investigation Efficacy of Platelet-Rich Plasma in Mohs Surgery Skin Wounds for Basal Cell Carcinoma: A Case Series

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Abstract:
Background: Platelet-rich plasma (PRP), an autologous blood product with a high platelet concentration, releases growth factors and cytokines (e.g., PDGF, bFGF, VEGF, IGF-1, TGF-β) that enhance tissue repair and regeneration. Due to its ease of preparation, high growth factor concentration, and minimal immunogenicity, PRP has been widely used in surgical and clinical settings. Research indicates promising results, especially in wound healing, including chronic wound management. PRP promotes vascularization by releasing VEGF, improving the healing of deep burns and diabetic wounds through angiogenesis, cell proliferation, and TGF-β1 expression. Additionally, PRP stimulates neovascularization in transplanted skin flaps, accelerating local wound revascularization. This study investigates the efficacy of PRP in promoting the healing of residual wounds following Mohs micrographic surgery in patients with basal cell carcinoma (BCC). **Methods:** A case series study was conducted in Isfahan Health City between 2024 and 2025 on patients with BCC who were candidates for Mohs surgery. Initially, the cancerous lesion was removed and after ensuring that the tumor was removed with a negative margin, a suitable flap was applied to fill the defect, depending on the type of defect. Patients whose surgical wound of flap did not heal after 3 months of flap placement were candidates for PRP injection. Plasma was collected by centrifugation (300 × g, 10 min), and platelets were concentrated by recentrifugation (300 × g, 20 min). 10 mL blood yields 2–3 mL PRP, activated by freeze-thaw. Injections were given monthly intradermally at the edges of the flap wounds. The injections were made using a 1cc insulin syringe with a 24 gauge and at a 45-degree angle to the epidermis. The injections were continued until the wound healed or there was no response to treatment. Before and after treatment images were evaluated by 2 independent dermatologists. The improvement rate was rated by dermatologists as 4: excellent, good, moderate, poor. Visual analogue scale (VAS) score (0-10) was used for subjective assessment. **Results:** 16 patients (11 males, 5 females) with a mean age of 62.3 years (50-83 years) were selected. 13 patients had scalp BCC and three patients had facial BCC. The mean number of sessions was 3.375 (1-6 sessions). 12 patients had an excellent response, 4 patients had a good response and there was no moderate or poor response. The average VAS score was 7.8. Resolution of inflammation and wound contracture were observed in all lesions. There were no side effects during the study. At 6-month follow-up, none of the patients had any recurrence of the wound. **Conclusion:** This study demonstrated that PRP significantly enhances re-epithelialization, promotes angiogenesis, and influences wound contraction and collagen deposition in wounds resulting from Mohs surgery in BCC patients.
Keywords:
Moh's Surgery, Wound, PRP, Dermatosurgery

Code: wtrc12-02620292
Title:

Artificial Intelligence in Risk Assessment and Nursing Decision Making for Diabetic Foot Ulcer Care

Authors:

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Abstract:

Background: Diabetic foot ulcers (FUDs) are among the most serious complications of diabetes and contribute substantially to infection, hospitalization, and lower-extremity amputation. In recent years, artificial intelligence (AI) and machine learning (ML) have gained attention as tools to support wound assessment, risk prediction, and clinical decision-making. This narrative review synthesizes evidence from validated, peer-reviewed studies to describe how AI contributes to risk assessment and decision support in diabetic wound care, with specific relevance to nursing practice. **Methods:** A narrative review approach was used. Peer-reviewed studies were identified in PubMed and leading journals from 2020–2025. Inclusion criteria were: (1) AI or ML methods applied to diabetic foot ulcers; (2) outcome measures such as amputation prediction, wound image classification, or wound segmentation; (3) original data or systematic reviews. Only findings confirmed from real publications were included. **Results:** Recent evidence shows that AI and machine-learning approaches are increasingly effective in supporting diabetic wound assessment and risk prediction. One study using the XGBoost model with SHAP explain ability achieved an AUC of 0.82 for predicting major lower-extremity amputation, with clinical factors such as white blood cell count, comorbidity burden, and tissue necrosis emerging as key predictors. Advances in imaging analytics are similarly promising: a 2025 system based on the Mask2Former architecture demonstrated high segmentation accuracy and an AUC of 0.94 for Wagner grading in a dataset of 671 DFU images. Machine-learning tools have also been applied to clinical grading, with a 2024 analysis of 616 ulcers showing that combining imaging and clinical variables improves severity classification. In addition, risk-stratification models for minor amputation have been validated, including an XGBoost model for University of Texas grade 3 ulcers that demonstrated strong predictive performance. A 2024 systematic review further supports these findings, reporting sensitivities ranging from 74.5% to 98% and accuracies from 64.6% to 99.3% across published AI studies in diabetic foot care, underscoring both the potential and the variability in current approaches. **Conclusions:** Real-world evidence demonstrates that AI and ML can significantly enhance diabetic wound care by improving risk prediction, wound grading, and imaging-based assessment. These tools have measurable value for nursing decision-making, including earlier identification of high-risk patients and more consistent wound evaluation. However, most existing studies are retrospective, and external validation is limited. Integrating AI into nursing workflows will require prospective testing, transparent model behavior, and co-design with clinical staff to ensure usability and safety. With proper implementation, AI-supported assessment has the potential to improve clinical outcomes and support more efficient, evidence-based nursing care in diabetic wound management.

Keywords:
Diabetic Foot Ulcer, Artificial Intelligence, Machine Learning, Nursing Decision Support, Risk Prediction, Wound Assessment

Code: wtrc12-00700291
Title:

In Silico Modeling and Simulation of a Polymeric Nanoparticle for Targeted Delivery of a Fusion Protein in Wound Healing

Authors:

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Abstract:
Background: Chronic wound healing remains a major challenge in regenerative medicine due to inflammatory conditions and tissue degradation that often hinder the proper function of bioactive factors. Recombinant and fusion proteins have shown potential to accelerate tissue repair; however, their instability, rapid degradation, and inefficient delivery to target sites limit therapeutic efficacy. Polymeric nanoparticles, particularly PLGA-PEG, have emerged as promising carriers because of their biocompatibility, protein-loading capacity, and controlled release properties. This study presents a comprehensive in silico approach for designing, docking, and performing molecular dynamics (MD) simulations of a PLGA-PEG nanoparticle loaded with a fusion protein aimed at enhancing wound healing. Methods / Materials and **Methods:** The physicochemical properties of PLGA-PEG nanoparticles were initially modeled to evaluate size, surface charge, and stability for protein delivery. Molecular docking was conducted using HADDOCK 2.4 and ClusPro 2.0 to determine binding energy, interaction types, and hydrogen bond formation. MD simulations were performed for 100 ns, and RMSD, RMSF, radius of gyration (Rg), and solvent-accessible surface area (SASA) were analyzed to assess structural stability. Controlled release of the fusion protein from the nanoparticle was predicted using Umbrella Sampling and free energy calculations. Key parameters, including nanoparticle diameter, surface charge, stability index, binding energies, RMSD, RMSF, and release profiles, were systematically analyzed. **Results:** The PLGA-PEG nanoparticle exhibited a diameter of 100 ± 5 nm and a positive surface charge of +10 mV, indicating suitability for penetration through the damaged tissue matrix. Molecular docking revealed optimal binding energies ranging from -120 to -135 kcal/mol, confirming stable interaction between the fusion protein and the nanoparticle. RMSD analysis over 100 ns indicated that the complex maintained overall structural stability, while RMSF values were limited to flexible loop regions of the protein. Constant Rg and SASA values demonstrated preservation of the nanoparticle's spherical shape and proper protein orientation. Controlled release simulations predicted that over 95% of the protein could be gradually released within 48 hours, highlighting a favorable sustained delivery profile. These results are consistent with previous studies on polymeric nanocarriers for protein therapeutics. **Conclusion:** This study demonstrates that PLGA-PEG nanoparticles serve as an effective platform for targeted delivery of fusion proteins in wound healing. High binding energy, structural stability, and controlled release profiles collectively indicate the high potential of this system to enhance therapeutic efficacy while reducing side effects. The in silico findings provide a solid theoretical foundation for subsequent in vitro and in vivo experiments and support the further development of advanced nanocarrier-based protein therapies for chronic wounds.

Keywords:
In Silico Design, Immunomodulatory Fusion Protein, Chronic Diabetic Wounds, Skin Lesions, Tissue Regeneration, Molecular Docking, Molecular Dynamics Simulation, Protein Engineering, De-immunization, Developability

Code: wtrc12-02910289
Title:

Medical Adhesive Related Skin Injuries and Their Predisposing Factors in Children Admitted to the Pediatric Intensive Care Unit

Authors:

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Abstract:
Background: Advances in treatment and care have reduced mortality in critically ill children admitted to the PICU to under 5%. On average, 12.8% of hospitalized children require intensive care. Children admitted to the intensive care unit may experience a variety of complications related to the extensive use of equipment, limited mobility, and their medical condition, including impaired skin health. In the intensive care unit, numerous adhesives are used to secure medical devices and equipment, which can be harmful to the skin of hospitalized children. The resulting skin injury is characterized by an abnormal skin condition (erythema, erosion, tear, blister, etc.) known as Medical adhesive related skin injury(MARSI) Moreover, there is limited reporting on MARSI-related risk factors; therefore, this study assessed MARSI frequency in the PICU and investigated related risk factors. **Methods:** The study was conducted from April 2024 to August 2025 in the PICU of a major northwest Iran pediatric referral hospital affiliated with Tabriz University of Medical Sciences, including children aged 1 month to 18 years with at least a three-day stay for two skin assessments. The sample size was determined based on a power of 80%, a confidence level of 95%. Using G*Power software, the sample size required was estimated at 250, assuming a 20% potential attrition rate. A demographic/clinical data checklist was constructed based on the Braden Q Scale and the Pediatric Wound Assessment & Evaluation Form (NHS-adapted), informed by a literature review. This study was approved by the Ethics Committee of Tabriz University of Medical Sciences (Ethical Code: IR.TBZMED.REC.1403.976). The collected data were analyzed using SPSS statistical software, version 27. The statistical significance level for all tests was considered $p<0.05$. A multivariate logistic regression analysis was conducted to identify factors associated with pressure injuries, including variables with bivariable $p < 0.1$. The predictive model was subsequently refined using backward elimination strategy. **Results:** In the present study, the incidence of MARSI was 13.3%. Risk factors associated with this type of skin injury were also identified, including: hemoglobin level/sedation during hospitalization and the presence of underlying disease. In this way, with an increase of one unit of hemoglobin, the risk of developing this type of skin injury decreased by 17%. Also, children who did not receive sedatives during hospitalization were 60% less likely to develop this type of skin injury than those who did receive sedatives. Finally, children who did not have underlying disease were 70% less likely to develop this type of skin injury than those who had underlying disease. **Conclusion:** This study identified a significant incidence of MARSI in the hospitalized pediatric population. The results strongly indicate that underlying disease and sedation during hospitalization are critical risk factors, while a higher hemoglobin level acts as a protective factor. These findings underscore the necessity for immediate implementation of stringent risk management protocols within Pediatric Intensive Care Units (PICUs) to facilitate active monitoring and substantially enhance the safety and quality of patient care.

Keywords:
Marsi،Picu،Skin Injury،Risk Factors

Code: wtrc12-04930287
Title:

The Evolving Role of Nurses in the Digital Age: A Systematic Review of Challenges and Opportunities in Integrating AI and New Technologies for Wound Management from the Operating Room to Home Care

Authors:

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Abstract:
Background: Innovative technology and AI are rapidly changing wound care for patients at all stages. Nurses must take on new duties and learn new skills as primary caregivers. In this systematic review, nurses' challenges and opportunities in using AI and digital health technologies for wound assessment, monitoring, and management in perioperative, inpatient, and home care settings were synthesized. Materials and **Methods:** This review was PRISMA-compliant. For research published between January 2018 and March 2025, PubMed, CINAHL, Scopus, and Web of Science were searched for keywords like "nurse," "artificial intelligence," "digital health," "wound care," "remote monitoring," and "telehealth." The inclusion criteria were qualitative, quantitative, and mixed-methods research on nurses' wound treatment technology experiences. Non-English editorials and research were excluded. Bias likelihood was assessed using the Joanna Briggs Institute critical evaluation methods. Narrative synthesis integrated the results thematically. **Results:** Thirty-eight studies with 5,210 nurses' survey data and 487 qualitative insights were included from 1,852 records. AI-powered imaging, EHR links, and innovative sensor dressings were used. In a meta-analysis of 15 trials (n=2,340 patients), technology-assisted nursing care significantly enhanced early problem identification (OR = 2.1, 95% CI [1.7, 2.6], $p < 0.001$), benefiting the intervention group. The main opportunities are improved diagnostic precision, streamlined paperwork, and patient autonomy in care management. More workflow interruptions, algorithmic bias, data protection issues, and training deficiencies were the primary concerns. **Conclusion:** Nursing will be transformed by AI and technology in wound care, which will improve patient outcomes but present significant implementation challenges. Comprehensive digital literacy training, collaborative technology design with front-line nurses, and strong ethical guidelines for its use are needed immediately. To succeed, nurses need help with digital transformation. Nursing requires human skills and empathy, which these tools should enhance.
Keywords:
Nurse ،Artificial Intelligence ،Wound Care ،Telehealth ،Digital Health ،Wound Care ،Remote Monitoring

Code: wtrc12-00700286

Title:

"In Silico Design and Simulation of an Immunomodulatory Fusion Protein for Immune Modulation and Tissue Regeneration: From Chronic Diabetic Wounds to Skin Lesions"

Authors:

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Abstract:

Background: Chronic diabetic wounds and skin lesions represent major challenges in regenerative dermatology due to persistent inflammation, impaired angiogenesis, and insufficient extracellular matrix remodeling. These conditions are associated with delayed epithelialization, increased susceptibility to infection, and poor functional recovery, highlighting the urgent need for innovative therapeutic strategies. **Methods:** In this study, we report the *in silico* design and simulation of a dual-functional immunomodulatory fusion protein aimed at concurrently modulating chronic inflammation and promoting tissue regeneration in skin. The computational workflow involved multiple steps: three-dimensional structure prediction using AlphaFold2, molecular docking to immune and pro-angiogenic receptors, all-atom molecular dynamics simulations with GROMACS for 100 ns, assessment of structural stability and developability, and computational de-immunization alongside immunogenicity evaluation. The fusion protein construct integrated functional domains from parental proteins, combining complementary mechanisms to achieve both anti-inflammatory and pro-regenerative effects. **Results:** The engineered fusion protein exhibited lower binding free energy and more stable intermolecular interactions with key immune and angiogenic receptors compared to the parental proteins. Physicochemical analysis and secondary/tertiary structure prediction revealed an optimal balance of α-helices and β-sheets, high hydrophilicity, solubility, and reduced instability indices, suggesting favorable folding and functional resilience. Molecular dynamics analysis confirmed structural stability, limited fluctuations in flexible regions, and maintenance of the functional conformation throughout the simulation. T- and B-cell epitope mapping and allergenicity assessment indicated a low immunogenicity profile, supporting potential safety for future therapeutic applications. **Conclusions:** The fusion protein approach offers multiple advantages over conventional single-protein or growth factor-based therapies, including simultaneous engagement of multiple molecular pathways, increased half-life and in vivo stability, higher target specificity, and reduced effective dosage with minimized side effects. These findings align with previous work on engineered fusion proteins for targeted cancer therapy and extend the framework to regenerative dermatology. This study presents a reproducible *in silico* strategy for identifying promising fusion protein candidates for wound healing and tissue regeneration. The results highlight a leading candidate for further *in vitro* and *in vivo* validation and provide a pathway for translating computational designs into preclinical development of safe and effective therapeutics for chronic diabetic wounds and other immune-compromised skin lesions. This work underscores the potential of integrative computational approaches to accelerate the discovery and optimization of multifunctional protein therapeutics in regenerative medicine.

Keywords:

In Silico Design, Immunomodulatory Fusion Protein, Chronic Diabetic Wounds, Skin Lesions, Tissue Regeneration, Molecular Docking, Molecular Dynamics Simulation, Protein Engineering, De-immunization, Developability

Code: wtrc12-04870284
Title:

Challenges of Wound Healing in Pregnant Women with Heart Failure

Authors:

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Abstract:
Background: Heart failure in pregnant women is a serious condition that, in addition to causing cardiovascular complications, disrupts the normal process of wound healing. This issue has significant clinical consequences, particularly for the healing of cesarean section wounds. The objective of this research is to investigate the underlying mechanisms, including tissue hypoxia, edema resulting from heart failure, and the direct impact of cardiac medications. **Methods:** This study was conducted as a review with the aim of collecting, integrating, and comprehensively analyzing existing evidence in this field. The required data were gathered through a systematic search in reputable scientific databases, including PubMed and Google Scholar, using relevant keywords. The inclusion criteria for articles were a focus on the relationship between heart failure in pregnancy and wound healing, particularly cesarean section wound, as well as the involved mechanisms and management strategies. Finally, the extracted data were analyzed using a descriptive-analytical method. **Result:** The review of results indicates that maternal heart failure is a risk factor in the wound healing process. Inadequate heart function causes tissue hypoxia. As a result of this hypoxia, fibroblasts are unable to proliferate rapidly and produce adequate collagen. Consequently, the new tissue formed during wound healing is weak and vulnerable. Parallel to this, edema resulting from heart failure and the accumulation of fluid in the interstitial space creates a distance between the capillaries and the cells undergoing repair. This situation impairs the exchange of oxygen and nutrients, and as a result, the swollen and weakened tissue will not withstand minor pressures such as coughing. The two main factors—hypoxia and edema—create conditions conducive to infection. Due to reduced exchange and the presence of edema, immune cells at the wound site will not function properly. Subsequently, the excessive proliferation of bacteria and the secretion of destructive enzymes damage the newly formed tissues and delay the wound healing process. Finally, cardiac medications such as ACE inhibitors inadvertently disrupt wound healing by affecting the process of angiogenesis (blood vessel formation). On the other hand, beta-blocker drugs, by reducing cardiac output, will have negative effects on the wound healing process. **Conclusion:** Given that heart failure in pregnancy and cesarean section wound healing affect the quality of life of the mother, it is necessary to pay attention to the consequences of the disease and the mother's condition on wound healing. The path ahead requires wound care technologies using developments in smart dressings, personalized medicine that provide personalized treatment and care programs, and optimizing the mother's cardiac and nutritional status before delivery is of great importance, and to create optimal conditions, the collaboration of cardiologists and anesthesiologists, obstetricians and gynecologists, wound care and nutrition specialists is essential. We hope that by understanding the care challenges, we will witness the development of wound care technologies that are specifically designed to meet the unique needs of the vulnerable population of pregnant mothers.

Keywords:
Wound Healing, Heart Failure, Pregnant Women

Code: wtrc12-02830283
Title:

Innovative Metal–Organic Framework Nanocomposites for Accelerated Healing of Chronic Diabetic Wounds

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Abstract:
Diabetes poses a significant global health challenge, with diabetic wounds standing as a serious consequence of this metabolic disorder. The intricate interplay of peripheral neuropathy, compromised blood supply, susceptibility to infections, and delayed healing processes in diabetic patients underscores the urgency for innovative wound management strategies. Metal–organic frameworks (MOFs), an assorted class of porous hybrid materials comprising metal ions coordinated to organic ligands, can display great potential in accelerating diabetic wound healing due to their good physicochemical properties. The release of metal ions during the degradation of MOFs can promote the differentiation of fibroblasts into myofibroblasts and subsequently angiogenesis. Secondly, similar to enzyme-like active substances, they can eliminate reactive oxygen species (ROS) overproduction (secondary to the bio-load of wound bacteria), which is conducive to accelerating diabetic wound healing. Subsequently, MOFs can support the slow release of drugs (molecular or gas therapeutics) in diabetic wounds and promote wound healing by regulating pathological signaling pathways in the wound microenvironment or inhibiting the expression of inflammatory factors. In addition, the combination of photodynamic and photothermal therapies using photo-stimulated porphyrin-based MOF nanosystems has brought up a new idea for treating complicated diabetic wound microenvironments. In this review, recent advances affecting diabetic wound healing, current means of rapid diabetic wound healing, and the limitations of traditional approaches are discussed. Further, the diabetic wound healing applications of MOFs have been discussed followed by the future challenges and directions of MOF materials in diabetic wound healing.
Keywords:
Metal-Organic frameworks, Diabetic Wound Healing, Antibacterial agents

Code: wtrc12-04150282
Title:

The Role of Phytochemicals and Herbal Formulations in Accelerating Wound Repair: A Pharmacological Overview

Authors:

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Abstract:
Chronic wounds, defined by persistent inflammation, resilient biofilms, and stalled tissue repair, continue to pose a significant clinical problem. This review examines the pharmacological rationale for using specific phytochemicals and standardized herbal extracts to promote faster wound healing. Drawing on a focused analysis of recent literature, we find that compounds like flavonoids, terpenoids, and alkaloids function as multi-target agents. They work by calming the inflammatory response, shielding tissue from oxidative damage, disrupting microbial biofilms, and directly stimulating crucial processes like fibroblast migration and collagen deposition. Notably, preparations derived from Curcuma longa (curcumin), Centella asiatica (asiaticoside), and medical-grade honey have consistently been shown to enhance wound contraction and accelerate skin regeneration in both animal and human studies. A key advantage lies in the innate synergy of these plant-based mixtures, where multiple compounds work in concert to provide a broader therapeutic effect than single-ingredient drugs. Integrating these evidence-backed herbal strategies with conventional wound care could therefore offer a more comprehensive and complementary path to managing difficult-to-heal wounds.
Keywords:
Phytopharmacology, Wound Healing, Phytochemicals, Chronic Inflammation, Multi-Target Mechanisms

Code: wtrc12-04550281

Title:

Restoring the Current of Injury: A Systematic Review of Bioelectric Dressings for Infection Control and Healing in Chronic Wounds

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Abstract:

Background: Endogenous bioelectric fields play a critical role in guiding cell migration during wound healing, a phenomenon known as galvanotaxis. Chronic wounds often exhibit disrupted bioelectric signaling. Bioelectric dressings, or "electroceuticals," aim to restore this physiologic current. This review systematically evaluates the mechanisms and clinical efficacy of bioelectric dressings in managing wound infection and promoting closure. **Methods:** A systematic review was conducted using PubMed, IEEE Xplore, and Web of Science databases for studies published between 2019 and 2024. Keywords included "bioelectric dressing," "electrical stimulation," "chronic wound," "biofilm," "galvanotaxis," and "electroceutical." PRISMA guidelines were followed to select preclinical and clinical studies evaluating wireless, microcurrent-generating dressings. **Results:** Sixteen studies were analyzed. The findings indicate that bioelectric dressings significantly disrupt multidrug-resistant bacterial biofilms, including P. aeruginosa and A. baumannii, by interfering with bacterial quorum sensing and membrane integrity. Clinically, these dressings were associated with reactivated healing installed chronic wounds, evidenced by increased keratinocyte migration and granulation tissue formation. The restoration of the transepithelial potential was identified as a key mechanism driving these outcomes. **Conclusion:** Bioelectric dressings offer a dual therapeutic advantage by effectively managing biofilm infection and restoring endogenous electrical cues for tissue repair. They represent a promising "smart" intervention for hard-to-heal wounds where traditional antimicrobial dressings have failed.

Keywords:

Bioelectric dressing, Electroceuticals, Galvanotaxis, Biofilm, Chronic Wounds

Code: wtrc12-04550280
Title:

Cold Atmospheric Plasma as a Dual-Action Therapy for Chronic Wounds: A Systematic Review of Antimicrobial Efficacy and Healing Acceleration

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Abstract:

Background: Cold Atmospheric Plasma (CAP) is an ionized gas technology that generates reactive oxygen and nitrogen species (RONS). It is hypothesized to offer a dual benefit in chronic wound management: eradicating multidrug-resistant bacteria while stimulating tissue regeneration. This systematic review evaluates the clinical evidence supporting CAP for the treatment of diabetic foot ulcers (DFUs) and venous leg ulcers. **Methods:** We conducted a systematic search of PubMed, Web of Science, and Embase for randomized controlled trials (RCTs) and clinical studies published between January 2020 and January 2025. Search terms included "cold atmospheric plasma," "chronic wound," "bacterial load," "biofilm," "wound healing," and "RONS." PRISMA criteria guided study selection. The primary outcomes were reduction in wound surface area and bacterial decontamination efficacy. **Results:** Fourteen clinical studies were included in the review. The data consistently demonstrated that CAP treatment significantly reduced bacterial load, including biofilm-forming organisms, without damaging host tissue. In terms of healing, CAP-treated wounds exhibited a significantly faster reduction in wound area compared to placebo or standard care groups ($p < 0.05$). The mechanism is attributed to RONS-mediated signaling that activates fibroblasts and enhances microcirculation, alongside bacterial cell wall disruption. No serious adverse events were reported. **Conclusion:** Cold Atmospheric Plasma is a safe and effective adjunctive therapy for chronic wounds, particularly those complicated by infection or biofilm. Its ability to accelerate healing while providing non-antibiotic antimicrobial action addresses two critical challenges in modern wound care.

Keywords:
Cold atmospheric plasma, Chronic wounds, Biofilm, Antimicrobial, Microcirculation

Code: wtrc12-04550279
Title:

Omega-3 Rich Acellular Fish Skin Grafts for the Management of Burns and Diabetic Wounds: A Systematic Review of Clinical Efficacy

Authors:

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Abstract:

Background: Acellular fish skin grafts (FSGs) have emerged as a novel xenograft for wound management, offering a porous structure homologous to human skin and high concentrations of Omega-3 fatty acids. Unlike mammalian grafts, FSGs carry no risk of viral or prion transmission. This systematic review synthesizes current evidence regarding the efficacy of FSGs in treating burns and diabetic foot ulcers (DFUs). **Methods:** A systematic review was conducted following PRISMA guidelines. Databases including PubMed, Cochrane Library, and ScienceDirect were searched for clinical trials and retrospective studies published from 2019 to 2024. Keywords included "fish skin graft," "acellular dermal matrix," "burns," "diabetic foot ulcer," "omega-3," and "xenograft." Outcomes of interest were wound healing rates, time to closure, pain scores, and infection rates. **Results:** Twelve studies (including randomized controlled trials and case series) involving over 500 patients were analyzed. Results indicated that FSGs significantly accelerated wound closure rates in deep partial-thickness burns and hard-to-heal DFUs compared to standard of care. The anti-inflammatory properties of Omega-3 fatty acids were associated with significantly reduced pain scores and improved transition from the inflammatory to the proliferative phase. Furthermore, FSGs acted as an effective bacterial barrier, with no reported cases of disease transmission. **Conclusion:** Acellular fish skin grafts represent a safe, effective, and cost-efficient alternative for the management of complex wounds. Their unique composition promotes faster healing and pain reduction, positioning them as a valuable tool in the reconstructive surgical armamentarium

Keywords:
Fish Skin Graft, Xenograft, Burns, Diabetic Foot Ulcer, Omega-3 Fatty Acids

Code: wtrc12-04550277
Title:

Cell-Free Therapy for Diabetic Foot Ulcers: A Systematic Review and Meta-Analysis of Mesenchymal Stem Cell-Derived Exosomes

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Abstract:

Background: Diabetic foot ulcers (DFUs) are characterized by prolonged inflammation and impaired angiogenesis. While Mesenchymal Stem Cell (MSC) therapy is effective, it entails risks such as immunogenicity, low cell survival, and tumorigenicity. MSC-derived exosomes (MSC-Exos) offer a cell-free alternative, carrying bioactive cargo that modulates tissue repair. This systematic review and meta-analysis evaluates the therapeutic efficacy of MSC-Exos in promoting healing in diabetic wound models. **Methods:** A systematic search was conducted in PubMed, Web of Science, and Scopus up to February 2024. Search terms included "exosomes," "mesenchymal stem cells," "diabetic foot ulcer," "wound healing," "extracellular vesicles," and "macrophage polarization." Studies were screened using PRISMA guidelines. Primary outcomes analyzed were wound closure rate, time to complete healing, and histological markers of angiogenesis and collagen alignment. Meta-analysis was performed using a random-effects model. **Results:** Twenty-one preclinical studies were included in the quantitative synthesis. The pooled analysis indicated that MSC-Exo treatment significantly accelerated wound closure compared to control groups (Standardized Mean Difference = 3.16, $p < 0.001$). Mechanistic analysis revealed that exosomes promoted the polarization of macrophages from the pro-inflammatory M1 to the anti-inflammatory M2 phenotype and enhanced the expression of angiogenic factors (VEGF, CD31). No significant adverse immune reactions were reported across included studies. **Conclusion:** MSC-derived exosomes demonstrate robust efficacy in accelerating diabetic wound healing by modulating immune responses and enhancing angiogenesis. This cell-free approach offers a safer, more scalable, and storable alternative to direct stem cell transplantation, warranting progression to clinical trials for DFU management.

Keywords:
Exosomes, Diabetic foot ulcer, Mesenchymal stem cells, Cell-free therapy, Angiogenesis

Code: wtrc12-04550276
Title:

Electrospun Nanofibrous Scaffolds for Dual-Stage Drug Delivery in Chronic Wound Management: A Systematic Review

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Abstract:

Background: Chronic wounds require a multifaceted treatment approach that addresses both infection control and tissue regeneration. Electrospun nanofibers, which mimic the architecture of the native extracellular matrix (ECM), offer a unique platform for sophisticated drug delivery. This review investigates the efficacy of electrospun nanofibrous scaffolds designed for dual-stage delivery—providing rapid antimicrobial release followed by sustained growth factor delivery—in the management of chronic non-healing wounds. **Methods:** A systematic search of PubMed, IEEE Xplore, and EMBASE was conducted from 2019 to 2024. Keywords such as "electrospinning," "nanofibers," "dual drug delivery," "wound dressing," "controlled release," and "chronic wound" were utilized. Following PRISMA guidelines, studies describing the fabrication, characterization, and in vivo testing of dual-loaded nanofibrous mats were included. **Results:** Twenty-two studies met the inclusion criteria. The review found that dual-stage nanofibrous scaffolds significantly reduced bacterial load (including S. aureus and E. coli) within the first 24 hours due to burst release of antimicrobial agents. Subsequently, the sustained release of bioactive molecules (e.g., VEGF, EGF) over 7–14 days significantly enhanced fibroblast proliferation, collagen deposition, and neovascularization compared to single-agent or traditional dressings. The ECM-mimetic structure further supported cellular migration and adhesion. **Conclusion:** Electrospun nanofibers capable of programmed dual-drug delivery offer a sophisticated therapeutic strategy for chronic wounds. By synchronizing therapeutic release with the physiological phases of healing, these advanced dressings hold significant promise for improving outcomes in complex, infected wounds.

Keywords:
Electrospinning, Nanofibers, Drug delivery, Infection control, Tissue engineering

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Code: wtrc12-04550275
Title:

Therapeutic Potential of Curcumin-Loaded Nanoparticles in Accelerating Diabetic Wound Healing: A Systematic Review of Preclinical Evidence

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Abstract:

Background: Curcumin possesses potent anti-inflammatory and antioxidant properties beneficial for wound healing, yet its clinical application is hindered by low hydrophobicity, poor bioavailability, and rapid metabolism. Nanotechnology-based delivery systems have emerged to overcome these pharmacokinetic limitations. This systematic review evaluates the efficacy of curcumin-loaded nanoparticles (Cur-NPs) in promoting the healing of diabetic wounds compared to free curcumin and conventional treatments. **Methods:** A systematic review was performed by searching Web of Science, PubMed, and Scopus databases for articles published between 2020 and 2025. Keywords included "curcumin nanoparticles," "diabetic wound," "nanomedicine," "drug delivery," "bioavailability," and "wound repair." Studies were selected based on PRISMA criteria, focusing on in vivo diabetic animal models that assessed wound closure rates, collagen synthesis, and inflammatory marker expression. **Results:** Nineteen preclinical studies were identified and analyzed. The pooled data demonstrated that Cur-NPs significantly accelerated wound closure rates and enhanced re-epithelialization compared to free curcumin groups ($p < 0.01$). Mechanistically, Cur-NPs were shown to effectively downregulate pro-inflammatory cytokines (TNF-α, IL-6) and upregulate antioxidant enzymes (SOD, catalase) within the wound tissue. Additionally, nanocarrier systems facilitated sustained drug release, leading to improved angiogenesis and denser, better-aligned collagen deposition in the remodeled tissue. **Conclusion:** Curcumin-loaded nanoparticles significantly enhance the bioavailability and therapeutic efficacy of curcumin in diabetic wound healing. By modulating the inflammatory microenvironment and promoting angiogenesis, Cur-NPs represent a promising bio-therapeutic strategy to address the complexities of impaired healing in diabetic patients.

Keywords:
Curcumin, Nanoparticles, Diabetic Foot Ulcer, Drug Delivery, Inflammation Modulation

Code: wtrc12-04550274
Title:

Injectable Stimuli-Responsive Hydrogels for the Management of Deep and Irregular Chronic Wounds: A Systematic Review of Recent Advancements

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Abstract:

Background: Deep, tunneling, and irregularly shaped chronic wounds, such as diabetic foot ulcers and pressure injuries, pose significant challenges for traditional pre-formed dressings due to poor conformability. Injectable hydrogels, capable of in situ gelation and adaptation to complex wound geometries, offer a promising solution. This review systematically analyzes the development and efficacy of stimuli-responsive injectable hydrogels that actively modulate the wound microenvironment to accelerate healing. **Methods:** A systematic literature search was conducted using PubMed, Cochrane Library, and ScienceDirect databases for studies published from 2019 to 2024. Search terms included "injectable hydrogels," "chronic wounds," "stimuli-responsive," "in situ gelation," "ROS-scavenging," and "tissue engineering." The selection process adhered to PRISMA protocols. Studies evaluating the physicochemical properties, rheology, biocompatibility, and in vivo wound healing outcomes of injectable hydrogel systems were included for analysis. **Results:** The search yielded 34 eligible studies focusing on pH-responsive, thermosensitive, and ROS-scavenging hydrogels. Results indicate that injectable hydrogels significantly improve granulation tissue formation and angiogenesis in cavity wounds compared to standard care. Specifically, ROS-scavenging hydrogels were found to effectively neutralize oxidative stress in diabetic wound beds, promoting a transition from the inflammatory to the proliferative phase. Furthermore, these systems demonstrated excellent capacity for the sustained, triggered release of bioactive agents, maintaining therapeutic concentrations locally while minimizing systemic toxicity. **Conclusion:** Injectable stimuli-responsive hydrogels demonstrate superior clinical potential for managing complex, deep-tissue wounds. Their ability to conform to wound topography and actively modulate the biochemical environment underscores their value as a next-generation therapeutic tool in regenerative medicine and complex wound management.

Keywords:

Injectable hydrogels, Chronic wounds, Stimuli-responsive polymers, Tissue engineering, Regenerative medicine

Code: wtrc12-04550273
Title:

Eco-Friendly Phyto-Synthesized Silver Nanoparticles: A Systematic Review of Enhanced Biocompatibility and Antimicrobial Efficacy in Chronic Wound Healing

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Abstract:

Background: The escalation of antibiotic resistance in chronic wound management necessitates novel antimicrobial agents that minimize host toxicity. Traditional chemical synthesis of silver nanoparticles (AgNPs) often results in residual toxicity due to hazardous reducing agents, limiting clinical application. Green synthesis, utilizing plant extracts as reducing and capping agents, offers a sustainable, biocompatible alternative. This systematic review evaluates the therapeutic efficacy, safety profile, and wound healing potential of green-synthesized AgNPs compared to conventional treatments. **Methods:** A comprehensive systematic search was executed across PubMed, Scopus, Web of Science, and Embase databases for articles published between January 2020 and December 2024. Keywords included "green synthesis," "silver nanoparticles," "wound healing," "plant extract," "phyto-synthesis," and "cytotoxicity." Studies were screened according to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Inclusion criteria focused on in vivo and in vitro studies assessing wound closure rates, antimicrobial activity against multidrug-resistant pathogens, and histological evidence of re-epithelialization. **Results:** Twenty-eight studies met the inclusion criteria. The analysis revealed that green-synthesized AgNPs demonstrated superior biocompatibility and significantly reduced cytotoxicity toward human dermal fibroblasts compared to chemically synthesized counterparts. These nanoparticles exhibited potent antimicrobial activity against methicillin-resistant Staphylococcus aureus (MRSA) and Pseudomonas aeruginosa, attributed to the synergistic effect of the metallic core and phytochemical capping. Furthermore, animal models treated with phyto-synthesized AgNPs showed a statistically significant acceleration in wound closure rates ($p < 0.05$) and enhanced collagen deposition, driven by the antioxidant properties of the plant-derived capping agents. **Conclusion:** Green-synthesized AgNPs represent a paradigm shift in nanomedicine, offering a dual benefit of potent antimicrobial action and enhanced tissue regeneration with improved safety profiles. These findings support the translation of eco-friendly nanomaterials into next-generation bioactive wound dressings for chronic, infected wounds.

Keywords:

Green synthesis, Silver nanoparticles, Wound healing, Antimicrobial resistance, Biocompatibility

Code: wtrc12-04770270
Title:

Engineered Scaffolds for Localized Nucleic Acid-Based Therapies in Wound Healing

Authors:

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Abstract:
Chronic and non-healing wounds, particularly diabetic ulcers, represent a major challenge in regenerative medicine, with conventional treatments often providing limited efficacy. Gene therapy and localized delivery of nucleic acids, including plasmid DNA, siRNA, miRNA, and mRNA offer promising strategies to modulate cellular behavior and promote tissue repair. These therapeutic nucleic acids regulate gene pathways involved in inflammation, cell proliferation and migration, angiogenesis, epithelialization, and oxidative stress, creating a pro-healing microenvironment. Biomaterial-engineered scaffolds are critical for effective nucleic acid delivery. Injectable and 3D-printed scaffolds can mimic native extracellular matrices while providing spatially and temporally controlled release of therapeutic nucleic acids. Advanced delivery systems, such as stimuli-responsive hydrogels and lipid nanoparticles, protect nucleic acids from degradation, enhance cellular uptake, and ensure sustained local therapy. Preclinical studies have demonstrated that these scaffolds enhance keratinocyte and fibroblast proliferation and migration, increase secretion of growth factors like VEGF and bFGF, and reduce pro-inflammatory cytokine levels, resulting in accelerated wound closure and reduced scarring. Integration with gene-editing technologies, including RNA interference and CRISPR-based approaches, further enables precise modulation of cellular behavior and personalized therapeutic strategies. Despite progress, challenges remain in balancing biocompatibility, scalability, and long-term safety, therefore, future research should prioritize multifunctional smart scaffolds with multi-stimuli responsiveness and patient-specific designs to advance clinical translation and fully realize the potential of localized nucleic acid–delivering biomaterial scaffolds as a promising platform for effective and personalized wound-healing therapies.

Keywords:
Chronic Wounds, Regenerative Medicine, Gene Therapy, Biomaterial-Engineered Scaffolds, 3d-Printed Scaffolds

Code: wtrc12-04670268
Title:

Efficacy of Luffa cylindrica-Based Biomaterials for Diabetic Foot Ulcer Management: A Systematic Review and Meta-Analysis of Clinical Trials

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Abstract:
Background: Diabetic foot ulcers (DFUs) represent a critical and costly complication of diabetes mellitus, with standard therapies often failing to achieve timely closure. There is a pressing need for novel, cost-effective, and biologically active dressings. The natural loofah sponge (Luffa cylindrica), due to its unique 3D porous structure and biocompatibility, has been investigated as a potential advanced wound dressing, either alone or as a carrier for bioactive agents. However, its specific efficacy in the high-risk DFU population has not been systematically synthesized. This review aimed to evaluate the clinical evidence for the effectiveness and safety of Luffa-based interventions in the management of DFUs.To systematically assess and quantify the efficacy of Luffa cylindrica-derived biomaterials (as standalone dressings or scaffolds) compared to standard or alternative wound care in promoting the healing of DFUs in human patients. **Methods:** A systematic literature search was conducted in PubMed, Scopus, Web of Science, Embase, and Cochrane Library from inception to December 2023. The search strategy combined terms for "Luffa", "diabetic foot", "foot ulcer", "randomized controlled trial", and "clinical trial". Only randomized controlled trials (RCTs) and controlled clinical trials (CCTs) evaluating Luffa-based dressings in human adults with DFUs were eligible for inclusion. Two reviewers independently performed study selection, data extraction, and risk of bias assessment using the Cochrane Risk of Bias tool (RoB 2). The primary outcome was the proportion of ulcers achieving complete healing. Secondary outcomes included time to complete healing, percentage reduction in ulcer area, and incidence of adverse events. A meta-analysis was performed using a random-effects model with RevMan 5.4. The certainty of evidence was evaluated using the GRADE framework. **Results:** From 1,084 initial records, eight RCTs involving a total of 562 patients met the inclusion criteria. The interventions included loofa sponge alone, loofa infused with honey, or loofa combined with platelet-rich plasma. Meta-analysis of seven trials showed that patients treated with Luffa-based dressings had a significantly higher rate of complete ulcer healing compared to control groups (Risk Ratio [RR] = 1.75; 95% CI: 1.40 to 2.18; $p < 0.001$; $I^2 = 35\%$). The mean time to healing was also significantly shorter in the Luffa group by an average of 2.8 weeks (Mean Difference [MD] = -2.8; 95% CI: -3.9 to -1.7; $p < 0.001$). No increase in serious adverse events was reported. The overall certainty of evidence was rated as moderate, primarily limited by the small sample sizes of individual trials and lack of blinding in some studies. **Conclusion:** This systematic review provides moderate-certainty evidence that Luffa cylindrica-based biomaterials are a highly effective and safe therapeutic option for accelerating the healing of diabetic foot ulcers. They significantly improve the rate of complete closure and reduce healing time compared to standard or alternative dressings. Given their low cost and favorable biological properties, Luffa-based dressings should be considered as a viable adjunctive therapy in DFU management protocols. Further large-scale, multi-center RCTs are warranted to optimize treatment protocols and confirm long-term benefits.

Keywords:
Luffa Cylindrica, Diabetic Foot Ulcer, Wound Healing

Code: wtrc12-04010267
Title:

Computationally Optimization Hydrogel Adhesives and Predictive Biofunctional Surface Design for Next-Generation Biomaterial-Based Wound Repair

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Abstract:

Computational engineering in biomaterials, defined here as the integration of molecular dynamics (MD) simulations with multiscale modeling and data-driven optimization, offers a novel approach for designing advanced adhesive hydrogel dressings. Within this framework, MD simulations play a central role by characterizing molecular interactions and the conformational behavior of grafted functional groups on biopolymer backbones. These simulations enable the more precise prediction of the optimal percentage of grafted molecules necessary to achieve desirable surface energy, stable hydration layers, and effective adhesive forces. Coarse-grained models extend these insights to the macroscopic scale, allowing the estimation of mechanical properties such as viscoelasticity, porosity, and degradation kinetics, ensuring that the engineered hydrogels remain mechanically and biologically stable within wound environments. Surface design algorithms complement this approach by modeling ligand density, spatial arrangement, and bifunctional presentation, thereby enhancing cell adhesion, modulating immune responses, and improving growth factor retention. When combined with iterative experimental validation, this computational pipeline accelerates the development of multifunctional adhesive hydrogels capable of controlled therapeutic release and enhanced tissue repair. Overall, this strategy establishes a rational, MD-guided framework for engineering sophisticated biomaterial systems tailored for next-generation wound healing applications.

Keywords:

MD simulations, Surface Design, molecular interactions, Biomaterials

Code: wtrc12-04780266
Title:

Mesenchymal Stem Cells in Skin Regeneration and Wound Healing: Molecular Mechanisms and Therapeutic Perspectives

Authors:

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Abstract:
Background: Chronic and non-healing wounds—such as diabetic ulcers, burns, and infected lesions—remain difficult to manage because they are often stuck in long-lasting inflammation, show limited vascular growth, and fail to rebuild a healthy extracellular matrix (ECM). Many conventional treatments cannot fully restore skin structure, which has shifted attention toward newer regenerative approaches. Mesenchymal stem cells (MSCs) have gained interest due to their ability to influence immune responses, release regenerative factors, and support tissue repair through multiple mechanisms. Although MSCs can differentiate into various skin-related cell types, current evidence suggests that most of their therapeutic benefit comes from the molecules they release, including extracellular vesicles (EVs) and exosomes. These vesicles transport a wide range of bioactive components—such as proteins, lipids, mRNAs, microRNAs, and antimicrobial agents—that coordinate different stages of wound healing. Their effects include shaping immune responses, encouraging macrophages to adopt pro-healing functions, promoting fibroblast activity, stimulating new blood vessel formation, and guiding ECM restoration. Materials and **Methods:** Recent experimental studies and bibliometric reports have explored both direct MSC therapy and the use of MSC-derived EVs in skin repair. Among various sources, adipose-derived and umbilical cord MSCs have received the most attention. In addition, different scaffold systems—including hydrogels, porous matrices, nanofiber structures, and 3D-printed materials—have been developed to improve MSC retention, support exosome stability, and deliver regenerative signals in a controlled manner. **Results:** Current findings indicate that MSC-based therapies can speed up wound closure, decrease excessive inflammation, and support re-epithelialization. Small extracellular vesicles (sEVs) from MSCs help deliver microRNAs and signaling molecules that enhance keratinocyte migration, promote angiogenesis, and assist in tissue remodeling. Compared with applying MSCs directly, treatments based on EVs tend to be more convenient, stable, and carry fewer safety concerns, making them an appealing cell-free option. The use of scaffolds further boosts these effects by improving cell attachment, vascular growth, and local immune regulation. **Conclusion:** MSCs, their secreted vesicles, and scaffold-supported delivery systems together represent a promising new direction for treating chronic and complex wounds. Although laboratory data are very encouraging, issues such as EV standardization, in vivo durability, and optimal scaffold design still need refinement. Continued research is essential to bring these strategies into clinical practice and make MSC-based therapies a reliable and scalable option for skin regeneration.

Keywords:
Mesenchymal Stem Cells (MSCs), Extracellular Vesicles (EVs), Skin Regeneration, Wound Healing, Paracrine Signaling

Code: wtrc12-04740265
Title:

Stimuli-Responsive Microneedles: A Promising Approach for Diabetic Wound Healing

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Abstract:
Wound healing is a complex and dynamic process whose disruption can cause chronic wounds and infections, persistent inflammation, and lead to a decrease in the quality of life of patients. This disruption is exacerbated in diabetic wounds due to chronic hyperglycemia, tissue ischemia, and dysfunctional macrophages and neutrophils, which increases the need to develop new and smart therapeutic strategies. The use of drug delivery systems with the ability to smartly respond to stimuli has attracted attention in wound healing. Among various technologies, smart and stimulus-responsive microneedles have been considered in the treatment of complex wounds, including diabetic wounds. Microneedles painlessly penetrate the layers of the skin, deliver drugs directly to the wound, and have advantages over traditional dressings and conventional hydrogels. Stimuli-responsive microneedles are typically designed based on materials that are sensitive to endogenous stimuli such as pH, glucose, redox potential, enzymes, and oxygen, or exogenous stimuli such as temperature, light, electricity, magnetism, ultrasound, and mechanical pressure. These systems can control the when and where of drug release by analyzing pathological changes in the wound. For example, in a case study, a pH-responsive microneedle was designed to release its drug in response to an increased pH in an infected wound. Recent advances in microneedle design allow for the loading of diverse therapeutic agents such as anti-inflammatory drugs, antibacterial drugs, antioxidant agents, growth factors, stem cells, metal nanoparticles, and bioactive molecules. Smart microneedles can effectively improve the healing process of diabetic wounds by modulating inflammation, inhibiting bacterial growth, accelerating epithelialization, stimulating angiogenesis, and improving extracellular matrix organization. In conclusion, smart and stimuli-responsive microneedles are a new generation of wound-healing technologies. The combination of sensing capabilities, targeted drug delivery, and personalized therapy puts these systems on track to become one of the most effective tools for the treatment of chronic wounds, especially diabetic wounds.

Keywords:
Stimuli-responsive Microneedle, Diabetic Wound Healing

Code: wtrc12-04750264
Title:

Therapeutic Effect of Argon Atmospheric Cold Plasma on Chronic Wound Healing

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Abstract:
Background: Chronic wounds, including diabetic foot ulcers, pressure ulcers, and burn wounds, represent major clinical challenges due to impaired healing from recurrent infections, reduced blood flow, and immune dysfunction. Conventional treatments such as antibiotics, advanced dressings, and surgery often yield limited efficacy. Argon atmospheric cold plasma (CAP) has emerged as a promising non-invasive therapy by generating reactive oxygen and nitrogen species (ROS/RNS), promoting fibroblast activation, collagen synthesis, angiogenesis, and microbial reduction without thermal damage. **Methods:** A prospective quasi-experimental study enrolled 68 patients with chronic wounds (diabetic foot ulcers, n=23; burn wounds, n=26; tumor-related ulcers, n=3; others, n=16). CAP was applied every other day using a 14 kV, 13 kHz, 35 W argon plasma device for 2 minutes per cm^2. Burn wounds received 10 sessions; diabetic ulcers, 14 sessions. Wounds were debrided, photographed, and evaluated before and after each session for size, exudate, pain (VAS), inflammation, granulation, and epithelialization. Adverse events were monitored. **Results:** CAP significantly accelerated wound closure, reduced exudate, pain, and inflammation, and enhanced tissue regeneration. In burn wounds (n=26), marked reductions in size, erythema, and pain were observed with minimal scarring. Diabetic foot ulcers (n=23) showed progressive improvement in necrotic tissue, exudate, and inflammation, with complete or near-complete closure in most cases. Tumor-related ulcers (n=3) demonstrated rapid infection control and tissue repair. Mean healing time was reduced by 40% compared to standard care. No serious adverse events occurred; patient satisfaction was high. **Conclusion:** Argon cold plasma is a safe, non-invasive, and effective adjunctive therapy for chronic wounds, particularly diabetic and burn ulcers. It accelerates healing, reduces pain and exudate, and improves tissue quality. Larger cohort studies with long-term follow-up are recommended to optimize protocols and evaluate sustained outcomes.

Keywords:
Argon Cold Plasma, Chronic Wound, Wound Healing

Code: wtrc12-04710263
Title:

Stimuli-Responsive Hydrogels: A Transformation in the Treatment of Chronic Wounds with Smart Dressings

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Abstract:

Background: The management of chronic, non-healing wounds—particularly diabetic foot ulcers—continues to pose a major clinical and economic burden on healthcare systems worldwide. These wounds persist due to the complex and dysregulated biological events that disrupt the normal phases of tissue repair. Conventional wound dressings lack the ability to dynamically respond to fluctuations in the wound microenvironment or interact with biochemical signals, limiting their therapeutic efficacy. This review aims to provide a comprehensive and critical assessment of recent advances in stimuli-responsive hydrogel-based smart dressings. It explores their physicochemical properties, mechanisms of action, biomedical applications, and existing challenges, and outlines innovative strategies for developing next-generation intelligent, personalized wound care systems. The insights presented herein aim to support the integration of smart responsive materials into regenerative medicine and enhance treatment outcomes for patients with chronic wounds. **Methods:** A systematic literature search was performed using PubMed, Scopus, Google Scholar, and Web of Science. The search strategy incorporated keywords including "stimuli-responsive hydrogels," "smart dressings," "chronic wounds," "diabetic foot ulcers," "biosensors," "nanoparticles," and "wound healing." Peer-reviewed articles published between 2010 and 2025 were evaluated. Studies focusing on hydrogel composition, physicochemical characteristics, mechanisms of responsiveness, therapeutic performance, and in vitro/in vivo outcomes were included. **Results:** Emerging evidence demonstrates that smart dressings based on stimuli-responsive hydrogels—especially those functionalized with metal or metal-oxide nanoparticles—offer significant advantages in managing chronic wounds. These materials can sense and respond to pathological changes such as altered pH, elevated glucose concentration, increased reactive oxygen species (ROS), and local temperature fluctuations. Upon detecting these biochemical cues, they can trigger intelligent responses such as on-demand drug release, modulation of antibacterial activity, or real-time biosensing feedback. Preclinical and early-stage clinical studies indicate that these hydrogels exhibit potent antibacterial activity, promote granulation tissue formation, enhance collagen deposition, and significantly accelerate epithelialization. Controlled release of therapeutic agents (e.g., antibiotics, growth factors, anti-inflammatory compounds) further contributes to infection control and improved wound microenvironment regulation. Despite these promising outcomes, challenges remain—including manufacturing scalability, cost constraints, long-term safety assessments, and limited large-scale clinical trials evaluating their effectiveness in human subjects. **Conclusion:** Stimuli-responsive hydrogel-based smart dressings represent a promising frontier in chronic wound management. Their ability to sense biochemical changes and deliver therapeutics in a controlled, responsive manner positions them as powerful tools for personalized and precision-based regenerative medicine. Continued interdisciplinary research, clinical validation, and cost-effective production strategies will be essential for translating these advanced biomaterials into routine clinical practice.

Keywords:

Hydrogels, Diabetic Ulcers, Chronic Wounds

Code: wtrc12-04510260
Title:

A Review of the Effects of *Arnebia euchroma* on Different Types of Wounds

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Abstract:
Background: Wound healing is a dynamic and normal biologic process involving fibroblast activation and migration, re-epithelization, proliferation of endothelial cells, and angiogenesis, which are accompanied by inflammatory response and oxidative reactions in the damaged area (1,2). The primary goals of the treatment of wounds are rapid wound closure and a functional and aesthetically satisfactory scar (2). The use of natural products to suppor of the wound healing is a common practice in the world (3). Based on studies, this plant can prosper in re-epithelization, an increase of fibroblasts, collagen production, and vascularization (4). Given the promising potential of Arnebia euchroma in preventing wound infections and accelerating tissue repair, as well as the growing demand for novel therapeutic agents with fewer side effects and greater efficacy, a comprehensive review of existing studies in this field appears essential.Therefore, the purpose of the present study is to review and analyze the available scientific evidence regarding the effects of Arnebia euchroma on the wound healing process. **Methods:** To access relevant sources, a comprehensive search was conducted in the PubMed, Google Scholar, ResearchGate, Web of Science, Scopus, and SID databases. Out of approximately 200 articles related to the study topic, and after applying the inclusion and exclusion criteria, 20 articles published between January 2020 and December 2025 were included in the review. **Results:** In this study, which examines the effects of Arnebia euchroma on various types of wounds, including second-degree burn wounds, pressure ulcers, post-laser wounds, post-hemorrhoidectomy wounds, and burn wounds in diabetic mice. most findings have reported a positive impact of Arnebia euchroma on the wound healing process. Furthermore, the majority of the evidence supports this plant's anti-inflammatory effects, fibroblast proliferation, collagen production, angiogenesis, wound contraction, reduction of wound area, and accelerated epithelialization (4-8). **Conclusion:** Arnebia euchroma, with bioactive compounds such as shikonin, naphthoquinones, and alkannins in its roots (9), has shown a significant impact on the healing process of various types of wounds. It is recommended that future studies investigate the effects of this plant on diabetic wounds, abrasion-induced wounds, postoperative scars, and others.
Keywords:
Arnebia euchroma ،Wound Healing ،Medical plants

Code: wtrc12-04670259
Title:

Efficacy and Safety of Luffa cylindrica-Derived Biomaterials in the Wound Healing Process: A Systematic Review and Meta-Analysis

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Abstract:
Background: Wound healing remains a complex clinical challenge, and the development of novel, high-efficacy, and low-cost dressings is a research priority. The loofah sponge (Luffa cylindrica) has emerged as a promising scaffold for tissue engineering and wound repair due to its 3D porous architecture, biocompatibility, biodegradability, and biological potential. However, the scientific evidence is disparate, and a comprehensive evaluation of its efficacy is lacking. This systematic review and meta-analysis aimed to quantitatively and qualitatively evaluate the available evidence on the effects of loofah-based biomaterials on histological, molecular, and clinical parameters of wound healing. **Methods:** A comprehensive search was conducted across PubMed, Scopus, Web of Science, Embase, and Persian databases (SID, Magiran) up to October 2023. Standardized MeSH terms and free-text keywords including "Luffa", "Luffa cylindrica", "wound healing", "tissue regeneration", "biomaterial", "scaffold", and "dressing" were combined using Boolean operators (AND/OR). In vivo (animal) and in vitro (cellular) studies investigating the effects of loofah sponge or extract on wound healing were included. Two reviewers independently screened studies by title and abstract, then reviewed full texts, and extracted data. Disagreements were resolved through discussion or by a third reviewer. Risk of bias was assessed using the SYRCLE tool for animal studies and the Cochrane RoB 2 tool for clinical trials (if any). For comparable data, a meta-analysis was performed using a random-effects model and RevMan 5.4 software. Heterogeneity was assessed using the I^2 and τ^2 statistics. **Results:** A total of 1,254 initial records were identified, of which 23 studies (18 animal and 5 cellular) met the inclusion criteria after screening. The meta-analysis of 12 animal studies reporting wound closure time showed that the loofah scaffold significantly accelerated healing by an average of 4.1 days (Mean Difference [MD] = -4.1; 95% CI: [-5.8, -2.4]; $p < 0.001$). Qualitative histological analysis revealed a significant increase in collagen density, re-epithelialization, and angiogenesis (via increased VEGF expression), and a reduction in inflammation (via decreased TNF-α and IL-6 levels) in loofa-treated groups. The in vitro studies confirmed the stimulatory effects of loofah on fibroblast proliferation and migration without significant cytotoxicity. The overall risk of bias was assessed as moderate, primarily due to a lack of reporting on blinding. **Conclusion:** The existing evidence strongly suggests that Luffa cylindrica-derived biomaterials are an efficient, safe, and low-cost scaffold for accelerating the wound healing process by modulating key cellular and molecular pathways. This potential positions loofah as an attractive candidate for clinical applications. However, there is an imperative need for high-quality, randomized controlled trials in humans to confirm these findings and establish standardized therapeutic protocols.

Keywords:
Luffa Cylindrica, Wound Healing, Biomaterial

Code: wtrc12-01720258
Title:

Regenerative Medicine in Wound Healing: Key Advances in Cell Therapy, Smart Biomaterials, and Three-Dimensional Bioprinting

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Abstract:
Background: Tissue repair and regeneration are essential processes for restoring tissue function and improving quality of life. They play a critical role in responding to surgical injuries, burns, chronic diseases, and aging, involving coordinated cellular activities and molecular signaling pathways. **Methods:** A comprehensive review of relevant scientific literature was conducted to analyze cellular mechanisms of tissue regeneration, the contribution of stem cells, immune responses, and the application of advanced technologies in tissue repair, including 3D hydrogels, bioactive dressings, and enzymatic debridement. **Results:** Evidence indicates that immune cells, stem cells, and innovative therapeutic approaches accelerate cell migration, proliferation, and differentiation, enhance angiogenesis and epithelialization, and promote organized collagen deposition and tissue strength. Integration of advanced biomaterials and regenerative strategies significantly improves tissue restoration and functional recovery. **Conclusion:** Combining stem cell therapies, targeted gene interventions, and cutting-edge regenerative technologies provides a foundation for personalized regenerative medicine, enabling faster healing and better clinical outcomes in patients with chronic wounds and burns.

Keywords:
Tissue Repair, Regeneration, Stem Cells, Hydrogels, Bioactive Dressings, Enzymatic Debridement

Code: wtrc12-04630256
Title:

Personalized Wound Care through AI-Driven Nursing Decision Systems: A Systematic Review

Authors:

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Abstract:
Background: Chronic wounds including diabetic foot ulcers, pressure injuries, and venous leg ulcers represent a critical global health burden characterized by prolonged healing times, infection risks, and escalating treatment costs. Conventional nursing practices often rely on subjective wound assessments and inconsistent decision pathways, leading to variability in care quality. Artificial intelligence (AI) driven nursing decision systems have recently emerged as innovative tools for personalized wound management, integrating patient specific data, wound images, and clinical indicators to support evidence based decisions. By emulating expert reasoning through machine learning and deep earning algorithms, these systems promise improved diagnostic accuracy, optimized intervention selection, and more consistent patient outcomes. This systematic review aimed to critically evaluate the impact of AI based nursing decision systems on clinical precision, workflow efficiency, and patient centered outcomes in wound care settings. **Methods:** Following PRISMA 2020 guidelines, a comprehensive literature search was performed across PubMed, Scopus, Web of Science, Embase and Google Scholar for studies published between January 2015 and June 2025. Search keywords included "artificial intelligence","machine learning","nursing decision support","personalized wound care", and "chronic wound". Eligible studies involved adult or geriatric patients with chronic wounds managed using AI assisted or algorithmic nursing systems, and reported quantifiable outcomes such as wound healing rate, prediction accuracy, or workflow metrics. Non peer reviewed papers, conference abstracts, or studies lacking outcome data were excluded. Two reviewers independently completed screening, data extraction, and methodological appraisal using the Joanna Briggs Institute (JBI) critical appraisal instruments. Data were synthesized narratively, with pooled accuracy and effect measures computed where methodological homogeneity allowed. **Results:** From 1,672 identified records, 33 studies met inclusion criteria, representing a cumulative sample of 7,214 patients. The majority (55%) employed convolutional neural networks or hybrid ML models for wound image classification and severity estimation, yielding pooled predictive accuracies ranging 0.82–0.96 (95% CI: 0.79–0.97). Nine studies (27%) integrated AI based decision support directly into nursing workflows, demonstrating reductions in assessment variability by 24–38% and time saving between 17–23 minutes per patient encounter. Six reports (18%) featured patient facing mobile or sensor driven digital tools that enabled personalized feedback loops, resulting in improved adherence to wound care protocols and reduced recurrence rates by 15–41%. Overall quality appraisal produced a mean JBI score of 80%, supporting moderate to high methodological credibility. Common limitations included small sample sizes, algorithm opacity, and lack of external validation. **Conclusion:** AI driven nursing decision systems show compelling potential for enhancing precision, personalization, and efficiency in wound care management. Their implementation enables objective wound assessment and supports nurses in selecting evidence based interventions aligned with patient profiles. Despite promising results, challenges persist in data interoperability, model transparency, and ethical governance. Future multicenter trials should validate algorithmic frameworks across diverse populations and develop standardized protocols ensuring accountability and patient safety. Integrating explainable AI into nursing practice may ultimately redefine wound care paradigms toward more predictive, individualized, and efficient clinical pathways.

Keywords:
Artificial Intelligence,Personalized Wound Care, Nursing Decision Systems, Machine Learning, Predictive Analytics, Chronic Wounds

Code: wtrc12-04610255
Title:

A Review of the Role of Organizational Factors and Artificial Intelligence Technology in Reducing the Knowledge-Practice Paradox in Pressure Injury Care

Authors:

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Abstract:
Background: Pressure injuries are a common and costly problem in healthcare systems and are considered an indicator of the quality of nursing care. Despite the existence of clinical guidelines and nursing education, the incidence of these injuries remains high among hospitalized patients. This situation reflects a gap between knowledge and practice (the knowledge–practice paradox) in nursing care, which negatively affects patient outcomes. The aim of this study is to investigate the role of organizational factors and artificial intelligence in reducing the knowledge–practice paradox and improving the quality of nursing care in patients with or at risk of pressure injuries. **Methods:** This systematic review was conducted using databases such as Civilica, PubMed, and SID. A search was performed with the keywords "Pressure Injury," "Nursing Care," "Knowledge–Practice Gap," and "Artificial Intelligence" within the timeframe of 2017 to 2025. Among the retrieved articles, 22 relevant Persian and English articles were qualitatively analyzed based on inclusion and exclusion criteria. Result: The review results showed that organizational factors, including high workload, staff shortages, and equipment limitations, are among the main causes of the knowledge–practice gap among nurses. In contrast, artificial intelligence technologies, particularly in the form of clinical decision support systems, machine learning tools, and self-care software, have helped improve clinical decision-making, reduce human errors, and predict pressure injuries. However, the full effectiveness of these technologies depends on the availability of organizational support, nurse training, and appropriate data infrastructure. **Conclusion:** The findings indicate that simultaneously addressing organizational structures and implementing artificial intelligence technologies can be an effective strategy for reducing the knowledge–practice paradox in pressure injury care. Strengthening digital education, enhancing technological literacy among nurses, and developing data-driven support policies are prerequisites for achieving this goal.
Keywords:
Nursing Care, Pressure Injury, Knowledge–Practice Gap, Artificial Intelligence

Code: wtrc12-04640254
Title:

Therapeutic Potential of Black Phosphorus Nanosheets in Modern Wound Management

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Abstract:
Background: Chronic and infected wounds remain a major therapeutic challenge due to persistent inflammation, microbial burden, impaired vascularization, and delayed tissue regeneration. Black phosphorus (BP) has recently emerged as a multifunctional two-dimensional nanomaterial with intrinsic photothermal activity, controlled biodegradation into biocompatible phosphate ions, and the ability to generate reactive oxygen species (ROS). These characteristics position BP-based formulations as promising candidates for next-generation wound-healing platforms. This review synthesizes current experimental evidence on the biological performance and therapeutic mechanisms of BP nanomaterials in cutaneous wound repair. **Methods:** A systematic search of PubMed was conducted using predefined terms related to BP nanomaterials and wound healing. Preclinical studies evaluating BP-based hydrogels, nanosheets, scaffolds, quantum dots, or microneedle systems in any cutaneous wound model were included. Review papers, non-cutaneous applications, and studies lacking BP formulations were excluded. Due to heterogeneity in wound models and material characteristics, a narrative synthesis was performed. **Results:** BP-based formulations consistently demonstrated potent antibacterial activity, largely mediated through photothermal heating and ROS-induced membrane disruption, with efficacy reported even against drug-resistant pathogens such as MRSA. Integration of BP with metallic ions (e.g., Ag, Zn, Sr) or semiconductor heterojunctions further enhanced antimicrobial effects by providing synergistic oxidative and photothermal mechanisms. Across multiple in vivo models, BP nanomaterials accelerated wound closure, promoted rapid re-epithelialization, and improved granulation tissue formation. Hydrogels and composite scaffolds containing BP offered sustained release of active components, maintained a moist microenvironment, and allowed on-demand activation using near-infrared light. Angiogenesis was significantly enhanced, with upregulation of VEGF and other endothelial markers, increased microvascular density, and activation of pro-angiogenic pathways such as PI3K/AKT, JAK/STAT, and ERK1/2. These effects contributed to improved oxygenation and nutrient support within the regenerating tissue. BP-based systems also exhibited notable immunomodulatory properties, including suppression of pro-inflammatory cytokines (TNF-α, IL-1β, IL-6) and promotion of macrophage polarization toward the M2 phenotype. This shift from a pro-inflammatory to a pro-repair immune environment reduced chronic inflammation and facilitated the proliferative phase of healing. Histological analyses across the studies revealed enhanced collagen deposition, improved collagen fiber alignment, restoration of epidermal architecture, and in some cases, partial regeneration of adnexal structures. Composite systems combining BP with bioactive molecules, antibiotics, oxygen-releasing agents, or biodegradable scaffolds provided additional synergistic benefits and improved mechanical stability. **Conclusion:** Current preclinical evidence demonstrates that BP nanomaterials offer a highly versatile and powerful platform for wound healing, combining antimicrobial, photothermal, angiogenic, antioxidant, and immunomodulatory effects. Their biodegradability and structural tunability further enhance their translational potential. Nevertheless, standardization of material characteristics, long-term safety assessments, and controlled comparative studies are essential steps before clinical application. BP-based systems represent a promising direction for the development of multifunctional therapeutic dressings in advanced wound care.

Keywords:
Black Phosphorus Nanosheets, Wound Healing, Photothermal Therapy, Antibacterial Hydrogen, Diabetic Wounds

Code: wtrc12-04240253
Title:

Empathy in Chronic Wound Care and Healing Outcomes

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Abstract:
Background: Chronic wounds (CWs) pose a significant clinical challenge due to their complex pathophysiology and slow healing process. These wounds often affect patients with chronic comorbidities. Consequently, they require more advanced and specialized management strategies to improve healing outcomes. Treating wound patients requires a complex, comprehensive approach due to the wide range of clinical conditions and patient-specific factors. Managing these wounds can be particularly challenging and demands greater healthcare resources because of the multiple factors that contribute to their chronic nature. Chronic wounds also reduce quality of life and increase healthcare burdens, highlighting the need for holistic and effective management strategies. Empathy is essential for gathering comprehensive patient information, enabling accurate wound assessment, personalized treatment plans, and engagement. When patients feel understood, they are more likely to share information that helps identify key factors affecting wound healing. Therefore, This study aimed to evaluate the role of empathy in chronic wound care and its impact on healing outcomes. Material & **Methods:** A review was performed independently based on the PICO criteria and aligned to the research objective and based on the PRISMA checklist and using PubMed, CINAHL, Medline, Web of Science, SID databases Google Scholar search engine, and Boolean operators. The time limit between 2020 and 2025 was determined using the MESH keywords “empathy”, “wound care”, “healing outcomes” and “chronic wound”. After checking the entry and exit criteria and critically evaluating the quality of the selected articles, a total of 14 articles were included in the study. **Results:** Empathy is strongly linked to improved clinical outcomes and higher patient satisfaction. Major barriers to empathetic care include high workloads, time constraints, and insufficient support. Providing empathetic care enhances treatment adherence, pain management, and reduces patient distress. In chronic wound (CW) management, combining clinical expertise with compassionate care improves quality of life, optimizes healthcare resource use, and supports both physical recovery and mental well-being by fostering better patient-provider communication and engagement. **Conclusion:** Empathy is essential for delivering high-quality healthcare, including in wound management. Recognizing the emotions and experiences of individuals living with wounds, and understanding how these wounds affect their daily lives, is fundamental to providing empathetic care. Wound care should adopt a holistic, person-centred approach, addressing the needs of the whole person rather than just the wound. In this context, empathy helps reduce psychological stress and supports the healing process. It relies heavily on effective communication, particularly person-centred communication built on trust and shared decision-making between the healthcare provider and the patient. Moreover, fostering empathy contributes to a more humanistic healthcare system, promoting patient adherence, recovery, and overall quality of life.

Keywords:
Empathy, Wound Care, Healing Outcomes, Chronic Wound

Code: wtrc12-04620252
Title:

Advanced Nanocarrier Systems Integrating Extracellular Vesicles and Liposomes: Innovative Therapeutic Strategies for Enhanced Wound Healing and Healthy Aging

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Abstract:
Background: Skin aging and chronic wounds are major health problems, both of which share oxidative stress, inflammation, and poor regeneration with the elderly. However, traditional therapeutics have certain limitations because of low bioavailability, poor stability of bioactive molecules, and nonspecific cellular targeting leading to ineffective healing and regeneration. To overcome these challenges, a new class of nanocarrier systems comprising extracellular vesicles (EVs) (endogenous, biocompatible carriers of signaling molecules) and synthetic liposomes with controlled release and improved stability have been developed as an alternative transport system for drug delivery. These hybrid systems make use of the innate targeting and regenerative abilities of EVs supported by the tunable physicochemical attributes of liposomes that are beneficial for speeding up wound healing and preventative care in healthy aging where age-related dermal degeneration is mitigated. **Methods:** Hybrid nanocarriers consisting of mesenchymal stem cell–derived EVs (MSC-EVs) and liposomes formed by phospholipids, cholesterol, and functional lipids were designed to incorporate antioxidants or growth factors. Preparation methods were extrusion for size homogenization, sonication for membrane fusion promotion and microfluidics-controlled cargo loading. Characterizations included measurement of particle size and zeta potential using dynamic light scattering, evaluation of morphology by transmission electron microscopy, and in-vitro release-kinetics testing to assess sustained delivery. Fibroblast and keratinocyte models were used for cellular uptake, while in vivo wound-healing or skin-aging animal models monitored penetration, bioavailability and biocompatibility. **Results:** The hybrid EV-liposome systems were more stable compared to their respective individual components and showed increased retention of cargo under physiological conditions as well as improved cutaneous delivery. In wound healing therapies, these systems have shown the ability of promoting accelerated wound closure due to enhanced angiogenesis and collagen deposition with epithelialization by decreasing inflammation. The nanocarriers efficiently sequestered reactive oxygen species, consequently modulated the inflammatory mediators and enhanced skin elasticity and hydration by prolonged release of bioactive component on age-related skin. Unlike conventional formulations, both short- and long-term delivery of antioxidants (e.g., vitamin C) and growth factors also was characterized by low immunogenicity and sustained therapeutic improvement to a degree greater than that reported previously in promoting fibroblast motility and dermal repair. **Conclusion:** Biomimetic and versatile Hybrid EV-liposome nanocarriers for skin therapy, integrating natural and synthetic delivery systems to promote wound healing and healthy aging. Although they present a remarkable regenerative potential, there are still technical limitations to scalability and standardization that need to be overcome for their translation into clinically relevant products.

Keywords:
Extracellular Vesicles ،Liposomes ،Hybrid Nanocarriers ،Wound Healing ،Healthy Aging

Code: wtrc12-04600251

Title:

Artificial Intelligence-based Early Detection Systems for Skin Cancer and Other Significant Dermatological Conditions: A Systematic Review of Methods, Evidence and Implementation Challenges

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Abstract:

The early detection of skin cancer, particularly melanoma, is crucial for improving patient outcomes and survival rates. Traditional diagnostic methods rely heavily on dermatologists' expertise and manual inspections, which can be prone to human error and variability. Over the past decade, artificial intelligence (AI)-based technologies, particularly deep learning models, have emerged as promising tools in dermatology, specifically for the early diagnosis of skin cancer and other significant dermatological conditions. These AI-driven systems leverage vast datasets of annotated skin images to train models capable of detecting subtle patterns that may be difficult for the human eye to distinguish. Despite their potential, the implementation of AI-based diagnostic systems in clinical practice faces significant challenges, including data diversity, algorithmic bias, and clinical validation. This systematic review aims to provide a comprehensive analysis of the methods, evidence, and challenges associated with AI-based early detection systems for skin cancer and other dermatological diseases. We systematically explore studies published in the last five years, focusing on the performance of AI models in detecting skin cancer from clinical and dermoscopic images. Additionally, we assess the impact of AI on diagnostic accuracy, sensitivity, and specificity compared to human dermatologists. The review also investigates the scalability of these systems in real-world settings and their potential for integration into clinical workflows. Moreover, we highlight the challenges associated with the widespread adoption of AI in dermatology, including issues related to the availability and quality of datasets, ethical concerns, and the need for regulatory frameworks to ensure the safe and effective use of AI in healthcare. Finally, we propose directions for future research, particularly in improving model generalization, addressing biases, and enhancing the transparency and interpretability of AI systems. This review provides insights into the current state of AI in dermatology and its potential to revolutionize the early detection of skin cancer, offering both opportunities and challenges for clinicians, researchers, and healthcare policymakers

Keywords:

Artificial Intelligence, Early Detection, Skin Cancer, Dermatology, Deep Learning, Diagnostic Systems

Code: wtrc12-04270250
Title:

Deep Learning-Based Automated Assessment of Diabetic Foot Ulcers Using Medical Imaging

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Abstract:
Chronic wounds are a major challenge for modern healthcare due to their slow healing process, with complex pathophysiology and a significant economic burden. Unlike acute wounds, which usually heal through a predictable biological process, chronic wounds-in particular, diabetic foot ulcers-often persist for months or even years. Diabetes, whose global prevalence is continuing to increase because of aging and increasing obesity, is strongly associated with foot ulcers. An estimated 15–25% of people with diabetes will experience DFU at least once in their lifetime, and many cases progress to severe complications, including infection, disability, and lower limb amputation. Conventional clinical assessment of wound healing remains subjective, being based on visual inspection and the clinician's experience, thereby increasing variability in diagnosis and treatment decisions. Most recently, advances in artificial intelligence, especially deep learning, have enabled new opportunities for objective and automated wound assessment by analyzing medical images. Some modern architectures like CNNs, U-Net, Mask R-CNN, and Vision Transformers have shown unparalleled performance in visual feature extraction from wound images for performing segmentation, tissue classification, and healing prediction tasks. Deep learning models automatically detect subtle patterns of texture, color, structure, and inflammation that may not be easily visible to the naked eye. Self-taught multi-level representation learning allows the systems to automatically differentiate between healthy skin and different kinds of wound tissues, such as granulation, necrosis, or epithelialization. A typical workflow for automated wound analysis includes, in order: image preprocessing to correct lighting differences, normalize colors, and reduce noise; segmentation models, which demarcate the wound from the surrounding skin to enable precise measurement of wound area, borders, and morphological characteristics. More advanced models combine spatial information with temporal changes from sequential images to estimate depth, phase of healing, and composition of tissue. Where recurrent architectures or temporal attention mechanisms are employed, the system can track the progress of healing over weeks and highlight stagnation or deterioration to the clinician. Integration of clinical data, like blood glucose, HbA1c, vascular status, neuropathy, and treatment history, further enhances the diagnostic accuracy. Multimodal fusion techniques, integrating imaging and medical records, allow the development of decision-support systems able to estimate risks, recommend treatment strategies, and foresee the outcomes. Such systems will be particularly useful in low-access or remote areas where images can be taken with a mobile phone and automatically analyzed, results appearing for health professionals. While developments have been promising, there still exist issues with variability in imaging conditions, limited availability of labeled datasets, and variations in skin tone and camera systems. Various methods for improving these challenges include transfer learning, data augmentation, and semi-supervised learning. As image analysis and clinical integration become more sophisticated, AI-assisted wound assessment will be a major player in the upcoming trends of personalized and preventive medicine, enabling better patient outcomes and lower healthcare costs.

Keywords:
Ai, Automatic Wound Assessment, Diabetic Foot Ulcer, Deep Learning, Chronic Wound, Traditional Wound Assessment

Code: wtrc12-03130249
Title:

Effect of of Sleep Quality and Psychological Stress on Healing of Chronic Wounds in Adult Patients: A Systematic Review

Authors:

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Abstract:

Background: Chronic wounds, including venous leg ulcers, arterial ulcers, diabetic foot ulcers, and pressure ulcers, impose substantial clinical and psychosocial burdens. These wounds persist due to impaired tissue repair mechanisms and are often complicated by comorbidities such as diabetes, vascular disease, and immobility. Emerging evidence suggests that sleep disturbances and psychological stress may adversely affect wound healing through neuroendocrine and immune dysregulation. The aim of this systematic review is to synthesize current evidence on the qualitative impact of sleep quality and psychological stress on healing outcomes in adult patients with chronic wounds. **Methods:** This systematic review was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A systematic search was conducted in PubMed, Web of Science, and Scopus for studies published between January 2015 and August 2025. Relevant Medical Subject Headings (MeSH terms) and keywords related to chronic wounds, wound healing, sleep quality, insomnia, psychological stress, and adult patients were used. Synonyms were also included for comprehensive coverage. Inclusion criteria comprised peer-reviewed original studies in English involving adults (≥18 years) with chronic wounds that reported outcomes related to sleep and/or stress and wound healing. Exclusion criteria included non-human studies, lack of full-text access, studies on acute or surgical wounds, and narrative reviews. Two independent reviewers screened studies and extracted data, resolving discrepancies by consensus. Data synthesis focused on qualitative patterns of sleep and stress variables and their impact on wound-healing outcomes. **Results:** The initial database search retrieved 1,152 records; 230 duplicates were removed. Screening of 922 titles and abstracts led to the exclusion of 841 irrelevant records. Full-text assessment of 81 articles resulted in the exclusion of 67 due to non-chronic wound populations, absence of sleep/stress measurement, or non-English language. Ultimately, 14 human studies were included: 9 examined stress, 3 examined sleep quality, and 2 investigated both sleep and stress. Across studies, poorer sleep quality and higher perceived stress were associated with delayed wound healing, increased pain, higher infection risk, prolonged hospitalization, and slower epithelialization. Sleep disturbances were also linked to reduced adherence to care regimens, while stress affected tissue repair through altered inflammatory responses, immune dysfunction, and neuroendocrine pathway activation. **Conclusion:** Qualitative evidence indicates that impaired sleep and elevated psychological stress negatively influence chronic wound healing. These findings highlight the importance of assessing and managing sleep and stress in clinical wound care, including interventions such as sleep-hygiene optimization, stress-reduction strategies, and behavioral support. Future research should focus on longitudinal and interventional studies to clarify causal relationships and evaluate the effectiveness of targeted interventions.

Keywords:

Adult patient, Chronic Wounds, Psychological stress, Sleep Quality

Code: wtrc12-04590248
Title:

Artificial Intelligence–Driven Predictive Models for Pressure Injury Prevention: A Structured Narrative Review

Authors:

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Abstract:
Background: Pressure injuries remain a major global challenge in acute and chronic care settings. Recent advances in artificial intelligence (AI) and machine-learning–based predictive models offer opportunities to identify high-risk patients earlier than traditional clinical tools. However, practical integration into nursing workflows remains limited. To synthesize current evidence on AI-based predictive systems for pressure injury prevention and to outline a practical, nursing-centered implementation framework. **Methods:** A structured narrative review was conducted by examining peer-reviewed studies (2018–2025) describing AI or machine-learning models for predicting pressure injury risk in hospitalized and long-term care patients. Databases included PubMed, Scopus, and CINAHL. Data were extracted on model types, input variables, accuracy metrics, clinical applicability, and implementation considerations. The narrative synthesis followed the SANRA standards for structured narrative reviews. Findings: AI-driven predictive systems demonstrated higher accuracy than traditional risk tools (e.g., Braden Scale) through multimodal data integration including electronic health records, mobility indicators, and physiological parameters. Despite promising accuracy, key barriers were identified: limited external validation, lack of transparency, workflow incompatibility, and nurses' insufficient training in interpreting algorithm-generated alerts. Evidence indicates that structured protocols, user training, and ongoing performance monitoring are essential for safe, effective integration. AI-supported pressure-injury prevention is feasible when combined with nurse-driven assessment. The review proposes a six-step implementation framework including local validation, threshold calibration, workflow alignment, targeted nurse training, real-time monitoring, and periodic reassessment of model performance. **Conclusion:** AI predictive models hold substantial potential for enhancing pressure injury prevention. A structured, nurse-centric implementation strategy can accelerate clinical adoption and improve patient outcomes. Further multicenter validation studies are warranted.
Keywords:
Artificial Intelligence in Nursing; Pressure Injury Risk Assessment; Predictive Modeling for Patient Safety

Code: wtrc12-04580246
Title:

The Use of Mesenchymal Stem Cell-Derived Exosomes for Chronic Diabetic Foot Ulcer Healing: A Case Report

Authors:

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Abstract:
Chronic diabetic foot ulcers (DFUs) has significant clinical challenges, often leading to prolonged healing times and complications such as infections and amputations. Traditional wound care strategies, including standard dressings, have demonstrated limited success in promoting complete healing of such ulcers, especially when the wound persists for an extended period. This case report describes the use of exosomes derived from mesenchymal stem cells (MSCs) isolated from human placenta for the treatment of a persistent DFU that had remained unhealed for approximately two years. A female patient with type 2 diabetes developed a chronic foot ulcer on the plantar surface of his left foot. Despite multiple attempts with conventional dressing therapies, the wound showed minimal progress in terms of size reduction and healing. Following informed consent, the patient received local applications of MSC-derived exosomes. Over the course of several weeks, significant improvements were observed in both the size and depth of the ulcer. The wound showed a marked reduction in area and demonstrated noticeable signs of epithelialization by the 4th week of treatment. This case highlights the potential of exosome-based therapy derived from MSCs as an effective, novel adjunct to traditional treatments for chronic DFUs. Further clinical studies are warranted to explore the broader applicability of this promising therapy in diabetic wound management.

Keywords:
Diabetes, DFU, Exosome, Wound healing

Code: wtrc12-04590245
Title:

Digital and Home-Based Models of Wound Care Using Portable NPWT and Smart Dressings: A Structured Narrative Review

Authors:

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Abstract:
Background: Rapid advancements in portable negative pressure wound therapy (NPWT), smart dressings with integrated biosensors, and telehealth platforms have enabled a shift toward home-based wound management. These innovations have the potential to reduce hospital visits, support early discharge, and enhance patient engagement. To synthesize the evidence on emerging digital and home-based wound-care technologies and to propose a practical nurse-led model for safe implementation. **Methods:** A structured narrative review of publications from 2017–2025 was conducted across PubMed, Web of Science, and CINAHL focusing on portable NPWT, sensor-enabled dressings, remote wound monitoring, and telehealth programs led by nursing teams. Outcomes assessed included healing time, readmission rates, patient satisfaction, usability, and clinical feasibility. **Results:** Single-use and portable NPWT systems demonstrated comparable effectiveness to traditional NPWT with improved mobility and patient satisfaction. Smart dressings capable of measuring temperature, exudate level, and moisture allowed continuous monitoring and early detection of complications. Tele wound platforms improved triage accuracy and reduced unnecessary clinic visits. Barriers included training needs, connectivity challenges, and workflow redesign. A nurse-centered eight-step home-wound-care model is proposed: patient eligibility screening, device selection, initial dressing application, patient/caregiver education, telemonitoring setup, scheduled data review, escalation pathways for abnormal findings, and structured discharge criteria. Integration into electronic wound-care documentation can further enhance consistency. **Conclusion:** Digital and home-based wound-care models are effective, patient-centered, and increasingly feasible. When implemented through structured nurse-driven protocols, these technologies can improve healing outcomes and reduce healthcare utilization.

Keywords:
Home-Based Wound Management; Portable Negative Pressure Wound Therapy; Smart Dressing and Telehealth Integration

Code: wtrc12-04110244
Title:

The Role of Patient Stress Management in the Treatment and Healing Process of Diabetic Foot Ulcers Based on Orem's Self-Care Model: A Systematic Review

Authors:

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Abstract:

Background: Diabetic foot ulcers (DFUs) are among the most complex complications in diabetes mellitus, characterized by delayed healing, high recurrence rates, and elevated risk of infection and amputation. Impaired healing in DFUs is influenced by metabolic dysregulation, chronic inflammation, and oxidative stress. Chronic psychological stress can exacerbate these impairments by activating the hypothalamic-pituitary-adrenal (HPA) axis, elevating cortisol levels, modulating immune responses, and altering the expression of genes critical for tissue repair. Recent molecular studies highlight the role of epigenetic modifications—including DNA methylation, histone acetylation, and non-coding RNAs—in regulating wound-healing genes in diabetic ulcers. Dysregulation of these epigenetic pathways has been associated with delayed angiogenesis, fibroblast dysfunction, and impaired extracellular matrix (ECM) remodeling. Integrating patient-centered stress management strategies may modulate both systemic endocrine signaling and local epigenetic mechanisms, potentially accelerating DFU healing. Background: Orem's Self-Care Model emphasizes patient autonomy and responsibility in maintaining and promoting health. In DFU management, empowering patients to manage stress may influence biological processes critical for wound repair. While conventional treatments focus on debridement, infection control, and vascular optimization, psychological interventions remain underutilized. We hypothesize that structured self-care stress-management interventions can: 1. Attenuate HPA-axis hyperactivity and reduce systemic cortisol levels 2. Lower pro-inflammatory cytokines such as IL-6 and TNF-α 3. Reprogram epigenetic marks on wound-healing genes, 4. Enhance fibroblast function, angiogenesis, and ECM deposition, thereby accelerating wound closure. **Methods:** Study Design: Randomized controlled pilot study over 12 weeks, comparing a self-care stress-management intervention group with a standard care control group in patients with diabetic foot ulcers. Participants: Adults with type-2 diabetes, Wagner grade I–II foot ulcers, stable glycemic control (HbA1c < 9%), no severe comorbidities or immunosuppressive therapy. Intervention: Weekly education on stress, self-care, and wound healing. Daily relaxation exercises and mindfulness meditation. Tailored moderate physical activity. Materials & Methods 1. Sample Collection: Blood and wound-edge biopsies at baseline, week 6, and week 12. 2. Hormone Assessment: Plasma and salivary cortisol via ELISA. 3. Cytokine Profiling: IL-6, TNF-α in serum and wound exudate (multiplex assay). 4. Epigenetic Analysis: DNA methylation (bisulfite sequencing) of wound-healing gene promoters. Histone modifications (ChIP-qPCR) for HDACs and acetylation status. Non-coding RNA miRNAs, lncRNAs) via RT-qPCR. 5. Functional Assays: Fibroblast proliferation, endothelial tube formation, and wound closure assessed clinically and histologically. **Results:** Patients receiving the self-care stress-management intervention are expected to demonstrate: Reduced cortisol levels and HPA-axis modulation, Decreased pro-inflammatory cytokines (IL-6, TNF-α), Epigenetic reprogramming of wound-healing genes, Enhanced fibroblast activity, angiogenesis, ECM deposition, and faster re-epithelialization, Clinically faster reduction in wound size and improved healing outcomes compared to controls. **Conclusion:** Integrating stress-management interventions based on Orem's Self-Care Model can serve as a complementary and targeted approach in the treatment of diabetic foot ulcers. Such interventions modulate the HPA axis, reduce pro-inflammatory cytokine levels, and reprogram epigenetic pathways, thereby enhancing critical wound-healing processes including fibroblast proliferation, angiogenesis, and extracellular matrix remodeling. Evidence suggests that empowering patients to manage stress not only accelerates ulcer healing but also contributes to reduced chronic complications, improved quality of life, and better clinical outcomes in patients with diabetes.

Keywords:

Diabetic Foot Ulcers, Stress Management, Self-Care, Orem's Self-Care Model, Wound Healing, Psychological Intervention, Chronic Wounds, Patient Empowerment

Code: wtrc12-01030240
Title:

Drug Delivery Application of Zeolite Framework-Based Hydrogels for Wound Healing

Authors:

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Abstract:
Background: Hydrogels are biocompatible, biodegradable, and three-dimensional hydrophilic networks considered as appropriate environments for wound healing. Zeolite frameworks are high porous multifunctional nanomaterials with antibacterial features, great drug loading capacity and controlled release. Therefore, they are promising drug delivery systems in many biomedical applications. This study aimed to investigate the drug delivery application of zeolite framework hydrogels in wound healing. **Methods:** Search engines including Scopus, Google Scholar, and PubMed were searched for the keywords zeolite framework, drug delivery, hydrogel, and wound healing. Accordingly, the articles with more correlation were reviewed. **Results:** Zeolite frameworks are ideal candidates as drug delivery systems which can have appropriate wound healing applications. Nevertheless, incorporating zeolites into hydrogels enhances antibacterial activity and drug delivery. Both synthetic and natural zeolite frameworks can be combined with hydrogels to form biocomposites with drug delivery applications for wound healing purposes. Synthetic zeolite frameworks, particularly ZIF-8, have been commonly used in hydrogel formulations. For instance, curcumin-loaded ZIF-8 in an injectable nanocomposite hydrogel construct exhibited pH-responsivity and thermosensitivity for diabetic wound healing, tremendous drug delivery, and antibacterial results. Additionally, a combination of ZIF-8 and chitosan matrices as a hydrogel formed multifunctional nanocomposite and released drugs under the acidic pH of wounds. Furthermore, drug-loaded ZIF-8 also supports wound repair in complex drug delivery systems. Superparamagnetic nanocomposite hydrogels based on ZIF-67 are cytocompatible and possess the capability of targeted drug delivery via magnetic guidance to wound sites. Moreover, the presence of ZIF-67 in semi-interpenetrating polymer network hydrogel biocomposite formulations not only enhances their antibacterial properties but also makes them effective controlled release systems for drugs such as curcumin. Additionally, natural zeolites, shuch as clinoptilolite, enable loading with drugs in hydrogel structure to improve mechanical properties. Surprisingly enough, zeolites facilitate controlled slow release of drugs, allowing for using lower doses of medication. Bionanocomposite hydrogel beads containing iron oxide-zeolite nanoparticles demonstrate high drug encapsulation, delivery, and release capabilities in chronic wound healing. In spite of the tremendous applications of zeolite frameworks in drug delivery via hydrogels to wound sites, the evaluation of human trials, and long-term safety and stability remain challenges that need to be addressed before broad clinical application. **Conclusion:** Drug-loaded zeolite framework-based hydrogels are inspiring materials with high potential for wound healing through drug delivery.

Keywords:
Zeolite Framework, Drug Delivery, Hydrogel, Wound Healing

Code: wtrc12-02690239
Title:

The Role of Candida albicans Biofilm Formation in Impaired Healing of Chronic Wounds

Authors:

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Abstract:

Background: Chronic nonhealing wounds including diabetic, pressure, arterial/venous, and postoperative ulcers are considered a “silent epidemic” due to their substantial morbidity and mortality, particularly among elderly, diabetic, and obese patients. At least half of these wounds harbor biofilms that impede healing. In chronic wounds, biofilm formation by fungal organisms is a key mechanism of resistance or tolerance to antimicrobial therapy. This review therefore examines the role of Candida albicans biofilm formation and its implications for the healing of chronic wounds. **Methods:** A literature search was conducted in the medical database PubMed using the keywords “chronic wounds,” “Candida albicans,” and “biofilm,” focusing on studies published from January 2020 to February 2025. Priority was given to clinical trials, systematic reviews, and meta-analyses. **Results:** The findings confirm the diversity of fungal species and drug-resistance phenotypes across different types of chronic non-healing wounds, with the yeast Candida albicans identified as one of the principal organisms involved in chronic wound infections. The type and abundance of fungal species in chronic wounds are dynamic and change over time; fungal diversity also increases with antibiotic administration and the onset of clinical complications. Importantly, the initial composition of dominant fungi at the time of first presentation can influence wound inflammation, the rate of epithelialization, interactions with co-colonizing bacteria, biofilm formation, and the intensity of the immune response. As Candida albicans is a component of the normal human mucosal flora, it may be among the earliest fungal species present in wounds.biofilm formation is one of the predominant mechanisms of antimicrobial resistance in Candida albicans. By inducing persistent low-grade inflammation, producing a protective extracellular matrix, releasing interfering factors, inhibiting phagocytosis, reducing tissue oxygenation, and forming a physical barrier against treatments, biofilms directly impair the stages of tissue repair and wound healing. Studies have shown that wounds infected with Candida albicans exhibit prolonged inflammation, slower healing rates, and recovery times that may extend beyond eight weeks. Moreover, interactions between Candida albicans and bacteria enhance biofilm resilience and persistence. **Conclusion:** Microbiome research on chronic wounds has largely focused on bacteria, and the relationship between fungal communities and clinical wound outcomes remains insufficiently characterized. However, emerging evidence indicates a correlation between the fungal mycobiome, biofilm formation, and the prognosis and healing of chronic wounds. These findings underscore the importance of effective clinical management of fungal infections in chronic wound care.

Keywords:
Chronic Wounds, Candida Albicans, Biofilm

Code: wtrc12-02690238
Title:

Microbiological Factors Associated with Impaired Wound Healing in Diabetic Foot Ulcers

Authors:

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Abstract:
Background: Diabetic patients are 1.5 to 4 times more likely to develop infectious complications and experience higher mortality. Diabetic foot ulcer (DFU) infections are usually polymicrobial, and bacteria play a pivotal role in the pathophysiology, chronicity, and response to treatment of these wounds. Biofilm formation and the emergence of multidrug-resistant (MDR) bacteria contribute to delayed wound healing, poor response to conventional antibiotic therapy, and progression to chronic infection, thereby increasing the risk of amputation. Consequently, rapid identification of causative pathogens and timely and targeted antimicrobial therapy are essential for the effective management of diabetic foot ulcers. In this study, we investigated the bacterial agents responsible for the development of diabetic foot ulcers. **Methods:** A total of 145 diabetic patients with diabetic foot ulcers (DFU) who were referred to an outpatient wound infection clinic in the north-central region of Iran were followed from September 2023 to September 2024. Among these patients, 98 were male and their mean age was 59.5 ± 11.7 years. After clinical confirmation and grading of diabetic foot ulcers by orthopedic specialist and after obtaining informed consent from each participant, three samples from each wound were collected for bacterial profiling using swabs and culture of excised tissue and histopathological examination. Bacterial identification was performed using traditional culture, microscopy, and biochemical methods. In order to determine tissue invasion, histopathological specimens were examined by pathologist. **Results:** A total 145 swab cultures infected diabetic wounds were analyzed. The swab cultures grew a total of 119 individually identified bacteria (82%), of which the most common detected isolates were *Staphylococcus aureus* (35.9%), followed by Pseudomonas aeruginosa (17.2%), Citrobacter spp. (15.2%), Klebsiella spp. (4.8%), Escherichia coli spp. (2.7%), Streptococcus spp. (2.1%), Proteus Mirabilis and Proteus vulgaris (each species with one isolate, 0.7%) and all the bacterial species on the surfaces of the foot soft tissues. histopathological examinations showed dissemination of bacterial species to the deep tissues. **Conclusion:** Effective diabetes management and proper foot care are essential for reducing the incidence and severity of diabetic foot ulcers (DFUs) and promoting faster wound healing. To achieve optimal outcomes, a comprehensive microbiological evaluation including deep tissue sampling, early identification of etiological agents, removal of necrotic tissue, appropriate debridement, implementation of anti-biofilm strategies, and targeted antibiotic therapy based on laboratory findings is crucial for the initial management and treatment of DFUs. Proper management not only accelerates wound healing but also reduces the risk of amputation and minimizes associated complications, thereby improving the overall prognosis for patients.

Keywords:
Diabetes mellitus, Foot infections, Bacteria

Code: wtrc12-00960237
Title:

Nursing Challenges in the Prevention and Management of Pressure Injuries in Long-Term Immobile Patients with Vascular Diseases: A Systematic Review

Authors:

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Abstract:

Background: Pressure injuries (PIs) represent a critical complication among patients with prolonged immobility, particularly those affected by vascular diseases. The interplay between impaired tissue perfusion and sustained pressure increases susceptibility to skin breakdown, leading to adverse clinical outcomes. These injuries not only diminish patients' quality of life but also contribute to substantial financial strain on healthcare systems. Nurses play a pivotal role in the prevention and management of PIs; however, they encounter multifaceted challenges when caring for immobile vascular patients. This systematic review aims to identify, categorize, and synthesize the nursing challenges associated with the prevention and treatment of pressure injuries in this high-risk population. **Methods:** A systematic and comprehensive literature search was performed across six databases: PubMed, Scopus, Web of Science, CINAHL, SID, and Magiran, covering publications from January 2020 to December 2024. The search strategy utilized keywords including Pressure injury, Vascular disease, Immobility, Nursing challenge, Prevention, and Treatment. Studies were selected based on predefined inclusion and exclusion criteria. Eligible studies included qualitative, quantitative, and mixed-method research focusing on nursing challenges in pressure injury prevention and treatment among immobile patients with vascular conditions. Exclusion criteria comprised duplicate records, non-English publications, inaccessible full texts, and studies that did not directly address nursing challenges. Two independent reviewers screened titles and abstracts, assessed methodological quality using MMAT and CASP tools, and extracted relevant data. Risk of bias was evaluated, and thematic synthesis was applied to analyze findings. The review process adhered to the PRISMA guidelines. **Results:** Out of 212 initially identified articles, 13 met the inclusion criteria and were included in the final synthesis. Analysis revealed five main domains of nursing challenges in preventing and managing pressure injuries (PIs) among long-term immobile patients with vascular diseases: 1. Risk Assessment: Difficulty in accurately identifying high-risk patients due to the complex interplay between vascular insufficiency and immobility, which can mask early PI signs. 2. Preventive Interventions: Barriers to implementing repositioning protocols caused by patient discomfort, pain, or hemodynamic instability, as well as challenges in selecting pressure-redistribution surfaces suitable for patients with compromised circulation. 3. Wound Management: Complexity in treating PIs due to poor tissue viability and mixed etiologies (pressure combined with ischemia), leading to uncertainty in dressing selection and treatment planning. 4. Education and Communication: Limited patient and family education on home-based PI prevention strategies, alongside inadequate interdisciplinary communication that hinders continuity of care. 5. Systemic Barriers: Persistent staff shortages, high workloads, and restricted access to advanced equipment such as pressure-mapping devices, which collectively reduce the effectiveness of PI prevention and management. **Conclusion:** This review highlights the multifaceted clinical and systemic challenges nurses face in pressure injury care for immobile vascular patients. Addressing these through standardized risk assessment, tailored repositioning, ischemia-sensitive wound care guidelines, and optimized staffing can inform evidence-based policies, targeted training, and improved care quality to reduce incidence.

Keywords:

Patient Safety Strategies, Immobility Risk Management, Vascular Disease, Pressure Injuries, Nursing Challenges

Code: wtrc12-01760236

Title:

Turning the Tide in Necrotizing Fasciitis: Vacuum Therapy as a Bridge to Grafting and Limb Salvage – A Complex Diabetic Case Report

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Abstract:

Background: Necrotizing fasciitis is a rapidly progressive and life-threatening soft-tissue infection with high morbidity and mortality, especially in patients with diabetes. Early diagnosis, aggressive debridement, infection control, and advanced wound-care modalities such as Negative Pressure Wound Therapy (NPWT) are crucial for optimizing outcomes and preventing limb loss. **Case Presentation:** A 63-year-old woman with controlled diabetes and hypertension presented with bilateral diabetic foot ulcers located at the lateral malleoli. The left-side ulcer measured 1×1 cm with a central depth of 10 cm, extensive undermining at 12 and 3 o'clock positions, and a fistula tracking to the Achilles tendon. Initial management with hydrofiber and honey dressings failed to promote granulation. Following clinical deterioration and a positive culture for Klebsiella pneumoniae, the patient was admitted and necrotizing fasciitis was confirmed. Broad-spectrum IV antibiotics were initiated, and extensive fasciotomy of the tibial regions, plantar foot, metatarsal area, and external malleolus was performed. Daily wound irrigation with hydrogen peroxide and povidone-iodine (one session in the OR, one in the ward) was continued. With infection control and rising granulation tissue, NPWT was started. The patient received 8 NPWT sessions in the operating room at pressures of –120 to –180 mmHg. Laboratory markers improved significantly (WBC declined from 30,000 to 6,000). After adequate granulation of the proximal wound segment, split-thickness skin grafting from the femoral region was performed and secured using NPWT and partial suturing techniques. Total hospitalization lasted approximately two months, resulting in complete limb salvage. Discussion: This case highlights the critical role of NPWT in the management of necrotizing fasciitis in diabetic patients. NPWT provided rapid control of exudate, enhanced granulation formation, reduced the need for repeated debridements, and prepared the wound bed for successful grafting. In complex deep-tissue infections with undermining and tendon exposure, NPWT serves as an effective bridge between surgical debridement and reconstructive procedures, significantly improving limb-preservation outcomes compared with traditional dressings. **Conclusion:** NPWT is a highly effective adjunctive therapy in necrotizing fasciitis, particularly in diabetic patients with deep, complex wounds. Its integration after adequate debridement can accelerate healing, reduce complications, improve graft acceptance, and prevent amputation.

Keywords:

Necrotizing Fasciitis, Negative Pressure Wound Therapy (NPWT), Skin Grafting, Granulation Tissue, Limb Salvage, Wound Management

Code: wtrc12-04310235
Title:

Efficacy and Safety of Cell Therapy for Pressure Ulcer Healing: A PRISMA-Compliant Systematic Review

Authors:

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Abstract:
Background: Severe pressure injuries (PIs) of Grade III/IV remain a significant clinical challenge due to high recurrence rates and patient morbidity. Conventional treatments often fail to achieve effective tissue regeneration. Cell-based therapies (CBTs), encompassing both cellular and acellular approaches, are emerging as promising regenerative strategies aimed at modulating inflammation, promoting angiogenesis, and accelerating tissue repair. This systematic review evaluates current evidence on the efficacy and safety of CBTs as primary or adjunctive treatments for deep PIs. **Methods:** Following PRISMA guidelines, a systematic review was conducted using PubMed and Google Scholar. Interventional studies (RCTs, non-RCTs, and pre-post studies) involving adult patients with deep PIs were included. Data extraction focused on cell types (e.g., macrophages, bone marrow mononuclear cells [BM-MNCs], hematopoietic stem cells [HSCs], mesenchymal stem cells [MSCs], acellular secretome), delivery methods (e.g., injection, scaffold), efficacy outcomes (wound closure, volume reduction), and safety endpoints (adverse events, recurrence, tumorigenicity). Risk of bias was assessed using validated tools. **Results:** Six interventional human studies (N=481) and two systematic reviews were included. CBTs consistently showed superior outcomes compared to standard care. Efficacy: Macrophage-based therapies achieved the highest complete wound closure rates (up to 69% vs. 13% in controls). BM-MNCs accelerated healing and reduced hospitalization duration (e.g., from 85 to 43 days). HSCs (CD34+) led to greater wound volume reduction (52% vs. 40%). MSCs promoted angiogenesis and tissue regeneration, especially when delivered via injection or scaffold. Safety: CBTs were generally well-tolerated, with no serious adverse events or tumorigenicity reported during follow-up (up to 2 years). One study noted increased long-term recurrence in the BM-MNC group, highlighting the need for extended monitoring. **Conclusion:** Cell-based therapies, particularly macrophage and BM-MNC approaches, offer a promising and safe alternative or adjunctive strategy for treating deep pressure injuries. Despite encouraging results, limitations such as small sample sizes and moderate-to-high risk of bias warrant further investigation. Future large-scale, methodologically robust randomized controlled trials are essential to determine optimal dosing, delivery protocols, and long-term outcomes.

Keywords:
Pressure Ulcer ،Cell Therapy ،Mesenchymal Stem Cells ،Macrophages ،Efficacy ،Safety

Code: wtrc12-04320234
Title:

Applications of Artificial Intelligence in Accelerating the Healing of Diabetic Foot Ulcers

Authors:

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Abstract:

Background: Diabetes affects approximately 1 in 10 adults worldwide. Among its most common and severe complications are diabetic foot ulcers (DFUs), which impact 19% to 34% of diabetic individuals during their lifetime. DFUs are associated with increased risk of lower-limb amputation and reduced life expectancy, posing significant challenges in clinical management and healthcare costs. Accurate diagnosis and timely treatment are difficult due to the complexity of chronic wounds and the risk of misclassification. Early detection of DFU risk can prevent or delay ulcer development. Wound healing is a dynamic process involving hemostasis, inflammation, proliferation, and remodeling. Evaluating components such as angiogenesis, inflammation, connective tissue restoration, contraction, and re-epithelization is essential for understanding healing mechanisms. Artificial intelligence (AI), including machine learning (ML) and generative AI, offers promising tools for wound assessment, diagnosis, and personalized treatment strategies. Methods/Material and **Methods:** A systematic review was conducted using PubMed and Scopus databases with keywords including "artificial intelligence," "diabetic foot ulcer," and "wound healing." Fifteen articles published between 2020 and 2025 were selected, focusing on AI applications in DFU diagnosis, assessment, prognosis, and treatment. **Results:** AI technologies have been applied to wound characterization, monitoring tissue changes, guiding daily therapy, and predicting outcomes. Sensor-based AI systems enable early screening for ulcer risk and potential amputation. AI also supports remote monitoring and personalized care, allowing earlier interventions. Key challenges include equitable access to AI tools, data privacy, and the need for diverse datasets for robust algorithm training. **Conclusion:** AI has the potential to accelerate DFU recovery by enabling earlier diagnosis, more accurate assessments, and targeted treatments. Integrating AI into DFU care can reduce complications and improve patient outcomes. Future research should validate AI models in clinical settings and establish standardized protocols for their implementation.

Keywords:

Artificial Intelligence, Wound Healing, Diabetic Foot Ulcers, Machine Learning

Code: wtrc12-03650233
Title:

Evaluation and Comparison of the Efficacy and Safety of Human Umbilical Cord Blood Serum and Platelet-Rich Plasma (PRP) in the Treatment of Striae Distensae: A Double-Blind Randomized Clinical Trial (Phase I)

Authors:

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Abstract:
Background: Striae distensae (SD) is a prevalent dermal disorder characterized by structural degradation of collagen and elastin fibers, and current therapeutic approaches remain suboptimal. Human umbilical cord blood serum (HUCBS), a biologically enriched substrate containing diverse growth factors, cytokines, and extracellular matrix components, has attracted attention as a potential regenerative modality. This study sought to evaluate and compare the bioregenerative efficacy and safety of intradermal HUCBS with autologous platelet-rich plasma (PRP) in individuals with SD. **Methods:** In this prospective randomized clinical investigation, thirty participants with clinically diagnosed SD were assigned to three HUCBS treatment arms (2%, 5%, and 10%) or a PRP comparator group. All participants received four intradermal treatment sessions. Outcomes were assessed for three months post-intervention using a multimodal evaluation framework comprising biometric analyses (cutometric measurements and ultrasound-based assessments of skin-layer thickness and density) and clinician- and patient-reported global improvement scales. Adverse events were systematically documented throughout the study period. **Results:** All treatment groups demonstrated discernible post-treatment enhancement in biomechanical and structural skin parameters. Higher-concentration HUCBS formulations (5% and 10%) produced clinical and regenerative responses that were broadly comparable to PRP. The interventions exhibited a favorable safety profile, with no hypersensitivity reactions or serious adverse events recorded. **Conclusion:** Intradermal HUCBS represents a safe and potentially effective regenerative therapy for striae distensae, yielding clinical outcomes comparable to autologous PRP. Its biomolecular composition may render it a promising candidate for further evaluation in larger controlled trials.

Keywords:
Striae distensae, Human umbilical cord blood serum, Platelet-rich plasma, Efficacy, Safety, Randomized clinical trial

Code: wtrc12-04520232
Title:

Limb Salvage in a Severe Diabetic Foot Ulcer Using Negative Pressure Wound Therapy: A Case Report

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Abstract:
Diabetic foot ulcers (DFUs) are one of the serious complications of diabetes mellitus, representing a major cause of morbidity, hospital admissions, and lower limb amputations. Approximately 25% of diabetic patients develop a foot ulcer during their lifetime, and it can lead to severe outcomes if not managed promptly. Although standard management, including debridement, infection control, and optimization of glycemic status, remains essential, extensive or deep ulcers may fail to heal and often necessitate amputation. Vacuum-assisted closure therapy (VAC) has emerged as an adjunctive treatment that promotes wound healing by removing exudate, enhancing granulation tissue formation, and reducing infection risk.

Keywords:
Wound, Diabetic foot ulcer, Vacuum-assisted closure

Code: wtrc12-04520231
Title:

Vacuum-Assisted Closure Therapy for Complex Wounds: A Case Series and Review of Current Evidence

Authors:

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Abstract:
Complex and chronic wounds, including diabetic ulcers, advanced pressure sores, and traumatic injuries, present major clinical challenges due to prolonged healing, high infection risk, and impaired quality of life. Traditional management with regular dressings, debridement, and infection control for such cases is often slow and prone to complications, while advanced dressings such as silver-coated and bioactive materials show improved outcomes . Vacuum-Assisted Closure (VAC) therapy, or Negative Pressure Wound Therapy (NPWT), applies controlled negative pressure via a sealed dressing to remove exudate, reduce edema, stimulate granulation tissue, enhance angiogenesis, and limit bacterial colonization. We report a single-center case series of four patients with complicated infected wounds treated with NPWT. The primary aim is to describe clinical course, healing outcomes, and treatment-related complications. All patients demonstrated progressive wound healing, decreased exudate, and no major therapy-related complications. VAC therapy facilitated granulation and wound closure where conventional methods had been insufficient. These cases, aligned with current literature, highlight NPWT as an effective adjunct in managing chronic, traumatic, and postoperative wounds.
Keywords:
Vacuum Assisted Closure, Wound, Ulcer, Dressing

Code: wtrc12-02460229
Title:

Antibiotic Therapy and Related Nursing Care in the Management of Diabetic Foot

Authors:

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Abstract:
Background: Diabetic foot ulcers are among the most costly complications of diabetes, representing a leading cause of hospitalization, severe infections, and limb amputation in diabetic patients. Impaired blood circulation, weakened immune function, increased microbial load, and dysfunction of repair cells are major factors delaying the healing of diabetic foot ulcers. Objective: This study aims to review therapeutic antibiotics and related nursing care in diabetic foot ulcers and to assess their role in promoting wound healing. **Methods:** This narrative review was conducted using scientific databases including PubMed, Google Scholar, Magiran, and SID. Keywords such as diabetic foot ulcer, antibiotic therapy, patient education, prevention were used. Research articles published between 2020 and 2024 in Persian and English that focused on antibiotic therapy and nursing care in diabetic foot ulcer management were included. In total, 8 relevant studies were selected and analyzed. **Results:** Antibiotic therapy is a cornerstone of infection control in patients with diabetic foot. The choice of antibiotic should be based on infection severity, microbial culture results, and the patient's clinical condition. For mild infections, oral antibiotics such as cloxacillin, cephalexin, clindamycin, levofloxacin, and amoxicillin-clavulanate are commonly used. For moderate infections, treatment can begin with oral or intravenous antibiotics and continue for 1–3 weeks. Severe infections require intravenous antibiotics, with treatment lasting 2–4 weeks. Methicillin-resistant Staphylococcus aureus (MRSA), Pseudomonas, or anaerobic infections are treated with agents such as vancomycin, daptomycin, linezolid, or piperacillin-tazobactam. In cases of bone involvement, longer therapy of 4–12 weeks combining oral and intravenous treatment is recommended. Nursing care plays a vital role in the management of these patients. Care includes daily wound assessment, monitoring for infection signs, patient education on foot hygiene and care, adherence to prescribed medications, and referral to physicians if symptoms worsen. **Conclusion:** Appropriate antibiotic therapy combined with active and regular nursing care prevents severe infections, reduces treatment duration, promotes wound healing, and decreases the need for amputation. Therefore, educating and empowering nurses in diabetic foot management and proper antibiotic therapy significantly contributes to improving patients' quality of life.

Keywords:
Diabetic Foot Ulcer ،Antibiotic Therapy ،Patient Education ،Prevention

Code: wtrc12-04450227

Title:

Network Analysis of Specialized Chronic Wound Care: Technical and Practical Insights

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Abstract:

Background: Chronic wound care presents complex challenges requiring multidisciplinary approaches for effective management. Network analysis offers a powerful methodological framework to explore the intricate relationships among clinical procedures, healthcare providers, patient outcomes, and resource allocation within specialized wound care settings. **Methods:** This investigation utilizes sophisticated network analysis methodologies grounded in established standards for network study to systematically model and quantify interaction patterns within the domain of specialized chronic wound care. Comprehensive data procurement encompassed electronic health records, standardized treatment guidelines, and interprofessional collaboration networks aggregated from multiple specialized wound care centers operating in Iran during the year 2024. Employing advanced social network analysis metrics—including degree centrality, betweenness centrality, network density, and modularity—alongside state-of-the-art graph visualization techniques, the study elucidates critical nodes, communication bottlenecks, and functionally cohesive clusters embedded within the care delivery architecture. Analytical processes were executed through robust computational platforms, prominently Gephi and R statistical software libraries such as igraph and statnet, enabling in-depth topological and functional assessment of the healthcare networks. Furthermore, the methodological framework integrated temporal dynamic network modeling to effectively capture and analyze longitudinal variations in treatment trajectories and multidisciplinary collaboration across a continuous 12-month observation period. **Results:** The analysis revealed critical nodes representing highly influential healthcare providers and treatment modalities significantly impacting healing outcomes. Key clusters corresponded to multidisciplinary teams that demonstrated superior coordination and consistency in delivering evidence-based interventions. Bottlenecks involving resource constraints and communication gaps were identified, highlighting areas for process optimization. Temporal network changes tracked improvement trajectories and identified periods requiring targeted interventions. Quantitative metrics substantiated the structural complexity and the interdependence of clinical, organizational, and patient-related factors in chronic wound management. **Conclusion:** Network analysis offers an insightful lens for unraveling the complex interplay in specialized chronic wound care, thereby enhancing our understanding of both technical and operational dimensions. The findings emphasize the value of integrated, data-driven strategies in optimizing team collaboration, resource allocation, and ultimately, patient outcomes. This study underscores the potential of network-driven approaches for advancing precision medicine and personalized wound management protocols.

Keywords:

Network Analysis, Chronic Wound Care, Multidisciplinary Teams, Healthcare Collaboration, Treatment Optimization, Graph Theory, Temporal Network Modeling

Code: wtrc12-04450226
Title:

Artificial Intelligence in Chronic Wound Management: A Systematic Review and Meta-Analysis of Diagnostic Accuracy and Prognostic Performance

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Abstract:

Background: Chronic wounds pose a substantial burden on healthcare systems worldwide due to prolonged healing times, high risks of infection, and associated morbidity. Recent advances in artificial intelligence (AI) have shown promising potential to optimize wound assessment, prediction, and individualized treatment strategies, yet comprehensive evidence synthesis remains limited. **Methods:** A systematic review and meta-analysis were conducted following PRISMA guidelines. Multiple electronic databases (PubMed, Scopus, Web of Science, IEEE Xplore) were searched up to October 2025 for studies utilizing AI techniques in the diagnosis, prognosis, or management of chronic wounds, including diabetic foot ulcers, venous leg ulcers, and pressure ulcers. Inclusion criteria encompassed original research employing machine learning, deep learning, or other AI models with quantitative outcome measures related to wound healing rates, accuracy of detection, or predictive performance. Data extraction was performed independently by two reviewers; quality assessment used the QUADAS-2 tool for diagnostic studies and ROBINS-I for interventional studies. Random-effects meta-analysis calculated pooled effect sizes (e.g., sensitivity, specificity, AUC) with heterogeneity assessed by I^2 statistics. **Results:** Twenty-six eligible studies comprising a cumulative sample size of 5,843 patients were systematically included in this review and meta-analysis. Artificial intelligence (AI) models demonstrated markedly enhanced diagnostic accuracy relative to traditional assessment methodologies. The meta-analytic pooling of diagnostic test parameters revealed a pooled sensitivity of 0.87 (95% confidence interval [CI]: 0.82 to 0.91) and a pooled specificity of 0.85 (95% CI: 0.80 to 0.89), underscoring substantial reliability in AI-based identification processes. Among the AI techniques evaluated, deep learning frameworks—most notably convolutional neural networks (CNNs)—exhibited superior efficacy in the automated analysis of wound imagery. Prognostic models designed for patient stratification effectively delineated the risk of delayed wound healing and subsequent complication development, as indicated by a pooled area under the receiver operating characteristic curve (AUC) of 0.82. Subgroup analyses further elucidated that integrative models combining clinical parameters with imaging data yielded enhanced predictive robustness and generalizability. Despite these promising findings, moderate heterogeneity was detected across studies (I^2 = 56%), attributed primarily to variability in study designs, patient populations, and heterogeneity in AI model architectures and training protocols. This evidence collectively emphasizes the transformative potential of AI-enabled tools for chronic wound management, although standardized methodological frameworks are warranted to optimize reproducibility and clinical integration. **Conclusions:** AI applications in chronic wound care offer substantial benefits in diagnostic precision and prognostic stratification, supporting personalized treatment planning. Despite promising results, standardization in methodology, larger multicenter validations, and integration into clinical workflows are crucial for translation into routine practice.

Keywords:
Artificial Intelligence, Chronic Wounds, Wound Care, Machine Learning, Deep Learning, Systematic Review, Meta-Analysis

Code: wtrc12-04390224
Title:

Rebuilding the Uterus: Dual-Action Janus Hydrogels for Endometrial Healing and Adhesion Prevention

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Abstract:
Intrauterine adhesions (IUAs), a major contributor to infertility, menstrual dysfunction, and recurrent pregnancy loss, remain a significant clinical challenge due to limited regenerative capacity of the endometrium and high recurrence rates after conventional interventions. Current therapies—surgical adhesiolysis, hormonal supplementation, intrauterine devices, and hyaluronic acid gels—primarily provide mechanical separation or transient trophic support, yet fail to actively modulate the hostile post-injury microenvironment characterized by hypovascularity, chronic inflammation, and fibroblast-driven fibrosis. Consequently, restoration of functional, adhesion-free endometrium remains unpredictable and suboptimal, highlighting an urgent unmet need for precision-guided regenerative strategies. Emerging biomaterial approaches, particularly hydrogels, offer promise for endometrial repair due to their tunable mechanics, high water content, and capacity for controlled delivery of growth factors or cells. However, conventional hydrogels are largely homogeneous and unidirectional, incapable of simultaneously addressing adhesion prevention and tissue regeneration in fibrosis-prone, inflammatory niches. Here, we propose Janus hydrogels—dual-faced, spatially compartmentalized biomaterials that integrate anti-fibrotic and pro-regenerative functionalities within a single platform. One face provides a physical and biochemical barrier to adhesion formation, suppressing fibroblast activation and ECM deposition, while the opposing face delivers stem cell chemoattractants, angiogenic growth factors, and immunomodulatory cues to restore epithelial-stromal architecture and function. Preclinical models demonstrate that this dual functionality can prevent adhesion recurrence, enhance vascularization, and promote durable endometrial regeneration. By converting a hostile post-injury microenvironment into a permissive, functionally regenerative niche, Janus hydrogels offer a precision-guided, multifunctional, and potentially patient-tailored therapeutic approach. This platform represents a conceptual and translational leap in gynecologic regenerative medicine, providing clinicians with a novel strategy to restore fertility, reduce adhesion recurrence, and improve long-term reproductive outcomes.

Keywords:
Intrauterine Adhesions, Endometrial Regeneration, Janus Hydrogels, Anti-fibrotic Therapy, Stem Cell Recruitment, Fertility Restoration, Immunomodulation.

Code: wtrc12-04390223
Title:

Decoding Trophoblast-endometrial Matrix Interference with Gelatin Hydrogel Platforms

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Abstract:
Endometriosis is increasingly understood not as a disorder of ectopic endometrial growth but as a systemic failure of matrix intelligence—a breakdown in the dynamic reciprocity between cells, extracellular matrix (ECM), and hormonal signaling that normally governs implantation. The pathological ECM of endometriosis—fibrotic, progesterone-resistant, and mechanically unyielding—mirrors a misappropriation of the same invasive machinery that drives physiological trophoblast implantation. Yet, despite this striking parallel, current models remain reductionist, unable to capture how mechanical stiffness, biochemical signaling, and immune–vascular crosstalk converge to dictate invasion competence. Here, we advance a conceptual and technological framework that reframes endometriosis through the lens of implantation biology using gelatin-based hydrogels as mechano-biomimetic platforms. Derived from collagen and inherently endowed with integrin-binding and MMP-cleavable motifs, gelatin hydrogels uniquely emulate the viscoelastic, degradable, and hormone-responsive landscape of the endometrium. By tuning stiffness, crosslinking, and biochemical patterning, these systems reconstruct both the physiological receptivity of the decidua and the pathological rigidity of endometriotic lesions—enabling direct interrogation of how trophoblasts and stromal cells sense, remodel, and respond to their matrix environment. This framework exposes a mechanistic gap at the heart of endometriosis: the loss of bidirectional mechanotransduction that permits trophoblast invasion but is silenced in fibrotic ECM. Through such tunable hydrogels, trophoblast invasion emerges not as a fixed trait but as a mechano-adaptive state, governed by ECM elasticity, ligand architecture, and growth factor reciprocity. Building on this principle, we propose gelatin hydrogels as translational biomaterials for regenerative gynecology—serving as scaffolds to restore endometrial pliancy, vehicles for anti-fibrotic drug delivery, and platforms for patient-specific modeling of implantation competence. By merging implantation biology, mechanobiology, and materials science, this work shifts the paradigm from describing endometriosis as misplaced tissue to decoding it as a failure of matrix governance. In doing so, it establishes gelatin hydrogels as both diagnostic analogs and therapeutic instruments—a bridge between modeling and medicine, capable of transforming our mechanistic and clinical understanding of endometrial receptivity, fibrosis, and reproductive success.

Keywords:
Endometriosis, Trophoblast Invasion, Gelatin Hydrogels, Extracellular Matrix Remodeling, Mechanotransduction, Endometrial Receptivity

Code: wtrc12-03400220
Title:

Emerging and Novel Therapeutic Strategies for Leishmaniasis: A Systematic Review of Cutaneous, Mucocutaneous, and Visceral Forms

Authors:

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Abstract:
Background: Leishmaniasis is a parasitic disease endemic to tropical and subtropical regions, manifesting in three primary clinical forms: cutaneous, mucocutaneous, and visceral. Conventional therapies are limited by prolonged administration, adverse effects, and increasing drug resistance. This systematic review aimed to evaluate and compare emerging therapeutic strategies for leishmaniasis and to provide insights into their clinical efficacy. **Methods:** A comprehensive systematic search was conducted in PubMed, Scopus, Web of Science, Embase, and Google Scholar. Articles published in English between 2010 and 2025 were included. Owing to heterogeneity among studies, data were synthesized descriptively and comparatively. **Results:** Traditional treatments, including pentavalent antimonials and liposomal amphotericin B, are constrained by toxicity, lengthy administration schedules, and resistance. Novel therapeutic approaches comprise oral miltefosine, combination regimens (miltefosine plus paromomycin), immunomodulators, and intralesional drug delivery. Physical and local interventions, including cryotherapy, thermotherapy, CO_2 laser, HECT-CL devices, and topical nitric oxide donors, demonstrated high efficacy with minimal adverse effects. Additionally, combined immunotherapy with chemotherapy and experimental vaccines—such as leishmanization and strategies aimed at eliciting Th1 cellular immune responses—showed promising outcomes in specific endemic regions. Multi-drug regimens and targeted therapies were associated with enhanced efficacy, reduced treatment duration, and improved safety profiles. **Conclusion:** Leishmaniasis remains a major global health challenge. However, emerging and combination therapeutic strategies offer substantial potential to improve treatment efficacy, minimize side effects, and shorten therapy duration. Future research should prioritize the development of safe oral agents, targeted therapeutic approaches, and effective vaccines to advance disease management.
Keywords:
Leishmaniasis, Novel Therapies, Drug Delivery, Immunotherapy, Cryotherapy, Miltefosine. Amphotericin B

Code: wtrc12-04340217
Title:

Hematologic Malignancy and Neurovascular Crisis: The Role of Tyrosine Kinase Inhibitors in Causing Intracranial Hemorrhage during Leukemia Treatment

Authors:

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Abstract:
Tyrosine kinase inhibitors (TKIs) have become a cornerstone in the treatment of leukemia, dramatically improving survival rates and outcomes. However, their use is not without risks, particularly the incidence of vascular toxicity. One of the most severe complications associated with TKI therapy in leukemia patients is an intracranial hemorrhage (ICH), which can be life-threatening. This article explores the intricate mechanistic links between TKIs and ICH, focusing on endothelial injury, platelet dysfunction, and off-target effects that can disrupt neurovascular homeostasis. We discuss the pathophysiology of ICH in leukemia, highlighting how leukemic infiltration, coagulopathy, and vascular permeability contribute to hemorrhagic events. We examine the clinical evidence for a variety of TKIs, including imatinib, dasatinib, nilotinib, and ponatinib, and the associated incidence of ICH. Additionally, we present a risk stratification based on leukemia subtypes and explore case studies that underscore the real-world impact of these vascular complications. Diagnostic and monitoring strategies, including early imaging and biomarkers, are discussed in order to better predict and manage ICH risks. Finally, we discuss therapeutic approaches including dose adjustment, platelet transfusion threshold, and future modifications of TKIs or combining therapies to mitigate the risk of ICH while maintaining therapeutic efficacy. This comprehensive review underscores the critical need for personalized medicine planning, enhanced surveillance, and future research to optimize the management of leukemia patients receiving TKI therapy, with a focus on minimizing vascular toxicity and improving long-term outcomes.

Keywords:
Hematologic Malignancy, Tyrosine Kinase Inhibitors, Leukemia, Platelets, Intra, cranial hemorrhage, Coagulopathy

Code: wtrc12-04340216
Title:

Smart DNA Hydrogels for Post-Surgical Hemostasis and Tumor Recurrence Prevention: Bridging Bioengineering and Clinical Translation

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Abstract:
Post-surgical complications, particularly hemorrhage and tumor recurrence, remain leading drivers of morbidity, extended hospitalization, and healthcare burden. Hemorrhage poses an immediate, life-threatening risk, while tumor recurrence undermines long-term survival and quality of life. Current hemostatic agents—while effective in providing rapid local clot formation—are constrained by poor tissue adherence, mechanical fragility, and limited durability, often necessitating re-intervention. Similarly, conventional adjuvant strategies (e.g., systemic chemotherapy or radiotherapy) fail to achieve adequate drug concentrations at the surgical bed, exposing patients to systemic toxicity while leaving behind residual disease that seeds recurrence. This dual clinical challenge underscores a critical unmet need for multifunctional, localized, and adaptive post-surgical interventions. Programmable DNA hydrogels have recently emerged as next-generation biomaterials uniquely suited to address this gap. Built from sequence-specific DNA motifs that self-assemble into three-dimensional networks, these hydrogels combine biocompatibility and biodegradability with tunable mechanical strength and stimuli-responsive release. Crucially, they can be engineered to carry pro-coagulant agents for immediate hemostasis while simultaneously delivering chemotherapeutics, immunomodulators, or targeted nanoparticles to suppress residual tumor growth. Beyond drug delivery, hybrid DNA hydrogel systems can integrate biosensing elements and smart, patient-specific responsiveness, enabling precision post-operative care.

Keywords:
Post-surgical hemorrhage, Tumor Recurrence, DNA hydrogels, Programmable Biomaterials, Targeted Drug Delivery, Tumor Microenvironment, Hemostasis, Immunomodulation

Code: wtrc12-03900213
Title:

Exploring the Limitations of Artificial Intelligence Applications in the Management of Diabetic Foot Ulcers: A Scoping Review

Authors:

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Abstract:
Background: Diabetic foot ulcers (DFUs) are one of the most severe and costly complications of diabetes, leading to high rates of infection, hospitalization, and lower-limb amputation. With the growing global diabetes burden, understanding the challenges that limit the effective use of artificial intelligence in DFU management is essential for improving early detection, enhancing treatment outcomes, and reducing preventable complications. Materials and **Methods:** This scoping review followed the Arksey and O'Malley (2005) framework and was reported according to PRISMA-ScR guidelines. A systematic search was performed in PubMed, Scopus, Web of Science, CINAHL, and Google Scholar for English-language articles published between 2010 and 2025. Search terms included "diabetic foot ulcer," "artificial intelligence," "machine learning," "deep learning," "computer vision," and "predictive modeling." In total, approximately 400 records were retrieved. After removing duplicates, around 350 titles and abstracts were screened. Of these, about 45 full-text articles were assessed for eligibility, and finally 24 studies met the inclusion criteria. Data were charted using a structured form, focusing on study design, AI methodology, data sources, clinical application, and reported limitations. **Results:** A total of 24 studies were included. Most studies used retrospective, single-center datasets with limited sample size and heterogeneous image acquisition, which reduced model generalizability. Significant variability in annotation quality, outcome definitions, and dataset imbalance—especially for advanced infection or amputation cases—further restricted model robustness. Only a small proportion of studies conducted external validation, resulting in potential overfitting and inflated performance estimates. Technical limitations included insufficient model interpretability, lack of uncertainty quantification, and minimal attention to calibration. Few studies assessed clinical workflow integration, patient safety, or economic feasibility, indicating a persistent gap between algorithmic performance and real-world clinical applicability. **Conclusion:** Despite promising diagnostic and predictive capabilities, current AI applications in DFU management are limited by small and heterogeneous datasets, inadequate external validation, and insufficient methodological rigor. Addressing gaps in dataset standardization, outcome harmonization, transparency, and explainability is essential. Future research should prioritize multicenter prospective studies, clinically meaningful endpoints, and real-world implementation evaluations to bridge the translation gap and support safe, effective integration of AI into DFU care.

Keywords:
Diabetic Foot, Foot Ulcer, Wound Healing, Artificial Intelligence.

Code: wtrc12-04220212
Title:

Wound Healing Effects of *Astragalus ecbatanus* extract against Cutaneous Leishmaniasis Lesions

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Abstract:
Background: Cutaneous leishmaniasis (CL) is recognized as the most prevalent form of leishmaniasis and is frequently reported in various countries, including Iran and Pakistan. The primary pharmacological treatment for CL involves pentavalent antimony compounds; however, these agents are associated with adverse side effects. Recent studies have documented complications related to their use, such as gastrointestinal, hepatic, and renal disorders, in addition to the emergence of drug resistance. Given the distinctive therapeutic properties of Astragalus species in disease management and immune system enhancement, the present study aimed, for the first time, to investigate the wound healing effects of the chloroform extract of Astragalus ecbatanus (AECE) on CL lesions in a murine model. Materials and **Methods:** A total of 32 male BALB/c mice, each weighing between 25 and 30 grams, were maintained under optimal standard laboratory conditions. To induce cutaneous leishmaniasis (CL), 0.1 mL of promastigotes (1×10^6 cells/mL) was administered via subcutaneous injection at the base of the tail. Following the development of Leishmania lesions, observed after six weeks, the infected mice were treated topically for 28 days with one of the following: normal saline, glucantime (GC) at a dose of 25 mg/kg, aqueous extract of CE (AECE) at 10 mg/kg/day, or AECE at 20 mg/kg/day. Lesion dimensions were subsequently measured using a Vernier caliper. Furthermore, parasite burden was evaluated by examining Giemsa-stained impression smears prepared from the lesions under a light microscope. **Results:** following four weeks of AECE therapy, lesions of CL were healed in the infected mice. The size of lesions after treatment with AECE at the doses 10 and 20 mg/kg significantly reduced by 2.93 and 0.26 mm, respectively; while the in the untreated mice the size of CL lesions were increased by 23.1 mm. Additionally, the number of the amastigote forms of Leishmania in the CL lesions was significantly reduced after AECE therapy of the infected mice ($p<0.001$). **Conclusion:** The chloroform extract of A. ecbatanus demonstrated promising therapeutic efficacy in improving CL lesions in BALB/c mice. Topical administration of AECE, particularly at 20 mg/kg, significantly reduced lesion size and parasite burden compared with untreated controls, indicating both wound-healing and antiparasitic properties. The extract not only inhibited lesion progression but also facilitated visible clinical recovery, supporting the traditional medicinal relevance of Astragalus species and highlighting their potential as complementary or alternative agents to pentavalent antimonials. These findings provide preliminary evidence that AECE may serve as a valuable candidate for developing plant-based topical formulations for CL management.
Keywords:
Leishmaniasis, Lesion, Natural Product, Treatment, Wound

Code: wtrc12-02280211
Title:

Recent Advances in MSC- and Exosome-Based Methods for Wound Healing

Authors:

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Abstract:
Background: Wound healing is a complex biological process involving the stages of inflammation, proliferation, regeneration, and tissue remodeling. Disruption in any of these phases—particularly in conditions such as diabetes, burns, or chronic wounds—can lead to delayed healing and serious complications. Mesenchymal stem cells (MSCs), due to their differentiation capacity, secretion of bioactive factors, and immunomodulatory properties, have emerged as promising candidates for the treatment of complex wounds. Recent studies indicate that the therapeutic effects of MSCs are largely mediated through the exosomes they secrete. Therefore, this review focuses on evaluating the roles of MSCs and their exosomes in wound repair. **Methods:** This work is a narrative review conducted through a systematic search of scientific databases including PubMed, ScienceDirect, Springer, and MDPI. A total of 50 research and review articles published between 2020 and 2025 that examined the role of MSCs and their exosomes in wound healing were selected and analyzed. Inclusion criteria consisted of full-text availability, high scientific quality, and relevance to cutaneous wound repair. **Results:** Evidence shows that MSC-derived exosomes contain miRNAs, growth factors, cytokines, and proteins that can enhance wound healing by reducing inflammation, promoting fibroblast proliferation and migration, stimulating angiogenesis, and facilitating extracellular matrix regeneration. Incorporating these exosomes into biomaterials such as hydrogels or hyaluronic acid has further improved their efficacy in animal models. Comparisons with cell-based therapies also demonstrate that exosome use offers advantages such as reduced immunogenic risk and easier storage and handling. **Conclusion:** Based on current evidence, MSC-derived exosomes represent an effective, safe, and clinically promising therapeutic option for skin wound repair, particularly in chronic wounds. However, further studies are required to determine optimal dosing, stabilization methods, long-term safety, and standardized production protocols before their widespread clinical application can be realized.
Keywords:
Mesenchymal Stem Cells, Exosomes, Wound Healing, Chronic Wounds, Tissue Regeneration, Angiogenesis

Code: wtrc12-04090210

Title:

Efficacy of Chlorhexidine in Diabetic Oral Wound Healing: A Scoping Review

Authors:

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Abstract:

Background: The clinical management of oral wound healing resulting from diabetes mellitus is affected by chronic hyperglycemia, infection risk, and impaired cellular regeneration due to damage to the microvascular supply that retards normal repair. The universal oral antiseptic, chlorhexidine, is the most frequently used in the context of oral health and in postsurgical care, but its speculative promoting impact in oral wound healing in diabetic individuals is not fully established. Diabetic acutely post-surgical patients undergo delayed tissue repair, increased microbial colonization, and an increased risk of future postoperative complications, making the oral wound healing process particularly burdensome for this patient group. Thus, this scoping review will systematically identify and summarize the current body of evidence relating to the use of chlorhexidine in oral wound healing in patients with diabetes, and describe the associated antimicrobial properties, impact on healing, and cytotoxic related adverse effects. **Methods:** A systematic literature search was performed in multiple domains of scientific databases for published literature until November 2025. The scoping review could analyze randomized controlled trials, observational studies, systematic reviews, and the identified preclinical research meeting the keywords, diabetes, oral wound healing, and chlorhexidine. Participants and eligibility took on the Arksey and O'Malley scoping review framework approach to inclusion/exclusion criteria. All studies included adult populations with diabetes related oral surgery, periodontal therapy, or mucosal wound status resulting from the use of chlorhexidine. The three major outcomes reviewed include infection rate, healing indices, and pain. Other outcomes of significance included healing and vascularization time, histological analysis, and adverse effects of the regular use of chlorhexidine incorporated in the management of oral wounds. **Results:** Accumulating data support the effectiveness of chlorhexidine as an antimicrobial agent in preventing surgical infection and lowering microbial colonization in oral wounds. The clinical application of chlorhexidine in oral wounds is primarily using a gel and rinse formulations typically ranging from 0.12 – 0.2% concentration. Only a small number of studies involving diabetic patients report the addition of adjunctive chlorhexidine in the management of oral surgery wounds, and periodontal therapy, which help in short-term clinical outcomes by improving clinical healing, pain reduction, and improving initial closure in comparison to placebo. Only limited studies evaluate cytotoxicity in diabetic patients; however, data show cytotoxicity in fibroblasts and keratinocytes to increase with dosage and duration of exposure, similar to in vitro clinical studies of extended duration on human tissue, which may slow cellular proliferation and migration capacity and repair potential in healing tissue. There is a shortage of diabetic-specific trials examining the effects of adjunctive chlorhexidine on long-term wound healing outcomes and glycemic forms results are still yet to be determined. Data do not fully explore the contemporary evidence regarding protocol optimization of adjunctive chlorhexidine use as it pertains to diabetic beds for oral wounds (especially as it relates to concentration and duration of use). **Conclusion:** Chlorhexidine is a reasonable antiseptic agent for the control of infection in oral wound management in diabetic patients, and can provide clinical benefits in the short term after oral surgery and periodontal therapy has been undertaken. However, the potential cytotoxic nature of chlorhexidine may prevent optimal healing of oral tissues, particularly in diabetics with impaired healing properties.Evidence-based parameters regarding chlorhexidine usage in oral diabetic wounds have yet to be established; therefore, additional investigation is warranted to elucidate safe and effective protocols, explore other agents, and assess chlorhexidine's influence on long-term healing and glycemic outcomes. A comprehensive interdisciplinary focus on infection and glycemic control, along with individualized patient-centered care, is warranted for optimizing oral wound healing in diabetes.

Keywords:

Diabetes Mellitus, Oral Wound Healing, Chlorhexidine, Antiseptics, Postoperative Complications

Code: wtrc12-00140209

Title:

Investigating the Effectiveness of Emerging Approaches in Wound Healing and Tissue Regeneration Aimed at 3D Printing and Bioengineered Skin

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Abstract:

Background: Chronic and acute wounds continue to represent a significant challenge in modern healthcare, often resulting in delayed healing, infection, and functional or aesthetic impairment. Traditional wound management methods, including dressings and grafts, can support healing but rarely restore the full structure and function of normal skin. Over the past decade, bioengineered skin substitutes have emerged as one of the most promising frontiers in regenerative medicine, combining advances in cell biology, biomaterials, and tissue engineering. Bioengineered skin aims to recreate the complex architecture of human skin, integrating cellular components (keratinocytes, fibroblasts, stem cells) within biocompatible scaffolds that mimic the extracellular matrix. These systems provide not only physical coverage but also biological signals that promote angiogenesis, collagen synthesis, and epithelialization. This innovative approach is reshaping wound care from passive protection toward active regeneration. Methods / Materials and **Methods:** This integrative review analyzed peer-reviewed literature published between 2017 and 2025, retrieved from PubMed, ScienceDirect, and Scopus databases. Keywords included "bioengineered skin," "tissue regeneration," "chronic wound healing," and "skin substitute." Studies were selected based on relevance to: 1. Development and composition of bioengineered skin (cellular vs. acellular models). 2. Application of biomaterials such as collagen, hyaluronic acid, and nanocomposites. 3. The role of stem cells and growth factors in promoting tissue regeneration. 4. Clinical outcomes related to healing rate, infection reduction, and scar quality. Particular emphasis was placed on the nursing perspective, focusing on clinical handling, patient education, and postoperative care of bioengineered grafts. **Results:** Recent studies demonstrate that bioengineered skin significantly enhances wound healing outcomes compared to conventional methods. Cellular constructs containing fibroblasts and keratinocytes have been shown to stimulate angiogenesis and accelerate epithelial coverage. Advanced scaffolds fabricated from collagen-based hydrogels, fibrin matrices, or biodegradable polymers provide a 3D framework that supports cellular proliferation and nutrient exchange. Stem cell–based bioengineered skin exhibits superior regenerative capacity by modulating inflammation and promoting neovascularization. Moreover, 3D bioprinting technologies now enable precise layer-by-layer reconstruction of skin architecture, allowing for customized grafts that match patient-specific wound morphology. Clinical applications reveal improved healing rates, reduced infection, minimized scarring, and enhanced elasticity of regenerated skin. From a nursing standpoint, the management of these innovative grafts demands advanced wound assessment skills, sterile handling protocols, and patient monitoring for graft integration, hydration, and potential rejection signs. Nurses also play a pivotal role in educating patients about post-transplant care and the importance of adherence to rehabilitation protocols. **Conclusion:** The development and implementation of bioengineered skin substitutes mark a new era in wound and tissue repair. These constructs go beyond traditional dressings by offering biological functionality, cellular communication, and true tissue regeneration. As regenerative medicine continues to evolve, the integration of bioengineering principles into clinical practice promises faster recovery, reduced morbidity, and improved quality of life for patients with complex wounds. For nursing professionals, embracing these advancements means expanding their role from traditional wound care providers to regenerative care specialists — bridging science, technology, and compassionate care. Bioengineered skin stands as a testament to how innovation and interdisciplinary collaboration can redefine healing, transforming hope into a tangible biological reality.

Keywords:

3D Printing, Skin, Bioengineered

Code: wtrc12-04250208
Title:

Efficacy of Dilute Acetic Acid in Eradicating Pseudomonas Infection in Complex Wounds: A Multi-Center Case Series

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Abstract:
Background: Infections caused by Pseudomonas aeruginosa present a significant clinical hurdle in managing chronic wounds, burns, and pressure ulcers due to the bacterium's capacity for biofilm formation and drug resistance. This Case Series aims to document the successful use of 0.1% Acetic Acid solution in treating Pseudomonas-related infections which has shown no response to other conventional antiseptics. **Methods:** and materials: The series incorporates observations of four patients across three different medical facilities (Farateb Clinic, Shahid Rahnemoon Hospital, and Goudarz Hospital). All patients presented with Pseudomonas colonization, evidenced by clinical signs (purulent, malodorous exudate) and positive microbiological cultures, following failed treatments using conventional agents such as PHMB, silver compounds, Povidone Iodine, and normal saline irrigation. • Case 1 (Severe Burn): A 36-year-old male patient with extensive posterior burns and a low Glasgow Coma Scale (GCS: 4) showed no enhancement after four sessions of treatment with silver compounds and PHMB. Significant improvement in exudate quality and odor class was achieved after three sessions of using 0.1% acetic acid irrigation. Case 2 (Zoster Infection): A 74-year-old female patient with refractory wound to Betadine and PHMB treatment protocols, achieved complete clinical and microbiological clearance of Pseudomonas following three sessions using acetic acid. • Case 3 (Chronic Pressure Ulcer): A 48-year-old male patient with a six-year history of a chronic Stage 4 pressure ulcer, unresponsive to silver alginates and Betadine demonstrated remarkable progress in reducing exudate and odor after three sessions of acetic acid irrigation. • Case 4 (Diabetic Foot Ulcer): This patient, also experiencing same issue with common antiseptics, experienced resolved malodorous, purulent drainage and negative wound culture subsequent to 6-session treatment with 0.1% acetic acid diluted in normal saline. **Results:** Low-concentration acetic acid (0.1%) demonstrated consistent clinical and microbiological effectiveness in eliminating infection and improving wound characteristics within a short period of time. **Conclusion:** The consistent efficacy observed across these multi-center cases depicts that diluted acetic acid at a 0.1% concentration is a highly effective topical treatment for eradicating multi-drug-resistant Pseudomonas. The rapid clinical improvement, often noted within just three sessions, supports the hypothesis that acetic acid probably can interfere with biofilm structure and devastate the favorable environment for bacterial proliferation. This method represents a possible cost-effective alternative when standard treatments fail. As noted, to establish this as a definitive clinical protocol, further rigorous studies are essential to confirm these preliminary observations, determine optimal dosing, and assess long-term safety profiles.

Keywords:
Acetic Acid, Pseudomonas, Antiseptic Resistant

Code: wtrc12-04240207
Title:

Innovations in Skin Wound Closure in the Emergency Department: A Systematic Review

Authors:

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Abstract:
Background: Effective management of skin lacerations in the emergency department depends on fast and reliable closure methods that reduce bleeding, prevent infection, and support proper healing. Common techniques include sutures, staples, and skin adhesives. Suturing is widely used in the emergency department because it is familiar to clinicians and provides dependable alignment of wound edges. Sutures ensure strong wound closure but require time and technical skill. Staples are faster to apply, yet they have been associated with higher infection rates and poorer cosmetic and patient satisfaction outcomes compared with sutures. Traditional wound-closure techniques show their weaknesses most clearly in urgent, high-risk cases where fast, precise, and infection-resistant repair is critical. Recent advances in closure technology have introduced devices that overcome many of these issues, offering quicker and more dependable results, reducing infection and complications, supporting better healing and cosmetic outcomes, and improving the experience for both patients and clinicians. **Methods:** A review was performed independently based on the PICO criteria and aligned to the research objective and based on the PRISMA checklist and using PubMed, CINAHL, Medline, Web of Science, SID databases Google Scholar search engine, and Boolean operators. The time limit between 2020 and 2025 was determined using the MESH keywords "wound closure", "innovation", "skin closure" "emergency department", and "wound management". After checking the entry and exit criteria and critically evaluating the quality of the selected articles, a total of 15 articles were included in the study. **Results:** Across the reviewed literature, innovative wound-closure methods—including tissue adhesives, noninvasive closure devices, advanced adhesive strips, and newer absorbable materials—showed potential advantages over traditional sutures and staples. Many studies reported shorter procedure times, improved patient comfort, and cosmetic outcomes comparable to or better than standard techniques. While several of these technologies demonstrated high patient satisfaction, their use was often limited by wound characteristics such as location, tension, or complexity. **Conclusion:** Emerging dermal wound closure technologies offer significant improvements over traditional methods, including faster application, reduced infection risk, enhanced healing, improved scar outcomes, and potential cost savings. Overall, these emerging methods appear to be effective alternatives to traditional techniques in selected cases.
Keywords:
Wound Closure, Skin Closure, Wound Management, Innovation, Emergency Department

Code: wtrc12-04170206
Title:

The Role of Psychosocial Factors in Predicting Healing Outcomes of Non-Operative Charcot Neuroarthropathy Wounds: A Case Series Analysis

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Abstract:

Background: Charcot neuroarthropathy (CN) represents a devastating complication of peripheral neuropathy, characterized by progressive skeletal destruction and debilitating foot deformities that predispose to recalcitrant plantar ulceration. The cornerstone of conservative management for non-surgical candidates is rigorous, sustained offloading, with total contact casting (TCC) established as the gold standard modality. While the biological efficacy of TCC in redistributing pressure and facilitating wound healing is unequivocally supported by robust evidence, its clinical effectiveness in real-world settings remains critically compromised. A formidable implementation gap exists, where the success of this biomechanical intervention is paradoxically contingent upon non-biomechanical factors—specifically, patient acceptance and adherence. Current wound care paradigms predominantly focus on optimizing biomedical parameters, often overlooking the profound influence of psychosocial determinants such as anxiety, claustrophobia, and socioeconomic pressures, which can fundamentally dictate a patient's capacity to tolerate recommended care. This case series was therefore conceived to critically investigate the hypothesis that in patients with biologically comparable CN wounds, psychosocial vulnerability—not technical wound care—serves as the ultimate prognostic arbiter, capable of overriding even the most meticulously applied standard of care and determining the final pathway towards limb salvage or amputation. **Methods:** This observational case series analyzed five male patients with neuropathic plantar ulcers secondary to midfoot Charcot neuroarthropathy. The cohort demonstrated significant homogeneity in baseline parameters: wound size (3.5-4.3 cm^2), location (plantar midfoot), perfusion ($TcPO_2 > 40$ mmHg), and glycemic control (HbA1c 7.5-8.2%), enabling isolation of offloading adherence as the key variable. All patients received identical guideline-based wound care including sharp debridement, polyhexanide cleansing, and silver foam dressings. TCC was primarily recommended, with removable walkers provided when refused. Beyond biomedical management, we systematically assessed psychosocial barriers through structured interviews and clinical observation. Primary outcomes were wound area reduction at 4 weeks and final healing/complication status at 12 weeks. **Results:** A stark dichotomy in outcomes was observed, directly correlated with offloading adherence. The three TCC-adherent patients achieved rapid wound progression with mean area reduction of 84.7% (82-88%) at 4 weeks and complete healing by 12 weeks. Conversely, the two non-adherent patients showed minimal improvement (15% reduction), with one developing superficial infection and the other progressing to MRI-confirmed osteomyelitis requiring surgical intervention. This divergence occurred despite identical biological management, establishing psychosocial barriers as the definitive prognostic factor separating limb salvage from catastrophic complications. **Conclusion:** This study demonstrates a critical clinical reality: gold-standard treatments can fail due to psychosocial barriers, not biological factors. The disparity between theoretical efficacy and real-world outcomes underscores that optimal wound care must integrate proactive psychosocial vulnerability assessments. Identifying and addressing these barriers is essential for transforming clinical evidence into successful limb salvage and preventing preventable amputations.

Keywords:

Charcot Neuroarthropathy، Psychosocial Barriers، Treatment Adherence، Offloading، Limb Salvage، Diabetic Foot Ulcer، Total Contact Cast، Patient-Centered Care

Code: wtrc12-04190205
Title:

Investigation of Wound-Healing Efficacy of a Novel Ethanolic Extract of Proboscidea jussieui in Rats: In Vivo

Authors:

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Abstract:
Many studies have been conducted to accelerate the natural wound healing process. For the first time, this study evaluated the safety and wound healing effectiveness of Proboscidea jussieui extract. Toxicity tests in rats showed no mortality or adverse effects at high doses, indicating the extract is relatively safe. In a wound healing experiment, low and medium doses of the extract promoted complete and thick epithelial wound coverage, outperforming control and standard treatment groups, which showed less healing and some inflammation. These results suggest P. jussieui extract has potential as a safe natural product for wound treatment.
Keywords:
Proboscidea jussieui, Ethanolic Extract, Wound Healing, Plant

Code: wtrc12-03980201
Title:

The Role of Artificial Intelligence and Nanotechnology in Accelerating Chronic Wound Healing: A Narrative Review

Authors:

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Abstract:
Background: Chronic wounds, including diabetic foot ulcers, pressure injuries, and venous leg ulcers, represent a significant clinical challenge due to delayed healing, high infection risk, and patient morbidity. Traditional management involves wound debridement, infection control, and dressing-based therapies; however, outcomes remain suboptimal, especially in patients with comorbidities such as diabetes or vascular insufficiency. Recent advances in artificial intelligence (AI) and nanotechnology have opened new avenues for personalized wound assessment, predictive analytics, and targeted drug delivery, aiming to enhance tissue regeneration, reduce infection, and accelerate wound closure. This review aims to summarize current evidence on the application of AI and nanotechnology in the management of chronic wounds. Materials and **Methods:** A narrative review of the literature was conducted using PubMed, ScienceDirect, and Google Scholar databases. Studies published between 2015 and 2025 were screened using keywords such as “chronic wounds,” “artificial intelligence,” “machine learning,” “nanotechnology,” “nanoparticles,” “drug delivery,” and “wound healing.” Case reports, clinical trials, in vivo and in vitro studies discussing AI-assisted wound assessment or nanotechnology-based therapeutic interventions were included. Studies unrelated to chronic wounds or focusing solely on acute surgical wounds were excluded. Data extracted included patient characteristics, wound types, AI algorithms or nanomaterial types, treatment protocols, healing outcomes, and complications. **Results:** Several studies demonstrated that AI algorithms could accurately predict wound healing trajectories, classify wound severity, and guide personalized treatment plans. Integration of machine learning with imaging tools, including digital photography and thermography, allowed real-time monitoring and early detection of infection or delayed healing. Concurrently, nanotechnology-based interventions, including nanoparticle-laden hydrogels, nanofiber scaffolds, and liposomal drug delivery systems, improved local drug bioavailability, reduced systemic side effects, and promoted tissue regeneration. Reported outcomes included accelerated granulation tissue formation, higher rates of wound closure, decreased microbial burden, and enhanced patient adherence. Some studies combined AI-guided monitoring with nanotechnology-driven therapies, yielding synergistic improvements in chronic wound management. **Conclusion:** Artificial intelligence and nanotechnology offer promising adjunctive strategies in chronic wound care, enabling personalized, predictive, and targeted interventions. AI facilitates timely decision-making, while nanotechnology enhances local therapeutic efficacy and tissue regeneration. Integration of these technologies into multidisciplinary wound care protocols may significantly improve clinical outcomes and reduce healthcare costs. However, most current evidence stems from pilot studies or small-scale trials; larger, controlled studies are warranted to standardize protocols and validate clinical effectiveness
Keywords:
Chronic Wounds, Artificial Intelligence, Machine Learning, Nanotechnology, Nanoparticles, Drug Delivery

Code: wtrc12-03480200
Title:

"Exosome-Hydrogel System for Enhanced Skin Regeneration: Controlled Release and Therapeutic Efficacy"

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Abstract:
Skin wound healing remains a significant clinical challenge, particularly in chronic wounds, burns, and other severe skin injuries. Exosomes, as nanoscale intercellular messengers, have demonstrated considerable potential in promoting tissue regeneration due to their ability to transfer bioactive molecules such as proteins, RNAs, and growth factors. However, their direct therapeutic application is limited by rapid clearance, short retention time at the wound site, and instability in physiological conditions. Hydrogels, as three-dimensional biomaterial scaffolds, provide a biocompatible environment for controlled and sustained release of exosomes, enhancing their stability and bioavailability. In this study, we developed an exosome-loaded hydrogel system and evaluated its regenerative efficacy in an animal model of skin wounds. The hydrogel system demonstrated a significant acceleration in wound closure, enhanced angiogenesis, and improved re-epithelialization compared to control groups treated with either empty hydrogel or untreated wounds. Histological analyses confirmed improved tissue organization and reduced inflammation in the treated group. These findings suggest that the exosome-hydrogel platform represents a promising strategy in regenerative medicine, providing both structural support and biological signaling for optimal skin repair. Moreover, this study addresses existing challenges in optimizing exosome dosage, release kinetics, and translational applicability, highlighting its potential for future clinical development.

Keywords:
Exosome, Hydrogel, Skin Regeneration, Controlled Release, Wound Healing, Tissue Engineering

Code: wtrc12-03420198
Title:

Astaxanthin-loaded Hyaluronic Acid/chitosan Hydrogel for Wound Healing Promotion

Authors:

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Abstract:

Background: Recent advances in biomaterials and nanomedicine have explored multifunctional hydrogels as promising platforms to accelerate tissue repair. Hyaluronic acid (HA) and chitosan (CS) are natural polymers widely documented for their biocompatibility, biodegradability. Astaxanthin (ASTX), a potent antioxidant carotenoid, reducing oxidative stress and inflammation at wound sites. ASX-loaded HA/CS hydrogel creates a system which can protects against oxidative damage. The aim of this study was to prepare hyaluronic acid/chitosan hydrogel-loaded with ASTX to promote wound healing. **Methods:** The HA/CS hydrogel was synthesized through polyelectrolyte complexation, employing vanillin as a natural cross-linking agent to enhance its stability and biocompatibility. CS (1% w/v) was dissolved in 1% acetic acid solution, followed by the dropwise addition of hyaluronic acid (0.5%) under continuous stirring. vanillin (0.01%) was added to the CS/HA mixture and stirred for an additional 1 hour to ensure complete cross-linking. Subsequently, 60 µL of exosome suspension (300 µg/mL) and 2 mg of ASX were incorporated into the final hydrogel formulation. FTIR was carried out to confirm the structural binding and interaction between the composite components. Contact angle was calculated to find out the hydrophilicity and hydrophobicity of the obtained hydrogel. FE-SEM has been considered to measure porosity of the prepared hydrogel. The in vitro free radical scavenging activity of isolated ASTX was assessed by the DPPH assay. The Alamar Blue assay was conducted to assess the cytotoxic effects and viability of fibroblasts participating in the cutaneous wound healing process. Results The obtained hydrogel presented a reasonable transparent and uniform appearance, with a smooth surface devoid of macroscopic roughness. Overall, the increase in contact angle in the obtained hydrogel exposed a clear upward trend, transitioning from a hydrophilic surface in the base sample to a hydrophobic surface in the presence of ASTX. The functional groups and the interaction of involved ingredients in the hydrogel were acknowledged by FTIR. The FTIR results obtained revealed that the presence of characteristic peaks from the loaded agents and the biomaterials matrix together verified the successful combination. The prepared hydrogels exhibited approximately 535 % water absorption after 1 h, reaching 628 % after 24 h of immersion. FESEM imaging was done to analyze the microstructure and morphology of the prepared hydrogels. The FESEM images shown that the obtained hydrogel possessed an obviously porous structure with around 60% porosity. **Results:** indicated that the final hydrogel preserved cell viability above 90 % for the fibroblast cell line Hu02 for up to 72 h. no cytotoxicity was observed in the prepared hydrogel. The results from DPPH assay pointed out that antioxidant activity of AST was higher than that of vitamin C. At a concentration of 132 µmol/L, ascorbic acid scavenged was around 41% of hydroxyl radicals, while ASTX scavenged was reaching about 62 %. **Conclusion:** The findings demonstrate that the developed hydrogel possesses a uniformly smooth and transparent structure, with the successful integration of ASTX confirmed by FTIR analysis. Incorporation of ASTX significantly increased the contact angle, shifting the hydrogel surface from hydrophilic to hydrophobic. The hydrogel displayed high water absorption capacity, biocompatibility and antioxidant activity.

Keywords:

Astaxanthin, Hyaluronic Acid, Hydrogel, Wound Healing

Code: wtrc12-03410196
Title:

Integrating Biomimetic Scaffolds with Decellularized Amniotic Membrane for Wound Healing

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Abstract:

Background: The skin, as the largest organ of the human body, acts as a vital protective barrier against the external environment. After injury, underlying tissues become susceptible to pathogen invasion and water loss. Wound healing is a complex biological process that involves hemostasis, inflammation, proliferation, and remodeling. Although minor skin defects usually heal within 7–14 days, full-thickness wounds remain challenging and often require medical intervention. To accelerate the repair of extensive injuries, bioactive matrices that promote cell adhesion, proliferation, and differentiation have been investigated alongside clinical strategies. Scaffolds serve as key elements in tissue engineering by providing a three-dimensional porous framework that supports the delivery of nutrients and growth factors while facilitating the excretion of waste products. Bilayer scaffolds have gained attention due to their ability to control degradation behavior and the possibility of sustained therapeutic release. Hydrogels are considered promising candidates for epidermal regeneration due to their biocompatibility, tunable mechanical properties, biodegradability, and in situ crosslinkability. To replicate the structure of the skin, highly porous nanofibrous scaffolds are used to reproduce the microstructure of extracellular matrix (ECM). Their collagen-like arrangement facilitates the transport of oxygen and nutrients in wound dressings while providing tissue adhesion, hemostatic properties, and sustained release of bioactive molecules. Human placental membranes, including the chorion and amnion, possess therapeutic potential. The amniotic membrane obtained following cesarean section acts as a natural scaffold due to its content of stem cells, growth factors, and biocompatibility. Decellularized amnion, produced by removing cellular components, reduces immunogenicity and risks of contamination. Hydrogels derived from decellularized tissues retain bioactive molecules that promote cell proliferation, differentiation, antimicrobial activity, and chemotaxis. Among these, amnion-based composite hydrogels are suitable for skin regeneration. Integrating such hydrogels with biomimetic bilayer scaffolding systems (BLS) containing epidermal growth factor (EGF) has been proposed to mimic natural skin architecture, with the upper amniotic hydrogel acting as an epidermal analog and the lower nanofibrous gelatin matrix acting as a mechanical skin substitute. **Methods:** This review combines findings on the integration of biomimetic scaffolds with decellularized amniotic membranes for wound healing. ScienceDirect and Google Scholar publications (2020–2025) were screened based on relevance to skin regeneration, scaffold design, and growth factor delivery, with an emphasis on bilayer scaffolds and composite hydrogels. **Results:** Existing evidence suggests that bilayer scaffold systems with distinct morphologies and compositions show high potential for skin tissue regeneration by supporting skin reconstruction and re-epithelialization. The hemostatic properties of hydrogels help minimize bleeding and fluid loss while providing a protective barrier against bacterial penetration. The interconnected porosity of electrospun fibers has been associated with improved diffusion of oxygen and nutrients during healing. Sustained release of EGF stimulates the proliferation and differentiation of keratinocytes and fibroblasts while maintaining the biological activity of the growth factor. **Conclusion:** Overall, the reviewed studies suggest that combining biomimetic bilayer scaffolds with decellularized amniotic hydrogels represents a promising strategy for advanced wound healing and skin regeneration. These systems integrate mechanical stability, bioadhesion, hemostasis, and controlled growth factor release. However, the diversity in fabrication methods, material composition, and biological outcomes highlights the need for further comparative and long-term studies to better define their functional potential in clinical applications.

Keywords:
Skin; Bioactive Bilayer Scaffold (BLS); Decellularized Amnion; Extracellular Matrix (ECM)

Code: wtrc12-04060195
Title:

Antibacterial Scaffold Construction with Hydrophobic Layer in Reducing Dryness and Infection in the Wounds

Authors:

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Abstract:
Chronic wounds and surgical site infections are serious issues in the contemporary healthcare, and novel solutions are needed to hasten healing and avoid microbial colonization. The paper describes the design and description of new antibacterial scaffolds with a hydrophobic outer layer, which is used at the same time to handle moisture retention and infection control in wound management. The scaffolds were produced in an electrospinning process, where a biodegradable polymeric framework was used, as well as antimicrobial compounds and a hydrophobic surface to produce a multimodal wound dressing system. It was based on polycaprolactone (PCL) or chitosan-based nanofibers soaked with silver nanoparticles and gentamicin sulfate, which were an inner layer of the scaffold giving long-term antimicrobial resistance to both Gram-positive and Gram-negative bacteria. The outer hydrophobic layer, which was made of polydimethylsiloxane (PDMS) or fluorinated polymers, acted as a moisture barrier to avoid excessive loss of fluids but sufficient gaseous exchange. The porous structure characterized structurally by scanning electron microscopy (SEM) contained fiber diameters between 200-800 nanometers in diameter, which allowed the diffusion of nutrients and the cellular infiltration. In vitro antimicrobial performance revealed that Staphylococcus aureus, Pseudomonas aeruginosa and Escherichia coli were significantly inhibited with the inhibition zones of over 15 millimeters. The contact angle measurements were used to confirm that the outer layer was hydrophobic (contact angle was more than 120deg), and the water vapor transmission rate (WVTR) testing showed that the water balance was optimum. Cell cultures of fibroblasts Biocompatibility tests of fibroblast cell cultures indicated good cell viability and growth with little cytotoxicity. Early in vivo trials with a rat full-thickness model of wound revealed that the wound closure rate, bacterial load, and tissue regeneration were better in comparison with traditional dressings. The histological examination showed that there was organized deposition of collagen and increased-re-epithelialization. The hydrophobic covering was very efficient in avoiding the desiccation of the wound as the antibacterial elements considerably lowered the infection rates. These results indicate that the dual-functional scaffold design is a promising treatment approach to treat infected wounds and avoid complications involved with the excessive moisture loss. Further studies will involve optimization of drug release kinetics and assessment of long-term clinical efficacy of drugs in wound healing of different wounds.

Keywords:
Antibacterial Scaffolds, Electrospinning, Silver Nanoparticles, Tissue Engineering, Moisture Retention, Nanofibers, Chronic Wounds

Code: wtrc12-02770190
Title:

Review of Nurses' Psychological Interventions in Patients with Chronic Wounds

Authors:

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Abstract:
Background: Chronic wounds impose a heavy psychological burden on patients, including anxiety, depression, social isolation, and reduced quality of life. These issues can delay the healing process. Nurses play a pivotal role in delivering psychological interventions. This review aimed to evaluate the effectiveness of nurses' psychological interventions in randomized controlled clinical trials. **Methods:** This evidence-based review was conducted by searching the databases PubMed, Scopus, CINAHL, and SID up to November 2025 (i.e., articles published until November 5, 2025) using the keywords "chronic wounds," "psychological interventions," "nursing interventions," "randomized controlled trial," and their Persian equivalents ("chronic wound," "psychological interventions," "nursing," "randomized controlled trial"). Inclusion criteria: Randomized controlled clinical trials in English or Persian that examined psychological interventions delivered by nurses in adults with chronic wounds. Exclusion criteria: Observational studies, qualitative studies, reviews, studies without a control group, and non-nursing interventions. Study quality was assessed using the Cochrane Risk of Bias 2 tool. Findings: From 589 articles identified after removing duplicates, 15 randomized controlled clinical trials (involving 1,857 patients) were included in the analysis. Study quality was evaluated using the RoB 2 tool: 12 studies had an overall low risk, and 3 studies had some concerns in the domains of blinding or reporting. Interventions were categorized into four groups: 1.Patient-centered education (7 studies), which significantly increased self-efficacy and reduced diabetic wound healing time by 2.3 weeks. 2.Emotional support and short-term counseling (5 studies), which reduced anxiety. 3.Mindfulness and stress management techniques (2 studies), which significantly improved quality of life and demonstrated pain reduction. 4.Leg Club model (1 RCT), which significantly reduced social isolation and increased the healing rate by 28%. The complete wound healing rate in the intervention group was 32% higher than in the control group. Implementation barriers included lack of specialized nursing training (reported in 10 studies), high workload (7 studies), and limited access to psychological resources (6 studies). **Results:** Nurses' psychological interventions demonstrate significant effectiveness in reducing psychological burden and accelerating wound healing; however, structural and educational barriers hinder widespread implementation. Integrating these interventions into nursing care protocols and providing continuous training are essential. **Conclusion:** It is recommended that future trials focus on hybrid digital-in-person models and long-term effects.

Keywords:
Chronic Wounds, Psychological Interventions, Nursing, Quality Of Life, Wound Healing

Code: wtrc12-03560189
Title:

Clinical Outcomes of Autologous SVF Therapy in Non-healing Surgical Wounds: A Review of Current Evidence

Authors:

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Abstract:

Background: Postoperative non-healing surgical wounds create major clinical and emotional challenges for patients, yet effective standardized treatments remain limited. Stromal vascular fraction (SVF), a cell-rich product derived from adipose tissue, has shown regenerative potential for enhancing wound repair. This review evaluates current evidence on the efficacy and safety of autologous SVF for improving healing outcomes in acute postoperative wounds. **Methods:** This review followed the principles of systematic review and PRISMA guidelines. A thorough search was conducted using relevant keywords related to "postoperative non-healing surgical wounds," "stromal vascular fraction," "SVF therapy," "acute wound healing," and "adipose-derived regenerative treatments" in databases including PubMed, Embase, Scopus, and Cochrane Library. Additional grey literature was retrieved through Google Scholar. Inclusion criteria consisted of randomized controlled trials and quasi-experimental studies evaluating the effects of autologous adipose-derived SVF on the healing outcomes of postoperative non-healing surgical wounds. Excluded were case reports, opinion papers, animal studies, and articles lacking primary clinical data. Data screening and extraction were independently performed by two researchers, with discrepancies resolved by a third researcher. The quality of randomized trials was assessed using the ROB 2 tool, while quasi-experimental studies were evaluated using the ROBINS-I tool. Extracted data were systematically organized into summary tables for analysis. **Results:** A total of 864 records were identified across the databases. After title, abstract, and full-text screening, nine studies met the criteria, including interventional and quasi-experimental designs evaluating autologous adipose-derived SVF for postoperative non-healing surgical wounds. Completed trials showed that SVF accelerated re-epithelialization, enhanced angiogenesis, and improved restoration of tissue integrity compared to standard care. SVF-treated wounds demonstrated faster granulation, increased dermal thickness, and earlier closure, driven by MSCs, endothelial progenitors, and paracrine factors that modulate inflammation and support microvascular repair. Ongoing studies assess outcomes such as healing kinetics, scar quality, pain, infection control, and safety. Early indications suggest good tolerability without procedure-related complications. Overall, despite limited evidence, current findings support a biologically plausible and clinically promising role for SVF in promoting healing of postoperative non-healing surgical wounds. **Conclusion:** Current evidence from available interventional and quasi-experimental studies suggests that autologous adipose-derived SVF may enhance healing in postoperative non-healing surgical wounds by accelerating epithelial repair and improving tissue regeneration. However, the overall evidence base remains limited and heterogeneous. More rigorously designed clinical trials with standardized outcomes and robust safety assessment are needed to clarify its therapeutic value.

Keywords:
Adipose-derived; Postoperative Non-healing Surgical Wounds; Stromal vascular fraction; Wound

Code: wtrc12-03910187

Title:

Smart Nanozyme Hydrogels Activated by Wound Microenvironment for Enhanced Wound Healing

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Abstract:

Chronic wounds have a dysregulated microenvironment. This includes elevated reactive oxygen species (ROS), persistent inflammation, and the overexpression of proteases, such as matrix metalloproteinase-9 (MMP-9), which can delay healing. Conventional dressings cannot respond to these pathological cues. To address this, a stimuli-responsive nanozyme hydrogel has been developed. It detects wound-specific signals and activates therapeutic functions, such as scavenging ROS, modulating inflammation, and regulating protease activity. This process creates a favorable environment for healing. The hydrogel contains Prussian blue nanoparticles (PBNPs) with enzyme-mimicking activities similar to superoxide dismutase (SOD) and catalase. These are encapsulated in gelatin nanospheres within a polyvinyl alcohol (PVA) matrix. When MMP-9 levels rise during the pro-inflammatory phase, the gelatin carriers degrade and release PBNPs. The released PBNPs scavenge ROS and regulate immune responses. This dual action provides precise spatial and temporal control of healing. It first reduces oxidative stress and influences the polarization of macrophages. Then, it supports angiogenesis and collagen deposition. The process mimics the natural phases of wound repair. In vivo studies in diabetic wound models show that this hydrogel accelerates wound closure. It also enhances re-epithelialization, promotes angiogenesis, and supports collagen maturation by rebalancing inflammation. PBNPs further exhibit potent antioxidant and anti-inflammatory effects in infected skin wound models. These findings confirm their therapeutic potential. However, even with encouraging results in animal studies, challenges remain, such as ensuring long-term safety in the body, making the hydrogel respond only to the correct triggers, and scaling up its manufacturing. In conclusion, hydrogels activated by the wound enzyme MMP-9 act as advanced wound therapies. They help manage harmful oxidative stress and inflammation by responding directly to the environment of the chronic wound.

Keywords:

Chronic Wounds, Reactive Oxygen Species (ROS), Matrix Metalloproteinase-9, Nanozyme Hydrogel, Prussian Blue Nanoparticles (PBNPs)

Code: wtrc12-02440186

Title:

Effective Synergy of Oncolytic Virus and Immune Checkpoint Blockade in Colon Carcinoma

Authors:

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Abstract:

Colorectal cancer (CRC) remains the third most commonly diagnosed malignancy worldwide. Although standard therapies achieve favorable outcomes in early-stage disease, their effectiveness diminishes in advanced CRC and is often accompanied by substantial toxicities. Immune-checkpoint inhibitors targeting the programmed death-1 (PD-1)/programmed death-ligand 1 (PD-L1) pathway have transformed cancer treatment; however, in CRC, checkpoint blockade as monotherapy frequently results in limited and short-lived responses, with a significant proportion of patients developing therapeutic resistance. This review examines the synergistic potential of combining oncolytic virus (OV) therapy with PD-1/PD-L1 inhibition in murine models of CRC. Oncolytic virotherapy, an emerging immunotherapeutic platform, selectively infects and lyses malignant cells while releasing tumor-associated antigens that activate dendritic cells and prime $CD8^+$ and $CD4^+$ T-cell–mediated antitumor immunity. By reshaping the tumor microenvironment from an immunologically “cold” to a “hot” phenotype, OVs function as in situ cancer vaccines and enhance responsiveness to checkpoint blockade. Preclinical evidence demonstrates that OV therapy significantly augments the antitumor efficacy of PD-1/PD-L1 inhibitors. Reported outcomes show that anti-PD-1 monotherapy achieved a 15.9% reduction in tumor burden, OV therapy alone resulted in a 63.2% reduction, and combination therapy produced an 86.3% reduction. In another model, OV alone inhibited tumor growth by 37%, anti-PD-1 monotherapy showed no measurable effect, and the combination achieved 69% inhibition. Collectively, these findings underscore the therapeutic promise of OV-checkpoint inhibitor combinations as a strategy to overcome immunotherapy resistance and improve outcomes in CRC and other solid tumors.

Keywords:

Oncolytic Virus, Colorectal cancer, Immune Checkpoint Inhibitor, Immunotherapy

Code: wtrc12-02440185
Title:

Effective Synergy of Oncolytic Virus and Immune Checkpoint Blockade in Colon Carcinoma

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Abstract:
Colorectal cancer (CRC) remains the third most commonly diagnosed malignancy worldwide. Although standard therapies achieve favorable outcomes in early-stage disease, their effectiveness diminishes in advanced CRC and is often accompanied by substantial toxicities. Immune-checkpoint inhibitors targeting the programmed death-1 (PD-1)/programmed death-ligand 1 (PD-L1) pathway have transformed cancer treatment; however, in CRC, checkpoint blockade as monotherapy frequently results in limited and short-lived responses, with a significant proportion of patients developing therapeutic resistance. This review examines the synergistic potential of combining oncolytic virus (OV) therapy with PD-1/PD-L1 inhibition in murine models of CRC. Oncolytic virotherapy, an emerging immunotherapeutic platform, selectively infects and lyses malignant cells while releasing tumor-associated antigens that activate dendritic cells and prime $CD8^+$ and $CD4^+$ T-cell–mediated antitumor immunity. By reshaping the tumor microenvironment from an immunologically "cold" to a "hot" phenotype, OVs function as in situ cancer vaccines and enhance responsiveness to checkpoint blockade. Preclinical evidence demonstrates that OV therapy significantly augments the antitumor efficacy of PD-1/PD-L1 inhibitors. Reported outcomes show that anti-PD-1 monotherapy achieved a 15.9% reduction in tumor burden, OV therapy alone resulted in a 63.2% reduction, and combination therapy produced an 86.3% reduction. In another model, OV alone inhibited tumor growth by 37%, anti-PD-1 monotherapy showed no measurable effect, and the combination achieved 69% inhibition. Collectively, these findings underscore the therapeutic promise of OV-checkpoint inhibitor combinations as a strategy to overcome immunotherapy resistance and improve outcomes in CRC and other solid tumors.
Keywords:
Oncolytic Virus, Colorectal Cancer, Immune Checkpoint Inhibitor, Immunotherapy

Code: wtrc12-04000184
Title:

Determining the Impact of Lifestyle on the Prevention of Diabetic Foot Ulcers: A Systematic Review

Authors:

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Abstract:
Background: Diabetic foot Ulcer (DFU), one of the most severe and costly complications of diabetes mellitus, poses a major global health challenge. According to the latest World Health Organization statistics, approximately 15-25% of diabetic patients are at risk of developing a DFU in their lifetime. This complication not only severely impairs patients' quality of life but also leads to over one million amputations worldwide annually. From an economic perspective, the direct and indirect costs associated with DFU impose an annual burden of over $20 billion on global healthcare systems. Recent studies suggest that in addition to medical factors, social and economic determinants also contribute to the onset of this condition. These include inadequate access to healthcare, low health literacy, and low socioeconomic status. Background: Given the rising global and National (Iran) prevalence of diabetes, along with the substantial economic, social, and psychological burden of DFU, identifying and implementing effective, practical, and cost-effective strategies to prevent this complication is a primary healthcare priority. While numerous individual studies have explored the role of various lifestyle factors in preventing DFU, no study has yet systematically synthesized and analyzed this evidence. Therefore, this study was conducted to systematically synthesize the existing evidence on the impact of different lifestyle components on preventing the incidence of DFU. Methods: This study was conducted as a systematic review following the PRISMA guideline. The process involved identifying studies, screening, assessing eligibility, and data extraction. Study quality was appraised using the Joanna Briggs Institute (JBI) critical appraisal tools. To ensure comprehensive coverage, the reference lists of selected studies were manually reviewed. A "snowball" search strategy was also employed to identify additional relevant studies. **Methods:** A comprehensive search of reputable international and Persian-language databases was conducted for studies published between 2017 and 2024, using relevant English and Persian keywords. Out of 450 identified records, 72 studies met the eligibility criteria. Following a final quality assessment, 38 high-quality studies were selected for inclusion. **Results:** Analysis of the 38 eligible studies revealed that various lifestyle components have a significant and substantial impact on preventing DFU. Based on the evidence: •Regular and proper foot care was associated with a 70-75% reduction in DFU incidence. •Regular and planned physical activity was linked to a 45-50% reduction. •Adherence to a healthy and balanced diet was associated with a 40-45% reduction. •Smoking and tobacco cessation correlated with a 55-60% reduction. •Regular and precise blood glucose control was associated with a 50-55% reduction. •Use of appropriate footwear and socks was identified as a crucial protective factor, with a 65-70% reduction in incidence. Subgroup analysis indicated that the effect of lifestyle interventions was significantly greater in patients with a previous history of DFU and those with peripheral neuropathy. Furthermore, the continuity and regular follow-up of these interventions were found to be crucial for their long-term effectiveness. **Conclusion:** The findings of this review clearly demonstrate that comprehensive lifestyle interventions can significantly prevent DFU.Implementing structured educational programs to promote healthy lifestyles among diabetic patients should be considered an effective strategy within the healthcare system. We recommend integrating these interventions into primary healthcare services. This study underscores the importance of a multifaceted approach to DFU prevention, highlighting that interdisciplinary collaboration among the healthcare team, the patient, and their family is essential for achieving optimal outcomes.

Keywords:
Lifestyle, Prevention, Diabetic Foot Ulcer, Foot Care

Code: wtrc12-03990183
Title:

The Effectiveness of Vibration Therapy on Hard-to-Heal Wound Healing

Authors:

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Abstract:
Background: Hard-to-heal wounds are defined as wounds that fail to heal with standard therapy That lead to functional loss, decreased quality of life, and prolonged hospitalization due to delayed healing. The healthcare costs of managing such wounds are substantial, that represent a profound and growing challenge to global healthcare systems. The potential of vibration therapy to improve chronic wound healing is a growing area of interest. Vibration therapy may help promote the healing of hard-to-heal wounds such as pressure injuries, diabetic foot ulcers, and venous leg ulcers by improving blood flow. This study proposed to determine The Effect of Vibration Therapy on chronic Wound Healing. **Methods:** A review was performed independently based on the PICO criteria and aligned to the research objective and based on the PRISMA checklist and using PubMed, CINAHL, Medline, Web of Science, SID databases Google Scholar search engine, and Boolean operators. The time limit between 2020 and 2025 was determined using the MESH keywords “vibration therapy”, “hard-to-heal wound", "wound healing” and “Complementary Therapies”. After checking the entry and exit criteria and critically evaluating the quality of the selected articles, a total of 15 articles were included in the study. **Results:** Diminished peripheral blood flow at the wound site is a key hindrance to effective wound healing. The low-frequency and low-intensity vibration therapies helped effectively treat wounds by improving blood flow, relieving pain, reducing exudate, removing necrotic tissue associated with wound healing. However, vibration therapy did not significantly reduce pain in these patients, indicating that its benefits may be more central to wound healing and neuropathy management rather than pain alleviation. **Conclusion:** Vibration therapy significantly accelerates wound healing by catalyzing epithelization, promoting angiogenesis, and enhancing muscle bulk. Considering that no clinically serious negative effects were found in the patients with vibrotherapy intervention that can be regarded as a complementary therapy to the existing ones to accelerate the healing chronic wounds. Furthermore, reducing wound care time and decreasing the healthcare cost will surely help improve the quality of life of patients suffering from hard-to-heal wounds.

Keywords:
Vibration Therapy, Hard-To-Heal Wound, Wound Healing, Complementary Therapies

Code: wtrc12-03980182
Title:

The Role of Negative Pressure Wound Therapy in the Management of Necrotizing Fasciitis: A Narrative Review

Authors:

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Abstract:

Background: Necrotizing fasciitis (NF) is a rapidly progressive, life-threatening soft tissue infection characterized by widespread necrosis of the fascia and subcutaneous tissue. Despite advances in antimicrobial therapy and surgical techniques, mortality rates remain high due to delayed diagnosis and systemic complications. Traditional management relies on prompt surgical debridement, broad-spectrum antibiotics, and supportive care. However, wound management following debridement remains challenging, particularly in patients with comorbidities such as diabetes mellitus or immunosuppression. Negative Pressure Wound Therapy (NPWT) has emerged as an adjunctive method that enhances wound healing by promoting granulation tissue formation, improving perfusion, and reducing bacterial load. This review aims to summarize the available evidence on the efficacy and clinical outcomes of NPWT in the management of necrotizing fasciitis. Materials and **Methods:** A narrative review of the literature was conducted using databases including PubMed, ScienceDirect, and Google Scholar. Studies published between 2015 and 2023 were screened using the keywords “necrotizing fasciitis,” “negative pressure wound therapy,” “vacuum-assisted closure,” and “NPWT.” Case reports, clinical trials, and retrospective studies discussing NPWT application in NF were included. Articles focusing on animal studies or unrelated wound types were excluded. Data extracted from eligible studies included patient characteristics, infection sites, NPWT settings, treatment duration, adjunctive therapies, and clinical outcomes such as healing time, surgical interventions, and complications. **Results:** Across multiple studies, NPWT demonstrated favorable outcomes in managing necrotizing fasciitis, particularly in head, neck, and extremity infections. The reported duration of NPWT ranged from 8 to 16 days, with effective wound granulation observed within 9–16 days. Average hospital stays varied from 17 to 23 days. Most patients achieved successful wound closure by primary suturing, split-thickness skin grafting, or flap coverage. NPWT reduced pain levels, enhanced wound bed preparation, and minimized the need for complex reconstructive procedures. Furthermore, the therapy facilitated infection control without recurrence or major complications. Studies employing instillation-based NPWT (NPWTi-d) with solutions such as saline or Prontosan® also showed improved wound cleansing and faster recovery compared with standard dressing methods. **Conclusion:** Negative Pressure Wound Therapy is a safe, effective, and reliable adjunct in the multidisciplinary management of necrotizing fasciitis. It enhances granulation tissue formation, accelerates wound closure, and decreases bacterial contamination, leading to improved functional and aesthetic outcomes. Integration of NPWT into standard treatment protocols, combined with timely surgical debridement and appropriate antibiotic therapy, can significantly reduce morbidity and mortality. Although current evidence is mainly based on case reports and small clinical series, further controlled studies are warranted to establish standardized NPWT parameters and optimize clinical outcomes in necrotizing fasciitis.

Keywords:

Necrotizing fasciitis, Negative Pressure Wound therapy (NPWT), Vacuum-assisted Closure (VAC), Wound Healing

Code: wtrc12-02490181
Title:

Low-Amplitude Micro-Vibration (LMV) as a Non-Invasive Strategy in Chronic Wound Management: A Review of Biomechanical Mechanisms, Efficacy Thresholds, and the Roadmap for Randomized Controlled Trials

Authors:

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Abstract:
Background: Impaired microcirculation is a major contributing factor in the development and persistence of chronic wounds, particularly diabetic foot ulcers and ischemic wounds. As the demand for noninvasive strategies to enhance tissue perfusion grows, low-amplitude micro-vibration has emerged as a promising biomechanical modality capable of improving capillary flow, stimulating mechanotransduction pathways, and promoting local vasodilation. Despite increasing interest, evidence on its physiological impact and potential role in wound healing remains fragmented and lacks integrated analysis. **Methods:** This narrative review synthesizes current experimental, physiological, and preclinical findings on micro-vibration therapy and its influence on microcirculation dynamics. Databases including PubMed, Scopus, and Google Scholar were searched for studies evaluating low-magnitude vibration (LMV) or micro-vibration and their effects on tissue perfusion, endothelial responses, angiogenesis, and wound healing. Human, animal, and mechanistic studies published between 2005 and 2024 were included. **Results:** Available evidence indicates that micro-vibration in the range of 30–200 Hz with amplitudes below 200 μm can enhance superficial blood flow by increasing endothelial shear stress, stimulating nitric oxide release, and improving erythrocyte mobility. Studies in healthy individuals demonstrate up to 15–40% improvement in microvascular perfusion, while preclinical wound models report accelerated granulation, collagen deposition, and neovascularization. Although early pilot studies suggest potential benefits in diabetes-related microcirculatory deficits, clinical evidence remains limited by small sample sizes, heterogeneous protocols, and lack of standardized vibration parameters. **Conclusion:** Micro-vibration therapy represents a rapidly emerging, noninvasive modality with notable potential to enhance microcirculation and support wound healing processes. While foundational biomechanical and preclinical data are promising, robust clinical trials, standardized therapeutic parameters, and device-based innovation are required before integration into routine wound care practice. This review highlights key mechanistic insights, summarizes existing evidence, and proposes future research directions aimed at translating micro-vibration technology into clinically applicable solutions for chronic wound management.

Keywords:
Micro-Vibration, Microcirculation, Wound Healing, Diabetic Foot Ulcer, Mechano-Transduction, Noninvasive Therapy, Tissue Perfusion

Code: wtrc12-03960179
Title:

Nursing Role in the Management of Diabetic Foot Ulcers

Authors:

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Abstract:
Background: Diabetic foot ulcer (DFU) is one of the most serious and disabling complications of diabetes, affecting nearly 15–25% of diabetic patients during their lifetime. These ulcers often result from peripheral neuropathy, peripheral arterial disease, and poor glycemic control, leading to infection, hospitalization, and even amputation. The management of DFU requires a multidisciplinary approach in which nursing care plays a central and continuous role. Nurses are responsible for assessing risk factors, providing wound care, educating patients on self-care, and preventing recurrence. This review aims to summarize the key nursing interventions and their impact on the prevention and management of diabetic foot ulcers. **Methods:** This narrative review was conducted through a literature search in PubMed, Scopus, and Google Scholar databases for studies published between 2015 and 2025. The keywords used were "nursing care," "diabetic foot ulcer," "self-care," and "wound management." A total of 68 studies were initially identified, of which 20 relevant papers focusing on nursing interventions and patient education were reviewed. The extracted data were analyzed qualitatively and categorized into assessment, education, wound management, and follow-up care. **Results:** from the reviewed literature emphasize that nurses play a crucial role in early detection and ongoing management of DFUs. Comprehensive assessment—including vascular status, neuropathy evaluation, and wound grading—is the first step in preventing complications. Regular wound inspection, maintaining a moist wound environment, and infection control are core nursing practices that accelerate healing. Education and patient empowerment are also essential components of nursing care. Teaching patients about daily foot inspection, proper footwear, and blood glucose control significantly reduces ulcer recurrence. Several studies have shown that nurse-led education programs improve self-care behaviors, glycemic control, and wound outcomes. Nurses also play a key role in coordinating multidisciplinary care by collaborating with physicians, podiatrists, and rehabilitation specialists. Home-based nursing interventions, including follow-up visits and telemonitoring, have been shown to improve healing rates and decrease hospital readmissions. Moreover, psychosocial support provided by nurses helps patients cope with anxiety, pain, and reduced mobility caused by chronic wounds. Despite these benefits, challenges such as limited resources, lack of standardized training, and insufficient staffing can hinder optimal nursing performance. Continuous professional education and institutional support are essential to overcome these barriers. **Conclusion:** Nurses are at the forefront of diabetic foot ulcer prevention and management. Through comprehensive assessment, patient education, wound care, and coordination of multidisciplinary teams, they play an indispensable role in reducing complications and improving patients' quality of life. Evidence suggests that nurse-led interventions enhance healing outcomes, minimize amputation rates, and promote long-term self-care adherence. Future efforts should focus on developing standardized nursing protocols, integrating telehealth services, and expanding educational programs to empower nurses in DFU management.

Keywords:
Nursing, Diabetic Foot Ulcers, Management

Code: wtrc12-00380178
Title:

Overcoming Multidrug Resistance in Burn Wound Infections: A Novel Synergistic Combination of Graphene Oxide and Clove Extract as an Alternative Therapeutic Strategy

Authors:

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Abstract:
Background: Chronic burn wounds frequently become colonized with multidrug-resistant (MDR) bacteria capable of forming robust biofilms, which severely compromise treatment outcomes. To address this challenge, the present study investigated the synergistic antibacterial and anti-biofilm effects of graphene oxide (GO) nanoparticles in combination with aqueous clove extract (*Syzygium aromaticum*) against MDR isolates recovered from chronic burn wound infections. **Methods:** GO nanoparticles were synthesized and characterized using FTIR, XRD, and SEM. Synergistic antimicrobial interactions between GO and clove extract were assessed through the checkerboard microdilution method, and the fractional inhibitory concentration index (FICI) was calculated to determine the level of synergy. The inhibitory and eradication effects on *Pseudomonas aeruginosa* biofilms were evaluated using a standard crystal violet microtiter assay. **Results:** The GO–clove combination demonstrated clear synergistic activity (FICI $\leq$ 0.5) against *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, and Enterococcus faecalis. Furthermore, the combined treatment significantly reduced biofilm formation—exceeding 90% inhibition—and was able to remove up to 85% of mature biofilms at higher concentrations, outperforming the individual agents. **Conclusion:** Co-administration of GO nanoparticles with clove extract enhances antibacterial potency and effectively disrupts both developing and established biofilms. This combination shows promise as a multifunctional topical candidate for managing biofilm-associated infections in chronic burn wounds.

Keywords:
Acinetobacter baumannii, Antimicrobial Resistance, Clove Extract, *Enterococcus faecalis*, Graphene Oxide, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, Synergy

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Code: wtrc12-03930177
Title:

Alginate-Based Hydrogel for Exosome Encapsulation in Wound Healing Applications

Authors:

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Abstract:
Background: Alginate, a natural polysaccharide derived from brown algae, is widely utilized in biomedical engineering due to its biocompatibility, non-toxicity, ease of processing, and low cost. In hydrogel form, it mimics the extracellular matrix, providing a hydrated environment suitable for tissue regeneration and controlled drug delivery. Its porous and tunable structure makes alginate hydrogels particularly suitable for wound healing. Vanillin, a natural crosslinker, is highly biocompatible, non-toxic, and exhibits antibacterial and antioxidant activities, enhancing the biomedical potential of hydrogels. Exosomes, nanoscale vesicles (40–150 nm) carrying proteins, lipids, and nucleic acids, promote tissue repair and intercellular communication, though maintaining their stability remains challenging. **Methods:** The alginate-based hydrogel was prepared via the inter-polyelectrolyte complex method. Sodium alginate (1% w/v) was dispersed in distilled water and stirred magnetically for 3 hours. Exosomes (100 μg/mL) were added and stirred for 30 minutes, followed by vanillin (5 mM) with continued stirring for 90 minutes. To preserve the porous architecture, samples were frozen at −80°C for 24 hours and then fully dried at −38°C for 48 hours using a freeze-drying system. **Results:** Alginate served as the encapsulating matrix for exosomes, with vanillin acting as a natural crosslinker. Vanillin enhanced the hydrogel's mechanical integrity and contributed to its wound-healing functionality. Freeze-drying produced a porous, sponge-like structure that stabilized exosomes and enabled controlled, sustained release. Structural and physicochemical analyses, including scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR), release profiling, and contact angle measurements, confirmed successful crosslinking and efficient exosome encapsulation. **Conclusion:** The alginate–vanillin–exosome hydrogel exhibited favorable porosity, water absorption, and hydrophilicity, along with enhanced mechanical performance and exosome stability. These results demonstrate the potential of this composite hydrogel as a multifunctional platform for controlled release and advanced wound-healing applications.

Keywords:
Alginate, Vanillin, Exosome, Wound Healing

Code: wtrc12-01130175
Title:

Postbiotic-Loaded Nanostructured Biomaterials for Chronic Wound Dressings: Local Modulation of LPS-Driven Inflammation

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Abstract:
Background: Chronic wounds, particularly diabetic foot ulcers, are characterized by persistent infection, biofilm formation, and a prolonged inflammatory phase driven in part by lipopolysaccharide (LPS) from Gram-negative bacteria. Conventional dressings often fail to adequately control local endotoxin-mediated inflammation. Postbiotics - non-viable microbial products and metabolites with defined bioactivity - exhibit antimicrobial, immunomodulatory, and barrier-supporting effects. Nanostructured biomaterials such as hydrogels, nanofibers, and polymeric films provide attractive platforms for the controlled delivery of such bioactives to the wound bed. **Methods:** This narrative review synthesizes and critically appraises published in vitro and in vivo studies on: (i) the role of LPS in sustaining inflammation in chronic wounds; (ii) the composition and mechanisms of postbiotics relevant to wound healing; and (iii) nanostructured biomaterial dressings capable of loading and releasing postbiotic preparations. Major themes were extracted and organized around pathophysiology (LPS-driven inflammation), postbiotic mechanisms, biomaterial design, and preclinical evidence for postbiotic-loaded wound dressings. **Results:** Evidence indicates that LPS in chronic wounds activates TLR4-dependent pathways, up-regulates pro-inflammatory cytokines, and contributes to impaired healing. Postbiotic preparations derived mainly from lactic acid bacteria contain organic acids, bacteriocins, exopolysaccharides, enzymes, and extracellular vesicles that can inhibit pathogen growth, disrupt biofilms, and attenuate LPS-induced inflammatory signaling at the cellular level. Nanostructured biomaterials – including chitosan- and alginate-based hydrogels, electrospun nanofibers, and thin polymeric films – can be engineered to encapsulate postbiotics and provide sustained local release while maintaining a moist, protective environment. Preclinical models suggest that such systems reduce bacterial burden, modulate local cytokine profiles, and enhance granulation tissue formation and re-epithelialization. Discussion The integration of postbiotics into nanostructured wound dressings offers a biologically rational strategy to target both microbial load and LPS-driven inflammation at the wound-tissue interface. Compared with live probiotics, postbiotics are more stable, more easily sterilized, and pose minimal risk of systemic infection, making them particularly suitable for incorporation into advanced biomaterials. However, available data are largely preclinical, heterogeneous in terms of postbiotic preparation and biomaterial design, and rarely include direct measurements of local endotoxin activity or robust clinical endpoints. **Conclusion:** Postbiotic-loaded nanostructured biomaterials represent a promising class of next-generation chronic wound dressings with the potential to locally modulate LPS-driven inflammation while supporting tissue repair. Further standardized preclinical studies and well-designed clinical trials are needed to optimize postbiotic formulations, delivery platforms, and dosing regimens, and to confirm their safety and efficacy in patients with chronic wounds.

Keywords:
Chronic Wounds, Postbiotics, Nanostructured Biomaterials, Wound Dressings, Lipopolysaccharide (LPS)

Code: wtrc12-03810174
Title:

An In-Depth Examination of Robot-Aided Tissue-Engineered Implants for Accurate Operative Reconstruction of Intricate Soft Tissue Damage

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Abstract:
Background: Procedures for repairing soft tissue injuries face difficulties in achieving effective graft integration and restoring normal function. Standard methods often mismatch anatomical requirements causing postoperative issues. However integrated assessments of robotic precision with stem cell-enhanced materials have not been thoroughly collated. Here we aggregate findings revealing robust integration of bioengineered constructs via robotic implantation. **Methods:** Databases including PubMed and IEEE Xplore were queried from 2020 to 2025 for reports on robotic grafting in tissue repair. Criteria included experimental and case series with histological or functional metrics resulting in 22 studies reviewed. **Results:** Combined results show vascular ingrowth amplified 3.5-fold with P under 0.001 in 500 models. Coverage attains 82 percent by week seven. Tensile properties align with host tissue at 97 percent similarity. Cell survival post-placement averages 90 percent. Inflammation reduces 55 percent relative to conventional approaches. Resolution in scans hits 0.8 millimeters verifying even dispersion. Benchmarks against non-robotic methods affirm 40 percent superior outcomes. **Conclusion:** This overview redefines paradigms in surgical tissue restoration. It unlocks potential for advanced regenerative applications in operative settings.

Keywords:
Robotic Graft Review, Bioengineered Materials, Surgical Repair, Stem Cell Integration, Tissue Engineering

Code: wtrc12-03810173
Title:

An Overview of Customized Nanoparticle Carriers for Growth Factors to Enhance Diabetic Wound Recovery in Internal Medicine

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Abstract:
Background: Diabetic wounds pose a major challenge in internal medicine frequently culminating in amputations due to disrupted healing mechanisms. Traditional treatments yield inconsistent results in fostering closure. However comprehensive evaluations of targeted nanoscale platforms customized to patient needs remain limited in the literature. Here we compile evidence establishing the enhanced efficacy of nanoparticle carriers in promoting tissue regeneration. **Methods:** Literature was retrieved from Embase Cochrane and Web of Science spanning 2018 to 2025 emphasizing nanoparticle applications in diabetic models. Selection encompassed preclinical and clinical studies with measurable endpoints yielding 18 publications for synthesis. **Results:** Meta-analysis reveals healing acceleration by 35 percent with P below 0.001 across 800 samples. Closure rates reach 92 percent at four weeks versus 55 percent in controls. Vascularization escalates 2.5-fold per imaging data. Inflammatory indices decrease 45 percent early on. Safety profiles indicate negligible adverse events. Extended observations note recurrence under 7 percent at follow-up. Optimal formulations center on 8 micrograms loading per unit. **Conclusion:** This analysis emphasizes the pivotal role of nanoparticle techniques in tailored approaches to diabetic ulcer care. Furthermore, such methods enable the formulation of advanced guidelines designed to prevent major complications.

Keywords:
Nanoparticle Review, Diabetic Healing, Growth Factor Delivery, Internal Medicine, Targeted Therapy

Code: wtrc12-03810172
Title:

A Systematic Review of AI-Powered Imaging Techniques for Early Detection and Management of Chronic Skin Wounds in Dermatology

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Abstract:
Background: Chronic skin wounds represent a significant burden in dermatology leading to extended morbidity and elevated costs. Conventional evaluations rely on subjective expertise often resulting in variability and postponed interventions. However the potential of automated systems to deliver consistent high-precision assessments has not been fully synthesized from existing evidence. Here we synthesize evidence demonstrating the superior accuracy of artificial intelligence models in wound staging and prognosis. **Methods:** A systematic search covered PubMed MEDLINE and Scopus databases from 2015 to 2025 focusing on studies employing machine learning for wound imaging. Inclusion criteria targeted clinical trials and observational reports with quantitative outcomes totaling 25 articles for analysis. **Results:** Pooled data indicate AI systems achieve 93 percent accuracy in tissue classification with a 95 percent confidence interval of 90 to 96 across 1500 cases from multiple studies at P less than 0.001. Depth estimation resolves to 0.2 millimeters outperforming clinicians by 1.8-fold. Prognostic models exhibit 89 percent sensitivity for healing predictions. Infection detection maintains specificity above 98 percent in diverse cohorts. Aggregated findings show 25 percent reduction in diagnostic time. Subanalyses on pressure ulcers confirm 92 percent precision. **Conclusion:** The analysis positions artificial intelligence as a pivotal shift in how dermatologists manage wounds. It lays out a structure to incorporate such systems into standard procedures and curb potential issues.

Keywords:
AI Imaging Review, Chronic Wounds, Dermatology, Machine Learning, Wound Assessment

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Title:

Preparation and Evaluation of a Chitosan-Collagen Hydrogel Incorporating Curcumin Nanoparticles for Enhanced Topical Drug Delivery and Wound Healing

Authors:

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Abstract:

Background: Chronic wounds present a significant clinical challenge, necessitating advanced dressings that not only provide a protective barrier but also actively promote healing. The ideal dressing should manage exudate, prevent infection, deliver therapeutic agents, and be biocompatible. This study aimed to develop and comprehensively evaluate a multifunctional hydrogel composed of natural biopolymers—chitosan and collagen—loaded with curcumin nanoparticles, designed to address these multifaceted requirements for accelerated wound healing. The hydrogel leverages the synergistic properties of its components: chitosan's antimicrobial and hemostatic effects, collagen's role as a natural extracellular matrix scaffold, and curcumin's potent anti-inflammatory, antioxidant, and antimicrobial activities. **Methods:** A composite hydrogel was fabricated by first preparing curcumin-loaded nanoparticles within a chitosan-collagen matrix via ionic gelation. Chitosan (0.3-0.4%) and collagen (0.2-0.4%) solutions were blended, followed by the addition of an ethanolic curcumin solution (1%). Sodium tripolyphosphate (TPP, 0.1-0.2%) was then added dropwise to induce nanoparticle formation. This colloidal system was dispersed into a 1% Carbopol 940 hydrogel base to achieve optimal viscosity for topical application. An optimized formulation (F3), comprising a 2:1 chitosan-to-collagen weight ratio and 0.2% TPP, was selected for extensive characterization. Evaluations included: physicochemical analysis (swelling ratio, mechanical properties, viscosity), microstructural and chemical characterization (SEM, FTIR, XRD), drug delivery performance (encapsulation efficiency, in vitro release kinetics, water vapor transmission rate), and biological efficacy (in vitro antibacterial activity, cytocompatibility via MTT assay, and a wound healing scratch assay with human dermal fibroblasts). **Results:** The optimized hydrogel (F3) was a homogenous, yellowish gel with excellent physicochemical properties. It demonstrated a high equilibrium swelling ratio of 1550 ± 85%, indicating a superior capacity for absorbing wound exudate. Mechanical testing revealed a flexible and durable material with a tensile strength of 45.3 ± 4.8 kPa and an elongation at break of 352 ± 30%. SEM analysis confirmed a highly porous, interconnected microstructure with pore sizes of 80–150 µm, which is ideal for nutrient transport and cell infiltration. FTIR analysis verified the successful ionic crosslinking between chitosan and TPP, while XRD patterns confirmed that curcumin was amorphously dispersed within the matrix, enhancing its potential bioavailability. The drug delivery system was highly efficient, with a curcumin encapsulation efficiency of 93.4 ± 2.1%. The in vitro release profile exhibited a desirable biphasic pattern: an initial burst release of 28.5% within the first 8 hours for immediate therapeutic action, followed by a sustained release reaching 75.6% over 72 hours. The hydrogel's water vapor transmission rate (WVTR) was 2250 ± 150 g/m^2/day, falling within the optimal range for maintaining a moist wound environment without causing maceration. Biologically, the hydrogel showed potent and broad-spectrum antibacterial activity, with significant zones of inhibition against Staphylococcus aureus (19.2 ± 1.5 mm) and Escherichia coli (17.5 ± 1.8 mm). The MTT assay demonstrated excellent cytocompatibility, with fibroblast cell viability maintained at 96.2 ± 3.5% after 24-hour exposure. Most importantly, the in vitro scratch assay revealed a significant acceleration of wound closure; the hydrogel-treated fibroblast monolayer achieved 71.4 ± 5.2% closure in 24 hours, compared to only 32.5 ± 4.1% in the control group ($p < 0.01$). **Conclusion:** This study successfully demonstrates the development of a chitosan-collagen-curcumin nanoparticle hydrogel with a compelling profile for advanced wound care. The formulation combines high fluid absorption, robust yet flexible mechanics, and a porous architecture with the sustained delivery of curcumin. The hydrogel's potent antibacterial activity, excellent biocompatibility, and demonstrated ability to promote fibroblast migration in vitro highlight its significant therapeutic potential. These findings strongly support the use of this composite hydrogel as a promising next-generation dressing for facilitating and accelerating the wound healing process.

Keywords:
Wound Healing, Hydrogel, Chitosan, Collagen, Curcumin, Nanoparticles, Topical Drug Delivery, Antibacterial, Cell Migration

Code: wtrc12-03800167
Title:

Assessing Nurses' Knowledge and Performance in Adhering to Standard Principles in Infection Prevention

Authors:

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Abstract:
Background: Hospital infections are one of the important health-care issues worldwide that impose medical costs, increase the length of hospitalization, and cause death in many patients. Controlling hospital infections improves the health of patients and reduces hospital costs for patients. This study aimed to determine the knowledge and performance of nurses in observing standard principles in infection prevention. **Methods:** This descriptive cross-sectional study was conducted on 190 nurses working in Khorramabad Teaching Hospital using census method in 2010. Data were collected using a three-part questionnaire. Data were analyzed using SPSS-19 statistical software, descriptive statistics, independent samples t-tests, chi-square, and Pearson correlation. **Results:** The mean score of knowledge and performance of nurses was 6.91±1.60 and 8.00±1.33, respectively, in the range of 0-10. Most of the samples under study had an average level of knowledge. There was no significant relationship between performance and knowledge and average work experience and class hours spent in relation to hospital infection. **Conclusion:** Considering the research findings regarding the average performance and educational needs of the majority of nurses in controlling hospital infections, as well as the significant relationship between training courses and the quality of performance of most nurses, it is essential for those responsible to take action to provide the necessary conditions to increase awareness and improve nurses' performance.

Keywords:
Knowledge, Performance, Nurses, Infection Prevention

Code: wtrc12-03140164
Title:

Nanotechnology-Enabled Gene Silencing and Genome Editing for Accelerated Wound Repair

Authors:

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Abstract:
Chronic wounds represent a significant and persistent global health challenge. Diabetic foot ulcers and severe burns are common examples. These wounds are difficult to heal. Their biology involves constant inflammation and high oxidative stress. They are also resistant to infection. Cell growth and movement are often disrupted. Traditional treatments are mostly inadequate. They do not fix the core molecular and genetic problems. Nanobiotechnology is a new and powerful field. It offers advanced and safe methods. These methods deliver nucleic acid drugs directly to the wound. This includes tools like siRNA and CRISPR-Cas9. Special nanocarriers can break through the skin's barriers. This allows them to adjust genes precisely and speed up repair. For short term gene silencing, hybrid systems work very well. One study created a Lipoproteoplex (LPP) carrier. It combines a lipid nanoparticle with a charged protein. It was designed for topical siRNA delivery. This LPP carried siRNA to block the Keap1 gene. Keap1 suppresses a key antioxidant protein called Nrf2. In mouse diabetic wounds, the LPP siKeap1 treatment restored Nrf2 activity. It improved the wound's antioxidant balance. It also greatly sped up healing with almost no body wide effects. Another strategy used biodegradable silicon nanoparticles. These particles were coated with chitosan. They provided slow release of siRNA against Flightless I (Flii). Flii is a protein that slows down healing. This method lowered Flii levels by 60%. In lab tests, skin cells multiplied and moved more. In animal tests, wound healing got much better. Other research with Spherical Nucleic Acids targeting GM3S also showed good results in diabetic models. This confirms the promise of nanocarriers. There are also solutions for permanent gene changes. The Tissue Nanotransfection (TNT) platform is one. It uses a tiny needle chip for nanoelectroporation. This delivers genetic material directly into cells at the wound site. For example, TNT can deliver CRISPR-dCas9 tools. This was used to activate a specific gene called PLCγ2. The process removed epigenetic marks from the gene's promoter. This restored blood vessel growth signaling in diabetic wounds. It helped the wounds recover functionally. TNT can also deliver genes for antimicrobial effects. One study used it to deliver the CAMP gene. This successfully killed bacteria in infected wounds. This shows TNT can fight infection and promote healing. In summary, nanotech delivery systems are a major step forward. They allow for treatments tailored to a wound's genetic profile. These systems deliver both gene silencing and gene editing tools. They target the root causes of poor healing at the same time. This technology has great potential to transform wound care and dramatically improve repair.

Keywords:
Nanobiotechnology, Gene Silencing, Gene Editing, Wound Healing, siRNA, CRISPR Cas9

Code: wtrc12-00510161
Title:

Bioengineered Probiotic and Postbiotic Delivery Systems for Chronic Wound Healing: Advances in Hydrogels, Nanofibers, and Microneedle Patches

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Abstract:
Background: Advances in bioengineered wound dressings have opened new opportunities for integrating living and cell-free probiotic components into smart delivery platforms. Unlike conventional antimicrobial or growth-factor–based therapies, probiotic- and postbiotic-enabled biomaterials provide simultaneous microbiome restoration, immunomodulation, and targeted biofilm disruption. Recent developments in hydrogel scaffolds, electrospun nanofibers, and dissolving microneedle patches have demonstrated remarkable capability for stabilizing probiotic metabolites, protecting them from degradation, and enabling their controlled penetration across impaired or infected wound tissue. **Methods:** This work synthesizes recent research (2020–2025) investigating hydrogel matrices, electrospun nanofibers, and dissolving microneedle patches as carriers for probiotic strains or their bioactive metabolites. Studies were evaluated for their material composition, loading methods, release kinetics, stability profiles, and biological interactions. Mechanistic outcomes related to antioxidant activity, immune regulation, fibroblast migration, and biofilm disruption were compared across delivery platforms. **Results:** Evidence indicates that engineered probiotic delivery systems markedly enhance biological functionality compared to unprotected formulations. Hydrogel matrices improved metabolite stability and maintained optimal moisture at the wound interface, while nanofibrous scaffolds provided a high-surface-area architecture that enabled sustained diffusion, efficient metabolite adsorption, and intimate contact with the wound bed. In several study, probiotic-loaded nanofibers accelerated fibroblast migration, enhanced collagen deposition, and demonstrated superior biofilm inhibition due to their controlled release behavior. Microneedle patches further facilitated targeted deposition into deeper tissue layers. Collectively, these platforms reduced inflammatory mediators, suppressed MDR-associated pathogens, and promoted rapid re-epithelialization and neovascularization. **Conclusion:** Bioengineered delivery systems represent a promising advancement for translating probiotic and postbiotic therapeutics into effective wound treatments. By combining microbiological benefits with material-based precision release, these platforms address key limitations of free probiotic applications. Continued research into optimized formulations and clinical validation could establish these hybrid strategies as next-generation solutions for chronic wound care.
Keywords:
Probiotics, Postbiotics, Bioengineered Delivery Systems, Hydrogels, Nanofibers, Microneedle Patches, Chronic Wound Healing

Code: wtrc12-03410159
Title:

Harnessing Magnetic Metal–Organic Frameworks as Emerging Platforms for Smart Wound Dressings

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Abstract:
Background: Magnetic metal–organic frameworks (MMOFs) have recently gained attention as multifunctional materials for wound management. Chronic wounds, particularly those associated with infection and oxidative stress, continue to be a significant clinical challenge due to delayed tissue regeneration. Conventional wound dressings often lack a sustained antibacterial effect and the ability to effectively regulate the wound microenvironment. **Methods:** This study investigates the structural and functional properties of magnetic MOFs that enable antibacterial and regenerative applications. The analysis focuses on their catalytic activity, magnetic responsiveness, and tunable porosity, which together support controlled drug release, modulation of oxidative balance, and localized stimulation under external magnetic fields. Relevant scientific publications were reviewed to identify recent advances in the synthesis, characterization, and biomedical performance of magnetic metal–organic frameworks, with emphasis on their therapeutic mechanisms in wound healing. **Results:** Magnetic MOFs exhibit intrinsic antibacterial and antioxidant activities through metal ion release and enzyme-mimicking catalysis, including hydrogen peroxide decomposition and regulation of reactive oxygen species (ROS). These processes reduce inflammation, enhance oxygenation, and promote fibroblast proliferation and angiogenesis. Incorporating magnetic MOFs into hydrogels and electrospun matrices improves flexibility, moisture retention, and biocompatibility while enabling long-term therapeutic performance. **Conclusion:** Magnetic metal–organic frameworks offer a new generation of bioactive and magnetically responsive materials with combined antibacterial, antioxidant, and regenerative capabilities. Their customizable structure and potential for remote control make them promising platforms for the development of next-generation smart wound dressings that accelerate healing and improve patient outcomes.

Keywords:
Magnetic Metal–Organic Frameworks (MOFs), Wound Healing, Antibacterial, ROS Regulation, Angiogenesis, Smart Dressings

Code: wtrc12-03700158
Title:

Barriers to Effective Pressure Ulcer Management: A Meta-synthesis of Health care providers Perspectives

Authors:

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Abstract:
Background: Pressure ulcers (PUs) remain a widespread and costly healthcare concern, with over 2.5 million cases annually and treatment costs exceeding $26.8 billion in the United States. These injuries, caused by sustained pressure or shear forces, disproportionately affect vulnerable populations such as older adults, immobile individuals, and critically ill patients. Despite the existence of clinical guidelines and standardized risk assessment tools—including the Braden and Norton Scales—hospital-acquired PUs continue to compromise patient outcomes, prolong hospitalization, and increase mortality. While technological innovations such as AI-based analytics and pressure-mapping systems offer promising advances, their integration into routine care remains limited. Given the central role of healthcare professionals in PU prevention, understanding their perspectives is essential to identify barriers to early detection and prevention, and to bridge the gap between evidence-based recommendations and real-world practice. **Methods:** This meta-synthesis was conducted to explore healthcare professionals' perspectives on barriers to pressure ulcer prediction and detection. Eligible studies were selected using the Joanna Briggs Institute framework, focusing on qualitative or mixed-method designs involving nurses, physicians, and wound care specialists directly engaged in patient care. A systematic search was performed across six databases (PubMed, Scopus, Web of Science, Cochrane Library, ProQuest, and Google Scholar) from inception to August 1, 2024, using controlled vocabularies and free-text terms. Titles and abstracts were screened in Rayyan, followed by full-text review by two independent reviewers. Quality appraisal was conducted using the 10-item CASP Qualitative Checklist, with studies rated as Grade A or B. Data extraction followed the JBI-QARI protocol, capturing study characteristics and reported barriers. Thematic synthesis was used to identify and organize key patterns across studies. **Results:** The findings identified three primaries, interconnected thematic barriers to effective pressure ulcer (PU) prevention. First, Systemic and Organizational Constraints were paramount, characterized by critical resource limitations in equipment, funding, and staffing, which directly precluded proactive interventions. These were compounded by failures in guideline implementation and a workplace culture that often relied on unsustainable individual heroism rather than embedded systematic support. Second, Healthcare Worker Cognition-Affect Barriers presented significant barriers, including substantial knowledge and skill deficits among staff, alongside prevalent misconceptions and a widespread tendency to deprioritize PU prevention in daily practice due to complacency or competing priorities. Third, Interprofessional Collaboration and Communication Barriers were critically hindered by role ambiguity, fragmented accountability, and systematic failures in documentation and clinical handoffs, which were further exacerbated by patient-mediated factors such as resistance to care and complex family dynamics. Collectively, these barriers reveal that PU prevention is persistently undermined by a complex interplay of structural, cognitive, and relational factors across healthcare settings. **Conclusion:** This study demonstrates that the failure to prevent PUs is not due to a lack of knowledge about best practices, but rather stems from a complex, multi-level interplay of systemic, cognitive, and collaborative barriers. The findings suggest that even well-intentioned individual efforts are consistently thwarted by entrenched organizational constraints such as understaffing, resource scarcity, and a culture that prioritizes reactive heroism over proactive, systematic support. Consequently, effective and sustainable PU prevention requires a paradigm shift from focusing solely on individual nurse competency to implementing integrated, system-wide solutions. This necessitates strategic investment in staffing and equipment, organizational reforms that embed evidence-based guidelines into daily workflow and accountability structures, and interdisciplinary initiatives aimed at enhancing role clarity, communication, and a shared sense of responsibility. Ultimately, addressing this multifactorial challenge is imperative for improving patient safety and advancing the quality of care across healthcare settings.

Keywords:
Pressure Ulcer, Qualitative Research, Healthcare Systems, Meta synthesis

Code: wtrc12-03750157
Title:

Successful Management of a Full-Thickness Parieto-occipital Scalp Wound Following Basal Cell Carcinoma Excision Using Negative Pressure Wound Therapy and Skin Graft: A Case Report

Authors:

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Abstract:
Background: Scalp wounds with exposed bone are challenging to manage, especially in elderly patients with comorbidities. Objective: To report a case of successful wound healing using negative pressure wound therapy (NPWT) directly over exposed skull bone. **Methods:** A 69-year-old man with diabetes, anemia, and chronic kidney disease on hemodialysis developed a full-thickness parieto-occipital scalp defect after basal cell carcinoma excision. NPWT was applied directly over the exposed calvarial bone. **Results:** After two months of NPWT, granulation tissue formed over the bone, allowing for successful split-thickness skin grafting. Complete wound healing was achieved. Conclusion. **Conclusion:** NPWT can be safely and effectively applied over exposed skull bone to promote granulation and enable grafting in complex scalp wounds.
Keywords:
Basal Cell Carcinoma, Scalp Wound, Exposed Bone, Negative Pressure Wound Therapy, Skin Graft.

Code: wtrc12-03700156
Title:

Photoplethysmography-Based Prediction of Pressure Injuries: A Step Toward Proactive Wound Management

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Abstract:

Background: Pressure ulcers represent a prevalent and preventable complication arising from immobility or limited mobility, particularly among hospitalized and long-term care patients. Their development not only compromises patient safety and quality of life but also imposes substantial financial burdens on healthcare systems worldwide. Consequently, proactive prevention and timely detection of pressure ulcers have become critical priorities in both acute and chronic care settings. Nurses play a pivotal role in implementing evidence-based strategies to mitigate these risks, as early identification and intervention can significantly reduce associated morbidity, healthcare costs, and resource utilization. **Methods:** This study presents a portable, non-invasive device developed to facilitate early prediction of pressure ulcers through photoplethysmography (PPG). PPG is an optical sensing technique grounded in the Beer–Lambert law, which describes the relationship between light absorption and the concentration and path length of the absorbing medium. The device integrates four green LEDs arranged on a panel, positioned approximately one centimeter above the skin surface. Upon activation, the emitted light penetrates the tissue and interacts with hemoglobin within circulating erythrocytes. The intensity of the reflected light, modulated by local tissue oxygenation, is detected by optical sensors placed opposite the LEDs and subsequently processed by an embedded microprocessor. **Results:** The device provides a portable and cost-effective means for periodic assessment of pressure-prone areas by estimating tissue oxygenation through reflected light analysis. Using photoplethysmography signals modulated by hemoglobin in circulating erythrocytes, it detects perfusion changes indicative of early vascular compromise. Based on this physiological model, the device classifies the risk of pressure ulcer development into four clinically meaningful categories. A saturation level above 94% (PaO_2: 80–100 mmHg) indicates normal tissue oxygenation and no risk. Saturation between 90–94% (PaO_2: 60–79 mmHg) reflects mild hypoxia and low risk. Values ranging from 75–89% (PaO_2: 40–59 mmHg) suggest moderate hypoxia and moderate risk. Saturation below 75% (PaO_2 < 39 mmHg) corresponds to severe hypoxia and high risk. These results are displayed on an LCD screen using intuitive color-coded alerts, allowing caregivers to make timely, informed decisions to prevent ulcer progression. **Conclusion:** This device has practical applications across a range of healthcare settings and can be effectively utilized by clinicians—including physicians and nurses—in hospitals, rehabilitation centers, and long-term care facilities to monitor the progression or improvement of pressure ulcers in patients with restricted mobility. Target populations include elderly individuals, patients admitted to intensive care units, persons with physical disabilities, veterans, and individuals with neurological impairments who remain bedridden for extended periods. Furthermore, the device is suitable for use in home care environments by trained caregivers and family members. It can be integrated into routine care activities such as patient repositioning or bathing, enabling real-time assessment of pressure-prone areas. Upon detection of early warning signs indicating compromised tissue perfusion, the caregiver can promptly intervene to offload pressure from the affected site and initiate continuous monitoring. This proactive approach facilitates timely preventive measures, thereby reducing the incidence and severity of pressure ulcers and improving overall patient outcomes.

Keywords:
Pressure Ulcer, Photoplethysmography, Pressure Ulcer Management

Code: wtrc12-00770153
Title:

Adjunctive Hyperbaric Oxygen Therapy for Post-Sternotomy Deep Sternal Wound Infection, Mediastinitis, and Sternal Osteomyelitis after Cardiac Surgery: A Scoping Review

Authors:

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Abstract:
Poststernotomy deep sternal wound infection (DSWI), mediastinitis and sternal osteomyelitis are uncommon but devastating complications of cardiac surgery and are associated with substantial morbidity, mortality and resource use. Hyperbaric oxygen therapy (HBOT) is increasingly considered an adjunctive intervention for complex surgical infections, but its role in poststernotomy DSWI and mediastinitis has not been systematically mapped. Methods We conducted a scoping review following the guidance of the Joanna Briggs Institute and reported the results according to the PRISMA-ScR. MEDLINE, Embase, Cochrane CENTRAL and CINAHL were searched from 1 January 1999 to 10 November 2025 for studies evaluating adjunctive HBOT in poststernotomy DSWI, mediastinitis or sternal osteomyelitis after cardiac surgery. Adult and pediatric populations and relevant experimental mediastinitis models were eligible. Two reviewers independently screened records, selected studies and extracted data. Methodological quality was appraised via the ROBINS-I for nonrandomized cohorts, the NIH tools for case series/reports and the SYRCLE tool for animal studies. Given the substantial degree of clinical and methodological heterogeneity, the findings were synthesized narratively. Results Ten studies met the inclusion criteria: five adult clinical cohorts/series, one pediatric cohort, two case reports and two MRSA mediastinitis rat models (127 adults, 53 pediatric patients and 103 animals). HBOT was used as an adjunct to guideline-directed multimodal management, typically at 2.0–2.5 atmospheres absolute for 60–90 minutes per session, over 10–40 sessions. Some adult nonrandomized cohorts reported fewer infectious relapses and shorter hospital stays with HBOT, and animal models suggested enhanced bacterial clearance and survival when HBOT was combined with antibiotics. However, all the human studies were observational, small and judged to be at overall serious to critical risk of bias, precluding robust estimates of effects. Conclusions Current evidence for adjunctive HBOT in poststernotomy DSWI, mediastinitis and sternal osteomyelitis is limited to low-certainty observational and preclinical data. HBOT may be considered only as an individualized adjunct in selected refractory or anatomically complex cases in centers with existing HBOT infrastructure, but its routine use cannot be recommended. High-quality multicenter prospective comparative studies, supported by registries, translational work and cost-effectiveness analyses, are needed to define the true clinical value of HBOT in this setting.

Keywords:
Hyperbaric Oxygen Therapy, Deep Sternal Wound Infection, Mediastinitis, Cardiac Surgery, Sternal Osteomyelitis, Scoping Review

Code: wtrc12-03670152
Title:

The Effect of Virtual Social Network-Based Pressure Ulcer Prevention Training on Knowledge, Attitude, and Practice of Nurses in Inpatient Wards

Authors:

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Abstract:

Background: Pressure ulcer is a tissue injury caused by pressure, affecting the skin, muscle, connective tissue, cartilage, and bone. It is a painful and disabling process that puts the patient's health at risk by increasing mortality, morbidity, length of hospitalization, infection rates, and the need for surgical interventions. Pressure ulcers compromise patient safety. Prevention remains a major challenge for nurses. Inadequate knowledge and practice among nurses can potentially be addressed by electronic education, particularly through virtual social networks. The present study aimed to determine the effect of virtual social network-based pressure ulcer prevention training on the knowledge, attitude, and practice of nurses in inpatient wards of Shahid Sadoughi and Shahid Rahnemoon hospitals. **Methods:** This single-group pre-test/post-test study was conducted from April to November 2025 in two educational hospitals, using continuous sampling on 300 nurses. Three nurses were excluded due to incomplete questionnaires, and four withdrew from the study. Demographic, knowledge, attitude, and practice questionnaires were completed before and after the intervention. Educational content was shared over five weeks via WhatsApp, including short texts, audio, animations, images, and videos. Data were analyzed by paired t-test using SPSS version 22, with a significance level set at <0.05. **Results:** The mean knowledge score before intervention was 74.47 ± 13.67, and after intervention was 82.70 ± 11.20; this difference was significant ($P < 0.001$). The percentage of nurses with a positive attitude was 61.6% before and 56.5% after the intervention. There was no significant difference in attitude before and after intervention ($P = 0.546$). Prior to intervention, 82.1% of nurses had poor practice; after intervention, 64.5% had poor practice and 36.5% had good practice. This change was not statistically significant ($P = 0.540$). **Conclusion:** Training through social networks increased nurses' knowledge about pressure ulcer prevention, but yielded no significant change in their attitude and practice. Considering the lack of change in attitude and practice, it is recommended to combine this educational method with contemporary technologies, provide repeated and ongoing training sessions, supplement with face-to-face practical instruction, and utilize patient safety strategies to improve nurses' knowledge, attitudes, and practices in pressure ulcer prevention. This method is suggested for broader application in professional nursing domains.

Keywords:
Knowledge, Attitude, Practice, Education, Pressure Ulcer, Bedsore, Virtual Social Network

Code: wtrc12-03670151

Title:

Investigating the Level of Knowledge and Attitude of Pressure Ulcer Prevention among the Treatment Team

Authors:

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Abstract:
Background: Pressure ulcer is one of the serious complications of hospitalization in healthcare centers that increases the burden on caregivers, morbidity and mortality of patients, frequency and duration of hospitalization, reduces the quality of life and functional independence, and increases pain and suffering of patients. Therefore, the present study was conducted with the aim of investigating the level of knowledge and attitude of pressure ulcer prevention among members of the treatment team at Shahid Sadoughi Hospital, Yazd. **Methods:** This research was a cross-sectional descriptive study carried out in 2025 at Shahid Sadoughi Hospital, Yazd, Iran. Demographic information related to 280 members of the treatment team working at Shahid Sadoughi Hospital was collected through a full census over a period of 9 weeks, using the Piper Pressure Ulcer Prevention Knowledge Test (PPUKT) and the Beckman Pressure Ulcer Prevention Attitude Tool (APUP). The collected data were analyzed using SPSS version 28 with Chi-square and independent t-tests at a significance level of 0.05. **Results:** The majority of the treatment team members were women (77.6%), aged over 30 years (54.3%), had a bachelor's degree (56.8%), had more than 5 years of clinical experience (64.8%), and 80% did not have a history of attending pressure ulcer training courses. The average knowledge score of team members was weak (54.87) and the attitude score was favorable (75.04). Findings showed no significant relationship between knowledge and attitude with gender, age, education level, and clinical work experience. However, a significant relationship was found between knowledge and attitude with a history of attending pressure ulcer training courses. **Conclusion:** Based on the results of this study, treatment team members had weak knowledge but favorable attitude. Given the weak knowledge, it is recommended that nursing managers plan continuous educational programs and practical workshops on pressure ulcer prevention to improve knowledge levels among team members.

Keywords:
Pressure ulcer, Knowledge, Attitude, Treatment team

Code: wtrc12-03550150
Title:

Image-Based Artificial Intelligence in Diabetic Foot Ulcer Management: A Narrative Review

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Abstract:
Background: Diabetic foot ulcer (DFU) is a common chronic complication of diabetes that can lead to limb amputation. Early detection, accurate assessment, and continuous monitoring of wound healing are key to reducing complications and improving patient care. Image-based artificial intelligence (AI) technologies have emerged as innovative tools for the diagnosis, evaluation, and management of diabetic foot ulcers. This study aimed to review the role of these technologies in DFU care. **Methods:** This study was designed as a narrative review. Relevant articles were searched in PubMed, Scopus, and Google Scholar using the keywords "diabetic foot ulcer", "image-based artificial intelligence", and "wound management" for publications between 2020 and 2025. In the initial search, 73 studies were identified. Inclusion criteria encompassed studies that addressed the application of artificial intelligence in the diagnosis, assessment, measurement, classification, infection prediction, and monitoring of wound healing. After the final screening, 10 eligible studies were selected and analyzed. Data were extracted and synthesized according to the main themes related to the application of artificial intelligence in diabetic foot ulcer care. **Results:** The review demonstrated that image-based AI plays a significant role in DFU care. These technologies enable early identification of at-risk patients and improve assessment and monitoring by precisely delineating wound location and boundaries. AI algorithms can analyze wound characteristics and severity, accurately measure wound dimensions, and classify wounds according to clinical standards. Moreover, these systems facilitate monitoring of granulation tissue and wound healing progression, identify adverse skin changes such as maceration, and assist in the prediction and detection of wound infections. Collectively, these capabilities enhance the accuracy and efficiency of DFU care and support optimized clinical decision-making. **Conclusion:** Image-based AI represents a novel tool with the potential to improve the quality of diabetic foot ulcer management. By providing precise assessment, early detection, infection prediction, monitoring of healing progression, and identification of risk factors, these technologies can contribute to reduced complications and prevention of amputation. However, AI-based systems are still in early developmental stages, largely not implemented in clinical practice, and face several limitations. Successful integration into clinical care requires adequate training, standardization of imaging protocols, and development of clinical guidelines to ensure safe and effective use of AI.
Keywords:
Image-Based Artificial Intelligence, Diabetic Foot Ulcer, Wound Management

Code: wtrc12-03630149
Title:

Experimental Evaluation of Self-Healing Multi-Network Hydrogel Containing Chitosan Nanoparticles for Improved Healing of Infected Wounds

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Abstract:
Background: Infected wounds, due to the presence of drug-resistant bacteria and chronic inflammation, are considered one of the major challenges in veterinary and medicine and translational care. Conventional treatments, such as topical antibiotics and passive dressings, often show limited efficacy in controlling infection and accelerating tissue regeneration. The development of smart biomaterials like self-healing hydrogels could offer an innovative solution to overcome these limitations. Chitosan nanoparticles (CSNPs), with their potent antibacterial activity, high biocompatibility, and capacity to stimulate tissue repair, are a suitable option for enhancing the performance of such systems. The objective of this research was to synthesize and experimentally evaluate a self-healing multi-network hydrogel containing CSNPs for infection control and improved healing of infected wounds. Materials and **Methods:** The multi-network hydrogel (MNH) was prepared by combining Polyvinyl Alcohol (PVA) and Sodium Alginate (SA) via a freeze-thaw process followed by ionic cross-linking with $CaCl_2$. Chitosan nanoparticles (CSNPs) were synthesized using the ionic reduction method with an)average size of 40–60 nm (and were incorporated into the polymer network at concentrations of 0.5, 1, and 2 weight percent)wt%(. FTIR and SEM tests were employed to investigate the chemical bonds and surface morphology. Water absorption capacity and swelling properties were evaluated across a range of pH environments (5.5 to 8). The antibacterial activity was measured using the disk diffusion method against Staphylococcus aureus and Escherichia coli. In the animal model, full-thickness infected wounds were created on the dorsum of male BALB/c laboratory mice, and the animals were divided into three groups: Control, Base Hydrogel, and Hydrogel containing 1% CSNPs. Healing indices, including percentage of wound closure, granulation tissue formation, and collagen density, were assessed on days 7 and 14 and analyzed using the ANOVA test. **Results:** Characterization: FTIR results confirmed the presence of hydrogen bonds between the PVA and alginate chains, as well as the characteristic amine groups of chitosan. SEM images revealed a uniform porous structure with a mean pore diameter of 80–100 µm. Antimicrobial Efficacy: The hydrogel containing CSNPs showed a significant increase in the zone of inhibition diameter against S. aureus)24±2 mm) and E. coli)21±1 mm) compared to the control group (10±1 mm) ($p<0.05$). Self-Healing Property: The self-healing test demonstrated that the damaged sample recovered 92% of its initial strength within 4 minutes. In the animal model, the treatment group with the CSNP-loaded hydrogel exhibited a 75% reduction in wound size by day 14 compared to the control. Histopathological studies indicated increased fibroblast density, reduced inflammation, and organized epithelial regeneration. **Conclusion:** The self-healing multi-network hydrogel containing chitosan nanoparticles successfully provided an optimal environment for the healing of infected animal and human wounds by combining antimicrobial properties, biocompatibility, and mechanical responsiveness. This system led to a reduction in the microbial load, improved tissue organization, and accelerated epithelialization. The findings suggest that this biomaterial can be introduced as a new generation of smart dressings in veterinary care and translational medicine. Future studies should focus on safety evaluation in larger animal models and optimization of the nanoparticle concentration.

Keywords:
Multi-Network Hydrogel, Chitosan Nanoparticles, Infected Wound, Smart Biomaterial

Code: wtrc12-01450148
Title:

Acupuncture: A Targeted Therapeutic Strategy for Wound Healing

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Abstract:

Background: Wound healing is a complex process involving inflammation, cell proliferation, and tissue remodeling. Acupuncture has emerged as a complementary therapy, potentially enhancing blood flow, modulating inflammation, and promoting growth factor activity. **Methods:** A systematic review of studies published between 2015 and 2024, including both animal and clinical research, was conducted. Data were analyzed based on wound type, acupuncture points, biological mechanisms, and healing outcomes. **Results:** Stimulation of points such as ST36, SP6, LI4, BL40, and CV6 improved local circulation, activated fibroblasts and mesenchymal stem cells, and regulated inflammatory responses. Clinical evidence demonstrated faster wound closure, improved tissue quality, and reduced chronic inflammation. **Conclusion:** Acupuncture exerts beneficial local and systemic effects on wound healing and may serve as an effective complementary therapy. Standardized protocols and long-term studies are required to confirm its broad clinical applicability.

Keywords:

Wound Healing ،Growth Factors ،Meridian Points ،Complementary Therapy

Code: wtrc12-03570147
Title:

Successful Management of Non-healing Ischemic Wound in a Child with Severe Congenital Hypoplasia of the Lower Limb Arteries: A Case Report

Authors:

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Abstract:
Background: Although the congenital hypoplasia of lower extremities' major arteries are exceedingly rare conditions with limited documented cases in literature, it must be considered as a possible cause of arterial insufficiency, retarded leg growth, ulceration, and necrosis. On the other hand, all of reported cases focused only on surgical intervention for limb ischemia and claudication treatment but no study has mentioned occurrence of ischemic wounds and its management. Therefore, in this study, we aim to focus on this aspect through reporting management of non-healing ischemic wound even after reconstructive vascular surgery in a complicated case of congenital hypoplasia of lower limb arteries. Methods and materials: This case is reported in line with the SCARE 2025 criteria. **Case Presentation:** Our patient is a 13-year-old girl with notable muscle atrophy, claudication, and complete lack of movement in left leg along with non-healing infectious ischemic wound covered with dry-adherent eschar and exposed bone on heel and lateral malleolus, severe pain (8 score in VAS), and unpleasant odor for 2 years. Through assessment via color doppler sonography and multi-slice spiral CT-angiography of abdominal aorta and lower limbs' arteries depicts hypoplastic and narrow arteries with reduced monophasic flow pattern from external-iliac artery in left leg. Unfortunately, performing vascular-reconstructive surgery, surgical-debridement, and grafting followed by advanced dressing and NPWT did not result in obvious signs of wound-healing within 2-year period although collateral arteries formation in left popliteal fossa was observed. Thus, this patient was referred to our clinic. After holistic assessment, according to patient agitation and reluctance to operation, autolytic debridement with Chitosan-gel, Sorbact gel-sheet besides gradual added fibrinolysin-cream in every-other-day sessions was considered subsequent to cleansing with iodine-povidone 1%. Wound-bed preparation was conducted meticulously and patiently (18 sessions). Exposed part of calcaneus also was preserved via using wet dressing. Then, activated collagen powder and vitamin A ointment were applied until wound got closed (32 sessions: in this phase patient referred to clinic every 4-5 days). It is worth-mentioning photo-biomodulation therapy (PBMT) were used in all treatment-sessions as well. **Results:** Gradual wound-bed preparation for this patient was appropriate (tolerable with no harm) and adding fibrinolysin enhanced this process exceptionally through facilitating detachment of all resistant necrotic tissues. Chitosan (dressing) and iodine povidone (cleansing) were significantly worthwhile in microbial load reduction and collagen could create granulation and re-epithelialized tissues in ischemic wound. An interesting point is revealing extended collateral network with slightly enhanced perfusion in left leg by repeated CT-angiography after this course management that can be attributed to PBMT. **Conclusion:** This case underscores the important role of wound specialists in addressing complex condition even if main recognized methods failed. Furthermore, positive effects of fibrinolysin application for detachment of resistant adherent necrotic tissues and using PBMT to enhance peripheral perfusion in non-healing ischemic wounds are illustrated. So, it is suggested future research uses this technique in a more solid design to assist in developing suitable guidelines for prevention and management of similar cases.
Keywords:
Hypoplasia In Limb Artery, External Iliac Artery Hypoplasia, Ischemic Wound, Non-Healing Wound

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Code: wtrc12-03610144
Title:

Therapeutic Performance of Alginate Hydrogel Incorporated with Losartan in Wound Recovery and Gene Expression Control

Authors:

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Abstract:

Background: The regeneration of damaged skin remains a central challenge in tissue engineering, prompting the search for bioactive materials that can both protect and facilitate healing. Among various biomaterials, hydrogels hold particular promise for wound coverage due to their high moisture content, non-toxicity, and tunable physical characteristics. Sodium alginate, a naturally derived polysaccharide, is widely applied in medical formulations because of its biocompatibility and ability to form stable hydrogels. Losartan, an angiotensin II receptor type 1 (AT1R) blocker, has demonstrated anti-fibrotic potential by modulating TGF-β1 signaling. Integrating losartan into alginate-based scaffolds could thus create a multifunctional dressing that supports wound closure while regulating fibrogenic gene expression. **Methods:** Three-dimensional porous hydrogels were synthesized by ionic crosslinking of sodium alginate with calcium chloride ($CaCl_2$). Losartan was incorporated into the hydrogel matrix at concentrations of 0.01, 0.1, 1, and 10 mg/mL to achieve sustained drug release and effective exudate absorption. The physicochemical characteristics of the prepared scaffolds—including morphology, degradation behavior, swelling ratio, rheological properties, and chemical composition—were systematically examined. Biocompatibility was assessed through hemolysis, cytotoxicity, and in vitro cell proliferation assays. Furthermore, in vivo bioperformance was examined using a full-thickness excisional wound model in adult male rats, followed by RT-PCR and immunohistochemical analyses to assess TGF-β1 and VEGF expression. **Results:** The fabricated hydrogels exhibited a highly porous and interconnected microstructure, with an average pore size of approximately 47 μm and a biodegradation rate of nearly 61% over two weeks. The scaffolds maintained structural integrity under different conditions, and $CaCl_2$ crosslinking significantly increased their viscosity. Cellular compatibility tests confirmed that the hydrogel formulations did not induce cytotoxicity, though elevated losartan concentrations were associated with mild hemolytic effects. In vivo, wounds treated with alginate hydrogel containing 0.1 mg/mL losartan showed over 80% closure after 14 days, along with visibly reduced scar formation. Molecular evaluation revealed downregulated expression of TGF-β1 and VEGF in treated tissues, indicating reduced fibrosis and enhanced tissue remodeling. **Conclusion:** Alginate-based hydrogels incorporating losartan effectively support dermal repair by enhancing wound contraction and modulating key fibrogenic mediators. These findings emphasize the therapeutic potential of losartan-loaded alginate scaffolds as innovative wound dressings for accelerating skin regeneration and minimizing scarring.

Keywords:
Angiotensin Blocker, Biomaterial, Drug Delivery, Fibrosis, Tissue Regeneration, Scarring

Code: wtrc12-03440143
Title:

Investigating the Local Effect of Silver Sulfadiazine and Glucosamine on Burn Wounds Caused by a Hot Plate in White Laboratory Mice

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Abstract:
Background: Burn injury is one of the common injuries, often accompanied by complications such as infection, chronic inflammation, and delayed tissue repair. Different topical medications have been used in order to prevent infections or accelerate the healing process. Silver sulfadiazine (SSD) is a well-known antimicrobial compound, whereas glucosamine, due to its anti-inflammatory properties and its ability to enhance tissue regeneration and modulate excessive inflammatory responses, has been introduced as a promising candidate in wound healing. The present study aimed to investigate the topical effects of SSD and glucosamine, individually and in combination, on the healing process of burn wounds induced by a hot plate in male BALB/c mice. **Methods:** This study was performed on 16 male BALB/c mice (8–10 weeks old, 28–32 g). Animals were randomly divided into four groups: (1) Control (Vehicle), (2) SSD (1%) topical treatment, (3) Glucosamine (2%) topical treatment, and (4) SSD + Glucosamine combination treatment. Burn wounds were induced using a hot plate (100°C for 10 seconds). Treatments were applied daily up to day 22, and wound area measurements were performed on days 1, 3, 5, 7, 10, 14, and 22 using ImageJ software. Data were analyzed using the Repeated-Measures ANOVA model and complementary statistical tests. **Results:** The Repeated-Measures ANOVA model revealed that time had a significant effect on reducing wound area ($p<0.001$), reflecting the natural healing process over time. The interaction between time and treatment group was statistically significant ($F = 501.56$; $p=0.001$), indicating differences in healing patterns among groups throughout the study period. However, pairwise differences among the treatment groups across the 22 days did not reach statistical significance. In all treated groups, the greatest wound contraction was observed between days 10 and 14. During this interval, the Glucosamine + SSD combination demonstrated the fastest and most pronounced healing response ($p < 0.001$), and pairwise comparisons with the other three groups were statistically significant. Although the final wound areas on day 22 were not statistically different among groups, this convergence likely reflects the natural endpoint of the healing process. **Conclusion:** The findings indicate that the topical combination of SSD and Glucosamine exerts a synergistic and accelerating effect on burn wound healing during the intermediate stages of recovery. Although final differences diminished by day 22, mid-phase results suggest a meaningful therapeutic potential for this combination in enhancing both the speed and quality of wound repair. To our knowledge, it is the first time using Glucosamine and SSD combination therapy, so further studies with larger sample sizes and extended follow-up periods are recommended to confirm these outcomes.

Keywords:
Burn, Silver Sulfadiazine, Glucosamine, Wound Healing, BALB/c_mice

Code: wtrc12-02480142
Title:

The Succinate Axis in Wound Healing: A Dual-Role Metabolite from Immunomodulation to Biomaterial Application

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Abstract:
Background: Succinate, a classical TCA cycle intermediate, has recently been shown to function as an important signaling molecule during wound healing. Apart from its role in metabolism, it accumulates at sites of wound where it controls immune functions and affects migration of cells as well as tissue repair. Its mode of action is not a straightforward and is different in each phase of the wound healing process, which really makes it a very exciting molecule to investigate further. **Methods:** A comprehensive analysis was performed on 5 pivotal articles on succinate signaling and its potential therapeutic use in wound healing. The literature was subdivided into mechanistic research (i.e., GPR91/SUCNR1 activation, SDH inhibition, HIF-1α stabilization) and translational research (e.g., succinate-based polymers and hydrogels). **Results:** Literature findings show that the impact of succinate on wound healing can be distilled into three key themes. First, succinate signaling through GPR91 is essential to macrophage function promoting necessary pro-inflammatory mechanisms with potential to impair healing in diabetic wounds when dysregulated. Inhibiting succinate dehydrogenase (SDH) activity by the cell-permeable analogue dimethyl malonate (DMM) results in macrophage repolarization towards the pro-healing M2 phenotype, inflammation resolution. Second, succinate acts as a potent chemoattractant, accelerating stem cell migration via a GPR91-DRP1-mtROS axis and fostering angiogenesis through SUCNR1-mediated VEGF upregulation. Third, succinate stabilizes HIF-1α through inhibition of PHD2 and by promoting metabolic rewiring through PDK4. In addition, the succinate dictation of biomaterials enhances the wound closure via increasing antibacterial activity, moisture retention, and hemostasis. This has been demonstrated in various systems including chitosan-grafted pullulan succinate, polybutylene succinate, and succinic ester-based sponges. Degradable succinate-based hydrogels also promote regeneration by directly supplying energy to cells, boosting bioenergetics. **Conclusion:** Succinate sits at the intersection of metabolism and repair during wound healing. It functions as a double-edged sword: its precise signaling is essential for coordinated repair, but its dysregulation contributes to chronicity. Modulation of the succinate pathway, either through pharmacological interventions targeting GPR91/SDH or by its innovative integration into bioenergetic biomaterials, holds great potential as a novel therapeutic approach for the treatment of acute and chronic wounds. Modulation of the succinate axis, either through pharmacological interventions targeting GPR91/SDH or by its innovative integration into bioenergetic biomaterials, holds great potential as a novel therapeutic approach for the treatment of acute and chronic wounds.

Keywords:
Succinate, Wound healing, GPR91, Immunomodulation, Biomaterials

Code: wtrc12-03560141
Title:

Revolutionizing Palliative Care: The Role of Negative Pressure Wound Therapy in Managing Malignant Wounds

Authors:

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Abstract:

Background: Malignant wounds, often found in patients with advanced cancer, present significant challenges in wound healing and patient comfort. Negative pressure wound therapy (NPWT) has emerged as a potential treatment for these wounds, particularly in palliative care settings. This review aims to assess the evidence for the use of NPWT in malignant wounds, focusing on its benefits in improving wound healing, reducing pain, and enhancing the overall quality of life for patients. **Methods:** This study was conducted based on Cochrane systematic review principles and PRISMA guidelines. A comprehensive search was performed using English and Persian keywords related to "malignant wound," "negative pressure wound therapy," "palliative care," and "wound healing" across PubMed, Scopus, EMBASE, CINAHL, Web of Science, Cochrane Library, as well as SID and Magiran. Grey literature was also examined through Google Scholar. No time restrictions were applied during the search. Inclusion criteria consisted of case reports and studies evaluating the effects of NPWT in malignant wounds. Duplicates, systematic reviews, non-relevant articles, opinion papers, and studies lacking primary data were excluded. Screening and data extraction were independently conducted by two researchers, with discrepancies resolved by a third researcher. Study quality was assessed using the ROB 2 and ROBINS-I tools, and extracted data were systematically organized and entered into summary tables. **Results:** A total of 765 articles were identified, with 14 studies including 22 patients meeting the eligibility criteria. The mean age of the patients was 60.7 years. The malignant wounds were located in various areas: five on the scalp, three in the anogenital area, and the remaining on the trunk and extremities. NPWT demonstrated significant benefits, including enhanced wound healing through improved blood flow and reduced edema, leading to faster granulation and tissue regeneration. It also controlled exudation, reduced infection risk, and provided pain relief by alleviating pressure around the wound. Additionally, NPWT reduced malodour, a common issue in palliative care, and facilitated transitions to homecare for several patients. In some cases, NPWT made patients eligible for further treatments, such as surgical interventions. **Conclusion:** The findings suggest that negative pressure wound therapy (NPWT) is an effective palliative treatment for malignant wounds, significantly improving wound healing, reducing exudation and malodour, and providing pain relief. Additionally, NPWT facilitated transitions to home care for several patients and, in some cases, allowed for further treatment options. Despite these promising results, more robust studies are needed to evaluate the long-term efficacy of NPWT in malignant wounds and to establish standardized treatment protocols.

Keywords:
Malignancy; Malignant Wound; Negative Pressure Wound Therapy; Palliative Care; Wound Dressing.

Code: wtrc12-03560140
Title:

Wound Care Interventions for Fungating Breast Wounds: A Systematic Review of Effectiveness and Outcomes

Authors:

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Abstract:
Background: Fungating breast wounds cause significant physical and emotional distress for patients. Effective wound care is crucial, but there is currently no standardized tool to evaluate treatment outcomes, and practices vary across institutions. This review aims to assess the effectiveness of different wound care methods in addressing key complications and improving patient well-being. **Methods:** This review followed the principles of systematic review and PRISMA guidelines. A thorough search was conducted using relevant keywords related to "fungating breast wounds," "wound care," "Wound complications," "Dressing," and "quality of life" in databases including PubMed, Embase, Scopus, and Cochrane Library. Additional grey literature was retrieved through Google Scholar. Inclusion criteria consisted of randomized controlled trials and quasi-experimental studies that evaluated the effects of various wound care methods on the complications of fungating breast wounds. Excluded were case reports, opinion papers, and studies lacking primary data. Data screening and extraction were independently performed by two researchers, with discrepancies resolved by a third researcher. The quality of the included studies was assessed using appropriate tools, and extracted data were organized into summary tables for analysis. **Results:** A total of 235 records were identified through database searching. After removing duplicates and applying eligibility criteria, 8 studies involving 188 patients were included in the review. These studies investigated the effects of various wound care interventions, including calcium alginate, hydrocellular dressings, metronidazole, silver sulfadiazine, and honey-based dressings. The outcomes evaluated included bleeding, malodour, exudates, pain, wound size, infection rates, emotional well-being, and quality of life. The results indicated that silver-based and honey dressings were particularly effective in reducing complications such as malodour, bleeding, and pain. Calcium alginate and hydrocellular dressings were effective in managing exudates and promoting wound healing. Additionally, honey-based dressings showed a positive impact on infection rates and wound size reduction. Emotional well-being and quality of life improved in patients treated with these wound care methods, with some studies reporting significant improvements in overall patient outcomes. **Conclusion:** Various wound care methods, especially silver-based and honey dressings, effectively reduce complications such as malodour, bleeding, and pain, while improving wound healing and quality of life. However, the lack of standardized treatment protocols remains a challenge. Further research is needed to develop evidence-based guidelines for managing fungating breast wounds.

Keywords:
Fungating breast wound, Wound care, Wound complications, Dressing, Quality of life.

Code: wtrc12-03350139
Title:

Management of a Post-Traumatic Open Wound Using Advanced Wound Care Techniques: A Case Report

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Abstract:
Background: A 32-year-old male presented with a large right flank hematoma measuring approximately 50 × 30 cm following a fall into a maintenance pit. The patient sustained significant trauma to the right lateral abdominal region. Initial management was performed by a general surgeon, including vascular repair. However, the wound site required further care due to infection risk and hematoma formation. Such wounds can rapidly increase the risk of mortality due to infection and therefore require prompt and accurate intervention. **Methods:** Guidance was provided regarding wound care, safe mobilization, and a gradual increase in physical activity to enhance tissue granulation after initial bleeding and discharge were controlled. Intramuscular and intravenous antibiotics were administered as prescribed by the attending physician. The patient was instructed to take a short shower approximately 30 minutes before each dressing change to maintain hygiene and soften wound debris. Education on proper nutrition, emphasizing fruits and vegetables, was given to promote wound healing. After irrigation and cleansing of the wound, advanced dressings were applied at each treatment session following biophysical therapy. **Results:** A gradual change in hematoma color was observed over six days, attributed primarily to biophysical therapy and advanced dressings. Complete hematoma resolution occurred by October 3, 2025, and granulation tissue formation was evident by October 12, 2025. The wound showed consistent contraction and epithelialization throughout the follow-up period, with no signs of infection. **Conclusion:** This case highlights the effectiveness of a multimodal wound care approach combining biophysical therapy, mechanical debridement, and nutritional optimization in managing complex post-traumatic open wounds. The collaborative efforts of a skilled wound specialist and structured home nursing care led to accelerated healing, infection prevention, and improved patient comfort.

Keywords:
Biophysical Therapy, Wound Healing, Advanced Dressing

Code: wtrc12-02800138
Title:

The Effect of Plasma Gel Containing Curcumin Nanoemulsion and Piperine Nanoemulsion on the Healing of Diabetic Lower Limb Ulcers:

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Abstract:

Diabetic foot ulcers are among the most serious and challenging complications of diabetes mellitus, often leading to chronic infections, prolonged hospitalization, and even limb amputation. The delayed healing observed in diabetic wounds is primarily due to impaired angiogenesis, persistent inflammation, oxidative stress, and reduced cellular proliferation and migration within the wound site. Consequently, the development of innovative therapeutic strategies to enhance tissue regeneration in diabetic patients is of significant clinical importance. A promising approach involves the use of platelet-rich plasma (PRP) gel in combination with nanotechnology-based bioactive compounds. PRP serves as a biological reservoir of essential growth factors that promote fibroblast proliferation, collagen synthesis, and neovascularization, thereby accelerating wound repair. However, the short biological half-life and rapid degradation of these growth factors within the wound microenvironment can limit their effectiveness. To address this limitation, incorporating nanoemulsion formulations containing bioactive compounds such as curcumin and piperine into the plasma gel can significantly improve the therapeutic outcome. Curcumin, the main active constituent of Curcuma longa, exhibits strong anti-inflammatory, antioxidant, and antimicrobial properties, which are beneficial for wound healing. However, its poor aqueous solubility and limited bioavailability restrict its direct clinical use. Encapsulation of curcumin in a nanoemulsion enhances its stability, solubility, and controlled release at the wound site, ensuring sustained biological activity. Similarly, piperine, an alkaloid derived from Piper nigrum, enhances the absorption and bioavailability of curcumin by inhibiting its metabolic degradation. Piperine also contributes additional anti-inflammatory and antioxidant effects, which further support tissue repair. When combined within a plasma gel matrix, these nanoemulsions produce a synergistic effect by modulating inflammatory pathways and promoting cellular regeneration. Experimental findings indicate that plasma gel containing curcumin and piperine nanoemulsions enhances collagen deposition, stimulates angiogenesis, reduces inflammatory cell infiltration, and accelerates epithelialization in diabetic wounds. Mechanistically, this formulation promotes the upregulation of key genes involved in tissue regeneration, such as vascular endothelial growth factor (VEGF), transforming growth factor-beta (TGF-β), and hypoxia-inducible factor-1 alpha (HIF-1α). Moreover, the potent antioxidant effects of curcumin and piperine protect tissue components from oxidative damage, thereby maintaining the structural and functional integrity of the regenerating tissue. In conclusion, plasma gel enriched with curcumin and piperine nanoemulsions represents a highly effective and innovative therapeutic approach for enhancing the healing of diabetic foot ulcers. This combined system improves growth factor stability, supports angiogenesis, mitigates oxidative stress, and reduces chronic inflammation, resulting in accelerated and more complete wound closure. As an advanced nanobiotechnological platform, this formulation holds great promise for integration into future regenerative medicine strategies and chronic wound management protocols for diabetic patients.

Keywords:
Curcumin Nanoemulsion, Piperine Nanoemulsion, Diabetic Foot Ulcer

Code: wtrc12-00510137
Title:

Probiotics and Postbiotics in Chronic Wound Healing: From Microbiome Modulation to Mechanistic and Therapeutic Insights

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Abstract:
Background: Chronic wounds, such as diabetic foot ulcers, venous leg ulcers, and pressure sores, represent a major global health burden due to delayed healing, microbial infections, and antibiotic resistance. Recent evidence has highlighted the pivotal role of the skin and gut microbiome in regulating wound repair processes. Probiotics—live beneficial microorganisms—and postbiotics—their bioactive metabolites—have emerged as promising adjuncts for modulating the wound microenvironment. Through immune regulation, antimicrobial activity, and stimulation of tissue regeneration, these biotherapeutics may offer a safe and effective alternative to conventional treatments. **Methods:** This review integrates current literature (2019–2025) on probiotics and postbiotics in wound management, focusing on molecular mechanisms, preclinical models, and translational studies. Peer-reviewed articles were identified from PubMed, Scopus, and ScienceDirect using keywords including probiotics, postbiotics, chronic wounds, microbiome modulation, and tissue regeneration. Studies exploring both topical and systemic applications, as well as nanocarrier and hydrogel-based delivery systems, were included. Mechanistic data were extracted regarding cytokine modulation, angiogenesis, collagen synthesis, and biofilm inhibition. **Results:** Findings consistently demonstrate that probiotics such as Lactobacillus rhamnosus, Bacillus subtilis, and Lactiplantibacillus plantarum promote wound closure by suppressing pro-inflammatory cytokines (TNF-α, IL-6) and enhancing anti-inflammatory mediators (IL-10, TGF-β). Postbiotic components—including short-chain fatty acids, bacteriocins, and exopolysaccharides—exhibit direct antimicrobial effects and accelerate fibroblast proliferation and collagen deposition. Novel formulations, such as probiotic-loaded hydrogels and microneedle patches, further enhance bioavailability and localized activity in chronic wounds. Collectively, these interventions show significant improvements in re-epithelialization, granulation tissue formation, and angiogenic responses compared to standard care. **Conclusion:** Probiotics and postbiotics represent an emerging therapeutic paradigm in chronic wound management, bridging microbiome science with regenerative medicine. By targeting both microbial dysbiosis and host signaling pathways, they offer a dual mechanism for infection control and tissue repair. However, further standardized clinical trials are essential to define optimal strains, dosing regimens, and delivery systems. Understanding these biotherapeutic interactions at molecular and cellular levels could pave the way for next-generation, microbiome-informed wound therapies with reduced antibiotic dependence and improved healing outcomes.

Keywords:
Probiotics, Postbiotics, Chronic Wound, Microbiome Modulation, Tissue Regeneration, Wound Healing

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Code: wtrc12-02980136
Title:

The role of Yeast-Based Therapies in Fungal-Infected Wound Healing

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Abstract:
Background: Fungal infections in wounds, particularly chronic ulcers, burn injuries, and diabetic foot ulcers, pose a significant clinical burden globally. Opportunistic fungi such as Candida albicans, Candida auris, and Aspergillus fumigatus often cause delayed healing, increased morbidity, and, in severe cases, systemic infections. Antifungal resistance and biofilm formation complicate treatment. Yeast-derived compounds like β-glucans enhance innate and adaptive immunity and promote tissue repair. This review aims to systematically evaluate the efficacy of these compounds in fungal-infected wounds. **Methods:** A systematic literature search was conducted in PubMed, Scopus, and Web of Science up to September 2025. Keywords included 'yeast', 'Saccharomyces', 'β-glucan', 'wound healing', 'fungal infection', 'Candida', and 'Aspergillus'. Inclusion criteria: studies evaluating yeast-derived compounds in fungal-infected wounds (in vitro, animal, clinical). Exclusion criteria: non-wound fungal studies, bacterial-only studies, reviews, and conference abstracts. Data extracted included study type, intervention, fungal target, outcomes, and adverse events. Quality was assessed using SYRCLE (animal studies), Cochrane RoB 2.0 (clinical trials), and NOS (observational studies). **Results:** From 1,246 identified records, 42 studies met inclusion criteria (24 in vitro, 12 animal, 6 clinical). In vitro studies reported 40-70% fungal growth inhibition and 30-55% biofilm reduction. Animal studies showed 60-70% fungal load reduction and 25-35% faster wound closure with topical β-glucans. Clinical trials demonstrated 25-35% wound size reduction and decreased secondary fungal infections over 4-8 weeks. Topical formulations were generally safe; systemic live yeast use required caution in immunocompromised patients. Discussion: Yeast-derived therapies provide immunomodulatory, antifungal, and wound-healing benefits. β-glucans activate macrophages, neutrophils, and dendritic cells, enhancing fungal clearance. They stimulate fibroblast proliferation, collagen deposition, angiogenesis, and epithelialization. Preclinical models consistently support dual-function effects. Clinical evidence, though limited, confirms accelerated wound closure and reduced infection. Safety is high for topical use; systemic administration requires monitoring. Limitations include study heterogeneity, small clinical sample sizes, and variable compound formulations. **Conclusion:** Yeast-derived compounds, particularly β-glucans, show significant potential in fungal-infected wound management. They reduce fungal burden and promote tissue repair. Topical applications are safe, but larger standardized clinical trials are essential to optimize formulations and ensure safety in high-risk populations.

Keywords:
Probiotic, Yeast, Fungi, Wound

Code: wtrc12-03510135
Title:

Innovative Cellulose-Based Nanostructures for Enhancing Stem Cell Growth and Regenerative Medicine

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Abstract:
Stem cells, due to their ability to differentiate into various cell types and self-renew, play a vital role in regenerative medicine and cell-based therapies. However, challenges such as low survival rates, poor adhesion, and lack of site-specific targeting limit their clinical applications. Biopolymers—especially cellulose—have gained significant attention in designing 3D cell culture systems for tissue engineering because of their biocompatibility, biodegradability, high water content, and structural flexibility. Cellulose-based hydrogels can be chemically modified or combined with other natural and synthetic polymers to enhance their mechanical and functional properties, making them suitable for advanced biomedical applications. Integrating cellulose with nanomaterials such as carbon nanotubes, graphene, silica nanoparticles, and metallic nanostructures has improved cellular interactions, mechanical strength, and tissue regeneration. For example, bacterial cellulose used as a supportive matrix in carbon nanotube-based scaffolds has enhanced osteoconductivity and osteoinductivity. Graphene-cellulose (G-C) papers also provide a suitable platform for both 2D and 3D cell cultures. Metallic nanoparticles play a key role in boosting the bioactivity of cellulose scaffolds. Composites like magnetic cellulose scaffolds and graphene-cobalt nanocomposites have enabled effective cellular differentiation under magnetic stimulation, contributing to bone regeneration. These findings highlight the importance of cellulose-nanomaterial composites in developing next-generation biofunctional scaffolds. Moreover, combining cellulose nanostructures with advanced technologies such as MEMS (Micro-Electro-Mechanical Systems), NEMS (Nano-Electro-Mechanical Systems), and microfluidics opens new horizons in stem cell research and tissue engineering. This synergy allows for the creation of intelligent cell culture environments, precise scaffolds, and real-time monitoring systems. MEMS technology enables the fabrication of microscale scaffolds using nanocellulose as a biocompatible material. These scaffolds not only support stem cell growth but also integrate sensors to monitor environmental factors like temperature, pressure, and nutrient levels. NEMS systems, with nanometric precision, can interact directly with cellulose nanostructures to provide mechanical or electrical stimulation, guiding cell differentiation and detecting subtle changes in cellular behavior or scaffold properties. Microfluidic systems also play a crucial role by controlling the flow of biological materials through microscale channels, delivering nutrients, drugs, and growth factors to cells in a controlled manner. In these systems, cellulose nanostructures serve as scaffolds that support cell growth under near-physiological conditions. This integration enables high-throughput experimentation, allowing researchers to study cellular responses efficiently. In conclusion, the convergence of cellulose-based nanostructures with MEMS, NEMS, and microfluidic technologies offers an innovative platform for developing smart bio-systems. This approach addresses current challenges in tissue engineering and paves the way for personalized therapies, complex tissue regeneration, and improved quality of life.
Keywords:
Cellulose, Stem Cell Growth, Nanocomposite, Natural and Synthetic Polymer, Tissue Engineering

Code: wtrc12-02160134
Title:

The Potential of Exosome Derived from Stem Cells in Chronic Wound

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Abstract:

Background: Chronic wounds including diabetic ulcers vascular ulcers traumatic wounds and burn injures which are often resistant to conventional treatment methods. It places considerable psychological and financial strain on patients and greatly affects them quality of life. Exosome are nanoscale vesicle that act as mediator of communication between stem cells and represent a cell-free regenerative approach. This study is a review that focuses on recent studies investigating the therapeutic potential of stem cell-derived exosomes. Chronic wounds such as diabetic ulcers, vascular ulcers, and burn injuries often go untreated for long periods of time. They result in negative psychological and financial impacts, and greatly affect one's quality of life. Exosomes are nanoscale vesicles that facilitate communication with stem cells and offer a cell-free regenerative option. This review centers on the most recent research about the therapeutic potential of exosomes derived from stem cells. **Methods:** As appropriate exerted search strategies have been conducted English literature Google Scholar Research Gate Embase Medline PubMed and on various electronic database to provide relevant and appropriate literature. **Results:** After analyzing 12 articles for this review, we established some strong and positive outcomes related to stem cell-derived exosomes. Every study showed that stem cell-derived exosomes help diminish inflammation and improve cell proliferation and migration, as well as angiogenesis, collagen deposition, and scar diminution in wounds. However, some outcome discrepancies were observed primarily due to the source of the tissue or cells from which the exosomes were isolated. In some of the studies, exosomes were co-integrated with other more therapeutically effective hydrogels of extracellular matrix origins **Conclusion:** generally, exosomes can improve the quality of chronic wound healing, specifically when used in addition to advanced wound dressings. However, we face several limitations and challenges to their clinical application, including their short half-life in the body and rapid clearance rate, which prevent them from remaining at high concentrations in the wound site for extended periods. Since most clinical studies have been conducted on animals and under laboratory conditions, future research should focus on large scale, randomized, double blind clinical trials with long term follow ups to determine the most effective types of exosomes and optimize therapeutic parameters for chronic wound treatment.

Keywords:
Exosome, Stem-cell, Chronic Wound

Code: wtrc12-03430133
Title:

The Role of Nurse Education and Empowerment in Preventing Wound Related Infection in Hospital Patients

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Abstract:
Background: Chronic and pressure ulcers create significant challenges for healthcare systems .These wounds not only significantly affect the patients quality of life but also impose a substantial economic burden on healthcare systems due to prolonged treatment and the need for continuous care. This study was conducted to review and summarize existing evidence on the effectiveness of nursing interventions in wound management and prevention, focusing on both international and Iranian research. **Methods:** This study is a narrative review examining the role of nurse education and empowerment in preventing wound related infections in hospitalized patients .A search was conducted using keywords such as 'wound nurse' and 'wound management' in international databases including PubMed/Medline, Scopus, Web of Science, and Google Scholar, as well as domestic databases SID and MagIran for studies published between 2012 and 2024. Ultimately, 20 relevant studies were selected for final analysis. **Results:** The findings indicate that the role of nurses is more prominent in three main areas: Direct wound care: Providing specialized nursing care improved the wound healing process and reduced the risk of infection. Prevention programs: Implementing preventive strategies led to a reduction in the incidence of pressure ulcers. Multidisciplinary coordination: Active participation of nurses alongside physicians, physiotherapists, and nutrition specialists improved continuity of care and reduced hospital stay length. Furthermore, continuous professional education, strengthening clinical assessment skills, independent decision-making, and effective communication with patients were consistently highlighted as key factors in enhancing the quality of nursing care. **Conclusion:** Developing care models centered on the nurse's role,where the nurse as the first member of the treatment team to observe wound changes is considered the executive manager of the process, and supporting the specialized position of nurses in wound management, can lead to better clinical outcomes as well as economic benefits for healthcare systems.

Keywords:
Wound Nurse, Wound Management, Nursing Care, Pressure Ulcers, Team Wound Care

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Code: wtrc12-01660132
Title:

Design and Fabrication of a Carboxymethyl Chitosan/Gelatin-Based Hydrogel Containing Magnesium Oxide Nanoparticles for Enhanced Pressure Ulcer Healing

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Abstract:
Background: Pressure ulcers are a common and serious challenge in clinical care, especially in frail, elderly, and long-term hospitalized patients. These ulcers are caused by continuous pressure and lead to blood flow obstruction, ischemia, necrosis, inflammation, and ultimately disruption of the natural skin healing process. These ulcers are known as the third most costly disease of the present century, which negatively affects the social, psychological, and physical quality of life of patients and require prompt treatment. Given the chronic nature of these wounds, the use of novel therapeutic systems such as biocompatible hydrogels, which are capable of creating a moist environment, gas exchange, removing tissue debris, and transporting biologically active agents, has been considered as a novel and effective approach in healing these wounds. Meanwhile, gelatin, as a collagen-derived polymer, with its RGD sequence, plays an important role in cell adhesion and accelerating tissue regeneration. Carboxymethyl chitosan, with its properties such as biocompatibility, non-adhesion to wounds, antibacterial properties, and the ability to remove tissue debris, is a suitable combination in the design of skin dressings. On the other hand, magnesium oxide (MgO) nanoparticles, with their antibacterial, anti-inflammatory, and especially angiogenesis-stimulating properties, play a key role in accelerating the healing process of chronic wounds, including pressure ulcers. **Methods:** In this study, an advanced hydrogel-based system was developed for potential use in pressure ulcer management. A multicomponent hydrogel composed of gelatin and carboxymethyl chitosan (in ratios of 1:1, 1:2, 2:1, and 3:1) was fabricated using the freeze-drying method and reinforced with magnesium oxide (MgO) nanoparticles. The hydrogels were evaluated for pH stability, degradation behavior, MgO release profile, and cell viability using the MTT assay at different time intervals (3, 6, 12, 24, and 48 hours, and 7 and 14 days). **Results:** The obtained hydrogels exhibited desirable pH stability within the physiological range and controlled degradation over time. Uniform dispersion of MgO nanoparticles within the hydrogel matrix was achieved, providing a consistent release profile during the 14-day period. Among all formulations, the hydrogel with a 3:1 ratio of carboxymethyl chitosan to gelatin demonstrated the most favorable physicochemical properties, including optimal porosity, uniform structure, and highest cell viability in the MTT assay. **Conclusion:** The results indicate that tuning the polymer ratio significantly affects the structural integrity, degradation rate, and biocompatibility of the hydrogel. The optimized 3:1 formulation exhibited the best combination of physical stability and biological performance, making it a promising candidate for further studies aimed at developing advanced wound dressings for pressure ulcers.

Keywords:
Carboxymethyl Chitosan; Gelatin Hydrogel; Magnesium Oxide Nanoparticles; Pressure Ulcer

Code: wtrc12-02540131
Title:

Application of Artificial Intelligence in Anesthesia

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Abstract:
Background: The field of anesthesia can potentially benefit from artificial intelligence due to its association with numerous elements of clinical care (critical care during surgery, pain management, and Drug Delivery). This study was designed to evaluate the impact of application of artificial intelligence (AI) in anesthesia. **Methods:** In order to assess the effect of application of artificial intelligence in clinical diagnoses, a comprehensive search was conducted in the databases of Pubmed, Web of Science, Scopus and Google Scholar. The search was conducted using a combination of the keywords "Artificial Intelligence", "Anesthesia", "Decision-making" and "Clinical Care", which were evaluated from 31 recovered articles, the full text of 11 articles. **Results:** Artificial intelligence computer systems can be used in anesthetic care before, during and after surgery; evaluate the patient's airway in direct laryngoscopy by facial and neck analysis, monitor the administration of anesthetic drugs and manage the patient's hemodynamics by analyzing several parameters and reducing false alarms, monitor EEG changes for each anesthetic drug, check ECG waves and cardiovascular status through 3D image visualization and predict respiratory drop in the postoperative period by checking number of breaths. In addition, artificial intelligence has been used so far to monitor the depth of anesthesia, predict risks, guide ultrasound and even manage the operating room. So AI can improve the efficiency of health care, timeliness and effectiveness of these measures. Yet while promoting artificial intelligence, the unforeseen disruption of job losses should not be ignored. **Conclusion:** Artificial intelligence lacks background awareness and requires educational data, for which significant investment is inevitable, while there is also the possibility of bias and errors in data entry. Duo to most doctors are not computer engineers and software designers, developing reliable and ethical AI algorithms requires collaboration between doctors and software designers.

Keywords:
Artificial Intelligence, Anesthesia, Decision-making, Clinical Care

Code: wtrc12-02540130
Title:

Application of Artificial Intelligence in Clinical Diagnoses

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Abstract:

Background: Accurate medical diagnosis is a fundamental part of effective patient care where doctors often fail. In fact, failure to receive this accurate diagnosis is an important reason for patients ' dissatisfaction with health care. To overcome this limitation, artificial intelligence (AI) is designed as a simulated strategy to expert human reasoning. This study was designed to evaluate the impact of application of artificial intelligence in clinical diagnoses. **Methods:** In order to assess the effect of application of artificial intelligence in clinical diagnoses, a comprehensive search was conducted in the databases of Pubmed, Web of Science, Scopus and Google Scholar. The search was conducted using a combination of the keywords "Artificial Intelligence", "AI", "Decision-making" and "Clinical Diagnoses", which were evaluated from 23 recovered articles, the full text of 10 articles. **Results:** The findings suggest that in clinical diagnostics, AI-based computer vision approaches are poised to revolutionize image-based diagnostics.The urgent need for rapid and accurate diagnosis of covid-19 patients can be noted. Integrating laboratory tests, CT scan findings from the chest and clinical symptoms with AI algorithms even with normal CT scan results helps to quickly diagnose positive patients for covid-19. This screening, in addition to the high speed of AI algorithms, can also be caused by their high sensitivity to radiographic images. In addition, it is difficult to diagnose lung cancer (the highest mortality rate in the world) due to the complexity of neoplastic changes and poor prognosis, and artificial intelligence can reduce the mortality rate caused by it through increased diagnostic efficiency and optimal treatment. However, the use of AI algorithms in Clinical Diagnostics is limited, regardless of the biases, cost and expertise required to interpret information. **Conclusion:** AI is a non-human aspect of clinical decision-making and helps to revise such decisions without directly interacting with patients. In fact, the AI system is a black box that produces output without any additional justification or reason. This is quite acceptable in low-risk situations but clinical decision-making is not a low-risk position.

Keywords:
Artificial Intelligence, AI, Decision-making, Clinical Diagnoses

Code: wtrc12-02540128
Title:

Application of Artificial Intelligence in Documentation of Nursing

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Abstract:
Background: Understanding the application of real-world artificial intelligence (AI) techniques is limited to the profession of nursing. However, the use of AI and its advanced technology has significantly transformed healthcare. This study was designed to evaluate the impact of application of artificial intelligence in documentation of nursing. **Methods:** In order to assess the effect of application of artificial intelligence in documentation of nursing, a comprehensive search was conducted in the databases of Pubmed, Web of Science, Scopus and Google Scholar. The search was conducted using a combination of the keywords "Artificial Intelligence", "Healthcare", "Documentation" and "Nursing", which were evaluated from 34 recovered articles, the full text of 12 articles. **Results:** Artificial intelligence and its advanced technology can be used to improve workforce safety, make sound decisions and care and provide services to patients. Performing tasks away from direct interaction with patients (documentation processes) is one application of artificial intelligence. AI speech recognition algorithms can speed up nursing documentation and accurate recording of patient data. In addition to, some organizations, such as the American Association of Colleges of Nursing (AACN), are moving to a competency-based education with a technology domain crossing over all domains due to the current need for this topic in all levels of nursing education. Applications equipped with artificial intelligence can help nursing students analyze complex medical data and make informed decisions that generally make health care more efficient. **Conclusion:** Although the use of artificial intelligence in nursing can be an auxiliary tool for nurses, it cannot be considered as an alternative to them. The role of nurses in providing health-care to patients and emotional and psychological support should not be overlooked. AI cannot replace the human role of nurses. It should also ensure that the integration of AI with the health system is ethical and aligns with the core values of nursing, such as compassionate care of patients.

Keywords:
Artificial Intelligence, Healthcare, Nursing, Documentation

Code: wtrc12-02540127
Title:

Application of Artificial Intelligence in Medical Emergencies

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Abstract:
Background: The quality of medical services in pre-hospital settings is important and is the most basic stage of emergency care for patients to reduce the risk of death and disability. Because there is not much information available from emergency patients, artificial intelligence (AI) is a new emerging technology that optimizes decision-making in these situations. This study was designed to evaluate the impact of application of artificial intelligence in medical emergencies. **Methods:** In order to assess the effect of application of artificial intelligence in medical emergencies, a comprehensive search was conducted in the databases of Pubmed, Web of Science, Scopus and Google Scholar. The search was conducted using a combination of the keywords "Artificial Intelligence", "Medical", "Decision-making" and "Emergencies", which were evaluated from 30 recovered articles, the full text of 11 articles. **Results:** Emergency medical service (EMS) plays an essential role in increasing survival rates as it provides first aid to victims of life-threatening emergencies. This early emergency intervention has relied on accurate and rapid diagnosis of patient conditions, which is challenging due to limitations in adequate measurement of standard vital signs. Hence AI is a new emerging technology for timely detection of changes in all physiological mechanisms. In this regard, triage of more sensitive patients and accurate and rapid decision-making for emergency care can be mentioned. AI algorithms overcome some common triage tools that are limited to certain situations such as trauma. In addition, predicting demand in emergency medical services is crucial for saving people's lives. Identifying the location of the ambulance demand emergency and the average distance from the nearest ambulance through a complex of interconnected space points are other applications of artificial intelligence in this field. **Conclusion:** Although new AI techniques have provided potential benefits for doctors and patients, they require training to providers, careful review of legal standards and support for confidentiality of patient information. In fact, emergency doctors should consider that AI is the same as some of the clinical skills of doctors and should not be used only.
Keywords:
Artificial Intelligence, Medical, Decision-making, Emergencies

Code: wtrc12-02540126
Title:

Application of Artificial Intelligence in Surgical Decision-makings

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Abstract:

Background: Surgical decision-making is based on hypothetical reasoning and personal judgment that, in addition to being time-consuming, can cause medical errors, less accuracy than expected, and preventable injuries, which can be addressed with the help of artificial intelligence (AI) algorithms. This study was designed to evaluate the impact of application of artificial intelligence in surgical decision-makings. **Methods:** In order to assess the effect of application of artificial intelligence in surgical decision-makings, a comprehensive search was conducted in the databases of Pubmed, Web of Science, Scopus and Google Scholar. The search was conducted using a combination of the keywords "Artificial Intelligence", "Surgical", "Decision-making" and "Surgery", which were evaluated from 22 recovered articles, the full text of 10 articles. **Results:** Surgeons have found that artificial intelligence can help in all aspects of health care, especially surgery. In a variety of complex cardiovascular surgeries, artificial intelligence can help surgeons with medical imaging and three-dimensional models of the heart and surrounding organs in advanced planning for surgery and reducing the risk of complications afterwards. This smarter decision-making continues during surgery, and by alerting the surgical team to any sudden changes in the patient's hemodynamics, it can help preserve time in the timely surgery. In neurosurgery, artificial intelligence has also gained double importance and can provide patients with the best intrusive and non-intrusive care by completing the skills of Surgeons. In other words, image analysis algorithms have helped to quickly identify disorders and have made it possible to plan for surgical procedures and support during surgery. However, unfortunately, most professionals don't have a proper understanding of artificial intelligence, so it can be a challenge for them in healthcare. **Conclusion:** Artificial intelligence is not a magic cartridge that can answer all questions, and its returns are limited by the accuracy of the clinical information entered, in which bias can affect artificial intelligence patterns. Despite the fact that there have been cases where traditional analysis methods have performed better than artificial intelligence, AI has the potential to revolutionize the surgical procedure with the promise of the future optimized for the highest quality patient care.

Keywords:

Artificial Intelligence, Surgical, Decision-making, Surgery

Code: wtrc12-02540125
Title:

Evaluation of the Effect of Ultrasonic Debridement on the Treatment of Pressure Ulcers

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Abstract:
Background: Pressure ulcer is recognized as the third most costly disorder after cancer and cardiovascular disease. Several treatments can be used to repair and treat pressure ulcer lesions, with radical deberidment, cleaning of dead wound tissues, and removing pressure from wounds being the most essential part of treatment. Despite new innovations in surgical techniques, the effective deberidment of pressure ulcers has still become a major challenge for surgeons. This study was designed to evaluate the impact of ultrasonic debridement on the treatment of pressure ulcers. **Methods:** In order to assess the effect of ultrasonic debridement on the treatment of pressure ulcers, a comprehensive search was conducted in the databases of Pubmed, Web of Science, Scopus and Google Scholar. The search was conducted using a combination of the keywords “Pressure Ulcer”, “Bed Sore”, “Debridement”, “Treatment” and “Ultrasonic”, which were evaluated from 45 recovered articles, the full text of 12 articles. **Results:** The findings suggested that ultrasonic debridement was a preferred choice for early management of pressure ulcers, and its direct use at low frequency and high intensity was a safe and reliable auxiliary treatment for such ulcers. In fact, the handpiece of the ultrasound device causes bubbling in tissue fluids through the vibrations of sound waves, and by creating heat and bursting bubbles, the surrounding necrotic tissues are denatured in a non-ionizing way. In addition, unlike sharp and mechanical debridement techniques, ultrasound debridement is generally considered painless. Compared to common scalpel surgical debridement, ultrasonic debridement is a low-invasive procedure that causes less bleeding, and is therefore the first choice for debridement of high-blood tissues. This method also reduces the likelihood of bacterial growth, and incomplete tissue granulation is improved by reducing bacterial colonization and removing biofilms and necrotic tissues. On the other hand, one of the disadvantages of this method is the problem of removing hard necrotic tissues or uneven surfaces, in which such wounds the combination of common surgical debridement and ultrasonic debridement should be used. **Conclusion:** Ultrasonic debridement of tissues in an atraumatic manner facilitates early healing of pressure ulcers, reduces the cost of the health care system and increases the quality of life of patients. In addition, due to the effect of ultrasonic debridement on reducing bacterial counts and promoting tissue repair, it can be stated that this method is effective not only for pressure ulcers, but also for cleansing and debridation of most hard-to-heal ulcers.

Keywords:
Pressure Ulcer, Bed Sore, Debridement, Treatment, Ultrasonic

Code: wtrc12-03340124
Title:

Management of Necrotizing Fasciitis by New Dressing

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Abstract:
Management of necrotizing fasciitis by new dressing. The most critical aspect of nursing care in necrotizing fasciitis is proper wound dressing management. This includes strict adherence to sterile techniques, regular dressing changes, and the use of advanced materials such as silver dressings, various types of foam, negative pressure wound therapy (NPWT), or colostomy bags when necessary.

Keywords:
Wound, Dressing, Necrotizing Fasciitis

Code: wtrc12-01330123
Title:

Microneedle-Based Delivery Systems for Targeted Therapy and Regeneration after Spinal Cord Injury

Authors:

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Abstract:

Recently spinal cord injury (SCI) has become a serious traumatic disorder of the central nervous system, with an increasing global incidence. SCI is categorized into primary and secondary injuries, in which the secondary injury is characterized by oxidative stress, inflammation, and neuronal death. The inflammatory microenvironment in secondary injury provides a therapeutic window, which is often treated through high-dose intravenous glucocorticoids such as methylprednisolone sodium succinate (MPSS). However, the blood-spinal cord barrier (BSCB) restricts the delivery of drugs to the spinal cord and reduces their efficacy. Despite advancements, the precision of tissue penetration in the nano-drug delivery system for spinal cord injuries remains highly limited. In contrast, microneedles (MNs), an array of small needles, provide an effective method for controlled drug delivery to the site of spinal cord injuries. Nitroxoline (Nit), also known as 5-Nitro-8-hydroxyquinoline, is a small molecule that acts as a Cathepsin B inhibitor and promotes scar-reduced repair after SCI. The poor water solubility and blood-spinal cord barrier (BSCB) permeability of Nit limit its potential application. Therefore, by combining the delivery advantages of nano-micelles and MNs, a dual drug delivery system composed of self-assembled nano-micelles and gelatin methacryloyl (GelMA) was developed. The local drug delivery of Nit-MN offers significant potential for SCI treatment and avoids systemic toxicity. Neurotrophic factors, including brain-derived neurotrophic factor (BDNF), activate tropomyosin receptor kinase B (TrkB) and facilitate the regeneration of nerve fibers following SCI. Conventional injection techniques exhibit minimal efficacy, necessitate repeated intramuscular delivery, and may induce discomfort. Recently a hyaluronic acid (HA) microneedle containing macrophage-membrane-coated BDNF was developed that enabled patients to self-administer treatment at home. After attaching to the skin, the HA matrix degrades, and the macrophage membrane coating facilitates the prolonged circulation of nanoparticles in the bloodstream and guides them to the injured tissues, where they release BDNF for neural repair. Metal-organic frameworks (MOFs), such as β-cyclodextrin metal-organic framework (CD-MOF) and zeolitic imidazole framework-8 (ZIF-8), are crystalline materials with high porosity that are made by coordinating metal ions with organic ligands. They serve as a drug carrier and provide a secondary extended release after separating from the microneedles. In vivo studies indicated that this novel drug delivery strategy has potential for clinical application and could constrict the inflammatory microenvironment in spinal cord diseases.

Keywords:

Spinal Cord Injury,Microneedle, MOF, Controlled Drug Delivery

Code: wtrc12-01330122
Title:

Advances in Microneedle-Based Therapeutic Strategies for Hypertrophic Scar Treatment

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Abstract:
Hypertrophic scars (HS) result from abnormal fibroproliferation after burns, injuries, or surgical procedures, leading to tissue dysfunction and psychological distress. Although conventional treatments such as surgery, radiotherapy, cryotherapy, and corticosteroids are available for the treatment of pathological scars, they have limited efficacy and cause side effects. Microneedles (MN) are arrays of micron-sized needles, which create pores in the skin and then locally deliver drugs into it in a non-invasive, easy-to-use, and biocompatible way. Although 5-fluorouracil (5-Fu) injections are routinely used to heal hypertrophic scars, patients often show poor compliance due to the discomfort of repeated injections. A double-layer dissolving microneedle containing asiaticoside and 5-Fu overcomes the skin barrier while causing the least amount of side effects. Although intralesional 5-fluorouracil (5-FU) is a recommended treatment for many patients, natural compounds are gaining attention due to their safety, cost-effectiveness, and availability. Among them, salvianolic acid B (Sal-B) from Salvia miltiorrhiza shows strong antioxidant, anti-inflammatory, and anti-fibrotic effects. Sal-B-loaded HA-based dissolving MNs that were inspired by the detachable and conical thorns of the silk floss tree revealed a markedly higher therapeutic efficacy compared to traditional topical anti-scar creams. Sal-B MN significantly down-regulated the expressions of collagen I, transforming growth factor beta 1 (TGF-β1), Signal Transducer and Activator of Transcription 3 (STAT3), and alpha-smooth muscle actin (α-SMA). Several studies have focused on improving the delivery profiles. A bilayer microneedle developed by combining fast-dissolving hyaluronic acid with a sustained-release PLGA layer that enables both rapid and prolonged delivery of dexamethasone and colchicine, which effectively modulates inflammation without repeated administration. Glucocorticoids are commonly used to treat various skin diseases due to their capacity to reduce local inflammation and suppress cell proliferation in dermal fibroblasts. Intralesional glucocorticoid injections are still the most common way to treat HS, but they often come with side effects. Prednisone is a synthetic glucocorticoid prodrug that is primarily converted into its active form in the liver. A silk fibroin microneedle patch loaded with prednisone can locally enhance expression of 11β-hydroxysteroid dehydrogenase type 1 (11β-HSD1), a specific enzyme that converts inactive glucocorticoids to their active form while reducing the side effects linked to traditional injections. Recent findings revealed that insufficient autophagic activity in fibroblasts limits their apoptosis and leads to abnormal matrix deposition. An active microneedle system developed using citric acid and sodium bicarbonate as a micromotor to generate CO_2 bubbles and facilitate the combined delivery of triamcinolone and curcumin results in remodeling the scar microenvironment for effective hypertrophic scar treatment. Therefore, it is critical to develop a precise and efficient HS therapeutic method that targets its inflammatory microenvironment. Significant members of the calcium-binding protein family, S100A8 and S100A9 modulate macrophage polarization and proliferation. Paquinimod is a specific inhibitor of S100A9 that revealed anti-fibrotic and anti-inflammatory effects. Clinical trials have predominantly used oral administration, but a new study suggested using methacryloylated hyaluronic acid hydrogels combined with Paquinimod exhibited superior therapeutic efficacy over intravenous and intradermal injections. In summary, MN-based delivery was proved as an effective transdermal delivery system for hypertrophic scars.

Keywords:
Hypertrophic Scar, Microneedle, Drug delivery, Fibroblast Modulation, Wound Healing

Code: wtrc12-02230120
Title:

White Foam: Polyvinyl Alcohol-Based Wound healing Innovations

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Abstract:
Wound healing is a burning issue in the clinical practice, especially in the case of chronic wounds that include venous leg ulcers, diabetic foot ulcers and pressure injuries, which have millions of cases worldwide and cause significant healthcare burdens. Conventional coverings do not tend to satisfy the complex requirements such as maintenance of exudates, infection prevention and tissue healing. Polyvinyl alcohol (PVA) foam, also known as white foam, because of its typical color and structure, is becoming an attractive biomaterial. This hydrophilic foam, which is derived as a result of synthetic PVA polymers, has a higher absorbency, non-adherence, and biocompatibility. Recent findings (20202025) indicate its effectiveness in negative pressure wound therapy (NPWT) and as a standalone measure where more than 70% of studies documented higher healing rates than the standard alternatives. Discussion: The polyvinyl alcohol that makes the core of PVA foam is a synthetic polymer, which is highly tensile and elastic, and can withstand heat. Made through freeze- drying or solvent casting, it adopts open-cell structure with pore sizes of 100- 500 uv, to permit the best fluid handling (up to 20 times its weight), and gas permeability. The main distinctive features are tunable porosity and mechanics, high-quality fluid manipulation, and ability to combine with NPWT instillation. White PVA usually has lower tissue ingrowth and adhesion and has the same pressure transmission properties as black polyurethane (PU) foams- properties again beneficial to tunnels, undermining, open structures, and graft/flap coverage. PVA has been used in antimicrobial delivery systems, with chromophore antibacterials and nanoparticles being delivered by PVA with a wide spectrum of bioburden control, and without silver-associated cytotoxicity. Head-to-head and model-based PVA studies indicate that PVA has the capacity to match and even surpass other foams in biomechanical properties and patient comfort, whereas modern composite PVA systems are reported to have superior hemostasis, absorption and healing kinetics on preclinical and early clinical studies. In conclusion white PVA foam complies with the concepts of moist wound healing and contemporary NPWT practice and excels in situations where atraumatic changes, control of exudates, and minimization of ingrowth are the main priorities. PVA foam must be viewed as a default interface to intricate wound geometry and sensitive beds and the preferred option in comparator to polyurethane foam, hydrocolloids, alginates, and gauze in most clinical situations due to its versatility and growing antimicrobial and bioactive product range. Its dominance will be further characterized by future randomized controlled trials that are end powered by randomized controlled trials and cost-effective

Keywords:
White Foam, Polyvinyl Alcohol (PVA), Negative Pressure Wound Therapy (NPWT), Wound Healing

Code: wtrc12-03320119
Title:

The Role of Nurses in Managing Patients with Cancer-Related Wounds and Oncologic Treatments

Authors:

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Abstract:
Background: Cancer-related wounds and wounds that result from oncologic therapies present a significant problem for nurses. Cancer-related wounds develop often alongside adverse effects of oncologic therapies such as pain, odor, secretions, infection, and bleeding into the patient's wound. These episodes negatively impact a patient's quality of life and overwhelm their families. Cancer as a disease is increasing in incidence locally and worldwide, therefore implementation of safe, effective, evidence-based nursing interventions for cancer-related wounds continues to be as important as ever. The aim of this narrative review was to analyze the nursing role of prevention, assessment, and management of oncologic wounds and to provide an overview of creative evidence-based strategies. **Methods:** Published articles from 2015-2025 were systematically searched in PubMed, Wiley, and Google Scholar, with the search terms of oncologic wounds, malignant fungating wounds, oncology nursing care, skin injury, wound care in oncology, as well as Boolean operators. English language studies were the eligible studies to be reviewed. The exclusion criteria for study selection were non-English, duplicates, and studies that had no focused on a nursing role. **Results:** Evidence-based nursing practices significantly decreased complications and improved quality of life in patients. Nurse-led research initiatives in surgical oncology reduced intraoperative pressure injuries by an estimated 50% and also decreased healthcare costs. Medical adhesive – related skin injury, which disproportionately affected cancer patients, was reported in approximately 24% of patients receiving wound dressings in the study, and thus careful nursing assessment protocols for dressing selection and change are necessary. Nursing care bundles, or coordinated evidence-based protocols in practice, included scheduled regular skin assessments, bleeding management, odor control, infection prevention, and appropriate dressings. Also, there were sizeable increased nursing knowledge and skills in oncology care when participating in training sessions in front of a classroom, in workshop format, using digital applications, and decision support systems. Standardized treatment guidelines and evidence-based wound dressing protocols aimed to improve interprofessional care coordination and nursing quality. Emerging technologies, such as digital wound monitoring tools and AI-based predictive modeling, offer opportunities to improve clinical management and reduce human error. **Conclusions:** The greatest opportunity to further influence the effectiveness of nursing care and the advancement of global standards in wound management is education, organizational support, and innovation of technology. However, current barriers are limited resources related to staffing and non-existent multi-disciplinary collaboration, in addition to heavy workloads on nurses, all needing policy change and an organizational response.

Keywords:
Oncologic wounds; Nursing care; Wound management

Code: wtrc12-03320118
Title:

The Role of Nursing Knowledge and Emerging Technologies in the Prevention and Management of Pressure Ulcers: A Narrative Review

Authors:

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Abstract:
Background: Pressure ulcer is one of the most significant patient safety concerns and a key indicator of nursing care quality. Its occurrence leads to increased treatment costs, prolonged hospitalization, and reduced quality of life for patients. In recent years, the use of innovative technologies has created new opportunities for improving nursing care. This narrative review was conducted to examine the role of nurses' knowledge and emerging technologies in the prevention and management of pressure ulcers based on recent research findings. **Methods:** This study was performed as a narrative review through a search of articles published between 2015 and 2025 in Wiley, PubMed, and Google Scholar databases. The main keywords included "Pressure Ulcer," "Nursing Knowledge," "Nursing Interventions," "Technology," "Prevention," and "Management," combined using Boolean operators. After screening, articles related to nurses' knowledge and attitudes, evidence-based interventions, and innovative technologies in pressure ulcer care were analyzed. **Results:** Findings showed that effective prevention and management of pressure ulcers rely on two main pillars: nursing knowledge and education, and the use of innovative care technologies. In the domain of nursing knowledge, continuous training and clinical experience enhance the proper implementation of interventions, while quick access to evidence-based guidelines improves nurses' performance.Alongside these factors, emerging technologies play a critical role in improving care quality. Artificial intelligence–based decision-support systems can predict high-risk patients and assist nurses in timely intervention. Clinical prediction models, by analyzing patient-specific data such as age, nutritional status, and physiological indicators, estimate the likelihood of pressure ulcer development and enable early preventive measures.Mobile educational applications provide interactive training and quick access to up-to-date scientific resources, thereby enhancing the knowledge of nurses and nursing students. Finally, digital coordination tools strengthen communication among healthcare team members and standardize the delivery of nursing interventions, leading to greater consistency and effectiveness of care. **Conclusion:** This review showed that ongoing evidence-based education is a key component of improving nursing performance and the use of artificial intelligence and clinical prediction models can be helpful in identifying high-risk patients early and reducing pressure ulcer incidence. Mobile applications and digital tools also offer access to guidelines and improve coordination around the team, and in turn, improved care quality. It is interesting to note that for these all to happen, an appropriate organizational and clinical context needs to be in place to facilitate the successful implementation of such interventions.

Keywords:
Pressure ulcer, Nursing, Emerging technologies, Knowledge, Management

Code: wtrc12-03320117

Title:

Nursing Interventions in the Prevention and Management of Radiodermatitis in Cancer Patients Undergoing Radiotherapy

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Abstract:

Background: Radiodermatitis is one of the most prevalent adverse effects of radiotherapy in patients with cancer, ranging from mild erythema to severe skin ulceration. The presence of radiodermatitis significantly impairs patients' quality of life, and can also interrupt the treatment trajectory. Nurses are in a prominent position for the prevention and management of radiodermatitis, as they directly care for patients with cancer. The purpose of this narrative review was to investigate nursing interventions for both the prevention, and the management of radiodermatitis to better describe their effectiveness, strategies, and barriers to clinical implementation. **Methods:** This narrative review was undertaken by searching PubMed, Wiley, Web of Science, and Google Scholar for relevant studies published from 2016 to 2025. The keywords used were radiodermatitis, radiotherapy skin reaction, nursing interventions, and skin care. After reviewing, English language studies focusing on nursing interventions for the prevention and management of radiodermatitis were included; while unrelated studies, duplicates, and outside the timeframe were excluded. **Results:** Evidence suggests that implementing structured team-based and patient-centered educational strategies can improve patients' quality of life and decrease symptom severity. Utilizing organizational quality and risk assessment models in addition to utilizing nurse led quality improvement programs can reduce both the incidence and severity of radiodermatitis. While applying standardized skin care procedures including maintaining paired skin moisture, preventing skin irritants, skin preparation for radiation, and monitoring skin (early detection is key) are validated prevention strategies. Prophylactic protective dressings (i.e., polyurethane films/Hydrofilm or silicone dressings) in selectively identified patient populations can decrease the potential for significant lesions as well. Additionally, limited utilization of topical creams and moisturizers may be effective and topical corticosteroids appear to be beneficial in some cases. Educational interventions, evidenced-based protocols, and technology that helps to monitor patient adhere, and reduce interruptions in treatment, is valuable. However, issues such as heterogeneity of study populations, diversity of protocols, and lack of large multi-center trials remain barriers to research. **Conclusions:** Structured and evidence-based nursing interventions, including targeted patient education, standardized skin care interventions, selective use of protective dressings, and utilization of organizational quality improvement models can ultimately reduce the severity and impact of radiodermatitis, and improve radiotherapy treatment continuity. Wide-spread clinical implementation requires on-going nurse education, incorporation of guidelines into clinical implementation, and larger, well-designed studies.

Keywords:

Oncologic Wounds, Radiodermatitis, Nursing, Wound Management

Code: wtrc12-02090116
Title:

Where Care Stops the Wound: A Scoping Review of Nurses' Knowledge and Attitudes toward Pressure Injury Prevention

Authors:

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Abstract:

Background: Pressure ulcers are common and preventable injuries in clinical care that directly reflect the quality of nursing services. Nurses' knowledge and attitudes play a key role in effective prevention. Understanding their perspectives is essential at the critical point where care can change the course of harm. This study aims to conduct a scoping review of existing evidence on nurses' knowledge and attitudes toward pressure ulcer prevention in order to identify assessment tools, prevailing trends, and research gaps. The findings will help clarify future educational and research pathways and support improvements in clinical practice and policymaking. **Methods:** This scoping review was conducted using Arksey and O'Malley's five-stage framework and guided by the PRISMA-ScR checklist. A comprehensive search was performed across SID, Magiran, PubMed, Scopus, and Web of Science, with no time restrictions. Both Persian and English keywords were used, including "Knowledge," "Attitude," "Nurse" or "Nurses," "Pressure Ulcer Prevention," and "Pressure Injury Prevention." Inclusion criteria encompassed studies that examined nurses' knowledge and attitudes toward pressure ulcer prevention, were published in Persian or English, and had full-text availability. Exclusion criteria included studies focused on treatment rather than prevention, non-nursing populations, or non-research formats such as letters to the editor, as well as those without accessible full text. Screening and data extraction were independently conducted by two reviewers, with any discrepancies resolved through discussion and consensus to ensure methodological rigor and reliability. **Results:** In the initial search, 25 articles were identified. After removing duplicates, applying inclusion and exclusion criteria, and screening titles and abstracts, 11 studies were ultimately included in the scoping review. Analysis of these studies revealed that nurses generally held positive attitudes toward pressure ulcer prevention, although their level of knowledge in this area was reported as inadequate. In some studies, positive attitudes were associated with longer work experience and higher educational attainment, and showed a significant correlation with preventive practices, whereas no such correlation was found between knowledge and practice. In certain cases, increased knowledge was paradoxically linked to a decline in positive attitudes, warranting further investigation. Several studies highlighted deficiencies in foundational education and the continuity of in-service training. Additionally, in long-term care settings, nurses often overlooked changes in patient condition when adjusting care plans. Findings suggest that nurses require improved baseline knowledge, and individual factors such as experience, education, and unit type may influence their attitudes and performance. **Conclusion:** Given the insufficient level of nurses' knowledge and the variability in their attitudes toward pressure ulcer prevention, it is essential to design evidence-based educational programs tailored to individual needs. Regular assessment of knowledge and attitudes, alongside improvements in foundational and in-service training, may enhance clinical performance. It is recommended that nursing managers develop targeted educational strategies to strengthen nurses' roles in pressure ulcer prevention and help foster improvements in care quality.

Keywords:
Knowledge; Attitude; Nurses; Pressure Ulcer Prevention; Pressure Injury Prevention.

Code: wtrc12-00260115
Title:

New Therapeutic Methods for Treatment of Skin Wounds Caused by Pathogenic Parasites

Authors:

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Abstract:

Background: Skin wounds caused by pathogenic parasites, including protozoa (Leishmania spp.), helminths (Onchocerca volvulus and Dracunculus medinensis), and ectoparasites (Sarcoptes scabiei and Tunga penetrans) are one of the principal public health issues in endemic areas especially the developing countries. Such infections may result in ulcerative wounds, and nodular wounds which may be complicated by secondary bacterial infections and fibrosis with loss of functionality. Drug resistance, population migration and climate change have made innovative treatments to be essential. This study assesses new interventions to use in treating parasitic skin wounds since 2010 to 2025 with the aim of determining evidence-based intervention to enhance its treatment. **Methods:** This systematic review was done in accordance with PRISMA, and by referring to PubMed, Google Scholar, SID, Magiran, Web of Science, and Scopus. The keywords for the searching were: cutaneous parasitic infections, skin wounds parasites, new treatments, protozoan skin wounds, and helminthic skin wounds. All English and Persian articles published from 2010 to 2025 were collected. The inclusion criteria were randomized clinical trials (RCTs), systematic reviews, and cohort studies of the treatment of skin wounds by pathogenic parasites. Case report studies with less than 10 patients, animal studies, and articles that were not within the time frame were discarded. **Results:** 68 articles out of 1,466 original articles were used to meet the inclusion criteria and mainly covered cutaneous leishmaniasis (CL), scabies, onchocerciasis, and tungiasis. In Leishmania major and L. braziliensis induced CL, oral miltefosine (50mg/day 28days) with reduced parasite load produced 70-90% cure rates, although there was genetic resistance (MSL gene mutations). The addition of miltefosine and topical use of paromomycin or liposomal amphotericin B doubled efficacy. The use of thermotherapy (applying the ThermoMed unit at 50 °C) produced a 73 percent cure rate and was safe in superficial wounds particularly with short-course miltefosine. In the case of scabies, oral ivermectin (200 µg/kg) used with doxycycline (against Wolbachia bacteria) minimized symptoms in resistant cases by 95% of cases. Moxidectin (8 mg single dose) was used in place of ivermectin in onchocerciasis, where it suppressed microfilariae in 18 months. Novel methods were nanotechnology (iron oxide nanoparticles to generate ROS and cause hyperthermia using magnets) and photodynamic therapy (utilizing methylene blue), which decreased parasite load by as much as 80 percent in CL models. The PD-1 and CTLA-4 inhibitors immunotherapy increased Th1 response and outcomes in resistant cases. The visceral leishmaniasis and CL showed treatment failure rates of 10-30% and 15-25% respectively, because of antimonial resistance and HIV coinfection. Conventional therapies such as pentavalent antimonials (meglumine antimoniate) are effective but have disadvantages of injection pain and resistance, particularly in L. donovani. The accessibility in resource-limited settings is enhanced using newer strategies like nanodrugs and thermotherapy, but larger long-term studies are required. **Conclusion:** The development of new therapeutic approaches such as drug combinations, thermotherapy and nanotechnology has greatly helped in the management of parasitic skin wounds and has enhanced the cure rates. Nonetheless, more studies are necessary to address resistance and expand access in the areas of endemicity.

Keywords:

Cutaneous Parasitic Infections, Skin Wounds Parasites, New Treatments, Protozoan Skin Wounds, Helminthic Skin Wounds

Code: wtrc12-00310114
Title:

The Role of Rehabilitation Nurses in Improving the Quality of Life of Patients with Chronic Wounds: A Systematic Review

Authors:

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Abstract:
Background: Chronic wounds significantly impact various aspects of patients' lives, leading to reduced quality of life, impaired physical function, and psychosocial problems. Rehabilitation nurses play a vital role in improving patient outcomes through comprehensive and specialized care. This systematic review aimed to determine the effectiveness of rehabilitation nursing interventions in improving quality of life for patients with chronic wounds. **Methods:** This systematic review was conducted through a comprehensive search of PubMed, Scopus, Web of Science, Cochrane Library, SID, and Magiran databases from 2010 to 2024. Search keywords included: "rehabilitation nurse", "quality of life", "chronic wound", "rehabilitation care" and their equivalents. The PRISMA protocol for systematic reviews was followed. All clinical trials and interventional studies related to the role of rehabilitation nurses in improving quality of life for patients with chronic wounds were reviewed. **Results:** Based on 38 eligible studies, rehabilitation nursing interventions were effective in four main domains: •Improving physical function through therapeutic exercises and movement training •Enhancing mental health through counseling and psychological support •Improving social function through social and family rehabilitation •Increasing self-care capabilities through specialized education These interventions led to significant improvements in quality of life scores, reduced pain, increased physical mobility, and enhanced psychosocial status of patients. **Conclusion:** Rehabilitation nursing interventions play a significant role in comprehensively improving quality of life for patients with chronic wounds. The multidimensional and integrated approach of rehabilitation nurses can lead to simultaneous improvement in physical, psychological, and social dimensions of patients' lives. Integrating rehabilitation nursing services into the care program of patients with chronic wounds appears essential.

Keywords:
Rehabilitation Nurse, Quality of Life, Chronic Wound

Code: wtrc12-00310113
Title:

The Nursing Role in the Management of Chronic Wounds Using Digital Technologies: A Systematic Review

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Abstract:
Background: Chronic wounds represent a major global health challenge, imposing a heavy burden on patients and healthcare systems. Nurses play a pivotal role in managing these wounds, and digital technologies have created innovative approaches in this field. **Methods:** This systematic review was conducted by searching the PubMed, Scopus, Web of Science, SID, and Magiran databases using the Keywords: nursing, chronic wound, and digital technologies, for studies published between 2010 and 2023. Eligible studies were selected based on pre-defined criteria, and data were systematically extracted. **Results:** Digital technologies have transformed the nursing role in managing chronic wounds. This transformation is evident in the areas of remote monitoring, mobile applications for documentation, digital imaging for specialist consultation, artificial intelligence for wound assessment, and smart sensors. These technologies have led to improved monitoring, increased assessment accuracy, and facilitated remote care. **Conclusion:** Digital technologies serve as a powerful complement that enhances nurses' capabilities in managing chronic wounds. Integrating these technologies into nursing care can lead to improved patient outcomes and reduced costs.

Keywords:
Nursing, Chronic Wound, Digital Technologies

Code: wtrc12-00310112

Title:

The Application of Modern Dressings in Wound Care: A Scoping Review of Nursing Evidence

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Abstract:

Background: Modern dressings represent one of the most significant technological achievements in wound care, creating remarkable transformations in the treatment of acute and chronic wounds. Utilizing advanced technologies, these dressings provide an optimal environment for wound healing. Nurses, as primary wound care providers, require up-to-date knowledge about the application of these dressings. This scoping review aimed to map existing evidence regarding modern dressings and related nursing guidelines. **Methods:** This scoping review was conducted through a systematic search of PubMed, Scopus, Web of Science, Cochrane Library, and SID databases from 2015 to 2024. Search keywords included: "modern dressings", "wound care", "nanofiber", "hydrogel", "nursing guidelines" and their equivalents. The PRISMA-ScR protocol for scoping reviews was followed. All studies related to the application of modern dressings in nursing wound care were reviewed. **Results:** Based on 42 reviewed studies, modern dressings were classified into five main categories: •Nanofiber dressings with controlled drug delivery capability •Tissue-compatible hydrogels for dry wounds •Absorbent foam dressings for high-exudate wounds •Antimicrobial dressings containing silver •Smart dressings with wound monitoring capability These dressings resulted in reduced dressing change frequency, accelerated wound healing process, decreased patient pain, and improved quality of life. **Conclusion:** Modern dressings play an effective role in accelerating wound healing by creating a controlled moist environment. Appropriate dressing selection should be based on careful assessment of wound characteristics and patient conditions. Continuous nursing education regarding the application of these dressings and development of standardized nursing protocols are essential.

Keywords:

Modern dressing, Wound care, Nursing

Code: wtrc12-00310111
Title:

Self-Care Education for Diabetic Foot Ulcer Patients: An Integrative Review of Nursing Interventions

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Abstract:
Background: Diabetic foot ulcer represents one of the most serious complications of diabetes, leading to frequent hospitalizations and amputations annually. Effective self-care plays a crucial role in preventing and improving these ulcers. Nurses, as key members of the healthcare team, are responsible for providing self-care education to these patients. This integrative review aimed to examine nursing educational interventions and their effectiveness in promoting self-care among diabetic foot ulcer patients. **Methods:** This integrative review conducted a systematic search in PubMed, Scopus, Web of Science, SID, and Magiran databases from 2010 to 2023. Search keywords included: "nursing education", "self-care", "diabetic foot ulcer", "foot care", "diabetes mellitus", and their Persian equivalents. All relevant quantitative and qualitative studies examining nursing educational interventions for diabetic foot ulcer self-care were reviewed. **Results:** Based on 35 reviewed studies, nursing educational interventions were categorized into four main domains: •Face-to-face and individual education •Digital technology-based education •Group and family-centered education •Regular follow-up programs These interventions led to significant improvements in self-care knowledge, enhanced foot care skills, improved quality of life, and reduced complication rates. **Conclusion:** Nursing educational interventions play a vital role in promoting self-care among diabetic foot ulcer patients. Combining different educational methods while considering individual patient conditions can lead to better outcomes. Designing structured educational programs with regular follow-up is considered a key factor in the success of these interventions.

Keywords:
Nursing Education, Self-care, Diabetic Foot Ulcer

Code: wtrc12-00310110
Title:

A Comprehensive Review of the Effectiveness of AI-Based Nursing Interventions in Pressure Injury Prevention: A Systematic Review Study

Authors:

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Abstract:
Background: Pressure injuries represent a significant and persistent challenge in healthcare settings worldwide, affecting approximately 2.5 million patients annually and generating substantial economic burdens estimated at $9-11 billion each year in the United States alone. These injuries not only cause considerable patient suffering and reduced quality of life but also extend hospital stays and increase healthcare costs. Nurses play a crucial frontline role in pressure injury prevention and have traditionally relied on standardized risk assessment tools such as the Braden Scale. However, these conventional methods often suffer from subjective interpretation and limited predictive accuracy. The increasing integration of artificial intelligence into clinical practice presents a transformative opportunity to enhance preventive strategies and improve patient outcomes through advanced computational capabilities. AI technologies offer the potential to analyze complex, multi-factorial patient data in real-time, enabling more precise risk stratification and personalized intervention plans that can significantly reduce pressure injury incidence rates across various healthcare settings. **Methods:** This systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure methodological rigor and comprehensive reporting. A systematic search was performed across six major electronic databases including PubMed, CINAHL, Scopus, Web of Science, Cochrane Library, and IEEE Xplore from their inception through December 2023. The search strategy incorporated a combination of keywords and Medical Subject Headings (MeSH) terms related to "artificial intelligence," "machine learning," "pressure injury," "pressure ulcer," "prevention," and "nursing." Additional studies were identified through manual searching of reference lists and grey literature. Two independent reviewers screened titles and abstracts against predefined inclusion criteria, followed by full-text assessment of potentially eligible studies. The quality of included studies was evaluated using the Cochrane Risk of Bias tool for randomized controlled trials and the Newcastle-Ottawa Scale for observational studies. Data extraction was performed using a standardized form to capture study characteristics, AI methodologies, outcome measures, and key findings. **Results:** The synthesized evidence from 28 included studies demonstrates that AI-based nursing interventions show significant potential in enhancing pressure injury prevention through several key mechanisms. Predictive analytics models utilizing sophisticated machine learning algorithms, particularly random forest and neural networks, have demonstrated 15-30% higher accuracy in identifying high-risk patients compared to traditional assessment methods. These models effectively integrate diverse data elements including electronic health records, real-time sensor data, and clinical documentation to generate comprehensive risk profiles. AI-powered clinical decision support systems provide evidence-based recommendations to nurses at the point of care, enabling more timely and targeted interventions through automated alerts and personalized care planning. The implementation of computer vision systems for automated wound assessment has shown remarkable precision in classifying pressure injury stages and monitoring healing progression, reducing assessment variability among different healthcare providers. Furthermore, natural language processing applications have demonstrated capability in extracting relevant risk factors from unstructured clinical notes, significantly enhancing early detection capabilities. These technologies collectively facilitate a paradigm shift from standardized protocols to personalized, data-driven care approaches, potentially revolutionizing pressure injury prevention strategies in clinical practice across acute care, long-term care, and home health settings. **Conclusion:** AI-based interventions serve as powerful complements to traditional nursing practices in pressure injury prevention, representing a significant advancement in healthcare technology integration. These technologies empower nurses to deliver more proactive, personalized, and effective care by enhancing risk prediction accuracy and providing real-time clinical decision support. The integration of AI systems into nursing workflows shows considerable promise for substantially reducing the incidence of hospital-acquired pressure injuries by 25-40%, thereby improving patient outcomes and reducing healthcare costs associated with pressure injury management. However, successful implementation requires addressing several important challenges including workflow integration, data privacy concerns, algorithm transparency, and initial financial investment. Future efforts should focus on developing comprehensive training programs for nursing staff, establishing standardized implementation protocols, and creating robust evaluation frameworks to maximize the benefits of these advanced technologies. Further research is needed to examine long-term outcomes, cost-effectiveness, and the impact on nurse workflow efficiency across diverse healthcare environments and patient populations.

Keywords:
Artificial Intelligence, Nursing, Pressure Injury Prevention

Code: wtrc12-01190109

Title:

The Effect of Collagen Derived from White Fish Skin on the Healing of Radiation-Induced Wounds

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Abstract:

Background: Radiotherapy is an effective approach for treating malignant tumors, yet it may also damage healthy tissues, causing wounds, necrosis, and skin inflammation that delay healing and complicate recovery. Collagen, a key component of the extracellular matrix, plays a vital role in tissue repair and is widely used in bioactive wound dressings. However, collagen from conventional animal sources such as bovine, porcine, and avian tissues carries risks of allergic reactions and disease transmission. Collagen derived from white fish skin, with its high safety, excellent biocompatibility, and lack of dietary restrictions, represents a promising natural alternative. It may effectively enhance the healing of radiation-induced wounds and offer a safer option for patients undergoing radiotherapy. **Methods:** The findings presented in this article are based on a comprehensive review of published research, conducted through a systematic search of databases such as SID, PMC, and Google Scholar. The keywords used for the search included "collagen," "collagen dressing," "collagen and wound healing," and "fish-derived collagen." **Results:** Approximately 90% of patients undergoing radiotherapy develop moderate to severe skin injuries. Within the irradiated area, irreversible damage occurs to endothelial cells and the small blood vessels in the skin. As a result, the affected skin heals slowly and remains vulnerable to infection. Due to collagen's regulatory effects on matrix metalloproteinases (MMPs), its high biocompatibility, immunomodulatory properties, and ability to promote the migration of macrophages and fibroblasts to the wound site—as well as its ease of application—collagen-based biomaterials have been increasingly used in wound dressings .White fish from the Caspian Sea constitute a significant portion of the region's fishing industry. The skin of this species contains a high concentration of collagen with an approximate molecular weight of 130 kDa, making it a promising candidate for wound dressings, particularly for wounds susceptible to infection. **Conclusion:** Given its high collagen content and superior characteristics compared to mammalian-derived collagen dressings, white fish skin represents a promising and effective natural alternative for the treatment of radiation-induced wounds that are at risk of infection.

Keywords:

Collagen, Collagen Dressing, Fish-derived Collagen, Wound Healing, Radiation-induced Wound

Code: wtrc12-03260108
Title:

Development of an Oral Vaccine against Shigella flexneri using FimG and IPAD Proteins Encapsulated in Chitosan Nanoparticles: Immunogenicity and Adhesion Inhibition in Mouse and Caco-2 Cell Models

Authors:

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Abstract:
Background: Shigella flexneri is a major cause of bacterial diarrhea in developing countries, disproportionately affecting children and the elderly. It ranks as the second leading cause of mortality among children under five years of age worldwide. With the alarming rise in antibiotic resistance, the development of effective, safe, and affordable vaccines with minimal side effects has become a critical public health priority. **Methods:** In this study, a novel oral vaccine was developed using the surface proteins FimG and IpaD. FimG, a fimbrial subunit, facilitates the initial attachment of the bacterium to host cells, while IpaD, a component of the type III secretion system, is essential for epithelial cell invasion. To enhance stability and ensure efficient delivery through the gastrointestinal tract, the proteins were encapsulated—both individually and in combination—within chitosan nanoparticles. The immunogenicity of these formulations was assessed in BALB/c mice by measuring specific antibody responses and performing live bacterial challenge tests. Additionally, bacterial adhesion to human epithelial cells was evaluated using the Caco-2 cell line. **Results:** The combined FimG-IpaD formulation encapsulated in chitosan nanoparticles elicited a significantly stronger immune response compared to the individual formulations. It also effectively inhibited Shigella adhesion and invasion in vitro. **Conclusion:** This novel oral vaccine formulation shows strong potential as a preventive strategy against shigellosis. Its ability to induce robust immune responses and block bacterial invasion highlights its promise for further development, particularly in the context of rising antibiotic resistance.
Keywords:
Shigella flexneri, Shigellosis, FimG, IpaD, Vaccine

Code: wtrc12-03240107
Title:

Investigation of the Antibacterial Effects of Silver Nanoparticle-Based Allicin, Ginseng, and Curcumin Extracts on Staphylococcus aureus and Escherichia coli

Authors:

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Abstract:

In this study, the antibacterial effects of a combination of plant extracts—allicin, ginseng, and curcumin—together with silver nanoparticles were investigated against two important pathogenic bacterial species, Staphylococcus aureus and Escherichia coli. The main objective was to evaluate the ability of this combination to inhibit bacterial growth and to compare its efficacy with that of each individual component. Due to their well-known anti-inflammatory, antioxidant, and antibacterial properties, plant extracts, when combined with silver nanoparticles that exhibit strong antimicrobial activity, can serve as effective alternatives to conventional antibiotics. In this study, standard methods such as disk diffusion and minimum inhibitory concentration (MIC) assays were employed to assess antibacterial activity. The results indicated that the combined formulation exhibited significant inhibitory effects against both bacterial strains, and in some cases, its effectiveness surpassed that of the individual components. Moreover, Staphylococcus aureus showed higher sensitivity to the combination than Escherichia coli. These findings suggest that this formulation may provide a promising foundation for the development of natural and nano-based therapeutic agents with high efficacy against antibiotic-resistant bacterial infections.

Keywords:

Allicin, Ginseng, Curcumin, Antibiotic resistance, Silver nanoparticles, Antibacterial activity

Code: wtrc12-03220106
Title:

The Effect of Fractional Co2 Laser on Cesarean Wound Healing

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Abstract:
Caesarean section is one of the most common surgical operations in the world, the rate of cesarean section in Europe and around the world is 24% and 12.4%, respectively, which increases by an average of 4.4% annually. Due to the prevalence of cesarean section around the world, hypertrophic and keloid scars, as a result of the healing of patients' wounds, are caused by surgical incisions, wounds and skin damage, which is one of the most important concerns of many women, the appearance of permanent scars after surgery Cesarean section is on the body, their treatment is primarily for women's appearance and beauty, but in addition, they cause itching, pain, reduced mobility and skin lesions, and for this reason, they affect the quality of life of women and need treatment because these chronic wounds show resistance to treatment. Laser treatment without surgical intervention has a positive effect on many diseases and skin problems without complications. CO2 laser in 1964 in the Bell laboratory of the United States. Muttahida was developed by Patel and his colleagues. Fractional co2 laser is a great treatment optionIt is effective for healing scars (hypertrophic and keloid), warts, skin moles and acne. Our purpose of this study is to describe the treatment of scars after cesarean section without surgical intervention and postoperative complications.
Keywords:
Fractional Co2 Laser, Caesarean Section Wound, Hypertrophic Scar, Keloid Scar, Wound Repair

Code: wtrc12-03180105
Title:

The Role of Interdisciplinary Care and Appropriate Therapeutic Strategy Selection in Preserving a Lower Limb with Extensive Necrosis Following Trauma: A Case Report

Authors:

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Abstract:
Background: Traumatic injuries are a leading cause of disability and mortality worldwide, often resulting in complex lower-limb wounds involving soft tissue, tendon, and bone exposure. Managing extensive necrosis requires timely interdisciplinary collaboration to optimize outcomes and minimize amputation risk. **Case Presentation:** We report a 52-year-old woman with extensive full-thickness necrosis of the right lower limb following trauma, initially considered for above-knee amputation. The patient underwent coordinated multidisciplinary management at Imam Musa Kazem Burn and Reconstructive Center in Isfahan over a 61-day hospitalization. Interventions: Serial debridements, antimicrobial silver dressings, and vacuum-assisted closure therapy were applied, followed by split-thickness skin grafting once infection and necrotic tissue were controlled. Physical therapy, psychological support, and infection monitoring complemented wound management. **Results:** Through timely and coordinated interdisciplinary care, infection was effectively controlled, granulation tissue formation was enhanced, and complete graft take was achieved, successfully preserving the affected limb without major complications. **Conclusion:** This case highlights the pivotal role of interdisciplinary care and strategic selection of modern wound-healing technologies in preserving limbs affected by severe post-traumatic necrosis. Early coordination between surgical, nursing, and rehabilitation teams can significantly improve prognosis and functional recovery.
Keywords:
Multidisciplinary Approach, Trauma, Wound Management

Code: wtrc12-03150102
Title:

Production of a Skin Patch Using Hyaluronic Acid and Nanocellulose and Its Effect on Wound Healing

Authors:

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Abstract:
Background: Rapid and safe wound healing is an important challenge in healthcare. Conventional dressings such as gauze and cotton protect the wound but often fail to accelerate tissue regeneration or prevent bacterial growth. To address this limitation, we developed a skin patch composed of hyaluronic acid and nanocellulose and evaluated its effect on wound healing. Methods / Materials and **Methods:** Nanocellulose was prepared through a green synthesis method and incorporated with hyaluronic acid to form a biocompatible patch. Cytotoxicity was tested on NIH3T3 fibroblast cells using the MTT assay. Antibacterial activity was evaluated against Gram-positive and Gram-negative bacteria. In vivo studies were performed on rats with induced wounds, and the healing progress was monitored for 7 days in treated and control groups. **Results:** The patch demonstrated excellent cell compatibility, with more than 90% fibroblast viability. Antibacterial evaluation showed inhibition zones of around 14 mm compared to 11 mm in the control. In vivo tests revealed significantly faster wound closure in the treated group, where wound diameter decreased from 1.5 cm to 0.4 cm in 7 days, while in the control group it remained around 1.0 cm. **Conclusion:** The skin patch containing hyaluronic acid and nanocellulose showed high biocompatibility, antibacterial properties, and accelerated wound healing. These findings suggest that such a patch can be considered as a promising and eco-friendly material for future wound care applications.

Keywords:
Wound healing, Skin patch, Hyaluronic acid, Nanocellulose, Antibacterial

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Code: wtrc12-03070101
Title:

Evaluation of Antimicrobial, Anti-Biofilm, Toxicity, and Wound Healing Effects of Timolactam Cream in Mice

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Abstract:
Background: Bacterial infections from antibiotic-resistant bacteria are a major cause of death in burn patients. Our study aims to evaluate the antimicrobial, anti-biofilm, toxicity, and wound-healing effects of an ointment containing Timolactam cream using mice. Material and **Methods:** This study was conducted in two parts: in vitro and in vivo. In the in vitro part, the antimicrobial effects of thymol, cefotaxime, and ceftazidime (Timolactam cream) were tested individually and in combination on various bacterial strains. The study also investigated chemical interactions, biofilm inhibition, and cytotoxicity. In the in vivo part, the activity of the compound (F) in cold cream was examined using a mouse model of third-degree burn infection. **Results:** The study found that thymol/cefotaxime/ceftazidime exhibited antimicrobial activities on specific strains at varying concentrations: 8/2/2, 16/4/4, 32/8/8, 16/4/4, 64/16/16, 128/32/32 μg/ml, respectively. These compounds also showed antibacterial activity at different concentration ranges: 2-1024/1-256/2-128, 4-128/2-64/1-32, 8-256/2-128/1-128, 16-1024/2-128/2-128, 4-512/2-256/4-128, 512-1024/128-256/128-256 μg/ml on clinical strains. Analysis with FTIR revealed the presence of OH carbohydrates, proteins, and polysaccharides, CH stretching alkene group, C-O-C-polysaccharide, and C=O ester group compound in these three compounds. Moreover, compound (F) showed biofilm inhibition rates of 91.01%, 93.33%, 88.02%, 95.05%, 89.02%, and 76.02% on the mentioned strains, and its toxicity against human RBCs and Ffk cells was 18.36% and 17.26%, respectively. The burn wound area in groups one to three was larger than that of group four and the positive control group. Consequently, in the first or third group, there was better inflammation control, growth of fibroblast cells in burnt tissue, ulcer healing, and blood vessel development compared to the other groups. **Conclusion:** The Timolactam cream ointment in cold cream shows strong antibacterial activity, high anti-biofilm properties, and low toxicity. It can be used in a clinical trial for infectious burn wounds.

Keywords:
Antimicrobial, Anti-biofilm, Toxicity, Wound Healing, Timolactam Cream

Code: wtrc12-03000100
Title:

Comparative Transcriptomic Analysis Reveals Differentially Expressed Genes between Healer and Non-Healer Diabetic Patients

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Abstract:
Background: Diabetic foot ulcers (DFUs) are one of the most serious complications of diabetes, often leading to chronic non-healing wounds and lower-limb amputations. Understanding the molecular mechanisms distinguishing healer and non-healer patients can provide valuable insight into impaired wound repair and potential therapeutic targets .Here, we aim to perform an integrated transcriptomic analysis to identify a common, robust gene signature that predicts healing failure in diabetic foot ulcers by comparing Healer and Non-Healer patients. **Methods:** Two RNA-seq datasets (GSE143735 and GSE134431) were downloaded from the Gene Expression Omnibus (GEO) database. Differentially expressed genes (DEGs) between healer and non-healer groups were identified using GEO2R, with a cut-off of $P < 0.05$ and $|logFC| \geq 1$. Overlapping DEGs were determined by Venn diagram analysis. The shared DEGs were further analyzed using the STRING database to construct protein–protein interaction (PPI) networks and identify enriched biological pathways. **Results:** Analysis revealed distinct expression profiles between healer and non-healer diabetic patients. Several common DEGs were identified, which were mainly involved in inflammatory response, extracellular matrix organization, and angiogenesis pathways according to STRING enrichment results. A total of 25 overlapped upregulated genes and 2 downregulated genes were identified. To identify the most influential genes in each group, we calculated the degree for all upregulated and downregulated genes and selected the top 10 genes with the highest degree values. Analysis showed that up-regulated genes involve in the hemostasis, cell surface interaction, epithelial to mesenchymal transition, integrin cell surface interactions. Down-regulated genes mainly associate with cell communication, protein transport. **Conclusions:** This study highlights key molecular differences between healer and non-healer diabetic individuals and identifies potential targets and pathways that may contribute to impaired wound healing, providing a foundation for future mechanistic and therapeutic investigations.

Keywords:
Diabetic Foot Ulcer (DFU), Transcriptomic Analysis, Prognostic Biomarker, Healing Failure

Code: wtrc12-00260099
Title:

Polymicrobial Wounds and Parasitic Coinfections: Complexities in Pathogenesis and Treatment

Authors:

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Abstract:

Background: Parasitic infections often occur with pathogenic bacteria, virus, and fungi. This concurrent can cause complex wounds with abnormality healing and create complex healing challenges. Polymicrobial ulcers and parasitic coinfections also make diagnosis more difficult, influence host immune system, and increase antimicrobial resistance. Integrated and effective diagnostic and therapeutic strategies are needed to target and eliminate parasites and microbes contaminating infected wounds. The aim of this study was to clarify the pathophysiological mechanisms, epidemiological trends, and management principles associated with concurrent parasitic and microbial infections producing multifaceted wounds. **Methods:** This study was conducted as a systematic review, and for accessing the scientific and research articles it was referred to databases including PubMed, Elsevier, Google scholar, SID, and Magiran. All publications from 2010 to 2025 were collected focusing on keywords such as parasitic co-infection, polymicrobial wounds, pathogenesis, treatment, and compound terms including scabies and impetigo, secondary leishmaniasis infection, and myiasis with bacterial sepsis. Out of 36 complete articles collected, 23 were selected for the present study. The selected articles comprised systematic reviews, cohort studies, and outbreak reports. The extracted data emphasized prevalence patterns, commonly isolated microbial partners, immunologic interactions, and clinical outcomes following combination antimicrobial and antiparasitic therapy. **Results:** Findings showed that cutaneous leishmaniasis-associated ulcers typically become secondarily colonized, a process that not only interrupts re-epithelialization but also increases the risk of disfiguring scars. Scabies predisposes patients to secondary streptococcal or staphylococcal impetigo, which can, in turn, progress to ecthyma, chronic ulcers, or systemic complications. The underlying pathogenesis of skin ulcers involves disruption of the natural skin barrier and parasite-induced immunomodulation, which provide an environment conducive to opportunistic pathogens. Myiasis wounds, particularly in immunocompromised hosts, serve as reservoirs for polymicrobial biofilms and may trigger severe bacterial sepsis. Wound closure, healing, and tissue regeneration become more difficult and complicated due to the persistence of biofilms and inflammatory processes. Best practices for management require the simultaneous diagnosis and targeted therapy of all clinically relevant pathogens, often combining antiparasitic agents with specific antibiotics, and, when necessary, surgical debridement. Integrating wound culture techniques, molecular diagnostics, and individualized wound care regimens enhances treatment success. Community-level integration of parasitic control measures can lead to reduce bacterial complications, ultimately improving outcomes for affected populations. Molecular techniques (PCR, sequencing) and wound cultures are superior to traditional methods for identifying biofilm-associated pathogens. Simultaneous use of targeted antiparasitic and antimicrobial agents, often with surgical debridement, is essential. Novel approaches include topical probiotics, anti-biofilm agents, and nano-emulsions for multidrug-resistant infections. Community-level interventions for parasitic control reduce secondary bacterial complications and improve overall outcomes. **Conclusion:** From the results of this study, it is concluded that effective and comprehensive treatment strategy of wounds complicated by the coexistence of parasitic and polymicrobial agents need an integrated diagnostic and therapeutic approach. Therefore, future research should focus on clinical trials comparing combined antimicrobial and antiparasitic strategies and formulating evidence-based guidelines for managing parasitic wounds complicated by biofilm formation and chronic infection.

Keywords:

Parasitic Coinfection, Polymicrobial Wound, Pathogenesis, Treatment, Scabies-Impetigo, Leishmaniasis, Myiasis, Biofilm

Code: wtrc12-02940098
Title:

Hydrogel Wound Dressing Composed of Sodium Alginate Cross-Linked with Chitosan and Carrying Growth Hormone and The Antibiotic Gentamicin

Authors:

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Abstract:
A novel hydrogel wound dressing—composed of sodium alginate cross-linked with chitosan and carrying growth hormone and the antibiotic gentamicin —has been produced with the aim of reducing infection and accelerating the healing of pressure ulcers, diabetic wounds, and burns. Given the rising prevalence of aging and diabetes, which can lead to an increased incidence of complications like diabetic foot ulcers and pressure ulcers in immobile individuals, along with the need for treating and repairing second and third-degree burns, the development of new, effective dressings is essential. These wounds are highly susceptible to infection, significantly reducing the quality of life for those affected. Hydrogels create a moist environment, leading to better wound debridement and accelerated healing of pressure ulcers compared to conventional dressings. In the case of diabetic wounds, hydrogel dressings have also recently gained wider application due to their benefits. Chitosan is a natural polymer with good biocompatibility and possesses properties such as: Antimicrobial activity against certain Gram-positive and Gram-negative bacteria and some fungi; immune system regulation through nitric acid induction; adhesive properties for faster and better repair; antioxidant and platelet-activating properties and anti-inflammatory properties. Research indicates that the most common bacterial strain in the infection of diabetic wounds, burns, and pressure ulcers (like bedsores) is Staphylococcus aureus. Gentamicin is a broad-spectrum antibiotic optimized for inhibiting Staphylococcus aureus, Streptococci, and some Gram-negative bacteria, and thus appears highly effective in preventing wound infection. Furthermore, due to the topical use of this antibiotic, the incidence of side effects like antibiotic resistance and other problems will be reduced. Studies have also shown that the use of growth factors in wound dressings can have a significant impact on accelerating wound healing and revascularization of the injured area. The alginate-chitosan hydrogel dressing containing human growth hormone and the antibiotic gentamicin—by combining moisturizing properties with antimicrobial and anti-inflammatory effects—can be a suitable and promising dressing for treating these types of wounds. Other features of such a dressing include ease of use, faster wound healing, and less scarring compared to conventional dressings
Keywords:
Hydrogel, Growth Hormone, Mupirocin, Wound Healing

Code: wtrc12-02950097
Title:

Complex Wound Management Caused by Amputation

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Abstract:
Background: To detail and validate a comprehensive, multi-faceted, and step-by-step treatment protocol for managing complex wounds, specifically those complicated by Exposed Bone and severe infection, aiming for successful wound bed preparation and closure. **Methods:** The protocol involved an integrated approach: Phase 1 utilized aggressive debridement and 2% Acetic Acid for initial infection control. Phase 2 employed Negative Pressure Wound Therapy (NPWT) (110-125 mmHg) for two weeks to promote granulation. Phase 3 focused on specialized exposed bone management using Atromen with Silver dressing continuously. **Results:** The systematic protocol achieved complete granulation tissue coverage within approximately 4 weeks, rendering the wound bed ready for definitive closure. The specialized bone management successfully controlled microbial load and maintained a favorable environment for healing. **Conclusion:** This case demonstrates the efficacy of a multimodal strategy—combining debridement, NPWT, and targeted topical silver therapy for exposed bone—in successfully preparing challenging wounds for final coverage via skin grafting, leading to optimal healing outcomes.
Keywords:
Complex Wounds, By Exposed Bone, Negative Pressure Wound Therapy, Silver Dressing

Code: wtrc12-00480094
Title:

Effect of a Topical Ointment Containing Ethanolic Extract of Usnea articulata Lichen on Skin Wound Healing in Wistar Rats

Authors:

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Abstract:
Background: Wound healing following surgery, burns, and trauma remains a major clinical challenge, with current advanced therapies such as tissue grafts, cell therapy, and gene therapy offering benefits but limited by high costs and accessibility issues [1]. Natural products, particularly medicinal plants, have emerged as promising alternatives due to their efficacy and affordability in promoting tissue repair [2]. Lichens, unique symbiotic organisms producing diverse secondary metabolites, have long been valued in traditional medicine but remain underexplored in modern pharmacology because of cultivation and harvesting limitations [3]. Usnea articulata, notable for its abundance and antioxidant, antimicrobial, and anti-inflammatory properties, was selected for this study as a potential wound-healing agent. Material and **Methods:** Usnea lichen was collected from the Noor highlands, identified at the Herbarium of the Iranian Organization for Scientific and Industrial Research, and assigned a herbarium code. After drying and pulverization, ethanolic extraction was performed by maceration, the extract was concentrated with a rotary evaporator, and stored at −4 °C. Ointments containing 3% and 6% extract were prepared by incorporating the respective amounts into an Eucerin base and homogenizing thoroughly. Thirty-two healthy male Wistar rats (250–300 g) were randomly divided into four groups: Treatment with Eucerin (as an ointment base), phenytoin ointment (positive control), 3% Usnea ointment, and 6% Usnea ointment (n = 8 each). Standardized full-thickness wounds were created, and wound areas were measured on days 0, 3, 7, 10, 14, 17, and 21 using ImageJ software. Wound closure was calculated by the standard formula, and on days 7, 14, and 21, tissue samples were collected for histopathological evaluation. Sections were stained with hematoxylin and eosin (H&E) for morphology and Masson's trichrome for collagen deposition. **Results:** Medicinal plants are increasingly recognized as alternatives to synthetic drugs due to their lower side-effect profile. In this study, Usnea articulata ointments (3% and 6%) enhanced epidermal and dermal thickness and fibroblast proliferation, with the 6% formulation showing superior efficacy. Its wound-healing effects were comparable to phenytoin, as confirmed by histopathological analysis. These findings highlight U. articulata as a promising, accessible natural agent for managing skin wounds in Iran. **Conclusion:** The findings of this study demonstrate that topical ointments formulated with ethanolic extract of Usnea articulata significantly promote wound healing, with the 6% preparation showing effects comparable to phenytoin. Enhanced fibroblast activity, epidermal and dermal thickening, and improved collagen deposition highlight its therapeutic potential. Given its abundance and accessibility, U. articulata may serve as a promising, cost-effective natural agent for managing skin wounds and related disorders.

Keywords:
Wound Healing, Lichen, Usnea

Code: wtrc12-02780093
Title:

Investigating AI-Based Approaches for the Prevention and Detection of Pressure Ulcers

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Abstract:
Background: Pressure ulcers, also known as bedsores, represent a prevalent and serious complication among hospitalized patients, particularly those in intensive care units with prolonged bed rest. These wounds can lead to significant adverse outcomes, including severe pain, complex infections, reduced quality of life, and increased healthcare costs. Accurate and timely diagnosis of pressure ulcers is of paramount importance; however, conventional assessment methods are often hindered by challenges such as human error and reliance on subjective clinical judgment. **Methods:** This systematic review was conducted in 2025. A comprehensive search was performed in both Persian and English scientific databases, including PubMed, Google Scholar, Magiran, SID, Scopus, and Web of Science, using key terms such as pressure ulcer, bed sore, artificial intelligence, and wound detection. The search was limited to studies published between 2020 and 2025. Following the application of inclusion and exclusion criteria, 16 relevant articles were selected and analyzed from an initial pool of 23 primary studies. **Results:** The findings indicate that artificial intelligence (AI)-based technologies, particularly deep learning models such as convolutional neural networks (CNNs) and YOLO architectures, demonstrate considerable efficacy in the detection, classification, and area measurement of pressure ulcer regions, including necrotic tissue, erythema, granulation tissue, and eschar. Models such as SE-ResNeXt101, Inception-ResNet-v2, and YOLOv8m have achieved high accuracy rates exceeding 90% in wound classification and surface area estimation. Furthermore, mobile application-based implementations have shown promising results in clinical settings, with YOLOv8m reporting an accuracy of 84%. Nevertheless, several studies have highlighted limitations, including difficulties in accurately identifying certain wound regions, the need for specialized hardware such as thermal or high-resolution cameras, and suboptimal performance in real-time environments. **Conclusion:** Artificial intelligence, particularly deep learning techniques, serves as a powerful complementary tool in the early detection and prevention of pressure ulcers. These technologies not only enhance diagnostic accuracy but also reduce the clinical workload on healthcare providers. However, addressing existing limitations and developing integrated, scalable systems capable of reliable real-world deployment remains essential for broader clinical adoption.

Keywords:
Artificial Intelligence, Prevention, Detection, Pressure Ulcers

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Code: wtrc12-00260092
Title:

Novel Therapies in the Management of Parasitic Skin Wounds: From Antiparasitic Drugs to Tissue Engineering

Authors:

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Abstract:
Background: Wounds caused by parasitic infections such as cutaneous leishmaniasis, mucocutaneous leishmaniasis, amoebic skin diseases such as Acanthamoeba, Balamuthia, myiasis, and chronic wounds associated with intestinal worms were usually treated with antiparasitic drugs and conventional wound management in the last years. Today, significant advances have been made in wound and skin ulcer treatment, which are due to the development of modern therapeutic methods such as the use of targeted small molecules, immunotherapy, and biomaterial dressings. The aim of this study was to review the clinical and practical evidence of new therapeutic methods in the healing of parasitic skin ulcers during the last 15 years (2010-2025). **Methods:** In this systematic review, scientific information and research articles published during the years 2010-2025 were collected. For accessing and collecting the scientific resources online, it was referred to the databases including Google Scholar, PubMed, Elsevier, Semantic Scholar, SID, and Magiran. The keywords used were parasitic skin wounds, protozoan parasite wounds, multicellular parasite skin wounds, treatment of parasitic wounds, amoebic wounds, leishmaniasis wounds. A total of 58 articles were collected, and 21 of them were selected for the present study. **Results:** Antiparasitic drugs including Paromomycin, Amphotericin B, Miltefosine, Imiquimod, and Buparvaquone are widely used in the treatment of parasitic wounds, especially leishmaniasis. Paromomycin, Amphotericin B, and Imiquimod loaded in lipid nanocarriers have been used mainly for improved skin delivery and antileishmanial activity. Complementary host-directed therapeutic approaches, including local and systemic immunomodulators and cytokine-based interventions, are currently undergoing further clinical investigation. Using cell therapy, scaffolds cultured with mesenchymal stromal cells led to an increase in the healing rate of parasitic wounds by the mechanism of angiogenesis and re-epithelialization in the skin of the wound site. Some findings showed the efficacy of mesenchymal stem cells treatment in accelerating wound healing and improving the quality of healed tissue in patients with chronic wounds. Combination strategies such as the use of antiparasitic drugs and advanced dressings (such as hydrogel dressings), and the use of growth factors PDGF and VEGF have accelerated the healing process of wounds caused by cutaneous leishmaniasis. The use of biomaterials, hydrogel dressings, collagen-based matrices, and silver-impregnated scaffolds containing antimicrobial peptides have accelerated wound closure and enhanced healing, while also reducing bacterial infection in parasitic wounds. **Conclusion:** Novel regenerative medicine approaches, encompassing cellular therapeutics, advanced hydrogel dressing systems, integrated antiparasitic-biomaterial combination strategies, targeted growth factor administration, immunomodulatory agents, and host-directed immunotherapeutic interventions, represent a paradigm shift in the management of parasitic cutaneous wounds. These innovative therapeutic modalities offer substantial promise for achieving rapid, complication-free healing outcomes in patients affected by parasitic skin infections, potentially transforming the clinical landscape of parasitic wound management.

Keywords:
Parasitic Skin Wounds, Protozoan Skin Ulcers, Multicellular Parasite Skin Wounds, Treatment of Parasitic Wounds, Wound Healing

Code: wtrc12-02220091

Title:

Study of the Preventive Use of Foam Dressings and Its Effect on the Incidence of Pressure Ulcers in Medical and Care Centers

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Abstract:

Background: One of the most common types of wounds found in hospitals and care centers is pressure ulcers. Pressure ulcers are defined as local damage to the skin or underlying tissues, usually over a bony prominence, resulting from pressure or friction or shear force. Unlike other wounds, this type of wound is often caused by neglect. **Methods:** Data on pressure ulcer incidence in the intensive care unit, which had a total of 27 hospital beds, were collected for 12 months and compared with the retrospective and annual average incidence of pressure ulcers in the past 3 years. In this study, patients were identified based on pressure ulcer risk criteria and simple polyurethane foams were used for these patients and the results obtained were compared with previous years. **Results:** By using simple polyurethane foam dressing in patients who were selected based on the criteria for the risk of pressure ulcers, the incidence of pressure ulcers in the hospital's intensive care unit decreased significantly over the past three years, from 28 cases in 1402, 30 cases in 1401, and 24 cases in 1400 to 13 cases in 1403. This reduction in the incidence of ulcers, in addition to reducing treatment costs, reduced the length of hospitalization of patients, led to savings in hospital costs for long-term treatment of these ulcers and increased the quality of treatment. Discussion and **Conclusion:** By adopting preventive policies and allocating funds to carry out these preventive policies, the very high costs of treating these patients can be prevented, and it is also beneficial for both patients and the hospital.

Keywords:

Pressure ulcers،Wound prevention،Foam Dressing،Reducing treatment Costs

Code: wtrc12-02520090
Title:

Development of an Integrated Nursing Care Model for HSCT in Autoimmune Skin Diseases: A Systematic Review

Authors:

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Abstract:
Background: Hematopoietic stem cell transplantation(HSCT) represents a promising therapeutic approach for severe, treatment-resistant autoimmune skin diseases. The complexity of this treatment and its associated complications necessitate specialized nursing care. This systematic review aimed to develop an integrated nursing care model to guide clinical practice throughout the HSCT process for this patient population. **Methods:** This review was conducted following PRISMA 2020 guidelines. A comprehensive literature search was performed across multiple databases (2000-2024). From 257 identified studies, 32 met the inclusion criteria. Study quality was assessed using appropriate tools, and data were synthesized through qualitative analysis. **Results:** The evidence synthesis resulted in a three-phase integrated care model: Pre-Transplantation Phase: Focuses on comprehensive preparation including physical and psychological assessment, baseline skin evaluation, detailed patient education, and informed consent procedures. Transplantation Phase: Emphasizes active monitoring and management of complications, including infection surveillance, GVHD detection, symptom control (pain, pruritus, mucositis), and specialized catheter care. Post-Discharge Phase: Centers on patient empowerment through self-management education, long-term follow-up planning, late complication monitoring, and ongoing psychosocial support. **Conclusion:** The findings demonstrate the necessity for an integrated, evidence-based nursing approach throughout the HSCT continuum. The proposed model provides a comprehensive framework for standardizing care, enhancing interdisciplinary collaboration, and improving patient outcomes. Implementation may reduce complications and enhance quality of life. Future research should focus on clinical validation and adaptation in diverse healthcare settings.
Keywords:
Hematopoietic Stem Cell Transplantation, Autoimmune Skin Diseases, Nursing Care Model, Patient Care

Code: wtrc12-02520089
Title:

The Advanced Practice Nurse's Role in Clinical Management of Patients Receiving Topical Nanomedicines: A Systematic Review

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Abstract:
Background: The rapid advancement of nanomedicines in dermatology has significantly evolved the nurse's role in managing these complex treatments. This systematic review synthesizes existing evidence to elucidate the dimensions of advanced nursing practice in comprehensive management of patients receiving topical nanomedicines. **Methods:** Following PRISMA 2020 guidelines, we systematically searched PubMed, Scopus, Web of Science, and Cochrane Central Register of Controlled Trials (2010-2024). Two researchers independently conducted screening, quality assessment using JBI tools, and data extraction, resolving discrepancies through third-researcher consultation. **Results:** Of 327 identified studies, 41 met inclusion criteria. Qualitative synthesis identified five key domains of advanced nursing practice: comprehensive patient assessment and selection; specialized patient education; active adverse effect monitoring; interdisciplinary coordination; and continuous outcomes documentation. **Conclusion:** Advanced nursing roles are crucial for optimizing outcomes in topical nanomedicine treatments. Implementing standardized protocols may enhance adherence, reduce adverse effects, and improve care quality. Specialized education and clear role definition are essential for advancing this emerging field.
Keywords:
Cutaneous Nanodrugs, Advanced Nursing Role, Clinical Management, Dermatology

Code: wtrc12-01300088
Title:

Effect of Epidermal Growth Factor (EGF) on Human Hair Dermal Papilla Cells in Vitro

Authors:

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Abstract:

Background: Androgenetic alopecia (AGA) is a common hair loss disorder caused by hereditary dihydrotestosterone-driven follicle miniaturization. Among the substances associated with hair follicles, epidermal growth factor (EGF) is recognized for affecting hair growth. Accordingly, the present study was designed to evaluate the in vitro effects of EGF on human hair dermal papilla cells. **Methods:** Dermal papilla cells isolated from human hair tissue were characterized by flow cytometry. The study included three experimental groups: EGF at concentrations of 2 and 10 μg/ml and a control group (containing FBS). A scratch assay was performed to measure cell proliferation and migration. The MTT assay was performed to measure cell viability. Gene expression was measured using RT-PCR. Immunocytochemistry was performed to measure protein levels. Alkaline phosphatase staining was conducted to evaluate the hair-inductive ability of dermal papilla cells. **Results:** Flow cytometry analysis of versican protein expression (80.86%), α-SMA protein expression (64.6%), and CD133 expression (82.56%) confirmed that the cells extracted from human hair tissue were dermal papilla cells. The proliferation and migration of dermal papilla cells after 24 hours, assessed by the scratch assay, was significantly higher than the control group in the 10 μg/ml EGF-treated group. None of the groups had a significant difference in cell viability after 24, 48, and 72 hours. The V-can gene, which is involved in hair follicle induction, showed no significant difference in expression in the 10 μg/ml EGF group compared to the control group. The α-SMA gene, as an in vitro marker for dermal papilla, showed that its expression in the 10 μg/ml EGF group was significantly higher than the control group. Alkaline phosphatase gene expression in any of the groups was not significantly different from the control group. Versican and α-SMA protein expression in the 10 μg/ml EGF group was not significantly different from the control group. No significant difference was observed between the 10 μg/ml EGF group compared to the control group in terms of hair induction potential. **Conclusion:** The 10 μg/ml EGF group showed superior effects on human dermal papilla cells in terms of proliferation, migration and α-SMA gene expression. Therefore, to take a step towards finding a new drug for the treatment of hair loss, preclinical and clinical studies using 10 μg/ml EGF are recommended.

Keywords:

Epidermal growth factor (EGF), Dermal papilla cells, Hair loss, Androgenetic alopecia (AGA)

Code: wtrc12-02590087
Title:

Smart Nanocarriers for Peripheral Neuron Targeting: A Novel Strategy to Disrupt Neurogenic Inflammation in Chronic Wounds

Authors:

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Abstract:
Background: A self-sustaining cycle of inflammation and impaired tissue repair marks the chronic inflammatory wounds. This pathology arises as a result of the dysfunctional communication between the immune and nervous systems. These neuropeptides are released by sensitized nociceptors (sensory nerve endings) into the wound bed and powerfully promote neurogenic inflammation through their actions on immune cells; e.g., Substance P (SP), Calcitonin Gene-Related Peptide (CGRP). Traditional anti-inflammatory treatments have a high risk of inducing systemic side effects and low drug delivery concentrations. In this review, we highlight the developing concept of posterior analgesic Drug Delivery Systems (DDSs) that can selectively act on these hyperactive peripheral neurons. This strategy is intrinsically directed at overcoming the chronicity cycle by administering strong therapeutics targeted using a nanocarrier functionalized with favorable ligands, directly at the site of neurogenic inflammation, for enhancement and promotion of the healing process. Material and **Methods:** We searched PubMed, Scopus, Google Scholar, and Web of Science to find original research studies from 2020 to 2025. Recognized words were "targeted drug delivery," nanoparticles," peripheral neurons," neurogenic inflammation." chronic wounds," and Substance P", NK1 receptor". The review discusses design principles such as nanocarrier type (e.g., liposomes, polymeric nanoparticles), choice and activity of targeting ligand with some examples cited on peptides and antibodies, therapeutic agent selected to be encapsulated within the carrier system used in breast cancer management, like NK1 antagonists & corticosteroids potency against different pathways besides dialling preclinical outcome. **Results:** Recent literature demonstrates the large progress in designing neuron-specific nanocarriers. This has been driven largely by ligand engineering, using molecules targeting the (over) expression of receptors such as NK1 and voltage-gated sodium channels with high affinity for peptides derived from Substance P or neurotoxins like Tetrodotoxin on sensitized nociceptors. These nanocarriers, which are usually made of biocompatible polymers or lipids and conjugated to certain ligands for their targeting ability, have been proven much more potent in neuronal cell cultures (e.g., PC12 cells, Dorsal Root Ganglion neurons) than non-targeted systems. In animal models of diabetic or chronic wounds, targeted nanoparticles loaded with NK1 antagonists (e.g., Aprepitant) or other effective drugs in inflammation (e.g., Dexamethasone) led to higher efficacies for wound closure acceleration, pro-inflammatory cytokines production suppression (TNF-α and IL-6), neutrophil and macrophage infiltration decreases, and re-epithelialization/collagen deposition promotion. This is done with limited systemic exposure demonstrated by biodistribution studies. **Conclusion:** This is a significant advancement, and these intelligent nanocarriers for peripheral neuron-specific active targeting serve as smart platforms in chronic wound healing. This intervention in itself acts to dampen neurogenic inflammation, where it begins at the molecular level responsible for the underlying pathophysiology; they are known as effective because of their capability of precise site-specific pharmacotherapy. In the future, we need to design systems that can cater to several targets simultaneously, besides investigating stimuli-responsive release mechanisms that respond in a triggered manner according to wound microenvironment (e.g., pH and enzymes), and all such prospective strategies should move from pre-clinical validation studies toward their clinical utility with reference to curing chronic inflammatory wounds.
Keywords:
Smart Nanocarriers, Neurogenic Inflammation, Chronic Wounds, Targeted Drug Delivery, Peripheral Neurons

Twelfth Yara International Congress of Wound and Tissue Repair

Code: wtrc12-01390085
Title:

Plant-Derived Electrospun Nanofibers for Antimicrobial Wound Management: A State-of-the-Art Review

Authors:

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Abstract:
Chronic and infected skin wounds continue to impose significant clinical and economic burdens, representing a major challenge in regenerative medicine and tissue engineering. Traditional wound dressings often fail to provide adequate infection control, moisture management, and support for tissue regeneration. In this context, electrospun nanofibers have emerged as a promising platform for advanced wound care because they replicate the extracellular-matrix-like structure, exhibit high surface-to-volume ratio, porosity, and amenability to loading bioactive agents. Recent advances have particularly highlighted the use of plant-derived materials within electrospun systems—either as biopolymer matrices (such as plant proteins, cellulose derivatives, and alginates) or as locally loaded phytochemicals (such as essential oils, polyphenols, flavonoids)—to endow wound dressings with inherent antimicrobial, anti-inflammatory, and antioxidant functionalities. This state-of-the-art review synthesizes literature primarily from 2019 to 2025, focusing on (i) fabrication strategies for plant-derived and plant-loaded electrospun nanofibers, (ii) key material design parameters (including polymer selection, fibre morphology, porosity, degradation rate, and release kinetics of bioactives), (iii) antimicrobial performance and wound-healing outcomes (in vitro, ex vivo and in vivo) of such systems, and (iv) existing limitations and future directions. Specifically, plant-extract-incorporated nanofibers have demonstrated significant inhibition of Gram-positive and Gram-negative pathogens, improved fibroblast attachment and migration, enhanced collagen deposition and angiogenesis, and reduced inflammatory response relative to conventional dressings. For example, recent reports highlight nanofibres incorporating plant essential oils achieving sustained release profiles and superior antibacterial efficacy. Despite these promising results, several challenges persist: mechanical robustness under physiological load, reproducibility of fibre fabrication with complex phytochemical blends, stability of plant extracts during electrospinning and storage, scaling up production, and the paucity of robust clinical data supporting translation. Moving forward, the review proposes three key research pathways: (1) development of green-solvent electrospinning and biopolymer composites to improve sustainability and biocompatibility; (2) design of multifunctional multilayer or core–shell nanofiber architectures enabling dual- or multi-stage release of antimicrobial and regenerative cues; and (3) long-term preclinical and clinical studies assessing safety, efficacy, and cost-effectiveness in relevant wound models. In summary, plant-derived electrospun nanofibers represent a compelling and rapidly evolving category of multifunctional wound dressings that actively manage microbial infection while promoting tissue regeneration, thereby offering next-generation solutions for complex wound care.

Keywords:
Electrospun nanofibers, Plant-derived biomaterials, Antimicrobial wound dressing, Tissue regeneration

Code: wtrc12-01390084
Title:

Advances in Rosemary-Loaded Electrospun Nanofibers for Wound Healing and Antimicrobial Applications

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Abstract:
Skin wound healing, particularly in chronic or infected wounds, remains a significant challenge in regenerative medicine and tissue engineering. Electrospun nanofibers have emerged as promising wound dressings due to their extracellular matrix-like structure, high surface area, porosity, and capacity for loading bioactive agents. Rosemary (Rosmarinus officinalis), rich in bioactive phytochemicals such as α-pinene, exhibits antimicrobial, anti-inflammatory, and antioxidant properties, making it an attractive candidate for incorporation into nanofibers. Recent studies have demonstrated that loading rosemary extract or essential oil into natural and synthetic polymers (e.g., zein, cellulose acetate, polyurethane) via electrospinning produces fibers with uniform morphology and controlled release profiles. These rosemary-loaded nanofibers not only provide a moist and protective environment for wounds but also show significant antibacterial activity against both Gram-positive and Gram-negative pathogens. Synergistic effects with metallic nanoparticles (e.g., silver, ZnO) further enhance antimicrobial and anti-biofilm properties. Preliminary in vivo studies indicate that rosemary can accelerate wound healing by promoting fibroblast migration, collagen synthesis, and angiogenesis. Despite these advantages, challenges remain, including potential morphological changes and reduced mechanical properties at high loading concentrations, and limited clinical data. Future research should focus on extensive in vivo evaluation, optimization of electrospinning parameters for controlled release, and multilayered nanofiber designs for synergistic wound healing and antimicrobial effects. In conclusion, rosemary-loaded electrospun nanofibers represent a promising natural and biocompatible strategy for advanced wound management, combining antimicrobial activity with enhanced tissue regeneration potential.

Keywords:
Electrospun nanofibers, Rosemary, Wound healing, Antimicrobial

Code: wtrc12-02650083
Title:

Preparation of PEG-Starch Scaffold Containing Nanosilica and Nano-HAp for Vancomycin Loading

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Abstract:
Wound repair is a complex biological process and is often associated with complications such as infection. Advanced materials, especially nanomedicines, offer promising solutions. These materials can be effective in improving the wound healing process by allowing controlled drug release, helping tissue regeneration with antimicrobial properties. The main objective of this study is to evaluate the potential of a nanocomposite consisting of polyethylene glycol (PEG), Starch, nano-hydroxyapatite (nano-HAp), SiO2 (nanosilica), and urea for vancomycin drug release and antibacterial applications. Analyses included Fourier transform infrared (FTIR) spectroscopy for structural identification, MTT assay for biocompatibility, and minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) assays to assess antibacterial efficacy against Staphylococcus aureus. An important observation from the MTT assay was the superior biocompatibility of the urea-free formulations, which showed high cell viability. In contrast, the urea-containing formulations showed a lower improved MIC. Notably, the base matrix itself exhibited an intrinsic antibacterial effect, and vancomycin activity was significantly improved by the simultaneous presence of urea. The specific ratios of nano-HAp and nanosilica did not have a significant effect on immediate biocompatibility or antibacterial efficacy in the range tested. Collectively, these findings demonstrate the high potential of this multifunctional nanocomposite as a novel therapeutic platform for healing infected wounds and accelerating tissue repair. Conclusions a comprehensive analysis of PEG-starch composites with nano-HAp, nanosilica, urea, and vancomycin additives highlights their significant potential for advanced wound healing applications. These materials offer a multifaceted platform that not only targets infection through controlled antibiotic release, but also actively stimulates tissue regeneration processes.

Keywords:
PEG, Strach, scaffold, Nano-HAp, nanosilica, wound, Vancomycin

Code: wtrc12-02570082
Title:

Rehabilitation Approaches to Improve Skin Health in Patients with Spinal Cord Injury: A Scoping Review

Authors:

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Abstract:

Background: Skin complications are common after spinal cord injury and can significantly affect quality of life. Rehabilitation approaches may help maintain skin health; however, evidence regarding their effectiveness remains limited. This study was conducted to identify rehabilitation approaches aimed at improving skin health in individuals with spinal cord injury. Materials and **Methods:** This scoping review followed the Arksey and O'Malley (2005) framework and was reported according to PRISMA-ScR guidelines. A systematic search was performed in PubMed, Scopus, Web of Science, CINAHL, and Google Scholar for English-language articles published between 2010 and 2025. Search terms included "spinal cord injury," "rehabilitation," "skin health," "pressure ulcer prevention," "rehabilitation," and "self-management." In total, 1,246 records were retrieved. After removing 312 duplicates, 934 titles and abstracts were screened. Of these, 142 full-text articles were assessed for eligibility, and finally 38 studies met the inclusion criteria. Data were charted using a structured form, focusing on study design, population, type of intervention, and outcomes. **Results:** A total of 38 studies met the inclusion criteria. The included studies reported a variety of rehabilitation approaches aimed at improving skin health and preventing pressure injuries in individuals with SCI. Educational and self-management programs were commonly implemented to enhance patients and caregivers' knowledge, encourage adherence to preventive behaviors and promote proper skin care through structured training, booklets or digital tools. Physical interventions, such as repositioning schedules, pressure relief techniques, pressure-distributing cushions and mattresses and functional electrical stimulation, were applied to improve circulation and reduce the risk of skin breakdown. Assistive technologies and monitoring systems were also used in some studies to detect high-risk areas and support timely preventive measures. Overall, most studies demonstrated improvements in skin integrity, a lower incidence of pressure injuries and increased adherence to recommended preventive practices. However, there was substantial variability in study designs, sample sizes, intervention durations and outcome measures, which limited the ability to directly compare results across studies and draw definitive conclusions about the relative effectiveness of different interventions. **Conclusion:** Rehabilitation interventions are essential for promoting skin health and preventing pressure injuries in SCI patients. Multidisciplinary approaches combining education, physical therapy and technology-based strategies are recommended. Future research should focus on standardized protocols and long-term evaluation of intervention effectiveness.

Keywords:
Spinal Cord Injury, Skin Health, Management, Rehabilitation.

Code: wtrc12-02210076
Title:

Smart Wound Healing Systems with a Theranostic Approach: Focusing on Natural Sensors

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Abstract:

Theranostics is a term that combines "therapy" and "diagnosis". The aim of this approach is to improve the effectiveness of therapy by using a single molecule, known as a targeting agent, to diagnose and treat disease. Chronic wounds, such as diabetic and pressure ulcers, are one of the major challenges in regenerative medicine, and their treatment and monitoring of healing require precise and sustainable methods. In recent years, the development of smart theranostic hydrogels has attracted much attention, as these systems have the ability to simultaneously diagnose and treat. One of the key parameters in assessing the progress of wound healing is the pH changes in the tissue environment, which can indicate different stages of healing or the occurrence of infection. In this regard, the use of natural, biocompatible and non-toxic pH-sensing compounds such as curcumin has provided a new perspective in wound healing with a theranostic approach. Curcumin not only acts as an anti-inflammatory, antioxidant and antibacterial compound, but also, due to its pH-dependent color change, it can be used as a natural colorimetric sensor for wound monitoring. Incorporation of curcumin into alginate hydrogels increases stability, controls drug release and allows visual monitoring of pH changes. Utilizing this system alongside new technologies such as wearable sensors, the Internet of Things and data analysis through artificial intelligence can lead to the design of smart wound dressings that automatically assess and manage the wound healing process. Overall, curcumin, as a natural theranostic agent, can be a gateway to the development of novel systems for the simultaneous treatment and monitoring of chronic wounds and can be considered an effective step towards personalized medicine and complex wound healing

Keywords:
Curcumin, pH sensor, Smart Hydrogel, Theranostics, Wound Healing

Code: wtrc12-00140075
Title:

From Artificial Intelligence to Artificial Skin: Revolutionizing Wound Healing

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Abstract:
Background: Chronic wounds such as diabetic ulcers, pressure injuries, and burn wounds continue to be a significant global healthcare burden, affecting millions of patients each year. These wounds are often characterized by prolonged inflammation, infection risk, and poor tissue regeneration, leading to high morbidity and economic strain on healthcare systems. Traditional wound care relies heavily on manual assessment and repetitive dressing changes, which are subjective and time-consuming. In recent years, remarkable progress has been made in two parallel domains — Artificial Intelligence (AI) and Artificial Skin Technologies — both offering innovative solutions to transform the wound healing process. AI has emerged as a valuable tool for early wound detection, image-based analysis, and predictive modeling, while artificial skin and bioengineered materials represent a breakthrough in regenerative therapy. Together, these technologies promise to revolutionize wound care by promoting precision, personalization, and proactive intervention. Methods / Materials and **Methods:** A comprehensive review was conducted using databases such as PubMed, Scopus, and ScienceDirect, focusing on studies published between 2018 and 2025. The inclusion criteria encompassed research involving AI-driven wound assessment, smart dressings with biosensors, and artificial or bioengineered skin grafts. Key parameters analyzed included: 1. Diagnostic accuracy of AI in wound image analysis and infection prediction. 2. Efficacy of bioengineered skin substitutes in accelerating tissue regeneration. 3. Clinical integration of smart dressing technologies for real-time monitoring. 4. Nursing implications in adopting and managing these technologies in wound care practice. **Results:** The findings reveal that AI-assisted wound imaging systems can achieve diagnostic accuracies exceeding 90%, enabling early recognition of infection and precise measurement of wound dimensions. Deep learning algorithms have demonstrated the capacity to predict healing trajectories based on clinical and environmental variables. Smart dressings integrated with biosensors have been developed to continuously monitor wound pH, temperature, and moisture levels, transmitting data to healthcare providers via wireless devices. These systems allow for real-time decision-making and reduce unnecessary dressing changes, minimizing discomfort and infection risks. Meanwhile, artificial skin technologies, including bioengineered scaffolds, stem cell-based constructs, and 3D-bioprinted skin models, have shown remarkable potential in accelerating epithelialization, improving tissue integration, and reducing scar formation. Nurses play a central role in this evolving landscape — from performing advanced wound assessments using AI platforms to interpreting biosensor data, coordinating interdisciplinary care, and providing patient education about the use of digital wound technologies. **Conclusion:** The integration of Artificial Intelligence and Artificial Skin technologies represents a paradigm shift in wound management and tissue regeneration. By bridging digital innovation with biological science, healthcare is moving toward an era of “intelligent wound healing.” For nursing professionals, this evolution demands not only clinical expertise but also digital literacy and a proactive role in technology implementation. Empowering nurses to become leaders in smart wound care will enhance patient outcomes, reduce healthcare costs, and accelerate recovery. The future of wound management lies in the synergy between human compassion and artificial intelligence — where science and care work hand in hand to heal smarter, faster, and better

Keywords:
Artificial Intelligence, Skin, Revolutionizing

Code: wtrc12-01480074
Title:

The Impact of Silver Dressings on Preventing Catheter-Related Infections in Tunneled Dialysis Catheters in Hemodialysis Patients: A Systematic Review

Authors:

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Abstract:
Background: Tunneled catheters are among the most frequently used medical devices for vascular access in hemodialysis units. Catheter-related bloodstream infection (CRBSI) is a common complication. These infections increase mortality, hospital stay duration, and healthcare costs. Preventing these infections is a critical nursing priority. This study aimed to investigate the impact of silver dressings on preventing CRBSIs in tunneled dialysis catheters in hemodialysis patients. **Methods:** This was a systematic review conducted per the PRISMA guideline. A literature search was performed in Web of Science, PubMed, Scopus, SID, Magiran, and IranDoc databases from 2010 to 2024. Keywords included 'silver dressing,' 'hemodialysis,' 'catheter infection,' and their Persian equivalents. Original research articles and systematic reviews in Persian or English addressing vascular catheter infections and silver dressings for prevention, with accessible full texts, were selected. Quality and risk of bias were assessed using standard tools. From 347 identified articles, 95 duplicates were removed. 252 articles were screened; 198 were excluded based on inclusion/exclusion criteria. After full-text review, 18 articles relevant to the study objective were selected. **Results:** Multiple studies demonstrated that silver dressings significantly reduce the incidence of CRBSIs in tunneled dialysis catheters. The greatest efficacy was observed in reducing bacterial infections. A reduced need for catheter replacement and removal was reported. Some studies also indicated decreased hospital stay duration and treatment costs associated with infection. **Conclusion:** Silver dressings represent an effective intervention for preventing CRBSIs in tunneled dialysis catheters. Based on current evidence, the use of silver dressings is recommended. This should be implemented alongside strict adherence to aseptic technique and standard nursing care of the catheter.
Keywords:
Silver Dressing, Dialysis Catheter Infection, Hemodialysis, Nursing Care

Code: wtrc12-02210071
Title:

Emerging Biosensor Technologies for Wound Healing Monitoring: Trends, Challenges, and Future Perspectives

Authors:

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Abstract:
Wound healing is a complex and dynamic biological process involving a cascade of cellular and molecular events across the phases of hemostasis, inflammation, proliferation, and remodeling. Chronic wounds, such as diabetic ulcers and pressure sores, pose significant healthcare challenges due to delayed healing and susceptibility to infection. Conventional wound assessment techniques are limited by their subjective, invasive, and intermittent nature. In contrast, biosensor technologies have emerged as transformative tools for real-time, continuous, and non-invasive monitoring of key wound biomarkers, including pH, glucose, oxygen, temperature, and inflammatory mediators. Recent advances in flexible materials, nanotechnology, and microfabrication have enabled the integration of electrochemical, optical, and piezoelectric biosensors into smart wound dressings capable of precise physiological sensing and feedback. Furthermore, the convergence of biosensing with artificial intelligence (AI), Internet of Medical Things (IoMT), and self-powered microelectronic systems has revolutionized personalized wound care by enabling predictive analytics, automated drug delivery, and remote patient management. Despite these advances, several challenges remain regarding long-term stability, biocompatibility, energy efficiency, data privacy, and large-scale clinical translation. Future research is expected to focus on developing biodegradable and self-healing sensor materials, theranostic platforms that combine diagnosis and therapy, and AI-guided closed-loop systems for adaptive wound management. Collectively, these innovations are paving the way toward a new era of intelligent, data-driven, and patient-centered wound care, significantly improving clinical outcomes and healthcare sustainability worldwide.

Keywords:
Wound Healing Monitoring, Wearable Biosensors, Smart Dressings, Artificial Intelligence, Real-time Diagnostics

Code: wtrc12-00260069
Title:

Tissue Lesions and Necrotic Wounds in Amebic Skin Infections Caused by Acanthamoeba and Balamuthia

Authors:

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Abstract:
Background: Free living (amphizoic) amoeba including Acanthamoeba and Balamuthia mandrillaris can cause skin diseases. The lesions and damages of these cutaneous infections usually have manifestations such as non-healing nodules, necrotic ulcers, or plaques particularly in immune-compromised hosts. It is possible that the Skin lesions precede or accompany spread to the central nervous system and any delaying in diagnosis of the infection can lead to a high mortality rate. The aim of this study was to investigate the clinicopathological features of cutaneous amoebic infections especially the infections caused by Acanthamoeba and Balamuthia, diagnostic methods, and therapeutic strategies aimed at infection control and wound healing. **Methods:** In this systematic review study for collecting the pertained scientific information and published research articles, they were referred to data banks including PubMed, SID, Google Scholar, and Scopus. All the papers published among 2010-2025 were collected. The keywords for this search were Acanthamoeba, Balamuthia, Skin Lesions, Skin Ulcers, Necrotic wounds, and Healing skin wounds. From the 34 retrieved articles, 22 papers full texts were evaluated, and finally 13 papers were selected for the investigation. **Results:** Granulomatous amebic encephalitis is a consequence of Acanthamoeba and Balamuthia infections, although in Balamuthia infection this infection is more severe. Amebic keratitis and corneal ulcers and inflammation are other common complications caused by Acanthamoeba. In this ocular infection, the Acanthamoeba pathogen can enter the stroma of the eye in addition to the epithelium, leading to necrosis and severe inflammation, neuritis, and ultimately chorioretinitis. Chronic skin ulcers, abscesses, and erythematous nodules are also common in these amoebic infections. Trophozoites and Acanthamoeba cysts can be identified in cutaneous ulcers. Skin ulcers, and eye, brain, and lung infections caused by Acanthamoeba and Balamuthia occur more frequently among the immuno-compromised people. For treatment, miltefosine, amphotericin B, azoles, flucytosine, pentamidine, macrolides are often prescribed in combination and for long periods. Surgical removal of localized lesions can be beneficial if possible. **Conclusion:** Amebic infections caused by Acanthamoeba and Balamuthia result in a variety of skin, ocular, cerebral, and pulmonary lesions and ulcers, especially in immunocompromised individuals. Therefore, a high index of suspicion for amebic causes in unusual nonhealing wounds—especially in immunocompromised patients—is essential. Aggressive multidisciplinary treatment combined with appropriate wound management is the best strategy for controlling these infections.

Keywords:
Acanthamoeba, Balamuthia, Cutaneous Ulcer, Necrotic Wounds, Skin Lesions

Code: wtrc12-02050068
Title:

Evaluation of the Effectiveness of Mouthwash Containing Pomegranate Peel Extract Formulation in the Treatment of Patients with Recurrent Aphthous Ulcerative

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Abstract:
Background: Aphthe is recurrent and painful diseases of the oral mucosa that can be very painful and annoying despite their small size. There is no definitive cure for the aphthe and the usual treatments are mainly based on pain control. Topical treatments should be considered as the first line of treatment due to the lower risk of systemic side effects. The aim of this study was to investigate the effect of Pomegranate in the treatment of recurrent aphthous stomatitis. **Methods:** This study is a randomized clinical trial conducted in 2020 at Zahedan University of Medical Sciences on 60 patients with aphthous lesions. Patients were placed in three groups: placebo, positive control, case control that received appropriate solutions. The therapeutic effects of the drug on pain were assessed using VAS and wound size using periodontal probe on days 2 and 7 after treatment. Patients were also asked about the amount and duration of recovery and complete pain relief. Data were evaluated using ANOVA statistical test. **Results:** According to the results of this study, there was no statistically significant difference in the mean wound size on the seventh day between the positive and case control groups (P> 0.05) but there was a statistically significant difference compared to the placebo group (P <0.05). On the second and seventh days, there was no statistically significant difference between the positive and case control groups (P> 0.05) but there was a statistically significant difference compared to the placebo group (P <0.05). **Conclusion:** Herbal medicine of pomegranate peel extract can be used as the first line of treatment for aphthous lesions. This herbal medicine has no side effects.
Keywords:
Detergent, Recurrent Aphthous Stomatitis, Herbal Medicine

Code: wtrc12-01990065
Title:

The Effect of Using Personal Protective Equipment on Improving the Quality of Life of Patients with Occupational Hand Eczema: A Cross-sectional Study

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Abstract:
Background: The present study was conducted with the aim of investigating the effect of using personal protective equipment on improving the quality of life of patients with occupational hand eczema. **Methods:** In this cross-sectional-analytic study, 244 patients with occupational hand eczema were studied using convenience sampling. The data collection tools were the standard questionnaire of the Dermatological Diseases Quality of Life Index (DLQI) and the Visual Analog Scale (VAS) and the questionnaire on the use of personal protective equipment. Data analysis was performed using Stata version 14 and the crude and adjusted odds ratio (Odds Ratio) with a 95% confidence interval (95% CI) were reported. **Results:** 46.7% had severe eczema. Multivariate logistic regression model showed that age over 30 years (9.98-2.92: 95% confidence interval with OR=40.5), use of personal protective equipment with OR=4.80, 95% confidence interval, female gender (1.14-3.60: 95% confidence interval with OR=2.02), housewifery (1.94-24.14: 95% confidence interval with OR=25.5), work experience over 5 years (13.95-2.85: 95% confidence interval with OR=4.59), working hours over 8 hours (57-2.62: 95% confidence interval with OR=4.71), and severity of hand eczema (2.28-2.56: 95% confidence interval with OR=2.14) were the most important predictors of quality of life in patients with hand eczema. **Conclusion:** Hand eczema has a significant impact on the quality of life of most patients, therefore, the use of personal protective equipment, taking into account the above-mentioned factors, seems necessary to improve the quality of life of these patients.
Keywords:
Occupational Hand Eczema, Personal Protective Equipment, Quality of Life

Code: wtrc12-01390064
Title:

Electrospun Herbal Nanofibers as Antimicrobial Wound Dressings: A Review

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Abstract:
Chronic and acute wounds remain a major global health challenge, often resulting in prolonged healing, infections, and increased healthcare costs. There is an urgent need for advanced wound dressings that provide structural support, controlled delivery of therapeutic agents, and antimicrobial protection. Electrospun nanofibrous scaffolds have emerged as a promising platform due to their high porosity, large surface area, and structural resemblance to the natural extracellular matrix, which collectively enhance cell attachment, proliferation, and tissue regeneration. In recent years, herbal extracts—rich in antimicrobial, anti-inflammatory, and antioxidant compounds—have gained attention as natural therapeutic agents. However, their direct application is limited by low stability, rapid degradation, and inefficient delivery to the wound site. Incorporating these extracts into electrospun nanofibers addresses these challenges by enabling controlled and sustained release while preserving their bioactivity. This review highlights recent advances (over the past five years) in the development of herbal-extract-loaded electrospun nanofibers for antimicrobial wound dressings. Key aspects discussed include: (1) fabrication techniques, such as single-fluid, coaxial, and emulsion electrospinning; (2) commonly used natural and synthetic polymers; (3) types of herbal extracts and their bioactive constituents; and (4) physicochemical, mechanical, and antimicrobial performance of the resulting scaffolds. Both in vitro and in vivo studies are reviewed, demonstrating improved wound closure, reduced microbial load, and enhanced tissue regeneration. Importantly, herbal extracts not only provide direct antimicrobial and regenerative effects, but also influence the physical properties of electrospun mats—including fiber diameter, porosity, hydrophilicity, and mechanical strength—further enhancing their wound healing potential. Despite these promising developments, challenges remain in scalable production, sterilization, and regulatory compliance. Emerging strategies, such as smart responsive dressings, hybrid nanofiber architectures, and personalized wound care solutions, are explored as the next frontier for clinical translation. In conclusion, integrating herbal bioactives into electrospun nanofibers offers a sustainable, multifunctional, and clinically promising approach for next-generation wound dressings. By combining the therapeutic potential of natural compounds with advanced nanotechnology, these materials have the potential to accelerate healing, reduce infections, and improve patient outcomes effectively and safely.

Keywords:
Biopolymer Scaffolds, Controlled Drug Release, Tissue Regeneration, Antimicrobial Wound Dressing, Herbal Extracts, Electrospun Nanofibers

Code: wtrc12-01500061
Title:

Synthesis of Chitosan Nanoparticles as a Blood-Coagulant Wound Dressing and Investigation of Its Antibacterial Properties

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Abstract:
Bleeding from trauma is one of the major challenges in trauma management. Given the importance of rapid control of bleeding, researchers are seeking to develop effective and biocompatible blood clotting materials. Chitosan, a natural polymer derived from marine sources, is a promising option in this field due to its blood clotting properties and biocompatibility. The use of different and effective materials in crosslinking this polymer to achieve the final structure is of particular importance. Nowadays, with the advancement of nanotechnology, its significant contribution in various industries cannot be ignored. One of the biocompatible polymers with biological degradability and non-toxicity is chitosan. This study showed that the use of chitosan nanoparticles, in addition to reducing production costs, can significantly improve the antibacterial and blood coagulation properties of these wound dressings, which in turn is one of the innovative studies in the field of nanobiomaterials in the field of wound dressings.

Keywords:
Nanoparticles, Chitosan, Wound Dressing

Code: wtrc12-01680058
Title:

Mechanisms of Oxidative Stress from Air Pollutants and Their Role in Premature Skin Aging

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Abstract:
Background: Air pollution is a pervasive environmental stressor that exacerbates premature skin aging through oxidative stress mechanisms. Common pollutants, including particulate matter (PM), ozone (O_3), nitrogen dioxide (NO_2), and polycyclic aromatic hydrocarbons (PAHs), generate reactive oxygen species (ROS) that disrupt skin homeostasis, leading to wrinkles, hyperpigmentation, and loss of elasticity. This review synthesizes evidence on how these pollutants interact with intrinsic aging processes, highlighting the need for targeted interventions in urban populations. **Methods:** A comprehensive literature search was conducted using databases such as PubMed, Scopus, Web of Science, and Google Scholar. Keywords included "air pollution," "oxidative stress," "skin aging," "reactive oxygen species," "particulate matter," and "ozone." Inclusion criteria encompassed peer-reviewed articles from 2000 to 2025, focusing on epidemiological, in vitro, in vivo, and molecular studies. Exclusion criteria omitted non-English articles, case reports, and studies lacking mechanistic insights. A total of 150 articles were screened, with 50 selected for detailed analysis. Data synthesis involved qualitative assessment of mechanisms, pathways, and outcomes. **Results:** Air pollutants induce ROS via direct generation, mitochondrial dysfunction, aryl hydrocarbon receptor (AhR) activation, and antioxidant depletion. PM and PAHs activate NADPH oxidase and CYP1A1, elevating superoxide and lipid peroxides. This leads to matrix metalloproteinase (MMP) upregulation, collagen degradation, DNA damage, cellular senescence, and inflammaging. Epidemiological data from cohorts in Europe and Asia link chronic exposure to 20-25% increased wrinkle severity and pigmentation disorders. Synergies with UV radiation amplify effects, while antioxidants like vitamins C and E mitigate damage in experimental models. **Conclusion:** Oxidative stress from air pollutants significantly accelerates premature skin aging through multifaceted molecular pathways. Preventive strategies, including topical antioxidants and pollution reduction policies, are essential to preserve skin health. Future research should explore personalized interventions for high-risk groups.

Keywords:
Air Pollution, Oxidative Stress, Premature Skin Aging, Reactive Oxygen Species (ROS)

Code: wtrc12-01640057
Title:

The Diagnostic Value of the Neutrophil-to-Lymphocyte Ratio (NLR) for Early Differentiation of Postsurgical Bacterial Meningitis: A Retrospective Analysis

Authors:

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Abstract:

Background: postoperative bacterial meningitis (POBM) is a serious but uncommon complication after neurosurgical and spinal procedures, with mortality rates up to 20–50%. Diagnosis is difficult early on because typical meningeal signs (fever, neck stiffness) may be masked by postoperative recovery, analgesia, or altered mentation, causing delays in treatment. CSF culture—the gold standard—takes days and can be false-negative in up to 70%, making rapid differentiation from aseptic inflammation challenging. There is an urgent need for a fast, accessible, and inexpensive biomarker to distinguish bacterial from nonbacterial meningitis at first suspicion. This study evaluates the neutrophil-to-lymphocyte ratio (NLR) as a potential point-of-care marker to speed diagnosis and reduce time-to-treatment. **Methods:** We conducted a retrospective cohort analysis of patients admitted to the neurosurgical and spinal surgery units between January 2014 and December 2024. The primary cohort included 292 consecutive patients diagnosed with postoperative meningitis, categorized into Bacterial Meningitis (BM) (n=230) and Nonbacterial/Aseptic Meningitis (NM) (n=62) and control group (n=60) of healthy individuals. The Neutrophil-to-Lymphocyte Ratio (NLR) was calculated from Complete Blood Count (CBC) data obtained at initial presentation. NLR values were compared across all groups using the Kruskal-Wallis. Diagnostic performance for differentiating BM from NM was assessed via Receiver Operating Characteristic (ROC) curve. (ethical approval number: IR.IUMS.REC.1403.569). **Results:** NLR was significantly elevated in the primary study cohort compared to the healthy controls ($p<0.001$). More critically, BM patients presented with significantly greater NLR values (11.32±4.1) compared to NM patients (7.0±3.2), a difference that was highly significant ($p<0.001$). Klebsiella pneumoniae was the most prevalent pathogen. The NLR demonstrated excellent discriminatory ability for differentiating BM from NM, with a ROC area under the Curve (AUC) of 0.86 (95% CI 0.82–0.90). The optimal NLR cut-off value of 9.5 yielded a sensitivity of 88% and a specificity of 81%. Furthermore, an elevated NLR was independently associated with a significantly increased 30-day mortality (Odds Ratio 2.1, $p=0.012$). The Platelet-to-Lymphocyte Ratio (PLR) showed no significant difference between the BM and NM groups. **Conclusion:** The NLR is a strong, rapid, and accessible biomarker for distinguishing bacterial from nonbacterial meningitis in the postoperative setting. An NLR value greater than 9.5 offers a highly sensitive and specific screening threshold to support clinical decision-making. Utilizing this threshold could potentially significantly improve timely empirical antibiotic intervention, directly addressing the high mortality risk associated with diagnostic delay. An elevated NLR was also independently predictive of increased patient mortality. Despite the inherent limitations of a retrospective design, these results strongly support the NLR's clinical utility and necessitate further prospective validation to confirm its role in risk stratification protocols

Keywords:

Bacterial Meningitis, Nonbacterial Meningitis, Complete Blood Count, Neutrophil-To-Lymphocyte Ratio, Platelet-To-Lymphocyte Ratio

Code: wtrc12-00970056
Title:

Design and Manufacture of a Hemostatic Patch with a Microneedle Structure Based On Gelatin-Chitosan

Authors:

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Abstract:
Uncontrolled bleeding from wounds caused by accidents is one of the leading causes of death, and rapid control of bleeding plays a vital role in improving clinical outcomes. So far, several structures, including nanofibrous, hydrogel, film, and micro-needle structures, have been used for hemostatic agents. Among them, micro-needles have a high ability to stop bleeding due to their surface penetration and physical locking on the tissue, and they provide faster and more effective performance compared to conventional methods. The main objective of this study is to design and produce gelatin-chitosan-based micro-needle patches for use as hemostatic agents. In this study, chitosan and gelatin-based micro-needle patches were prepared by molding. Chitosan as a biodegradable polymer with antibacterial properties and gelatin as a collagen-derived protein were selected to provide physical hemostatic properties and improve flexibility. First, 2% chitosan and 10% gelatin solutions were prepared and mixed in a 1:1 weight ratio, and 1% tannic acid was used as a cross-linker. Then, the polymer solutions were converted into micro-needle patches by micro-molding. For physicochemical characterization, tests including SEM and FTIR were performed. Also, the effectiveness of the hemostatic patch was evaluated by biological tests including MTT and hemostasis. The results show that the morphology of the fabricated micro-needle patches includes conical and uniform micro-needles with an average height of 1 mm. The FTIR results indicate physical interactions between the patch components. The MTT test results indicate the lack of cytotoxicity and the rate of cell viability, growth, and proliferation on the micro-needle patch is excellent. Finally, the hemostasis test results showed that the blood drop clotted in 25-28 seconds. The results show that the chitosan-gelatin-based micro-needle structure has a very effective function in accelerating the hemostasis process. This achievement can be a valuable step in the development of a new generation of smart dressings and bio-adhesives for clinical applications in bleeding control and wound healing.

Keywords:
Micro-needle patch, Chitosan, Gelatin, Hemostatic Agent

Code: wtrc12-01650055
Title:

Dicentracin-Like from Asian Sea Bass Fish and Moronecidine-Like from Hippocampus Comes: Two Candidate Antimicrobial Peptides Against Leishmanina Major Infection

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Abstract:
Anti-Leishmanial drug therapy faces significant challenges related to cytotoxicity and drug resistance. Thus, new and efficient anti-Leishmanial drugs need to be identified. Due to their broad-spectrum antimicrobial and also immunomodulatory activities, antimicrobial peptides (AMPs) have attracted considerable attention. In this study, we comparatively assessed the anti-Leishmanial activities of two recently identified AMPs (dicentracin-like and moronecidine-like) and the well-known AMP piscidin from the hybrid striped bass. AMPs were first assessed against Leishmania major promastigotes using MTS. Subsequently, macrophages were infected with L. major and treated with AMPs to evaluate anti-amastigotes activity of AMPs, and non-infected macrophages were treated with AMPs to determine cytotoxicity against mammalian cells using MTS. The induction of factors limiting L. major growth (IL-12, TNF-α and reactive oxygen species (ROS)) by AMPs was measured by ELISA and dichlorofluorescin-diacetate (DCFH-DA) assay, respectively. Piscidin was more efficacious against L. major promastigotes as compared to dicentracine-like or moronocidin-like peptides, whereas, dicentracine-like and moronocidin-like peptide exhibited a higher activity against L. major amastigotes compared to piscidin. In turn, piscidin was most cytotoxic in non-infected macrophages compared to the other two AMPs. A direct association was observed between hydrophobicity of AMPs and their anti-promastigote and cytotoxic activities. Dicentracine-like or moronocidin-like peptides induced higher levels of IL-12, TNF-α and ROS in macrophages compared to piscidin. Collectively, our results suggest that dicentracine-like and moronocidin-like peptides represent potentially promising multi-functional therapeutic agents that might not only directly kill L. major but also induce anti-Leishmania factors that can limit L. major growth and intracellular survival

Keywords:
Leishmania, Antimicrobial Peptides, Anti-amastigote Activity, Anti-promastigote Activity, Cytotoxicity

Code: wtrc12-01650054
Title:

Exploring the Potential of Taq Man Quantitative PCR for the Simulated Diagnosis of Cutaneous and Visceral Leishmaniasis in Clinical Samples in Iran

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Abstract:
Leishmaniasis is a major neglected tropical disease that can lead to fatalities among infected individuals. Cutaneous leishmaniasis (CL) is the most common form and causes skin lesions, mainly ulcers, on exposed parts of the body. These can leave life-long scars and cause serious disability or stigma. About 95% of CL cases occur in the Americas, the Mediterranean basin, the Middle East and central Asia. It is estimated that 600 000 to 1 million new cases occur worldwide annually but only around 200 000 are reported to WHO. Cutaneous leishmaniasis can be confused with tuberculosis of the skin and many forms of cancer. Clinical identification was based on microscopic examination and parasitological culture performed by trained technicians. The limited accuracy and inconvenience associated with the microscopic analysis may lead to the misdiagnosis and recurrence of leishmaniasis. Consequently, an in-house TaqMan quantitative PCR (qPCR) method using the kinetoplast minicircle DNA (mkDNA) gene was developed simultaneously diagnose cutaneous and visceral leishmaniasis in clinical specimens. A total of 77 skin lesion samples, 10 canine blood samples, aspirates and 65 samples as control were confirmed by microscopy, in vitro cultured promastigotes, and rK39 rapid diagnostic tests. The mkDNA gene was analyzed by qPCR to determine the detection limit, sensitivity, and specificity of the test. These results demonstrated a sensitivity of 96.3% (95 CI 81.03–99.91%), specificity of 100.00% (95 CI 94.04–100.00%), and accuracy of 98.85% (95 CI 93.76–99.97%). The test efficiency ranged from 70 to 97%, with an R2 value of 0.988. The qPCR assay established in this study is a valuable tool for diagnosing cutaneous and visceral leishmaniasis. It is easier to perform than parasitological exanimation because it saves time and reduces the risk of contamination for clinical surveillance and determination of the incidence of leishmaniasis in Iran, an endemic region. This has paved the way for other researchers to explore commercial TaqMan real-time PCR diagnostic kits in Iran.

Keywords:
Leishmania, TaqMan Quantitative PCR, Ulcer

Code: wtrc12-00260052
Title:

Role of Pathogenic Protozoa in Human Skin Ulcers: From Pathophysiology to Therapeutic Strategies

Authors:

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Abstract:
Background: Protozoan parasites, particularly those belonging to the genera Leishmania, Acanthamoeba, and Balamuthia, are recognized as principal etiological agents responsible for the manifestation of cutaneous and mucocutaneous ulcers in human populations. Cutaneous leishmaniasis (CL) represents a considerable public health concern in regions where it is endemic, exhibiting a broad spectrum of clinical presentations and varying responses to therapeutic interventions. Although amoebic cutaneous infections are less prevalent, they have the potential to inflict severe tissue damage, especially in patients with compromised immune systems, a situation often exacerbated by delays in diagnosis. Objective: The aim of this study was to conduct a systematic review of the pathogenesis associated with protozoan parasite-induced ulcerations, with an emphasis on the histopathological and immunological features, various diagnostic modalities (encompassing both conventional and molecular techniques), as well as the current and emergent therapeutic strategies. **Methods:** An exhaustive review of the literature was performed, scrutinizing clinical, histopathological, and laboratory investigations published in peer-reviewed journals utilizing databases such as PubMed and PMC. The review encompassed species-specific ulcerative pathology, host immune responses, diagnostic assay sensitivity and specificity, treatment regimens, and patient outcomes. From this targeted search, 21 unique records were retrieved. After title/abstract screening, 14 full texts were obtained and assessed for eligibility; 9 articles/reviews were included in the final synthesis **Results:** Species of Leishmania, including L. tropica, L. major, and L. braziliensis, are known to elicit ulcers characterized by the infiltration of macrophages containing amastigotes, granulomatous formation, and, in some instances, necrosis and ulceration. Chronic lesions frequently exhibit fibrosis and a propensity for mucocutaneous dissemination. The histopathological diversity is closely associated with the parasite load and the profiles of the host immune response. Infections caused by Acanthamoeba and Balamuthia generally present as non-healing ulcers or nodules, with ulcerated plaques often preceding involvement of the central nervous system. Diagnosis is frequently delayed; histological assessments reveal trophozoites, cysts, necrotic tissue, and, in certain cases, vascular invasion. The diagnostic methodologies reviewed include microscopy (in the form of smears and histological sections), culture techniques, immunohistochemistry, and molecular assays such as polymerase chain reaction (PCR) and sequencing. Molecular diagnostics targeting the Leishmania ITS1 and kDNA regions exhibit enhanced sensitivity and facilitate species-level differentiation. Treatment approaches are contingent upon the specific parasite species and the stage of the disease: standard therapies for Leishmania infections include antimonial compounds, amphotericin B (including its liposomal formulations), and miltefosine; for Acanthamoeba and Balamuthia infections, combination regimens of anti-amoebic agents (such as azoles, miltefosine, and experimental pharmaceuticals) alongside surgical excision are utilized. Recent developments also explore the use of topical therapies and immunomodulatory strategies. **Conclusions:** The effective management of protozoan ulcerative skin diseases requires timely diagnosis that incorporates histopathological assessments and molecular techniques, in conjunction with species-specific treatment strategies to minimize morbidity and related complications. Further investigative efforts, including randomized controlled trials of innovative therapeutic options and the creation of accessible diagnostic tools appropriate for resource-limited endemic contexts, are critical. Early intervention and a multidisciplinary methodology involving dermatological, pathological, and infectious disease expertise are vital for enhancing patient outcomes.

Keywords:
Leishmania, Acanthamoeba, Balamuthia, skin ulcer, molecular diagnosis, therapy, Pathogenic Protozoa

Code: wtrc12-01510050
Title:

Innovative Models of Wound Care and the Evolving Role of Healthcare Providers: A Systematic Review

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Abstract:
Chronic wounds are one of the major challenges in healthcare, leading to reduced quality of life, increased risk of infection, repeated hospitalizations, and a heavy economic burden. Traditional wound care methods do not fully meet patients' needs. In recent years, innovative wound care models and the active role of nurses and multidisciplinary teams have been recognized as effective approaches to improving clinical outcomes and enhancing patient satisfaction. The present study provides a systematic review of this evidence and the evolving role of healthcare team members
Keywords:
Innovative Models, Wound Care, Healthcare Providers, Evolving Role

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Code: wtrc12-01010049
Title:

A Comparative Meta-Analysis of the Efficacy of Growth Factor-Based Interventions on Healing Outcomes in Diabetic Foot Ulcers

Authors:

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Abstract:
Background: Diabetic foot ulcers (DFUs) represent a prevalent and severe complication of diabetes, frequently resulting in prolonged healing times and an elevated risk of amputation. Growth factor-based therapies have demonstrated promise in accelerating wound repair by stimulating cellular regeneration and angiogenesis. Nevertheless, comparative evidence regarding the relative efficacy of various growth factors remains sparse and inconclusive. **Methods:** A systematic search was performed in PubMed to identify randomized controlled trials (RCTs) evaluating growth factor (GF) therapies in comparison to standard of care (SOC) or other GF treatments for diabetic foot ulcers (DFUs). Two independent reviewers conducted study screening, data extraction, and quality assessment based on predefined inclusion and exclusion criteria. Meta-analytical synthesis was carried out using R software, employing relative risk (RR) to assess dichotomous outcomes and mean difference (MD) for continuous outcomes. **Results:** A total of 48 randomized controlled trials were included in the meta-analysis. Compared to standard of care (SOC), epidermal growth factor (EGF), platelet-derived growth factor (PDGF), and platelet-rich plasma (PRP) demonstrated significant improvements in healing rates. Additionally, EGF and PRP were associated with reduced healing times, while PDGF significantly decreased ulcer area. Notably, PRP was linked to a significant reduction in both adverse event (AE) incidence and amputation rates. Ranking analyses indicated that for healing rate, the top three growth factors were EGF, vascular endothelial growth factor (VEGF), and granulocyte colony-stimulating factor (G-CSF). In terms of healing time, EGF, PRP, and fibroblast growth factor (FGF) showed the most favorable outcomes. For ulcer area reduction, PDGF, EGF, and PRP ranked highest. Regarding safety profiles, PRP, PDGF, and FGF exhibited the lowest incidence of adverse events. Finally, for amputation rates, PRP, G-CSF, and PDGF were the leading interventions. **Conclusion:** Most growth factors (GFs) demonstrated superior outcomes compared to standard of care (SOC) in terms of healing rate, healing time, and reduction in ulcer area. Specifically, epidermal growth factor (EGF), platelet-derived growth factor (PDGF), and platelet-rich plasma (PRP) significantly enhanced healing rates relative to SOC. Both EGF and PRP significantly shortened healing time, while PDGF notably reduced ulcer area. Among the GFs assessed, EGF appears to be the most effective. With the exception of vascular endothelial growth factor (VEGF), which was associated with a significant increase in adverse events (AEs), other GFs did not exhibit a statistically significant rise in AEs when compared to SOC. Notably, PRP was associated with the lowest rates of amputation and adverse events.

Keywords:
Diabetic Foot Ulcer, Growth Factors, Standard of Care, Randomized Controlled Trial

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Code: wtrc12-01170047
Title:

Enhanced Osteogenic Differentiation of Adipose-Derived Mesenchymal Stem Cells in 3D vs. 2D Nanofibrous Scaffolds

Authors:

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Abstract:

Two-dimensional (2D)-fabricated nanofibrous scaffolds failed to recapitulate the in vivo three-dimensional (3D) cellular microenvironment, which is vital for the repair and regeneration of damaged tissues. In this study, we prepared 3D and 2D nanofibrous scaffolds consisting of polycaprolactone (PCL) and type I collagen (Col I) using mold-assisted electrospinning and conventional electrospinning, respectively. Next, we evaluated the physicochemical properties, biocompatibility, and other requisites for employing fabricated scaffolds in tissue engineering and regenerative medicine (TERM). The 3D nanofibrous scaffolds demonstrated excellent biocompatibility, significantly promoting adipose-derived mesenchymal stem cells (ADSCs) attachment and proliferation compared to 2D nanofibrous scaffolds. The results of the osteogenic differentiation assay (alkaline phosphatase activity and calcium deposition) indicated that the 3D nanofibrous structures had higher osteogenic differentiation capacity than the 2D structures and control groups. The results indicated that 3D nanofibrous scaffolds can mimic the natural 3D cellular microenvironment and provide the mechanical and biochemical signaling for osteogenic differentiation of adipose-derived stem cells.

Keywords:

3D Nanofibrous Scaffolds, Osteogenic Differentiation, Aadipose-derived Mesenchymal Stem Cells

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12th WTR

Code: wtrc12-00680046
Title:

Advancements in Artificial Intelligence for Precision Assessment and Nursing Management of Psoriasis: A Systematic Review

Authors:

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Abstract:

Background: Psoriasis is a chronic, immune-mediated skin condition that significantly affects patients' physical health and quality of life. Nursing care plays a vital role in managing symptoms, supporting treatment adherence, and addressing psychosocial impacts. Recent advancements in artificial intelligence offer new tools to enhance assessment accuracy and personalize care plans. This systematic review aims to explore the latest AI developments relevant to the assessment and management of psoriasis. **Methods:** We conducted a systematic search of studies published between 2015 and 2025 across PubMed, Scopus, EMBASE, Web of Science, CINAHL, and the Cochrane Library, following the PRISMA guidelines. Search terms included MeSH and free-text keywords such as " Psoriasis", "Artificial Intelligence", "Machine Learning", "Deep Learning", "Natural Language Processing", "Mobile Health", "Care" and "Nursing". Eligible studies were peer-reviewed original research focusing on AI-driven methodologies, including ML, DL, and NLP, applied to psoriasis assessment and nursing management. Exclusion criteria comprised duplicate records, irrelevant studies, non-English publications, and articles without full text. Two researchers independently screened the articles and excluded studies of low quality or relevance. The risk of bias was assessed using the Cochrane Systematic Review Handbook and the Joanna Briggs Institute (JBI) Critical Appraisal Tools. Data extracted from the included studies, and covered study design, target population, intervention type, comparisons, outcomes, and key results. **Results:** Out of 425 articles, 6 met the inclusion criteria. Recent evidence demonstrates that artificial intelligence is transforming nursing practice in psoriasis care by enhancing assessment accuracy, care planning, patient education, and engagement. AI-powered tools enable nurses to objectively evaluate and monitor psoriatic lesions, minimizing subjectivity and improving consistency. Mobile health applications allow remote symptom tracking, supporting timely nursing interventions and promoting treatment adherence. Predictive models help identify patients at risk of therapy discontinuation, enabling proactive care strategies. In addition, AI-driven analysis of medical records through natural language processing facilitates comprehensive patient assessment. AI also assists in predicting treatment responses, optimizing therapy selection, and quantifying outcomes using advanced imaging. Moreover, AI chatbots and automated systems provide patient-friendly education, clarify medical reports, and enhance communication efficiency, empowering nurses to deliver more personalized, informed, and efficient care. Despite challenges such as potential data inaccuracies or misinformation, integrating AI into nursing practice holds strong potential to improve patient outcomes and satisfaction in psoriasis management. **Conclusions:** Artificial intelligence holds significant promise to enhance nursing and individualized care in managing psoriasis. Despite encouraging advances, challenges such as limited diverse patient data, absence of standardized protocols, validation gaps, and ethical concerns remain. Future nursing research and practice should focus on multicenter collaborations, integrating diverse clinical data, and fostering strong partnerships between nurses and AI technologies to ensure safe, effective, and equitable patient-centered care.

Keywords:

Psoriasis, Artificial Intelligence, Machine Learning, Deep Learning, Mobile Health, Nursing

Code: wtrc12-01290045
Title:

Exploring the Effect of Wound Related Pain on Psychological Stress, Inflammatory Response, and Wound Healing

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Abstract:
The interplay between pain and impaired healing is complex, potentially influenced by psychological stress and irregularities in the inflammatory response. This study aimed to investigate the biopsychosocial model of pain by analyzing the interrelationships among pain, stress, inflammation, and healing in individuals with chronic wounds. This research constituted a 4-week prospective observational study designed to elucidate the connections between pain, stress, inflammation, and wound healing within a convenience sample of patients suffering from chronic wounds at a chronic care hospital in Canada. Participants were exclusively individuals aged 18 and older with chronic wounds, defined as lesions persisting for over 4 weeks due to various etiologies, including pressure injuries, venous disease, arterial insufficiency, surgical trauma, and diabetic neuropathy. Pain levels were assessed using the Brief Pain Inventory-Short Form, the McGill Pain Questionnaire-Short Form, and the Leeds Assessment of Neuropathic Symptoms and Signs scale. Stress was quantified utilizing the Perceived Stress Scale (PSS). Comprehensive evaluations of all wounds were conducted using the Pressure Ulcer Scale for Healing tool. Additionally, levels of matrix metalloproteinases were analyzed through the collection of wound fluid from all participants. A total of 32 individuals with chronic wounds were enrolled in the study. Correlation analyses revealed that pain severity was positively and significantly associated with pain interference, McGill Pain Questionnaire scores, neuropathic pain, and matrix metalloproteinase levels. Logistic regression analysis was employed to identify predictors of high versus low perceived stress. The only significant variable contributing to stress levels was the BPI-I. Results indicated that participants experiencing higher levels of pain interference had a 1.6-fold increased likelihood of reporting elevated stress levels, even when controlling for other factors within the model. Pain represents a multifaceted biopsychosocial phenomenon that significantly impacts the quality of life in individuals with chronic wounds. The findings of this study underscore the substantial relationship between pain, stress, and wound healing.

Keywords:
Chronic Wounds Pain Stress MMPs Inflammation Wound Healing Bio Psychosocial Model

Code: wtrc12-00980044
Title:

The Use of Stem Cells in the Treatment of Infection after Reconstructive Surgery of the Genital Area: A Case Report

Authors:

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Abstract:
Background: Surgical site infection (SSI) is a major complication after genital reconstruction and reconstruction. These infections may occur due to decreased blood supply, the presence of resistant microorganisms, and delayed tissue healing. Conventional antibiotic therapy, debridement, and dressing are not sufficient in some patients. Stem cells (especially mesenchymal stem cells) have the ability to modulate the immune system, increase angiogenesis, and tissue repair, and may also play a role in improving the inflammatory response and reducing microbial burden. In this article, we report a successful case of using stem cells in the management of infection after genital reconstruction surgery. **Case Presentation:** Patient profile: A 27-year-old male gender identity patient presented 2 weeks after gender reassignment surgery to remove the female genitalia and create a male penis. Symptoms included redness, swelling, and purulent discharge from the surgical site. Initial investigations showed that the infection remained localized and did not spread to deeper tissues. The patient mentioned a history of DVT in previous surgeries. 3. Management and Intervention Treatment: 1. Antibiotic therapy: The patient was treated with levofloxacin 500 mg daily to reduce the microbial load. 2. Debridement and wound cleansing: Necrotic tissues were carefully removed using a sharp debridement technique to provide a suitable bed for healing. 3. Use of stem cells: After cleaning the wound site, stem cell-containing dressings were applied to the wound along with hydrofiber dressings. These cells were used to reduce inflammation, stimulate tissue regeneration, and increase blood supply. 4. Antibacterial dressing: To reduce the microbial load and create a suitable environment for healing and the use of stem cell dressings, silver, hydrofiber, and hydrobalance dressings were used. In addition to creating suitable conditions for healing, these dressings also helped reduce inflammation. 5. Number of treatment sessions: The patient returned to the treatment center every 48 hours for washing and changing the dressing. 4. Outcome After two months of treatment, the symptoms of infection completely resolved. The patient was discharged without any side effects and with successful healing of the surgical site. Also, subsequent examinations showed that vascular and neurological function in the graft area had improved. 5. Discussion Managing surgical site infection in complex surgeries such as gender confirmation requires a multifaceted approach. In this study, the use of a combination of mesenchymal stem cells and novel dressings showed that this method not only reduces inflammation and microbial load, but also significantly accelerates the process of wound regeneration and repair. Stem cells with the ability to differentiate into specialized tissue cells, in addition to regenerating damaged structures, increase blood supply and improve the cellular environment at the surgical site. These features, along with anti-inflammatory effects, have made them an attractive option for the treatment of resistant infections. On the other hand, the use of novel dressings such as silver alginate and hydrofiber and hydrobalance has improved moisture balance, reduced microbial growth and increased the effectiveness of stem cells in the wound healing process. The innovation of this method lies in its therapeutic combination; Thus, the combination of cell therapy and advanced technologies in biological dressings, in addition to faster wound healing, helps reduce the need for re-surgical interventions and reduce treatment costs. These findings indicate that this technique can be used as an effective and minimally invasive solution in the management of surgical site infections in complex surgeries such as gender confirmation. 6. **Conclusion:** In the future, further research in the field of optimizing stem cells, combining them with new biomaterials and examining the long-term effects of this method can lead to further improvement and standardization of this treatment method, and larger clinical studies are necessary to confirm the findings.

Keywords:
Stem cells, surgical site infection, Genital reconstructive surgery, Wound healing

Code: wtrc12-01060043
Title:

A Review of Cold Atmospheric Plasma's (CAP) Application in Healing Wounds and Tissue Repair

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Abstract:
Cold Atmospheric Plasma (CAP), a partially ionized gas generated at room temperature, has emerged as a non-thermal and highly versatile tool in regenerative medicine. CAP delivers a complex mixture of reactive oxygen and nitrogen species (RONS), photons, and electric fields that can be precisely tuned to target pathological processes without inflicting thermal damage on healthy tissue. This unique physicochemical profile underlies its dual ability to eradicate pathogens and promote wound healing. At the cellular level, CAP-generated RONS act not as indiscriminate cytotoxic agents but as modulators of redox signaling. Therapeutic doses regulate key molecular pathways such as NF-κB and Nrf2, thereby shifting the wound microenvironment from chronic inflammation to active regeneration. Histological evidence supports this transition, showing enhanced clearance of necrotic tissue and macrophage polarization from a pro-inflammatory (M1) to a pro-healing (M2) phenotype. Simultaneously, CAP exhibits potent antimicrobial activity against bacteria, fungi, and viruses, including biofilm-forming pathogens that commonly hinder chronic wound repair. This is achieved through electrostatic disruption of microbial membranes and oxidative damage to lipids, proteins, and nucleic acids. Beyond antimicrobial effects, CAP directly stimulates regenerative processes. It promotes fibroblast proliferation and collagen deposition, visible histologically as denser and more organized extracellular matrix formation. CAP also induces angiogenesis by upregulating growth factors such as VEGF and FGF-2, resulting in the formation of new capillaries that restore oxygen and nutrient supply. Furthermore, CAP accelerates keratinocyte migration and re-epithelialization, facilitating wound closure. In summary, CAP represents a paradigm shift in wound and tissue repair, combining pathogen eradication with activation of host regenerative pathways. This multimodal, noninvasive, and tunable therapy offers significant promise for treating complex wounds, including diabetic ulcers, burns, and surgical injuries. Standardization of treatment protocols and deeper mechanistic insights will be essential for translating CAP into routine clinical practice.

Keywords:
Cold Atmospheric Plasma (CAP), Wound Healing, Tissue Regeneration

Code: wtrc12-00990042
Title:

Synergistic Mechanisms of Milk-Derived Exosomes and PDRN in Acute Wound Healing

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Abstract:

Background: Acute wound healing is a highly coordinated process involving inflammation, angiogenesis, tissue proliferation, and remodeling. However, conventional therapies are often insufficient in preventing delayed healing, infection, or scarring. In recent years, cell-free therapeutic approaches have gained increasing attention as safe and effective alternatives to cell-based therapies. Among these, milk-derived exosomes and polydeoxyribonucleotide (PDRN) have emerged as promising candidates. Milk-derived exosomes are naturally enriched with proteins, growth factors, and regulatory microRNAs that enhance cellular communication, reduce oxidative stress, and promote tissue regeneration. PDRN, a DNA-derived molecule, exerts its effects through the activation of adenosine A2A receptors, leading to vascular endothelial growth factor (VEGF) release, anti-inflammatory signaling, and stimulation of fibroblast activity. Both agents demonstrate strong regenerative properties independently, yet their combined action may yield synergistic effects that accelerate wound closure and improve overall tissue quality. **Methods:** This narrative review was based on a structured literature search of PubMed, Scopus, and Web of Science for publications between 2020 and 2025. Keywords included "exosome," "milk-derived exosome," "PDRN," "acute wound healing," "angiogenesis," and "tissue regeneration." Preclinical studies, in vitro models, and translational research articles were analyzed. Studies describing the biological actions of exosomes and PDRN were critically reviewed to identify overlapping and complementary mechanisms. Particular attention was given to molecular pathways, including angiogenesis, collagen remodeling, epithelialization, and inflammation control, to propose potential synergy in wound healing when these agents are combined. **Results:** Milk-derived exosomes were found to regulate fibroblast proliferation, keratinocyte migration, collagen deposition, and angiogenesis. They also attenuate inflammatory cytokines such as TNF-α and IL-6 while enhancing the expression of growth factors that promote tissue regeneration. PDRN was consistently shown to activate adenosine A2A receptors, which suppress inflammatory mediators, stimulate VEGF production, and improve endothelial and fibroblast activity. Taken together, these actions suggest four key mechanisms of synergy: 1.Anti-inflammatory action – Exosomes modulate NF-κB signaling, while PDRN decreases pro-inflammatory cytokines via A2A receptor activation. 2.Angiogenesis – Exosomal miRNAs stimulate endothelial migration, and PDRN enhances VEGF expression, leading to robust neovascularization. 3.Collagen remodeling – Exosomal proteins upregulate fibroblast function, while PDRN supports DNA synthesis and extracellular matrix organization. 4.Rapid epithelialization – Both agents accelerate keratinocyte proliferation and migration, leading to faster wound closure and reduced scar formation. **Conclusion:** The combination of milk-derived exosomes and PDRN represents a promising, cell-free therapeutic approach for acute wound healing. Their complementary molecular mechanisms—anti-inflammatory modulation, angiogenesis, and collagen remodeling—may provide a synergistic benefit that surpasses the effects of either therapy alone. Further preclinical and clinical investigations are warranted to validate efficacy, optimize dosage, and explore delivery methods such as hydrogel dressings or injectable formulations.

Keywords:
Milk-Derived Exosome, PDRN, Wound Healing

Code: wtrc12-00940041
Title:

Construction of a Fibrillar β-Lactoglobulin–Mumijo–Nanohydroxyapatite Biomaterial for Wound Repair

Authors:

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Abstract:

In this study, we developed and systematically characterized a novel multifunctional complex (fBMHA) composed of fibrillar β-lactoglobulin (BLG), Mumiju, and nanohydroxyapatite (nHAP), designed to enhance wound healing and tissue regeneration. Structural and physicochemical analyses, including Fourier-transform infrared (FT-IR) spectroscopy, scanning electron microscopy (SEM), zeta potential measurement, and X-ray diffraction (XRD), confirmed the successful integration of all components into a hybrid matrix with both amorphous and crystalline features. MTT assay revealed a concentration-dependent increase in fibroblast viability, with maximal proliferative stimulation at 10 mg/mL after 48 h and an IC50 of 71 mg/mL. Flow cytometry demonstrated significant alterations in cell cycle progression, with a reduction in G1 phase (64.7% to 59.4%) and increases in S (25.3% to 27.8%) and G2/M phases (4.6% to6.7%) ($P < 0.05$), indicating enhanced proliferation. AO/EtBr staining further confirmed intact nuclear morphology with minimal fragmentation. Scratch assay results showed substantial wound closure within 48 h, supporting the complex's ability to promote fibroblast migration and confluency. Immunofluorescence analyses revealed upregulation of E-cadherin and fibronectin, key markers of epithelial integrity and extracellular matrix remodeling. Additionally, disc diffusion assays demonstrated antibacterial activity, with inhibition zones of 22.7 ± 0.5 mm against Staphylococcus aureus and 20.0 ± 0.2 mm against Escherichia coli. Collectively, these findings establish the fBMHA complex as a biologically safe and multifunctional therapeutic candidate that simultaneously promotes fibroblast proliferation, accelerates wound closure, and provides antibacterial protection, underscoring its translational potential for advanced regenerative applications.

Keywords:

Mumijo; Nano-sized Hydroxyapatite; Fibroblast Proliferation; Wound Healing; Fibrillar β-Lactoglobulin

Code: wtrc12-00860040
Title:

Graphene Oxide as a Multi-Stimuli-Responsive Platform for Smart Drug Delivery Systems

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Abstract:
Drug delivery systems (DDS) with the aims of drug preservation and controlled delivery are a significant focus in biomedical research. The advantages of using DDS include painless delivery, high drug efficacy, and ease of use. Stimuli-responsive materials are widely studied in DDS research, and they can respond to external stimuli (such as temperature, magnetic force, electricity, light, and ultrasound waves) and internal signals (such as temperature, glucose, enzymatic activity, pH, and ionic concentration). Carbon-based nanomaterials, such as carbon nanotubes, graphene, graphene oxide (GO), and reduced graphene oxide (rGO), are among the stimuli-responsive materials. Graphene oxide is a monolayer that is obtained from the synthesis of graphite with oxidizing agents. GO has attractive physical and chemical properties, such as good mechanical strength, high electrical and thermal conductivity, a high specific surface area, chemical stability, a light weight, flexibility, and relative biocompatibility. Also, research shows that it has antibacterial properties due to its hydrophobic nature and production of reactive oxygen species (ROS). GO is a suitable candidate for DDS due to its desirable properties and its ability to respond to temperature and electric field stimuli. Changes in the structure of GO occur with changes in internal temperature (such as inflammation, infection, and tumors) or external temperature (such as hyperthermia and electrothermal therapy). Research shows that increasing temperature can improve thermal stability, increase thermal conductivity, and weaken the binding of the drug to the carrier, which causes an increase in delivery and permeability of the drug. On the other hand, by exposing GO to an electric field, its physical and chemical properties can be changed. The effect of an electric field on GO leads to increased conductivity, a change in the orientation of the plates as a result of increased drug permeability, and a change in the interaction of the drug with the carrier surface, causing drug delivery. Therefore, designing GO-based DDS with the ability to respond to temperature and electric field stimuli could be suitable in drug release. However, Insufficient control in the design of effective parameters can diminish its efficiency and reduced biocompatibility. In this study, after reviewing DDS and the properties of GO in biomedical applications (including drug delivery), we will investigate how drugs are released from GO under temperature changes and exposure to an electric field. It is hoped that this study will improve the design of DDSs.

Keywords:
Graphene Oxide, Electrical-responsive, Thermo-responsive, Drug Delivery Systems, Smart Biomaterial

Code: wtrc12-00840039
Title:

Chitosan-Alginate Nanocomposite Dressing with Glucose Oxidase for Diabetic Wound Management

Authors:

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Abstract:
Diabetic foot ulcers present persistent clinical challenges halting from impaired healing processes and elevated infection risks in hyperglycemic wound environments. To address these critical issues, we engineered an innovative wound dressing combining chitosan nanofibers with glucose oxidase-loaded sodium alginate microspheres. This advanced composite material delivers sustained enzymatic activity that generates therapeutic hydrogen peroxide for antibacterial protection while actively regulating glucose concentrations and keeping proper wet condition at the wound site. Material characterization studies demonstrated uniformly distributed microspheres within a highly porous nanofiber network exhibiting 82 percent porosity, optimal for promoting oxygen diffusion and nutrient transport. The composite dressing achieved impressive mechanical stability with a tensile strength measuring 14.2 MPa and demonstrated substantial fluid absorption capacity at 320 percent swelling ratio. Comprehensive antibacterial evaluation revealed significant microbial reduction against common wound pathogens, including a 3.1 log reduction for Staphylococcus aureus and 2.8 log reduction for E. coli, while maintaining significant cellular compatibility with fibroblast viability exceeding 88 percent. Structural analysis confirmed preserved enzyme functionality throughout a seven-day period. This multifunctional wound dressing successfully integrates three essential therapeutic properties by providing structural support for tissue regeneration, sustained antimicrobial activity, and metabolic regulation. The demonstrated performance surpasses conventional wound dressing capabilities, offering a comprehensive solution for diabetic wound care. With its proven biocompatibility and combined therapeutic effects, this chitosan-alginate-glucose oxidase composite shows tremendous potential for clinical application in managing chronic diabetic ulcers and improving patient outcomes.

Keywords:
Chronic Diabetic Wound Therapy, Glucose Oxidase, Bioactive Biomaterials, Chitosan Nanofiber, Controlled Release, Antimicrobial Activity

Code: wtrc12-00830038
Title:

Enzyme-Activated Wound Dressing for Dual Glucose Modulation and Antibacterial Action in Diabetic Wounds

Authors:

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Abstract:
Chronic diabetic wounds require innovative solutions addressing hyperglycemia and bacterial infection simultaneously. We engineered a composite wound dressing incorporating glucose oxidase (GOx)-loaded within a bacterial cellulose nanofiber matrix. This design provides dual functionality through continuous glucose depletion and controlled hydrogen peroxide generation. In vitro testing demonstrated significant antimicrobial activity, achieving 2.4±0.4 log reduction against E. coli and 3.2±0.3 log reduction against S. aureus over 72 hours, while maintaining >90% fibroblast viability. The dressing reduced ambient glucose concentration by 68±5% within 24 hours, effectively modifying the diabetic wound microenvironment. Material characterization revealed favorable physical properties including 85±7% porosity, optimal swelling capacity (350±25%), and mechanical strength (G' = 12.5±1.2 kPa) suitable for wound application. FTIR analysis confirmed stable GOx encapsulation with preserved enzymatic activity over 7 days. The composite structure demonstrated controlled degradation (25±3% mass loss in 7 days) and sustained hydrogen peroxide release below cytotoxic thresholds. This dressing offers superior performance to conventional alternatives. The results establish this GOx-bacterial cellulose composite as a promising therapeutic platform for diabetic wound care, capable of simultaneously addressing metabolic dysregulation and microbial challenges while maintaining tissue compatibility. This approach shows significant potential for clinical translation to improve healing outcomes in chronic diabetic wounds.
Keywords:
Diabetic Wound Healing, Enzyme-Functionalized Dressing, Nanocomposite, Bioactive Wound Dressing, Controlled-Release System

Code: wtrc12-00810037
Title:

The Effect of Lifestyle Modification Programs on Wound Healing and Tissue Repair: A Systematic Review

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Abstract:

Background: Wound healing is a complex and dynamic biological process influenced not only by medical interventions but also by modifiable lifestyle factors such as nutrition, physical activity, sleep, stress management, and smoking cessation. Evidence indicates that unhealthy lifestyle behaviors may delay healing and increase the risk of chronic wounds, while targeted lifestyle modification programs can accelerate tissue repair, reduce complications, and improve patients' quality of life. Nurses play a pivotal role in assessing lifestyle risk factors, providing education, and implementing evidence-based behavioral interventions in collaboration with multidisciplinary teams. Despite growing interest in this area, there is a lack of comprehensive synthesis of available evidence regarding the impact of lifestyle modification on wound healing. Aim: This systematic review aimed to synthesize current evidence on the effectiveness of lifestyle modification programs in promoting wound healing and tissue repair. **Methods:** The review was conducted in accordance with PRISMA guidelines. A systematic search was performed in PubMed, Embase, Web of Science, CINAHL, and Google Scholar for studies published between January 2010 and January 2025. Keywords included "wound healing," "lifestyle modification," "nutrition," "physical activity," "smoking cessation," and "nursing interventions." Eligible studies included randomized controlled trials, quasi-experimental studies, qualitative research, systematic reviews, and meta-analyses that assessed the role of lifestyle interventions in wound healing and tissue repair. Studies not published in English, lacking full-text availability, or without clear clinical outcomes were excluded. Screening of titles, abstracts, and full texts was independently conducted by two reviewers. Study quality was appraised using the JBI Critical Appraisal tools and the Cochrane Risk of Bias tool. **Results:** Out of 1,560 identified records, 42 studies met the inclusion criteria. Findings revealed that nutritional interventions, including increased protein intake, micronutrient supplementation (zinc, vitamin C, vitamin D), and adequate hydration, were consistently associated with faster wound closure and reduced infection rates. Physical activity and rehabilitation programs improved circulation, enhanced oxygen delivery, and supported tissue repair. Smoking cessation interventions demonstrated a significant reduction in wound healing complications and recurrence rates. Stress management techniques and sleep optimization strategies also showed potential benefits, though evidence in these areas remains limited. Nurse-led educational and behavioral counseling programs were reported as effective in improving patient adherence to lifestyle recommendations. However, heterogeneity in intervention design, variations in outcome measurement, and relatively small sample sizes were common limitations across studies. **Conclusion:** The evidence suggests that lifestyle modification programs have a substantial positive impact on wound healing and tissue repair. Nutrition optimization, physical activity promotion, and smoking cessation are particularly well-supported interventions. Nurses, through their central role in patient education, motivation, and ongoing support, are essential in implementing these programs. Future high-quality studies with larger sample sizes, standardized outcome measures, and inclusion of emerging areas such as stress management and sleep hygiene are warranted to strengthen the evidence base. Integrating structured lifestyle interventions into wound care protocols could significantly improve clinical outcomes and enhance quality of life for patients with chronic or complex wounds.

Keywords:

Wound healing, Lifestyle modification, Nursing interventions, Rehabilitation

Code: wtrc12-00780036

Title:

A Novel Oleuropein-Enriched Nanocomposite Hydrogel with Controlled Release Capability for Advanced Wound Healing

Authors:

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Abstract:

The development of next-generation wound dressings demands materials capable of mimicking the native skin extracellular matrix, a challenge increasingly met through advanced hydrogel-based systems. Present study aimed to design and fabricate a robust composite hydrogel from silk fibroin, hydroxypropyl methylcellulose (HPMC), and Arabic gum nanoparticles, containing oleuropein as efficient antioxidant for enhanced wound management. In spite of thin and lightweight structure, silk fibroin was exhibited vigorous mechanical resilience while and HPMC facilitated gelation and cross-linking and Arabic gum nanoparticles were essential for their high drug-loading capacity. FTIR analysis confirmed effective chemical integration of all components, including oleuropein. Constructed hydrogel effectively enabled a controlled and sustained release profile for the oleuropein. Composite hydrogel displayed optimal hydrophilicity, as shown by contact angle measurements, and ideal water vapor permeability, creating a moist environment conducive to healing. Degradation studies in PBS indicated a complete degradation profile over approximately ten days, suggesting excellent stability for clinical application. Favorable physicochemical properties and controlled release profile observed in vitro suggested fabricated oleuropein-loaded hydrogel is a promising way for modulating the wound microenvironment, potentially addressing key challenges in chronic wound healing.

Keywords:

Oleuropein, Controlled Drug Release, Wound Healing, Antioxidant Hydrogel, Arabic Gum Nanoparticles, Silk Fibroin

Code: wtrc12-00140035
Title:

Application of Deep Learning in Wound Image Analysis

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Abstract:
Background: Chronic wounds, including diabetic foot ulcers, pressure ulcers, and venous leg ulcers, are a major challenge in healthcare systems worldwide. Accurate wound assessment is critical for selecting appropriate treatments and predicting healing outcomes. However, traditional wound evaluation often relies on manual inspection, which can be subjective, time-consuming, and prone to inter-observer variability. Recent advances in deep learning, a branch of artificial intelligence (AI), have created new opportunities for automated wound image analysis. Deep learning models, particularly convolutional neural networks (CNNs), have demonstrated remarkable accuracy in identifying wound boundaries, classifying tissue types, and detecting complications such as infection. These technologies have the potential to improve diagnostic precision, optimize treatment strategies, and support clinicians with data-driven insights. **Methods:** The application of deep learning to wound image analysis involves several key stages: 1. Data Collection: Thousands of wound images are captured using digital cameras or smartphone devices. Images are labeled by experts, identifying wound edges, tissue composition (granulation, necrosis, slough), and signs of infection. 2. Preprocessing: Images undergo normalization, resizing, and augmentation techniques (such as rotation, flipping, and color adjustment) to improve model robustness and prevent overfitting. 3. Model Development: CNN architectures such as ResNet, U-Net, and VGGNet are trained to learn complex patterns within wound images. U-Net is commonly applied for wound segmentation, while classification networks distinguish between healing and non-healing wounds. 4. Training and Validation: The dataset is divided into training, validation, and test sets. Loss functions (e.g., cross-entropy or Dice coefficient) are optimized using algorithms such as Adam or stochastic gradient descent. 5. Integration with Clinical Tools: The final model is embedded into mobile applications or decision-support systems, enabling clinicians and patients to capture images and receive automated wound assessments in real time. **Results:** Research studies and pilot clinical trials have reported highly encouraging results from deep learning-based wound analysis: Accurate Segmentation: CNN-based segmentation models achieve Dice similarity coefficients above 0.90, providing precise wound boundary detection. Tissue Classification: Models can differentiate granulation, necrotic, and epithelial tissues with accuracies exceeding 85%, supporting clinicians in monitoring wound progress. Healing Prediction: Deep learning models analyzing longitudinal images predict healing trajectories more effectively than traditional assessment methods. Time Efficiency: Automated analysis reduces the time required for wound evaluation, allowing clinicians to focus on treatment planning. Remote Monitoring: Smartphone-based applications with embedded deep learning models enable patients in remote areas to access continuous wound monitoring and expert feedback. These findings suggest that deep learning not only increases diagnostic accuracy but also supports scalable, cost-effective wound care solutions. **Conclusion:** Deep learning has emerged as a powerful tool in wound image analysis, offering solutions to the limitations of traditional visual assessments. Through accurate segmentation, tissue classification, and healing prediction, deep learning enhances clinical decision-making and enables personalized treatment strategies. As these technologies are integrated into mobile health applications and electronic health systems, they promise to reduce diagnostic subjectivity, expand access to care, and improve patient outcomes. Future directions include larger multicenter datasets, integration with wearable sensors, and explainable AI models to ensure transparency and clinician trust. The application of deep learning in wound analysis represents a major step toward data-driven, patient-centered, and intelligent wound management systems that can transform the future of wound and tissue repair.

Keywords:
Deep Learning, Wound

Code: wtrc12-00140034
Title:

Smart Wound Monitoring Systems: The Role of Wearable Sensors and Artificial Intelligence

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Abstract:
Background: Chronic wounds represent a significant global health burden, particularly among patients with diabetes, vascular disease, and immobility-related complications. Traditional wound assessment often relies on visual inspection during clinical visits, which can be subjective, infrequent, and resource-intensive. As a result, delayed detection of complications such as infection, necrosis, or poor healing trajectories remains common. The integration of wearable sensors and artificial intelligence (AI) has emerged as a promising solution for continuous and precise wound monitoring. Wearable devices equipped with biosensors can capture critical parameters such as temperature, pH, oxygenation, and moisture in real time. When combined with AI-driven data analytics, these systems provide predictive insights and personalized recommendations, enabling earlier intervention and optimized wound management. **Methods:** Developing a smart wound monitoring system involves multiple technological and clinical steps: 1. Sensor Design and Data Acquisition: Flexible, biocompatible sensors are embedded into wound dressings or attached externally. These sensors monitor biochemical and physiological markers (e.g., pH for infection, oxygen saturation for tissue perfusion, temperature for inflammation, and exudate levels for moisture balance). 2. Data Transmission: Wireless technologies such as Bluetooth or Near-Field Communication (NFC) transfer data to mobile devices or cloud-based platforms for real-time monitoring. 3. Artificial Intelligence Processing: Machine learning algorithms analyze the incoming data streams. For example: Neural networks detect early signs of infection by recognizing abnormal temperature or pH patterns. Predictive models estimate healing time and risk of complications based on patient-specific data. 4. Clinical Decision Support: Processed results are presented through user-friendly dashboards for clinicians and patients. The system generates alerts when abnormal values are detected, prompting timely medical attention. 5. Validation and Testing: Pilot studies and clinical trials compare AI-driven assessments with traditional wound evaluations to confirm accuracy, reliability, and patient safety. **Results:** Preliminary research and prototype implementations have demonstrated the effectiveness of AI-enhanced wearable systems in wound care: Early Detection of Complications: Studies show that pH and temperature sensors can detect infection up to 48 hours earlier than standard clinical inspection. Accurate Healing Predictions: Machine learning models analyzing continuous sensor data achieve predictive accuracies above 85% in forecasting wound healing trajectories. Improved Patient Engagement: Mobile applications connected to smart dressings allow patients to track their wound progress at home, reducing unnecessary hospital visits. **Continuous:** monitoring helps prevent severe complications such as sepsis or amputation, ultimately reducing healthcare costs. Enhanced Clinical Decision-Making: AI-powered dashboards provide clinicians with objective, data-driven insights that improve treatment personalization. These findings indicate that smart wound monitoring systems have the potential to revolutionize wound management by bridging the gap between patients and healthcare providers. Conclusion The combination of wearable sensors and AI represents a major advancement in personalized wound care. By enabling continuous, non-invasive monitoring and intelligent data interpretation, these systems address many limitations of conventional wound assessment. Early detection of complications, predictive modeling of healing outcomes, and improved patient self-management all contribute to better clinical outcomes and lower healthcare expenditures. For clinicians and researchers in the field of wound and tissue repair, smart monitoring technologies highlight the future direction of care: proactive, data-driven, and patient-centered. As ongoing studies refine sensor accuracy, data security, and AI algorithms, widespread adoption is expected to transform wound care practices, leading to faster healing, fewer complications, and enhanced quality of life for patients worldwide.

Keywords:
Wearable, Artificial Intelligence

Code: wtrc12-00140033
Title:

Wound and Tissue Healing Using Artificial and Medical Intelligence

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Abstract:
Background: Artificial Intelligence (AI) has become a transformative force in healthcare, enabling more accurate diagnosis, efficient workflows, and patient-centered care. One of its most promising applications is in personalized medicine, where therapies are adapted to the unique genetic, clinical, and lifestyle characteristics of each patient In the field of wound healing and tissue repair, this approach is particularly valuable. Chronic wounds such as diabetic ulcers, venous leg ulcers, and pressure sores remain difficult to treat due to patient variability and comorbidities. Traditional methods often follow standardized protocols, which may not address individual healing dynamics. AI-driven personalized medicine provides clinicians with tools to predict healing outcomes, optimize interventions, and improve patient quality of life—an important focus for the Congress on Wound and Tissue Repair **Methods:** The methodology behind applying AI to personalized wound care involves several steps: 1. Data Collection: Clinical records, laboratory results, imaging data, and genetic profiles are gathered. Wearable sensors and mobile wound-monitoring applications also provide continuous updates. 2. Data Processing: Machine learning algorithms analyze wound size, tissue composition, infection risk, and healing patterns. Convolutional Neural Networks (CNNs), for instance, can classify wound images with high precision. 3. Predictive Modeling: Algorithms such as decision trees and gradient boosting predict which patients are at risk of delayed healing and identify the most effective interventions, including advanced dressings, negative pressure therapy, or biologics. 4. Clinical Decision Support: AI-driven platforms provide physicians with personalized recommendations, dosage adjustments, and monitoring alerts, ensuring that care remains dynamic and patient-specific. **Results:** Research and pilot studies highlight several benefits of integrating AI into wound care: Higher Accuracy: AI-assisted wound image analysis achieves diagnostic accuracies above 90%, outperforming visual assessments by clinicians. Optimized Care: Predictive analytics identify non-healing wounds early, allowing timely interventions that reduce amputation risks and complications. Cost Efficiency: Personalized treatment pathways lower hospital readmissions and minimize the use of ineffective therapies. Enhanced Monitoring: Mobile and remote monitoring systems allow continuous assessment, increasing patient engagement and adherence. Innovation in Tissue Repair: AI is also applied to regenerative medicine, where it supports the design of biomaterials and cell therapies tailored to patient-specific needs. These results demonstrate that AI not only improves wound healing outcomes but also aligns with healthcare's broader goal of efficiency and sustainability. **Conclusion:** AI-powered personalized medicine represents a paradigm shift in wound management and tissue repair. By integrating diverse data sources and applying predictive modeling, clinicians can move from standardized treatment protocols to individualized care plans. This transition improves healing rates, reduces complications, and lowers costs. For participants of the Congress on Wound and Tissue Repair, these advances highlight the importance of interdisciplinary collaboration. The future of wound care will rely on partnerships between clinicians, data scientists, and engineers to refine AI algorithms and ensure safe, ethical application in practice. Ultimately, AI provides not only a powerful analytical tool but also a pathway toward a more precise, patient-centered healthcare system.
Keywords:
Artificial Intelligence, Personalized Medicine, Wound

Code: wtrc12-00680031
Title:

Transforming Burn Patient Nursing Care with Artificial Intelligence: A Systematic Review

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Abstract:
Background: Burn injuries are among the most complex and resource-intensive conditions, often requiring prolonged hospitalization, intensive monitoring, and multidisciplinary management. Nurses play a pivotal role in the comprehensive care of burn patients, including wound assessment, pain management, infection prevention, and psychosocial support. Recent advances in artificial intelligence (AI) have shown potential to transform burn care nursing. This review aims to examine the applications, benefits, and challenges of AI in nursing care for burn patients. **Methods:** A systematic search was conducted for studies published between 2015 and 2025 in PubMed, Scopus, EMBASE, Web of Science, CINAHL, and the Cochrane Library, following PRISMA guidelines. The search strategy included keywords such as "Burns", "Nursing Care", "Artificial Intelligence", "Machine Learning", "Deep Learning", and "Clinical Decision Support". Eligible studies were peer-reviewed original research focusing on the use of AI in nursing practice for burn patients, including assessment, monitoring, prediction, education, and decision-making. Exclusion criteria included duplicate articles, irrelevant topics, non-English publications, conference abstracts without full text, and studies of low methodological quality. Two independent reviewers screened articles. Risk of bias was assessed using the Cochrane Handbook for Systematic Reviews and the JBI Critical Appraisal Tools. Extracted data included study design, AI application type, nursing role, outcomes, and main findings. **Results:** From 642 identified articles, 18 met the inclusion criteria. AI applications in burn nursing care were categorized into four main areas: (1) Wound assessment and healing prediction, Computer vision and deep learning algorithms were used to analyze wound images, enabling objective measurement of burn depth, surface area, and healing progress, improving accuracy and reducing inter-observer variability. (2) Complication prediction, Machine learning models effectively predicted risks such as sepsis, delayed wound healing, and mortality, assisting nurses in prioritizing care and initiating timely interventions. (3) Pain and psychological status monitoring, AI-driven wearable sensors and mobile applications helped track patient-reported outcomes and physiological indicators, facilitating personalized pain management and emotional support. (4) Education and patient engagement, Chatbots and AI-based educational tools supported nurses in delivering patient-friendly information on wound care, rehabilitation, and self-management, improving adherence and self-efficacy. Reported benefits included enhanced assessment precision, early complication detection, reduced nursing workload, and improved patient satisfaction. However, barriers such as limited AI integration in clinical workflows, technology acceptance issues, and the need for nurse training were noted. **Conclusion:** AI holds significant potential to enhance nursing care for burn patients by improving clinical assessment, predicting complications, personalizing interventions, and supporting patient education. Successful integration requires addressing challenges related to usability, data quality, ethical considerations, and training. Further high-quality research is essential to validate AI tools in real-world nursing settings and ensure they complement, rather than replace, the critical judgment and empathy of burn care nurses.

Keywords:
Burns, Nursing Care, Artificial Intelligence, Machine Learning, Clinical Decision Support, Wound Assessment

Code: wtrc12-00690030
Title:

Artificial Intelligence in Wound Healing: From Smart Diagnosis to Personalized Treatment

Authors:

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Abstract:
Background: Recent advances in Artificial Intelligence (AI) and personalized medicine have revolutionized the management of both chronic and acute wounds. With the rising prevalence of metabolic diseases like diabetes, the need for precise and automated methods for wound diagnosis, prevention, and treatment has become increasingly critical. This study examines the applications of Machine Learning (ML) and Convolutional Neural Networks (CNN) in enhancing tissue repair processes. **Methods:** This research conducted a systematic review combined with clinical data analysis from PubMed, IEEE Xplore, and Google Scholar (2018-2024). Selection criteria included studies utilizing AI for wound diagnosis (e.g., wound image classification) or treatment response prediction. Data were analyzed using meta-analysis and qualitative assessment methods. **Results:** CNN-based systems achieved 94% accuracy in diabetic wound diagnosis compared to dermatologists' evaluations. Treatment response prediction algorithms (e.g., Random Forest) could recommend optimal treatment options (e.g., advanced dressings vs. skin grafts) with 87% accuracy. Hybrid AI-nanotechnology models (e.g., smart drug delivery systems) demonstrated a 40% improvement in tissue regeneration speed. Discussion: Findings indicate that AI can reduce human diagnostic errors and predict patient treatment responses, thereby minimizing unnecessary costs. However, challenges such as the need for more clinical data and ethical privacy concerns remain. Future research should focus on integrating AI with medical robotics and wearable biosensors. **Conclusion:** Artificial Intelligence serves as a powerful clinical assistant in wound care. Developing standardized model training frameworks and clinical adaptation protocols represents the next crucial step for this technology.

Keywords:
Artificial Intelligence, Wound Healing, Smart Diagnosis, Personalized Medicine, Nanotechnology, Machine Learning, Diabetic Wounds.

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Code: wtrc12-00680029
Title:

Enhancing Patient Outcomes in Skin Cancer: The Impact of Nursing Mobile Applications – A Systematic Review

Authors:

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Abstract:
Background: Skin cancer, including melanoma and non-melanoma types, is among the most common cancers, and early detection and management can improve survival rates up to 98%. Nurses play a pivotal role in patient education, treatment adherence, and psychosocial support. Mobile health (mHealth) applications focused on nursing provide tools for self-care, monitoring, and complication management. This review examines the impact of nursing educational apps on the management, self-care, and quality of life of patients with skin cancer. **Methods:** A systematic search was conducted for studies published between 2015 and 2025 in PubMed, Scopus, EMBASE, Web of Science, CINAHL, and the Cochrane Library, following PRISMA guidelines. Search terms included combinations of keywords such as nursing education, mHealth, mobile applications, skin cancer, melanoma, non-melanoma skin cancer, patient self-care, remote monitoring, treatment adherence, and symptom management. Eligible studies were peer-reviewed original research, including randomized controlled trials, clinical trials evaluating the effects of nursing educational mobile applications on patient outcomes in skin cancer care. Exclusion criteria were duplicates, irrelevant studies, non-English publications, and articles without full text. Two independent reviewers screened titles, abstracts, and full texts, with disagreements resolved through consensus. Risk of bias was assessed using the Cochrane Risk of Bias tool for randomized studies and the JBI Critical Appraisal checklists for non-randomized designs. Extracted data included study design, sample characteristics, type of mobile intervention, comparators, clinical and psychosocial outcomes, and main findings. **Results:** Of 452 articles screened, 12 met the inclusion criteria. The reviewed studies demonstrated that mobile health (mHealth) applications can enhance skin cancer care by supporting nursing education and patient self-management. These interventions improved patient self-monitoring, symptom reporting, and management of treatment-related side effects, contributing to better quality of life. Continuous nursing support delivered through digital platforms facilitated timely guidance and personalized care, reducing adverse effects such as treatment-related fatigue. Several studies highlighted that mobile interventions also promote patient engagement by providing educational content, coping skills training, and motivational support. Overall, the findings indicate that mHealth applications enable nurses to monitor patients remotely, deliver individualized education, and strengthen adherence to care plans. Collectively, these digital tools enhance the delivery of nursing care, improve patient outcomes, and empower patients to take a more active role in managing their skin cancer treatment and recovery. **Conclusion:** Nursing educational mobile apps demonstrate potential to enhance self-care, side effect management, psychosocial support, and remote monitoring in patients with skin cancer. Future research should focus on longitudinal studies, improved usability, and integration with healthcare systems to optimize patient outcomes.

Keywords:
Mobile health, Nursing, Skin Cancer, Self-care, Symptom Management

Code: wtrc12-00660028
Title:

In Vitro and In Vivo Differentiation of Stem Cells into Skin Melanocytes: A Systematic Review and Meta-Analysis

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Abstract:
Background: Melanocytes are essential for skin pigmentation and protection against ultraviolet radiation. Stem cell–based approaches for generating functional melanocytes offer promising strategies for treating pigmentary disorders such as vitiligo. Research has explored differentiation in both in vitro (cell culture) and in vivo (animal/preclinical) models, but a comprehensive synthesis of protocols, stem cell sources, and functional outcomes is lacking. Objective: This systematic review and meta-analysis aims to evaluate current evidence on stem cell differentiation into melanocytes in both in vitro and in vivo settings, focusing on stem cell types, induction protocols, differentiation efficiency, and functional outcomes. **Methods:** A systematic search will be conducted in PubMed, Scopus, Web of Science, and Embase for studies published up to 2025. Eligible studies include in vitro, preclinical, and translational research reporting differentiation of any stem cell type (iPSCs, ESCs, MSCs, or other sources) into melanocytes. Data on differentiation efficiency, marker expression, melanin production, functional assays, and transplantation outcomes will be extracted. Risk of bias will be assessed using standardized tools, and meta-analysis will be performed where appropriate. Expected **Results:** We expect to summarize the most efficient protocols for melanocyte differentiation in vitro, evaluate integration and functionality in vivo, compare outcomes across different stem cell sources, and identify gaps in current research. **Conclusion:** A systematic evaluation of stem cell–derived melanocyte generation across in vitro and in vivo models is crucial to optimize protocols, enhance differentiation efficiency, and accelerate clinical translation for skin regeneration and treatment of pigmentary disorders.

Keywords:
Stem Cells, Melanocytes, Differentiation, in vitro, in vivo, Regenerative Medicine, iPSC, ESC, MSC, Vitiligo, Skin Regeneration

Code: wtrc12-00600027
Title:

Integration of Oxygen and Nitric Oxide-Releasing Nanomaterials in Smart Dressings: A Systematic Review of Recent Advances and Therapeutic Potential in Accelerating Infected Wound Healing

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Abstract:
Background: Chronic infections from wounds, like diabetes-related ulcers and burns, are increasingly problematic in contemporary healthcare because of infection from bacteria that is difficult to treat, slow healing, and reduced blood flow. Modern smart dressings that utilize nanomaterials capable of releasing therapeutic gases, such as oxygen (O_2) and nitric oxide (NO), offer new ways to enhance healing in tissues. The goal of this systematic review is to analyze advancements made from 2020 to 2025 and explore their impact in therapeutic management of infected wounds. The goal is to understand the impact of such nanomaterials focusing on advanced research in aspects such as molecular processes, their clinical usage, and prevailing difficulties. Materials and **Methods:** I conducted a systematic search in PubMed, ScienceDirect, and Google Scholar employing the terms "gas releasing nanomaterials for wound healing," "smart dressings for nitric oxide releasing nanomaterials," and "nanoparticles for infected wounds." The inclusion criteria were for original research published between the years 2020 and 2025, and excluded were review articles, case reports, and unrelated preclinical research. The documented preclinical studies were evaluated with the CONSORT and STROBE frameworks, and a total of 48 original research articles were located (28 concerning O_2 releasing, 15 NO, and 5 combined, most of which were conducted in or with diabetic mice and in vitro). **Results:** The engineered smart hydrogels with integrated nanoparticles of calcium peroxide (CaO_2) released controlled doses of oxygen which mitigated hypoxia and boosted cellular metabolism. In animal studies, these nanomaterials improved angiogenesis and reduced infected wound healing time by up to 40% and 30% respectively across 22 studies. For example, the CaO_2-based nanocomposite dressings for diabetic wounds enhanced ROS production and suppressed Staphylococcus aureus. S-nitrosothiol based nanocarriers incorporated into electrospun dressings are classified NO-releasing nanomaterials which reduced stubborn infections by their anti-biofilm activity and induction of keratinocyte migration. We have 12 accounts of 25% enhanced wound closure, primarily in infected burn wounds, caused by PI3K/Akt and other pathways. Smart dressings with integrated pH/temperature sensors and combined O_2 and NO release showed improved tissue regeneration while dramatically reducing bacterial count by 90% with tissue necrosis spurring around the wound. Key obstacles reported in 8 studies were considered to be the possible toxicity of nanoparticles, e.g. accumulation in tissue and controlled precision of gas release. Discussion: In smart dressings, these nanomaterials optimize the wound environment: O_2 treats hypoxia, and NO reduces inflammation via antimicrobial and vasodilatory pathways. For infected wounds, especially in diabetics with resistant infections, these nanomaterials may offer great therapeutic value. Still, more clinical studies and safety evaluations are required beyond the five studies conducted during this time. There is a possibility of enhancement by coupling with photothermal therapies or using stimuli-responsive nanomaterials acting on bacterial enzymes. **Conclusion:** Research studies clearly demonstrate the efficacy of gas-releasing nanomaterials within smart dressings for enhancing the healing process of infected wounds. This approach has the potential to redefine standards of wound care management; however, additional clinical research is necessary to further develop this innovative technology.

Keywords:
Gas-releasing Nanomaterials, Smart Dressings, Infected Wounds, Oxygen Therapy, Nitric Oxide

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Code: wtrc12-00510026
Title:

Fabrication and In Vitro Assessment of Probiotic-Loaded Hyaluronic Acid–PVA Electrospun Mats for Use as Wound Dressings

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Abstract:
Background: Recently infectious wounds have resulted in many challenges. Certain treatments for the infectious wounds are antibiotics, and their efficacy has been reduced by antibiotic resistance. In recent years, researches have been conducted on use of probiotics in curing infectious wounds and probiotics have inhibited resistant bacteria very well. The goal of this study is to prepare and evaluate of hyaluronic acid/poly vinyl alcohol fibers with the encapsulated Micrococcus luteus as a probiotic to manage the infectious wound. Materials and **Methods:** Polyvinyl alcohol and hyaluronic acid blended fibers were produced by electrospinning process. Fibers were crosslinked with three dry heat methods and the fiber morphology of best method was investigated by scanning electron microscopy before and after the heat crosslinking process. Scanning electron microscopy, mechanical strength and FTIR analysis were performed on the sample of best crosslinking method. Water vapor transmission rate test was conducted for assessing the electrospun nanofiber as a wound dressing. Melanwhile, encapsulated Micrococcus luteus poly ethylene oxide were electrosparyed on the fibrous mat. The viability of loaded Micrococcus luteus was measured during 14 days and inhibitng ability was evaluated against Staphylococcus aureus and Pseudomonas aeruginosa. The MTT test was done on L929 fibroblast cells in contact with the extraction of the samples at different concentrations (10–1000 μM). Wound healing potential was evaluated using the scratch assay, measuring scratch closure at 0, 4, and 24 hours. **Results:** Hyaluronic acid/Polyvinyl alcohol fibers were acquired at 202 ± 23 nm and a significant reduction in fibers diameter was observed after the crosslinking process. FTIR results showed that during electrospinning, an esterification reaction happened between two polymers and heat crosslinking reduced the hydroxyl content. The tensile strength test showed that the mechanical properties of the fibers were in the range of an appropriate wound dressing. Water vapor transmission rate test showed no statistically significant differences among the groups, with all values falling within the acceptable range for wound dressing applications, confirming suitability for maintaining a moist wound environment The viability of the electrosprayed probiotic was acceptable and the probiotic-loaded sample completely inhibited both types of pathogenic bacteria. The MTT assay demonstrated more than %80 cell viability at all tested concentrations after 24 hours of exposure, indicating excellent biocompatibility and no significant cytotoxic effects. At the same time, the crosslinked sample with PEO electrosprayed fibrous mat showed %100 scratch closure within 24 hours and much more than other groups. Discussion and **Conclusion:** Hyaluronic acid/polyvinyl alcohol fibers with the cooperation of encapsulated Micrococcus luteus could be used as a wound dressing in the treatment of infectious wounds.
Keywords:
Probiotic, Wound Dressing, Infectious Wound, Hyaluronic Acid, Poly Vinylalcohol

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Code: wtrc12-00470023
Title:

Explainable AI in Predicting Chronic Wound Healing Outcomes: A Systematic Review of Clinical-Grade Models

Authors:

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Abstract:
Background: Chronic wounds represent a significant clinical and economic burden worldwide, often resulting in prolonged treatment, infections, and reduced quality of life. Predicting wound healing outcomes accurately can optimize personalized treatment and resource allocation. While Artificial Intelligence (AI) models have shown promise in predicting chronic wound healing, their clinical adoption is hindered by the lack of transparency. Explainable AI (XAI) techniques, such as SHAP and LIME, offer interpretable insights into model decisions, facilitating clinical trust and acceptance. This systematic review aims to evaluate the current state of clinical-grade XAI models applied to chronic wound healing prediction. **Methods:** A comprehensive literature search was conducted in PubMed, Scopus, Web of Science, IEEE Xplore, and Embase databases for studies published up to June 2025. Search terms combined keywords related to "chronic wounds," "wound healing," "artificial intelligence," and "explainable AI" (e.g., SHAP, LIME). Inclusion criteria were: (1) studies applying AI models to predict chronic wound healing outcomes, (2) use of explainability techniques, (3) clinical or real-world data, and (4) original research articles. Exclusion criteria included studies without explainability components, reviews, editorials, and animal studies. After screening 1531 articles, 18 studies met inclusion criteria for detailed analysis. **Results:** Among the 18 included studies, sample sizes ranged from 150 to over 260,000 patients with various chronic wounds such as diabetic foot ulcers, venous leg ulcers, and pressure ulcers. The majority employed machine learning algorithms including XGBoost, Random Forest, and Support Vector Machines, integrated with explainability methods like SHAP and LIME. Reported model performance metrics ranged from AUC 0.81 to 0.99 for wound healing prediction. Notably, one study utilizing over 260,000 patient records demonstrated an AUC of 0.92 in predicting 12-week healing outcomes. Explainability scores varied, with models providing clear feature importance highlighting clinical parameters such as wound size, infection status, and comorbidities. Only 6 studies reported prospective validation or implementation in clinical workflows, emphasizing the emerging nature of clinical adoption. **Conclusion:** Explainable AI models show high accuracy and provide interpretable insights into chronic wound healing predictions, potentially enhancing clinical decision-making and personalized care. However, the limited number of prospective studies and real-world implementation highlights the need for further validation and integration efforts. Future research should focus on standardizing explainability metrics and improving user-friendly interfaces to bridge the gap between AI research and clinical practice.

Keywords:
Chronic wounds, Explainable AI, Wound healing prediction, SHAP, Machine learning

Code: wtrc12-00470022

Title:

Digital Self-Care Platforms for Wound Prevention in High-Risk Populations: A Systematic Review of Usability and Clinical Impact

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Abstract:

Background: Chronic wounds pose a significant health challenge, especially among high-risk populations such as elderly patients, diabetics, and individuals with mobility impairments. Digital self-care platforms, including mobile applications and web-based tools, have emerged as promising interventions for wound prevention by promoting patient engagement and early risk detection. However, the usability and clinical impact of these platforms remain underexplored. This systematic review aims to assess the effectiveness and user-friendliness of digital self-care tools designed to prevent wounds in high-risk groups**. Methods:** We conducted a systematic search of PubMed, Scopus, Web of Science, IEEE Xplore, and Cochrane Library databases for studies published up to August 2025. Keywords included "digital self-care," "wound prevention," "high-risk populations," "usability," and "clinical outcomes." Inclusion criteria were original research articles evaluating digital platforms for wound prevention in adult high-risk populations, reporting both usability measures and clinical outcomes. Studies focusing solely on treatment rather than prevention, pediatric populations, or lacking quantitative usability data were excluded. Out of 1,245 records identified, 22 studies met the inclusion criteria for qualitative synthesis. **Results:** The included studies covered diverse high-risk groups, predominantly patients with diabetes (59%), elderly individuals (27%), and those with limited mobility (14%). Digital platforms ranged from smartphone apps to web portals and wearable-integrated systems. Usability was assessed using validated scales such as the System Usability Scale (SUS), with scores averaging 78/100, indicating good user satisfaction. Clinical impact analyses showed significant reductions in wound incidence and early detection of risk factors, with reported wound prevention rates improving by 20–35% compared to standard care. Several studies highlighted enhanced patient engagement and self-efficacy as key mediators of clinical benefits. Nevertheless, variability in platform design and limited long-term follow-up were noted challenges. **Conclusion:** Digital self-care platforms demonstrate promising usability and positive clinical outcomes in preventing wounds among high-risk populations. These tools empower patients through education, monitoring, and timely interventions, potentially reducing healthcare burden. Future research should prioritize standardized usability frameworks, long-term efficacy studies, and integration with healthcare systems to optimize these digital interventions' scalability and impact.

Keywords:

Digital self-care, Wound prevention, High-risk populations, Usability, Clinical impact

Code: wtrc12-00410021
Title:

Systematic Review of efficacy, safety and satisfaction, Platelet-Rich Plasma, fluid Platelet-Rich Fibrin for chronic wound healing (2017–2025)

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Abstract:
Background: Chronic wounds, including diabetic foot ulcers (DFUs), pressure ulcers, and Non-healing surgical wounds, pose significant clinical challenges due to delayed healing and increased risk of complications. Platelet-rich plasma (PRP), enriched with growth factors, has gained attention as a regenerative treatment for enhancing wound healing. This review aims to summarize the latest evidence regarding the use of PRP in the treatment of chronic wounds and mature scars, highlight its mechanisms of action, compare it with conventional treatment methods, and identify future directions for clinical application and research. Platelet-Rich Fibrin (PRF) is a newer form of platelet concentrate that naturally forms a fibrin scaffold, helping to gradually release growth factors at the wound site. Its simple preparation and ability to support tissue repair make it a promising option for managing chronic wounds, alongside PRP. Objective: This study aims to systematically evaluate the efficacy and safety of PRP and PRF in the management of chronic wounds, based on randomized controlled trials (RCTs) published between 2017 and 2025. **Methods:** A comprehensive search was conducted in databases including PubMed, EMBASE, Cochrane Library, and Web of Science. Outcomes such as wound healing rate, healing time, ulcer area reduction, amputation rates, and adverse events were assessed. **Results:** Most included studies demonstrated that PRP significantly improved healing rates and reduced healing time compared to standard care, without increasing adverse events. While PRF may theoretically offer a sustained release of bioactive factors, current comparative evidence does not demonstrate a clear superiority over PRP in chronic wound healing. Further large-scale, high-quality studies are warranted to establish definitive conclusions. **Conclusion:** PRP has been widely used for its rapid regenerative effects, especially in deeper wounds, whereas PRF's longer release mechanism makes it more suitable for surface healing and long-term tissue support. Combining these two therapies, such as PRP injections for deeper tissue healing and PRF for surface-level regeneration, could provide a comprehensive treatment approach for chronic wounds. PRF alongside PRP appears to be a safe and effective adjunct therapy for chronic wound treatment. Standardization of protocols is recommended for future studies.

Keywords:
Platelet-Rich Plasma(PRP), Injectable Platelet-Rich Fibrin(i-PRF), Chronic Wound, Wound Healing, Systematic Review

Code: wtrc12-00020001
Title:

Enhancing Wound Healing Using Hydrogel Dressings Containing Gum Arabic–Sericin: A Simple Review of Recent Studies

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Abstract:
Background: Chronic wounds such as pressure ulcers and diabetic foot ulcers impose significant burdens due to delayed healing. Biocompatible dressings are promising tools for accelerating tissue regeneration. Gum arabic, with its antioxidant activity, and sericin, a silk-derived protein stimulating cell proliferation, have gained attention when combined in hydrogel dressings. This study aimed to review recent findings on the effectiveness of this composite in promoting chronic wound healing. **Method:** This simple review was conducted by searching PubMed, ScienceDirect, and SID from 2015 to 2024. Inclusion criteria were original, review, or laboratory articles published in English or Persian addressing the use of hydrogel dressings containing gum arabic and/or sericin for wound healing. Exclusion criteria included lack of full text, irrelevant formulations, and non-translatable animal data. Out of 103 articles retrieved, 17 were included in the final analysis. **Results:** Gum arabic facilitates healing by providing moisture and antibacterial protection. Sericin enhances collagen synthesis and fibroblast proliferation, accelerating tissue repair. Their combination enables controlled release of active ingredients, reduces inflammation, and improves epithelialization. Experimental studies showed superior efficacy in wound size reduction compared to conventional hydrogels. The selection of this biocomposite is due to its non-toxicity, affordability, and excellent tissue compatibility. **Conclusion:** Among the reviewed outcomes, hydrogel-based dressings containing gum arabic and sericin demonstrated the highest efficacy in reducing inflammation and enhancing wound closure due to their synergistic antioxidant and regenerative properties. Further clinical trials are needed to validate these results.

Keywords:
Hydrogel dressing, Wound healing, Gum arabic, Sericin, Chronic wounds, Natural dressings

Twelfth Yara International Congress of Wound and Tissue Repair

Code: yara12-0240

Regenerative Effects of Aulactinia stella–Derived Exosomes on Human Skin Fibroblasts: A Novel Marine-Based Approach to Wound Healing

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Background: Marine invertebrates possess remarkable regenerative capacities, yet their potential contribution to mammalian wound repair remains largely unexplored. This study investigates the proliferative and migratory effects of exosomes derived from regenerating sea anemone Aulactinia stella on human skin fibroblasts—key cells orchestrating dermal wound healing. **Methods:** Regenerating tissue from A. stella was harvested, and exosomes were isolated and characterized using SEM, TEM, and nanoparticle size distribution analysis. Human foreskin fibroblasts (HFFs) were treated with graded concentrations of aquatic extracts and purified exosomes. Cellular proliferation was assessed by MTT assay, while wound closure capability was evaluated via in vitro scratch assay. In silico protein–receptor docking was performed to identify potential interactions between exosomal proteins and fibroblast growth factor receptors (FGFRs). **Results:** Aquatic extracts showed modest proliferative effects, with 60 μg/mL significantly enhancing fibroblast migration at 12–24 hours. Exosomes exhibited stronger regenerative activity: the 50 μg/mL exosome treatment significantly increased fibroblast proliferation ($p = 0.011$) and accelerated wound closure at 12 h and 24 h compared to controls. Characterization confirmed typical nanoscale morphology (~99 nm) and biomolecular cargo including protein, RNA, and DNA species. In silico analysis suggested strong binding affinities between exosomal proteins (notably thypedin and RHO-family proteins) and FGFR1–FGFR4, indicating activation of key pathways involved in fibroblast proliferation and migration. **Conclusion:** A. stella–derived exosomes promote significant fibroblast regeneration and directional migration, demonstrating a novel xenogenic exosome-based strategy with promising therapeutic potential for enhancing cutaneous wound healing. These findings introduce a new marine-derived bioactive platform for future wound-repair biotechnologies.

Code: yara12-0250

Mapping the Bench-to-Bedside Translation of Mesenchymal Stem Cell-Derived Extracellular Vesicles

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Background: Mesenchymal stem cell–derived extracellular vesicles (MSC-EVs), including exosomes, have emerged as a cell-free therapeutic platform with strong potential in tissue repair, immune modulation, and management of inflammatory diseases. However, the global structure, maturity, and translational trajectory of MSC-EV research have not been systematically mapped. **Methods:** A bibliometric analysis was performed using Web of Science, Scopus, and PubMed up to March 2025. English-language original research articles on MSC-EVs in in vitro, in vivo, and human studies were identified through a structured search and screened for relevance. The final dataset of 99 articles was analyzed in R (bibliometrix/Biblioshiny) for publication trends, citation impact, collaboration networks, thematic evolution, and translational depth. Clinical, animal, and mechanistic studies were further categorized by disease indication, MSC source, and administration route, and evaluated for alignment with MISEV 2018/2023 guidelines. **Results:** MSC-EV research showed a 27.11% annual growth rate from 2014 to 2025, with 841 authors publishing in 70 journals, reflecting a highly collaborative and interdisciplinary field. We identified 29 clinical trials, 6 case reports, and 50 animal studies spanning respiratory diseases (especially COVID-19 and ARDS), osteoarthritis and cartilage repair, spinal cord and brain injury, dermatologic and wound-healing indications, and autoimmune disorders. EVs were administered via intrathecal, intra-articular, topical, intravenous, and inhaled routes, with consistent signals of safety and biological activity. Nonetheless, only a minority of clinical studies fully complied with MISEV standards for EV characterization and nomenclature. **Conclusions:** MSC-EV research is rapidly transitioning from experimental models to early-phase clinical use, particularly in inflammatory and regenerative indications relevant to wound and tissue repair. Strengthening methodological standardization and expanding late-phase trials will be pivotal to realizing their full therapeutic potential.

Code: yara12-0260

Application of Artificial Intelligence in Neuro-Management of Chronic Wound Pain: From Multimodal Signal Analytics to Adaptive Neuromodulation

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Abstract

Chronic wounds—including diabetic foot ulcers, pressure injuries, and venous leg ulcers—pose major clinical and economic burdens on healthcare systems and are frequently accompanied by persistent neuropathic pain that remains refractory to conventional therapies. This pain arises from impaired tissue repair combined with maladaptive alterations in nociceptive processing, driven by inflammatory dysregulation, peripheral sensitization, and extensive synaptic and network-level reorganization within the central nervous system. Existing clinical approaches rely heavily on subjective pain reports and fragmented assessment methods, underscoring the need for objective, multimodal, and adaptive strategies that can more accurately characterize and modulate wound-related pain mechanisms. Recent advances in artificial intelligence have enabled integrated analysis of clinical data, neurophysiological signals, and neuroimaging modalities, providing new opportunities to decode the neural underpinnings of chronic pain. To synthesize current evidence, this structured narrative review evaluated studies published between 2015 and 2025, yielding approximately 30 eligible investigations focused on AI-based neural pain decoding or adaptive neuromodulatory interventions. Deep learning architectures—including convolutional neural networks, long short-term memory networks, and hybrid attention models—have typically reported classification accuracies in the 70–90% range when estimating pain intensity from EEG, HRV, or combined peripheral biosignals. Explainability analyses frequently identified neural signatures associated with chronic neuropathic pain, including changes in theta–gamma coupling, reductions in alpha-band activity, and enhanced somatosensory cortical synchrony. Emerging reinforcement learning–based closed-loop neuromodulation systems—including adaptive spinal cord stimulation and personalized transcranial electrical stimulation—have reported approximately 20–35% improvements in analgesic outcomes by continuously optimizing stimulation parameters in real time. These developments highlight the capacity of AI-enhanced neural decoding frameworks to improve signal interpretation accuracy and support individualized modulation strategies. The integration of AI methodologies with neurobiological insights delineates a new paradigm of intelligent pain medicine in which diagnosis, prediction, and intervention operate within a continuous, adaptive, and self-optimizing loop. This framework holds significant potential for advancing precision pain management in patients with chronic wounds and persistent neuropathic pain, offering a pathway toward individualized, mechanism-based, and dynamically responsive therapeutic strategies.

Keywords: chronic wound, neuropathic pain, artificial intelligence, adaptive neuromodulation, EEG, deep learning, precision medicine

Code: yara12-420

A Neurogenic Peptide-Modified *Euphorbia grantii* Cellulose Scaffold for Neural Tissue Engineering

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Abstract

Background: Neural tissue engineering increasingly relies on biomaterials that do more than provide passive structural support. An effective scaffold should reproduce key physical features of the extracellular environment while also presenting biochemical signals capable of influencing cell attachment, survival, and lineage-specific behavior. Plant-derived cellulose matrices are attractive because of their naturally organized three-dimensional architecture, accessibility, and biocompatibility, yet their intrinsic neurogenic activity is limited. In this study, a cellulose scaffold derived from decellularized *Euphorbia grantii* leaves was modified with an alginate-based coating carrying a neurogenic peptide. We investigated whether this bioactive interface could preserve the structural advantages of the plant matrix while supporting neural differentiation-associated responses in human bone marrow-derived mesenchymal stem cells (BM-MSCs). **Methods:** The decellularized leaf scaffold was biofunctionalized with alginate and a neurogenic peptide. Its chemical composition, elemental profile, structural organization, nanoscale topography, wettability, and gas-accessible pore characteristics were examined using Fourier-transform infrared spectroscopy, energy-dispersive X-ray spectroscopy, X-ray diffraction, atomic force microscopy, water contact angle analysis, and Brunauer-Emmett-Teller measurements. Cytocompatibility and cell-scaffold interactions were assessed using the MTT assay and scanning electron microscopy. Neural differentiation-associated responses were evaluated at days 7 and 14 through morphological assessment and RT-qPCR analysis of Nestin, beta-III tubulin, and GFAP expression. **Results:** Decellularization preserved a cellulose-rich plant framework suitable for subsequent surface modification. Alginate/neurogenic peptide functionalization produced measurable changes in the chemical profile, elemental composition, apparent structural organization, nanoscale roughness, wettability, and accessible pore characteristics of the scaffold. Despite these modifications, the final construct maintained an overall hydrophilic character and showed no evidence of overt cytotoxicity. MTT analysis indicated that the scaffold supported BM-MSC metabolic activity, while scanning electron microscopy demonstrated cell attachment and surface colonization on the modified matrix. During neural induction, BM-MSCs cultured on the peptide-modified scaffold progressively developed more elongated and neuron-like morphological features. Neural differentiation-associated gene expression also increased over time, with the peptide-containing scaffold showing a stronger overall response, particularly at day 14. Together, these observations indicate that the modified scaffold provided a more instructive microenvironment for BM-MSC neural differentiation than the non-functionalized plant matrix. **Conclusions:** The results demonstrate that a decellularized *Euphorbia grantii* cellulose matrix can be converted into a bioactive, peptide-presenting scaffold while retaining the essential architecture of the plant-derived framework. By combining a naturally organized cellulose substrate with an alginate-mediated neurogenic cue, the system supported cell compatibility and promoted neural differentiation-associated changes in BM-MSCs. This approach may provide a useful foundation for developing accessible and biologically instructive scaffolds for neural tissue engineering and regenerative medicine. Further functional and in vivo studies will be important for defining the translational potential of this platform.

Keywords: Plant-derived cellulose; *Euphorbia grantii*; Neurogenic peptide; BM-MSCs; Neural differentiation

Chapter II

Oral Speakers

Code: wtrc12-05920565
Title:

Targeted Healing of Refractory Venous Leg Ulcers Using Engineered Fibroblast-Derived Extracellular Vesicles Loaded with Anti-Fibrotic MicroRNA

Authors:

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Abstract:
Background: Venous Leg Ulcers (VLUs) represent a pervasive challenge at the intersection of dermatology, internal medicine, and vascular surgery, characterized by a chronic inflammatory state and aberrant fibroblast activity leading to excessive fibrosis and impaired healing . Current advanced therapies, including growth factors and cellular grafts, often yield suboptimal outcomes due to short half-lives, complex logistics, and failure to correct the pathological wound microenvironment . Extracellular vesicles (EVs) have emerged as critical mediators of intercellular communication, offering a novel "cell-free" therapeutic strategy by transferring bioactive molecules to recipient cells . We hypothesize that EVs engineered to deliver specific anti-fibrotic signals can directly reprogram the wound microenvironment, overcoming a key barrier to healing in refractory VLUs. **Methods:** A prospective, randomized, double-blind controlled trial was conducted with 50 patients with chronic VLUs persisting for >12 weeks. Fibroblast-derived EVs were isolated and characterized via nanoparticle tracking analysis and western blot. The intervention group (n=25) received topical application of EVs engineered via electroporation to be loaded with a mimic of microRNA-29b, a potent inhibitor of collagen deposition and fibrosis, delivered in a novel thermosensitive hydrogel. The control group (n=25) received a placebo hydrogel. The primary endpoint was the percentage of wound area reduction (WAR) at 6 weeks. Secondary endpoints included complete wound closure time, histopathological assessment of collagen organization (via Masson's Trichrome staining), and changes in pro-fibrotic cytokine levels (TGF-β1) in wound fluid. **Results:** Treatment with engineered miR-29b-EVs resulted in a significantly greater mean WAR of 78.4% (±9.2%) compared to 41.7% (±14.5%) in the control group at 6 weeks ($p < 0.001$). The median time to complete closure was reduced to 8.5 weeks in the intervention group versus 14.3 weeks in controls ($p < 0.01$). Histological analysis revealed a more organized collagen matrix with significantly reduced hypertrophic scarring in the EV-treated group. Furthermore, a marked decrease in TGF-β1 levels was observed in wound exudate from the intervention arm, confirming the targeted anti-fibrotic mechanism of action. No treatment-related adverse events were reported. **Conclusion:** This study demonstrates that topically applied, engineered fibroblast-derived EVs represent a safe and highly effective therapy for chronic VLUs. By directly delivering anti-fibrotic microRNA to the wound bed, this targeted approach successfully modulates the pathological microenvironment, accelerates healing, and improves tissue quality. This "cell-free" regenerative strategy presents a scalable and innovative therapeutic platform for complex wound management.

Keywords:
Engineered Extracellular Vesicles, Venous Leg Ulcer, MicroRNA Delivery, Anti-Fibrotic Therapy, Cell-Free Regeneration

Code: wtrc12-05920563
Title:

Accelerated Healing of Chronic Diabetic Foot Ulcers via a Novel Point-of-Care Therapy Combining Cryopreserved Adipose-Derived Regenerative Cells and a Sensor-Embedded Smart Hydrogel Dressing

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Abstract:
Background: Chronic diabetic foot ulcers (DFUs) represent a profound clinical and economic burden, characterized by impaired angiogenesis, persistent inflammation, and dysfunctional cellular activity. Traditional treatments often fail to restart the stalled healing cascade. While regenerative cell therapies show promise, challenges with cell viability, engraftment, and monitoring the dynamic wound microenvironment post-application limit their efficacy. This study investigates a novel, integrated therapeutic strategy designed to overcome these limitations by combining the potent, point-of-care application of cryopreserved adipose-derived regenerative cells (ADRCs) with a responsive smart hydrogel dressing that provides real-time monitoring and sustained support. **Methods:** A single-center, randomized controlled trial was conducted with 60 patients with chronic, non-healing DFUs. The intervention group (n=30) received a single application of autologous, cryopreserved ADRCs, isolated from lipoaspirate and characterized by flow cytometry (CD45-, CD90+, CD73+, CD105+), delivered via a novel chitosan-based hydrogel dressing. This smart dressing was embedded with micro-sensors for continuous, wireless monitoring of wound bed temperature and pH. The control group (n=30) received standard hydrogel dressings. The primary endpoint was the percentage of wound area reduction (WAR) at 4 weeks. Secondary endpoints included complete healing time, incidence of infection (confirmed by fluorescence imaging), and quality of neotissue formation, assessed using standardized digital imaging and histological analysis of punch biopsies at week 4. **Results:** The ADRC-Smart Hydrogel group demonstrated a statistically significant improvement in the primary endpoint, achieving a mean WAR of 82.5% (±8.4%) at 4 weeks compared to 44.2% (±12.1%) in the control group ($p < 0.001$). The median time to complete wound closure was reduced by 40% (7.2 weeks vs. 12.1 weeks, $p < 0.01$). The sensor data provided objective evidence of a faster normalization of the wound microenvironment in the intervention group, with a return to a physiologic pH (5.5-6.5) 4-5 days sooner than controls. Furthermore, the intervention group showed a 60% reduction in clinical infection rates and histological evidence of enhanced angiogenesis and more organized collagen deposition. **Conclusion:** The point-of-care combination of cryopreserved ADRCs and a sensor-embedded smart hydrogel dressing is a safe and highly effective therapy for chronic DFUs. This multimodal approach significantly accelerates wound closure, reduces complications, and actively modulates the wound environment. The integration of a monitoring system provides clinicians with unprecedented, objective data for adaptive treatment planning, representing a significant step forward in personalized, regenerative wound care.

Keywords:
Adipose-Derived Regenerative Cells, Diabetic Foot Ulcer, Smart Dressing, Point-of-Care Therapy, Wound Healing

Code: wtrc12-04260559
Title:

Artificial Intelligence in Dermatology Personalized Medicine: A Systematic Review

Authors:

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Abstract:

Background: Artificial intelligence (AI) has become integral to precision dermatology, supporting individualized risk stratification, diagnosis, therapeutic decision-making, and treatment monitoring across malignant and non-malignant conditions. As applications continue to expand, a comprehensive synthesis of existing evidence is essential to clarify current capabilities, methodological limitations, and translational potential. **Methods:** This systematic review followed the PRISMA 2020 guidelines. Searches were conducted in PubMed, Scopus, Web of Science, Embase, and ScienceDirect from inception to 15 November 2025, without language restrictions. Controlled vocabulary and free-text terms related to "artificial intelligence," "machine learning," "deep learning," "precision medicine," and "dermatology" were combined. Studies were included if they: (1) applied AI for personalized or individualized dermatologic care; (2) involved human participants or dermatologic image/biopsy datasets; and (3) reported outcomes relevant to prediction, classification, treatment guidance, risk assessment, or disease monitoring. Exclusion criteria were: animal studies, reviews, editorials, purely technical papers without clinical relevance, and studies lacking outcome reporting. Two reviewers (R.N. & N.T.) independently screened titles, abstracts, and full texts. Data were extracted on AI model type, dataset characteristics, dermatologic condition, personalization component, and performance metrics; any disagreements were resolved by consultation with a third reviewer (S.R.). Study quality was assessed using PROBAST for prediction models and QUADAS-2 for diagnostic models. **Results:** From 2,314 retrieved records, 56 studies met the inclusion criteria. The most common conditions addressed were melanoma and pigmented lesions (n=23), psoriasis (n=9), atopic dermatitis (n=6), acne (n=5), and cutaneous lymphoma, hidradenitis suppurativa, or autoimmune dermatoses (n=13). Deep learning, which basically is predominantly convolutional neural networks, was used in 40 studies, classical machine-learning models (random forests, SVM, gradient boosting) in 11, and hybrid multimodal architectures in 5. Personalized applications included: individualized lesion risk prediction (n=18); patient-specific diagnostic or phenotyping models (n=21); treatment response forecasting, particularly in psoriasis and atopic dermatitis (n=9); automated severity scoring tailored to patient characteristics (n=6); and personalized monitoring using longitudinal imaging or mobile-based systems (n=7). Model performance was generally high, with melanoma-focused AI achieving pooled sensitivity ranges of 87–98% and specificity 82–96%, often comparable to or exceeding dermatologists' performance. Personalized therapeutic prediction models demonstrated variable but promising accuracy (AUC 0.72–0.93). However, 36 studies (64%) exhibited high or unclear risk of bias due to non-representative datasets, inadequate external validation, missing demographic subgroup reporting, or lack of calibration metrics. Only 12 studies performed external validation, and only 3 addressed fairness across skin types, revealing persistent data imbalance affecting performance on Fitzpatrick IV–VI. Reporting quality was inconsistent, especially regarding dataset provenance, preprocessing pipelines, and clinical integration processes. **Conclusion:** AI shows strong potential to enable personalized dermatologic care, particularly for melanoma risk stratification, individualized severity grading, and prediction of therapeutic response in inflammatory skin diseases. However, methodological limitations, including insufficient external validation, limited diversity of training data, and inconsistent reporting, restrict clinical translation. Future research must prioritize multicenter datasets, standardized reporting, fairness evaluation, and prospective clinical trials to establish reproducibility and real-world impact.

Keywords:
Artificial Intelligence, Personalized Medicine, Dermatology, Systematic Review

Code: wtrc12-03580545
Title:

Bioinformatic Analysis of the Wound Peptidome: A Review of Its Potential for Biomarker Discovery and Antimicrobial Peptide Identification

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Abstract:
Background: Wound infection remains a major clinical challenge, contributing to delayed healing, increased morbidity, and higher healthcare costs. Early and accurate diagnosis of wound status is essential for effective management, yet current diagnostic approaches often lack sensitivity and specificity. Peptidomics has emerged as a promising omics-based approach for studying bioactive peptides involved in inflammation, immune response, and tissue regeneration. Among available biological samples, wound fluid represents an optimal source for peptidomic analysis, as it directly reflects the local molecular environment of the wound site. **Methods:** This review summarizes and analyzes published studies focusing on wound fluid peptidomics and bioinformatic approaches used for data analysis. Emphasis is placed on label-free tandem mass spectrometry techniques combined with sorting algorithms and open-source bioinformatic tools. The reviewed methodologies aim to establish unbiased analytical pipelines for comparing and differentiating wound peptidomes under various physiological and pathological conditions, including infected and non-infected wounds. **Results:** The reviewed literature demonstrates that wound fluid peptidomes are highly dynamic and strongly individualized. Bioinformatic analyses have revealed distinct peptide patterns associated with wound healing progression and infection status. Several host-derived peptides with potential antimicrobial, immunomodulatory, and pro-healing properties have been reported. These findings highlight the ability of peptidomic profiling to uncover candidate biomarkers and therapeutic peptides that may not be detectable using conventional protein-based approaches. **Conclusions:** Bioinformatic analysis of the wound peptidome represents a powerful and innovative strategy for advancing wound diagnostics and therapy. The integration of peptidomics with robust computational tools enables the identification of novel biomarkers and antimicrobial peptides, supporting the development of personalized wound management strategies. Future efforts should focus on standardizing analytical workflows and validating candidate peptides to facilitate clinical translation.

Keywords:
Wound peptidomics; Bioinformatics; Biomarkers; Antimicrobial peptides; Wound healing

Code: wtrc12-03040541
Title:

Chitosan-TPU Nanocomposite Scaffold Containing Reduced Graphene Oxide with Suitable Biocompatibility and Angiogenesis for Cardiac Tissue Engineering

Authors:

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Abstract:
Background: Cardiac tissue engineering requires scaffolds that are biocompatible, conductive, and have strong angiogenic properties. This study aimed to prepare a nanocomposite scaffold based on chitosan and thermoplastic polyurethane (TPU) crosslinked with sodium alginate and calcium gluconate and containing different amounts of reduced graphene oxide (rGO) to evaluate its biocompatibility, angiogenesis, biodegradability and antimicrobial properties. **Methods:** Nanocomposite scaffolds were prepared by combining a chitosan solution (2% w/v) in 10 ml of 90% glacial acetic acid (v/v) and a thermoplastic polyurethane (TPU) solution with a concentration of 6% w/v in tetrahydrofuran (THF), along with 0.075 g of sodium alginate, 0.1 g of calcium gluconate and different amounts of reduced graphene oxide (0.004, 0.02 and 0.04 g) by the solvent casting/particle leaching method. The mixtures were first dried in a vacuum-connected desiccator for 24 hours and then in a vacuum oven (40°C and -0.8 bar pressure) for 4 hours. The samples were named as CTC as the base (abbreviation for chitosan-thermoplastic polyurethane-crosslinked (sodium alginate and calcium gluconate)) and CTCrGO1, CTCrGO2 and CTCrGO3 for samples containing 0.004, 0.02 and 0.04 g of reduced graphene oxide (rGO), respectively. **Results:** The biocompatibility of the scaffolds on HUVEC cells was evaluated by the MTT assay. On the third day, all three groups containing rGO increased cell growth compared to the control, but only the CTCrGO2 scaffold showed this increase significantly ($p < 0.05$), and the changes in CTCrGO1 and CTCrGO3 were not significant. On the fifth day, cell growth decreased in all scaffolds containing rGO compared to the control, but this decrease was not significant. On the seventh day, only CTCrGO1 had a significant decrease compared to the control, and no significant difference was observed in the CTCrGO2 and CTCrGO3 groups. CTCrGO2 and CTCrGO3 scaffolds showed a significant increase trend over time. The results indicated that the CTCrGO2 scaffold with a moderate amount of rGO provided the best biocompatibility. Angiogenesis was performed by the CAM method. After 7 days, the density of blood vessels around the scaffolds increased and the vessels converged towards the scaffolds. Statistical analysis with IKOSA software showed that the number of branches and the area of vessels increased significantly ($p < 0.0001$) with increasing rGO content, and the control sample had the lowest angiogenesis rate, confirming the positive effect of rGO on the angiogenesis process. The biodegradability of the scaffolds was evaluated in PBS for 56 days. The CTCrGO3 scaffold lost only about 45% of its initial weight, but the CTCrGO1,2 scaffolds showed a more gradual degradation process and finally lost about 60% of their weight. According to the sources, the appropriate degradation rate of the scaffolds has been reported to be between 50 and 70% over a period of 56 days, so it can be said that the CTCrGO1,2 scaffolds, especially CTCrGO2, showed more appropriate degradation. In the MBC test, CTCrGO2,3 scaffolds showed complete bactericidal activity against S. aureus and CTCrGO3 scaffold against E. coli, while CTCrGO1 lacked bactericidal activity. **Conclusions:** In summary, it can be said that CTCrGO2 scaffold, by providing an optimal balance between high biocompatibility, strong angiogenesis, controlled degradability, and targeted bactericidal activity against S. aureus, is introduced as a multifunctional and smart biomaterial for cardiac tissue engineering. Although this scaffold was initially designed for cardiac tissue engineering, its impressive angiogenesis and biocompatibility results also indicate the potential for broader application in other tissues requiring vascularization, such as chronic wound healing.

Keywords:
Nanocomposite scaffold, Chitosan, Thermoplastic polyurethane, Reduced Graphene Oxide, HUVEC, Angiogenesis, Biodegradability, Wound healing

Code: wtrc12-06170535
Title:

The Latest Advances in Cold Atmospheric Plasma for Wound Care: Mechanisms, Clinical Evidence, and Future Directions

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Abstract:
Background: Cold atmospheric plasma (CAP) has emerged as one of the most promising non-thermal technologies in modern wound care, offering a unique combination of antimicrobial, regenerative, and immunomodulatory effects. Although CAP devices have become more widely available in recent years, their mechanisms of action and clinical performance remain frequently misunderstood within the wound-care community. This presentation aims to provide a comprehensive, clinically oriented overview of CAP biology, explore the variability among existing plasma sources, address current challenges in standardization and dosing, and outline the direction in which plasma medicine is evolving. **Methods:** Non-thermal plasma interacts with biological tissues through a complex mixture of reactive oxygen and nitrogen species (ROS/RNS), transient electric fields, charged particles, photons, and localized changes in pH. These components act synergistically to disrupt microbial biofilms, modulate inflammation, promote angiogenesis, and stimulate keratinocyte and fibroblast activity. In contrast to thermal ablative devices, cold plasma operates within a temperature range compatible with living tissue, enabling targeted bioactivation without inducing thermal injury. The regenerative effects of CAP are increasingly understood as controlled redox idative stress—a distinction that has contributed to CAP's expanding therapeutic applications. **Results:** A major challenge in the field arises from the heterogeneity of plasma devices. CAP generated from helium jets, argon jets, dielectric barrier discharge (DBD) systems, spark-based plasmas, and hybrid configurations differ substantially in energy distribution, reactive species profiles, plume dynamics, penetration depth, and user-dependent variability. These differences can translate into distinct biological effects and inconsistent treatment outcomes. Moreover, the absence of unified parameters—such as plasma dose, exposure intensity, species flux, and treatment geometry—remains a barrier to establishing universal clinical protocols. Understanding device-specific characteristics is therefore essential for clinicians who aim to integrate CAP into routine wound management. Safety is another critical component of CAP therapy. Current evidence supports CAP as a well-tolerated modality with minimal risk of thermal damage, mutagenicity, or systemic toxicity when applied within validated parameters. However, inappropriate delivery—such as excessive exposure, incorrect nozzle–tissue distance, or the use of devices lacking quality control—can compromise outcomes. As CAP becomes increasingly accessible across clinical settings, the need for training, device certification, and standardized treatment metrics becomes more urgent. **Conclusion:** We will also highlight the existing gaps in evidence, including the lack of long-term outcome data, limited head-to-head comparisons between plasma sources, insufficient mechanistic clarity regarding plasma–immune interactions, and the need for robust clinical trials in chronic and ischemic wounds. Finally, emerging directi o
Keywords:
Cold Atmospheric Plasma (CAP), Wound Healing, Plasma Dosing and Standardization, Safety and Biological Effects

Code: wtrc12-06150512
Title:

Academic Studies on the Therapeutic Effects of Bee Products

Authors:

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Abstract:
Academic Studies on the Therapeutic Effects of Bee Products Dr. Mohammadreza Niakan Lahiji (Pharm.D, Medical Ph.D), Professor of Natural and Herbal Pharmaceutical Products Bee products, like any natural foodstuff, consist of main and secondary constituents. The main constituents (sugars, salts, proteins, fats, vitamins, etc.) provide nutritional value. Secondary constituents, present in smaller amounts, are primarily produced for preservation, environmental adaptation, or sustaining life (like enzymes, pigments, alkaloids, flavonoids, terpenes, etc.), and these impart medicinal properties to the product. The preservation and stability of honey against bacteria and microbes are due to its acidity, osmotic pressure, and the inhibitory effect of Hydrogen Peroxide (H_2O_2) resulting from the activity of Glucose Oxidase and bacteriolytic enzymes. Studies on over one hundred university research articles have confirmed honey's therapeutic effects, including: antimicrobial, healing, immune system boosting, anti-inflammatory (pulmonary and intestinal tissues), appetite stimulant, anti-constipation, anti-anemia, anti-diarrhea, anti-vomiting, treatment for conjunctivitis and corneal ulcers, stomach ulcers and inflammation, kidney stones (renal and bladder), prostate issues, throat inflammation and sore throat, healing of purulent and simple skin wounds, burn treatment, gentle skin moisturizer, reducing hair loss and stimulating hair growth, analgesic, nerve tranquilizer, and cellular protection against ionizing radiation. **Royal Jelly**, known as the "elixir of youth" and recognized as a powerful tonic, is effective in strengthening bees against microbial attack due to **Royalactin**, a strong antimicrobial substance, and is potent against both Gram-positive and Gram-negative bacteria. Royal Jelly, due to containing **10-Hydroxydecenoic Acid**, has an anti-tumor effect against malignant tumors, sarcoma, glioma, and blood cancer. It is effective in treating viral infections by increasing the defensive compounds Interferon and Immunoglobulins, showing remarkable results in treating acute respiratory illnesses and pharyngeal/laryngeal inflammation. The use of **Beeswax** in creams, ointments, and lotions for its softening effect, as well as its anti-inflammatory, antimicrobial, antiseptic, and breath-freshening properties, and for the sustained release of medicinal products, has a long history. **Propolis** has a strong antibacterial effect, used in treating chronic wounds, boils, burns, and repairing oral mucosa, and also contains an **antifungal** substance. Even **Bee Saliva** has strong antimicrobial effects, intensifying the antimicrobial property of pollen. **Bee Venom** stimulates hematopoiesis (red and white blood cells), is a cardiac muscle stimulant, increases blood pressure, is a diuretic, reduces cholesterol, prevents arteriosclerosis, excretes water and salt (similar to cortisones), and is beneficial in treating rheumatoid arthritis, facial nerve pain (trigeminal neuralgia) and peripheral polyneuritis, iritis. It possesses antiviral, antibacterial, and anticancer properties, exerts an inhibitory effect on Macrophages, B and T Lymphocytes, and Neutrophils, enhances platelet aggregation, and is effective in treating autoimmune diseases (such as MS, AIDS, Rheumatism), and is highly allergenic. **Pollen**, a secondary bee product, in addition to its antimicrobial properties, has multi-faceted strengthening effects and stimulates the body's defense system.

Keywords:
Bee Products, Wounds

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Code: wtrc12-06060487
Title:

Effect of Adamak Ethanolic Root Extract on Wound Healing Superficial Partial-thickness in Rats: An Experimental Study

Authors:

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Abstract:
Background: Adamak (Chelle Dagh) is from the family of Geraniaceae which is one of the local plants of North Khorasan with the scientific name of Biebersteinia multifida DC. Since this plant has many biological properties, including antimicrobial, anti-inflammatory, analgesic, and antioxidant, it seems that it can be effective in the wound healing process and increase the speed of wound healing. Therefore, in the present study, the effect of the on wound healing in male Wistar rats will be investigated. **Methods:** In this experimental study, adult male Wistar rats weighing 250 to 300 grams were used. They were anesthetized by intraperitoneal injection of 10 mg/kg xylazine and 75 mg/kg ketamine, and a 10% superficial partial-thickness burn was created in the animals. Thirty-six adults male Wistar rats were randomly divided into five groups: two experimental groups that received 10% and 20% extracts of Chelle Dagh (CD) and three control groups that received silver sulfadiazine ointment, Eucerin, or no treatment. A 5 cm partial thickness superficial burn was created using boiling water at 95°C for 6 seconds. The treatments were applied topically once a day for 18 days. Wound healing was assessed by measuring the reduction in wound area using ImageJ software, and the data were analyzed by analytical tests using SPSS 27 software. **Results:** Significant differences in wound healing emerged among the groups over time ($p < 0.001$). The average burn severity declined in both the 10% and 20% groups, with a more rapid reduction in the 20% group during the initial study days. Consequently, early effectiveness was greater in the 20% group than in the 10% group. Overall, after the first week, the 10% and 20% groups demonstrated higher effectiveness compared with the other groups, with a more pronounced difference ($p < 0.001$). The differences between the silver sulfadiazine group and both the Eucerin and control groups were not significant ($p > 0.05$), nor were differences between the Eucerin and control groups. **Conclusions:** The results of this study support the effect of ethanolic extract of the root of the plant Chelle Dagh on accelerating the healing of burn wounds in rats. Wound healing with silver sulfadiazine ointment is slower than that of the control group. However, it is suggested that this study be studied in the phase II study of burn wound healing in volunteers.
Keywords:
Biebersteinia Multifidi DC, Wound Healing, Superficial Partial-Thickness

Code: wtrc12-04850461
Title:

Integrated Nursing–Lifestyle Models For Diabetic Foot Ulcer Management: A Systematic Review

Authors:

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Abstract:
Background: Diabetic foot ulcers result from interacting biomedical and lifestyle factors. Integrated care models that combine nursing protocols with lifestyle interventions (nutrition, physical activity, smoking cessation and psychosocial support) may improve healing trajectories and reduce recurrence. This review synthesizes evidence from 2020–2025 on integrated nursing–lifestyle approaches for DFU management. **Methods:** In this systematic review, an extensive search was conducted with keywords related to "Diabetic foot ulcer," "Nursing," "Lifestyle," in international databases PubMed/Medline, Web of Science Core Collection, Scopus, Google_Scholar search engine and national databases SID, Magiran, Irandoct. The initial search yielded 1201 studies. Inclusion criteria were Articles published between 2020 and 2025 in English or Persian, full-text availability, human studies, observational or interventional designs, and studies assessing combined nursing-led care and explicit lifestyle components with wound healing or recurrence endpoints. Exclusion criteria included: review articles, conference abstracts, letters, editorials, grey literature, animal studies, duplicated records, and studies lacking wound outcomes. Ultimately, 22 studies were analyzed. Ethical considerations of non-bias were observed in the stages of selection, extraction, analysis, and classification of evidence, and the abstract was reported according to PRISMA. **Results:** Interventions varied but typically included nurse-led assessment and dressing protocols, structured nutritional counseling, supervised or home-based exercise and off-loading programs, glycemic self-management education, smoking cessation support, and psychosocial coaching. Combined models were implemented in outpatient clinics, nurse-led foot clinics, and community care settings. integrated interventions produced higher rates of complete ulcer healing, faster median time to closure, and lower recurrence. Multifaceted programs that included structured off-loading, protein supplementation, and supervised activity reported the most robust outcomes. Patient adherence and regular nurse follow-up were consistent predictors of success. Telehealth augmentation maintained outcomes comparable to In-person follow-up and improved access in rural populations. **Conclusions:** Integrated nursing–lifestyle models significantly improve DFU healing and reduce recurrence when they combine standardized nursing care with targeted lifestyle interventions and structured follow-up. We recommend adopting a core package for DFU clinics: (1) nurse-led assessment and dressing protocol; (2) nutritional optimization; (3) individualized off-loading + supervised exercise plan; (4) glycemic education and smoking cessation support; and (5) structured follow-up. Future trials should standardize core components and report adherence and cost-effectiveness to support wider implementation.
Keywords:
Diabetic foot ulcer, Integrated care, Nursing, Lifestyle intervention, Off-loading, Systematic Revie

Code: wtrc12-05450444
Title:

Design, Development, and Evaluation of a Mobile-Based Self-Care and Patient Monitoring Application for Individuals Undergoing Novel Regenerative Therapies

Authors:

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Abstract:
Background: Advances in regenerative and wound-healing therapies have introduced a new generation of treatment modalities that require continuous monitoring, timely detection of complications, and active patient engagement to achieve optimal outcomes. Mobile health (mHealth) technologies have emerged as powerful tools capable of enhancing self-care behaviors, strengthening patient–provider communication, and enabling real-time assessment of wound status. This study aims to design, develop, and evaluate a mobile-based self-care and monitoring application for patients receiving innovative regenerative therapies, with the goal of assessing its effectiveness in promoting self-care practices, facilitating timely monitoring, and enhancing overall healing outcomes. **Methods:** This developmental–applied study was conducted in three phases. In the first phase, the software content was generated through a needs-assessment process that included interviews with seven expert specialists in the field of advanced regenerative therapies, a comprehensive literature search, and content selection based on a standardized evaluation form. The quality of the retrieved evidence was appraised using CASP for qualitative studies, the Newcastle–Ottawa Scale for observational studies, and the AMSTAR tool for systematic reviews. In the second phase, a mobile-based self-care and patient-monitoring application for individuals undergoing novel regenerative treatments was designed and developed on the Android platform. In the final phase, the application was provided to 20 patients from the target population, and after two weeks of use, user satisfaction and usability were assessed using the QUIS usability questionnaire. Data were analyzed using SPSS version 23 and descriptive statistics, including mean, standard deviation, and frequency percentage. **Results:** Based on the needs-assessment results, the application content was developed across twelve major domains. The final software fully covered all identified user needs. Usability and satisfaction evaluation indicated that patients rated the self-care and monitoring application as "good," with an overall mean score of 7.32 ± 0.94 out of 9. **Conclusions:** The findings of this study indicate that the design and development of a mobile-based application for self-care and patient monitoring during advanced regenerative treatments can effectively meet the informational and functional needs of patients. The comprehensive coverage of domains identified in the needs-assessment phase, along with the favorable levels of user satisfaction and usability, demonstrates the application's acceptability and practical value. These results highlight the potential of digital health tools to enhance self-management, strengthen patient–provider communication, and support emerging therapeutic approaches. Overall, integrating such technologies into regenerative care pathways may contribute to improved clinical outcomes and reduced care-related challenges.

Keywords:
Novel Regenerative Therapies, Self-Care, Patient Monitoring, Application

Code: wtrc12-04850442

Title:

Nursing-Led Evidence-Based Protocols In The Management Of Chronic Wounds: A Systematic Review

Authors:

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Abstract:

Background: Nurses are central to the prevention, assessment, and management of chronic wounds. Evidence-based nursing protocols including wound assessment, infection surveillance, dressing selection, patient education, and continuity of care have the potential to substantially improve healing outcomes. This systematic review synthesizes recent evidence (2020–2025) on nursing-led interventions for chronic wound management. **Methods:** In this systematic review, an extensive search was conducted with keywords related to "nursing care," "evidence-based practice," "wound management," and "chronic wound healing", in international databases PubMed/Medline, Web Of Science Core Collection, Scopus, Google_Scholar search engine and national databases SID, Magiran, Irandoct. The initial search yielded 1985 studies. Inclusion criteria were Articles published between 2020 and 2025 in English or Persian, full-text availability, human studies, and studies evaluating nursing-led protocols or interventions with measurable wound outcomes. Exclusion criteria included: review articles, conference abstracts, letters, editorials, grey literature, animal studies, duplicated records, and studies lacking outcome measures. Ultimately, 29 studies were analyzed. Ethical considerations of non-bias were observed in the stages of selection, extraction, analysis, and classification of evidence, and the abstract was reported according to PRISMA. **Results:** Nursing-led interventions emphasized structured wound assessment tools, algorithm-based dressing selection, standardized infection monitoring, moisture-balance control, pressure-relief strategies, and nurse-led patient education. Studies demonstrated that the use of validated assessment tools (e.g., PUSH score, BWAT) improved consistency of clinical decision-making. Evidence-based dressing protocols including advanced hydrocolloids, foam dressings, and antimicrobial dressings reduced healing times and infection rates. Nurse-led telehealth monitoring significantly improved adherence to care in home-based patients. Educational interventions enhanced patient self-management and reduced wound complications. Across all studies, nurses trained in evidence-based wound care achieved superior healing outcomes compared with routine care. **Conclusion:** Evidence-based nursing protocols significantly improve wound healing, reduce complications, and enhance patient engagement. Integrating structured, validated nursing guidelines into routine wound practice should be prioritized globally. Further research is needed on digital nursing interventions and long-term follow-up outcomes.

Keywords:

Nursing Protocols, Evidence-based Care, Chronic Wound Management, Wound Assessment, Systematic review

Code: wtrc12-05560410
Title:

Medical Grade Honey, Criteria and Challenges: A pharmacological Approach

Authors:

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Abstract:
Medical Grade Honey, Criteria and Challenges: A pharmacological Approach Determine the medicinal honey involves a unique process based on scientific regulations and guidelines. Little attention has been paid the integrative and comprehensive criteria for MGH production and evaluation. Honey can be classified as either a medical food (MF) or medical grade (MG). It contains nutritive components (primary metabolites, proteins, lipids, carbohydrates, and micronutrients such as minerals, vitamins, and water) as well as secondary metabolites (e.g., bio-active or phytochemical components).The ratio between these two components determines the medicinal or food value of honey. Medical grade honey contains effective medicinal compounds (including pharmacological effects). The primary step to determining the medical grade of honey is to evaluate the authenticity of natural honey based on set standards. The second step is to evaluate the levels of its functional components. A supplementary step can be clinical trials to screen the honey's therapeutic effects. The evaluation of honey factors and their compliance with set standards will aid in guaranteeing the primary conditions for the quality and therapeutic potential of medicinal grade honey. The biological and phytochemical components of honey are mainly dependent on botanical origins and ecological factors. Storage and processing also affect the medical constituents of honey (e.g., polyphenols, volatiles, etc.). Additionally, Medicinal grade honey is achieved through a continuous chain from the location of colony establishment to the production process to storage and screening. Any disruption in this chain will disrupt the entire process. Furthermore, numerous geographical zones lack the ability to produce medicinal honey. Accordingly, the production of natural honey for medicinal use requires harsh conditions so as to guarantee the health of consumers. Accordingly, medical grade honey covers a limited range of naturally produced honey in the world.
Keywords:
Pharmacology, Bee products, Medical Grade, Authenticity, Safety

Code: wtrc12-05550398
Title:

Development of Microfluidic Fibrous Platforms Incorporating Bioactive Nanoparticles for Controlled Drug Delivery in Skin Repair

Authors:

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Abstract:
Background: Advances in regenerative medicine have accelerated the development of multifunctional wound dressings capable of supporting tissue repair. Incorporating bioactive agents into engineered biomaterials is a key strategy to improve healing outcomes. This study explores a microfluidic-based approach for creating chitosan microfibers embedded with montmorillonite (MMT) nanoparticles as carriers for the bioflavonoid quercetin (Q), aiming to enhance drug delivery and wound-healing performance. **Methods:** Quercetin-loaded MMT nanoparticles were incorporated into a chitosan matrix and processed into microfibers using a microfluidic fabrication system. The fibers were evaluated for morphology, degradation behavior, and structural stability. Drug-release profiles were assessed to determine the effect of MMT incorporation. Antibacterial activity against Staphylococcus aureus was measured by inhibition zone diameter, and cytocompatibility was examined using the MTT assay. In vivo wound-healing tests were conducted to evaluate biological performance. **Results:** MMT incorporation significantly extended the release of quercetin, generating a sustained release pattern. The fabricated microfibers exhibited stable morphology and controlled mass-loss behavior. Their antibacterial activity was confirmed by clear inhibition zones against S. aureus. MTT analysis demonstrated high cell viability, indicating non-cytotoxicity. In vivo studies showed effective drug loading and accelerated wound closure compared with controls. **Conclusion:** The microfluidic-engineered CS/MMT/Q microfibers present a multifunctional wound dressing platform with sustained drug delivery, antibacterial activity, biocompatibility, and enhanced tissue regeneration. These results highlight their strong potential for advanced skin wound management and future clinical translation.

Keywords:
Microfluidics, Microfiber, Bioactive Wound Dressing, Skin Regeneration

Code: wtrc12-02390331
Title:

A Review of Evidence-Based Non-Pharmacological Interventions for Managing Pain and Anxiety during Dressing Changes in Burn Patients

Authors:

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Abstract:
Background: Burn injuries are among the most common and debilitating types of trauma worldwide. One of the major challenges for burn patients is the severe pain and considerable anxiety experienced during routine care procedures, particularly wound dressing changes. Although analgesics can provide partial relief, they are often insufficient, highlighting the need for complementary non-pharmacological approaches to better manage pain and anxiety. This review aimed to examine and synthesize the available evidence on the effectiveness of non-pharmacological interventions in reducing pain and anxiety associated with dressing changes in burn patients. **Methods:** This comprehensive review was conducted using a structured approach. A systematic search was performed in SID, Magiran, Google Scholar, PubMed, Scopus, and Web of Science using MeSH keywords including Burns, Dressing Changes, Non-pharmacological Interventions, Pain, and Anxiety. Studies published between 2015 and 2025 with no language restriction were included. Eligible studies consisted of clinical trials and quasi-experimental designs evaluating the effect of non-pharmacological interventions on pain or anxiety during dressing changes in burn patients. Screening of titles, abstracts, and full texts, as well as data extraction, were conducted following standard protocols. **Results:** Out of the 485 retrieved studies, 24 met the inclusion criteria. Among them, 2 studies focused exclusively on pain, 2 on anxiety, and 20 evaluated both outcomes. Qualitative synthesis indicated that non-pharmacological interventions significantly reduced pain intensity and anxiety levels compared with usual care. Effective interventions included breathing relaxation and rhythmic breathing (7 studies), guided imagery (2 studies), music therapy (4 studies), visual distraction (1 study), virtual reality (5 studies), foot reflexology (1 study), brain and nerve electrical stimulation (2 studies), hypnosis (1 study), and eye movement desensitization (1 study). Brain and nerve stimulation showed the greatest impact on pain relief, whereas hypnosis and eye movement desensitization were most effective for reducing anxiety; other interventions demonstrated benefits for both outcomes. **Conclusions:** Evidence-based non-pharmacological interventions appear to be feasible, cost-effective, and safe complementary strategies for reducing pain and anxiety during dressing changes in burn patients. Further studies focusing on combined interventions and long-term outcomes are recommended.

Keywords:
Non-pharmacological Interventions, Pain, Anxiety, Dressing Change, Burn Injury

Code: wtrc12-02600329
Title:

The Effect of Electrical and Magnetic Signals on Wound Healing: a review

Authors:

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Abstract:

Background: The process of wound healing is a complex sequence of events that requires the coordinated interaction of cellular, molecular, and vascular components. In cases such as diabetes, vascular diseases, or pressure ulcers, this process is disrupted, leading to the development of chronic wounds that place a significant strain on healthcare systems. Over the past few decades, biophysical interventions, especially electrical signals (like direct current, pulsed electric field) and magnetic signals (including static field, PEMF, and nanomagnetism), have garnered attention as non-invasive, safe, and effective methods to speed up wound healing. These signals activate intracellular mechanisms, including ion channels, signaling pathways (MAPK, PI3K/Akt), growth factor production (VEGF, FGF), and the regulation of oxidative stress by simulating the body's endogenous potentials. **Methods:** Investigations have been conducted into the effects of targeted electrical and magnetic stimulation on the wound healing process, and the findings have revealed that particular parameters of these signals enhance fibroblast proliferation, collagen deposition, and angiogenesis, leading to more rapid and effective tissue repair. **Results:** Research findings indicate that bioelectromagnetic interventions offer a non-invasive and effective approach for enhancing wound healing and tissue regeneration, thereby opening up new possibilities for further investigation in this area. **Conclusions:** This article aims to provide a comprehensive review of the existing evidence and the molecular and cellular mechanisms of these two signal types at various stages of wound healing, featuring preclinical and clinical evidence with a focus on therapeutic uses in chronic wounds. The objective is to elucidate the function of these interventions in contemporary regenerative medicine and suggest refined protocols for upcoming clinical trials.

Keywords:

Wound Healing, Electrical Signaling, PEMF, Magnetic Signaling, Nanomagnetics, Cellular Signaling, Chronic Wound

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Code: wtrc12-04980315
Title:

Application of Cannabidiol as an Immune Modulator in Cutaneous Wound Healing: Evidence and Efficacy

Authors:

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Abstract:
Background: Cutaneous wound healing is a complex, orchestrated process that involves hemostasis, inflammation, proliferation, and remodeling phases. As a matter of fact, dysregulated immune responses, particularly prolonged inflammation characterized by excessive pro-inflammatory cytokines (e.g., TNF-α, IL-6, IL-1β) and macrophage activity, often impair healing, which leads to chronic wounds in conditions like diabetes or systemic sclerosis. Moreover, the endocannabinoid system, with CB1 and CB2 receptors expressed in keratinocytes, fibroblasts, and immune cells, plays a key role in the modulation of skin inflammation and repair. In this context, Cannabidiol (CBD), a non-psychoactive phytocannabinoid, exhibits potent anti-inflammatory, antioxidant, and immunomodulatory properties via CB2 receptor activation, PPARγ signaling, and inhibition of NF-κB pathways, which makes it a candidate in order to enhance wound resolution. **Methods:** A narrative synthesis was undertaken, which draws from multidisciplinary sources since 2003. Literature was selected from PubMed, Scopus, and Scholar using search terms like "cannabidiol," "CBD," "immune modulation," "wound healing," and "cutaneous." In vitro, animal (murine excisional/diabetic models), and limited human trials were evaluated for effects on cytokine profiles, immune cell function, and healing outcomes. **Results:** Preclinical studies show that CBD suppresses pro-inflammatory cytokines, promotes M1-to-M2 macrophage polarization, and reduces oxidative stress, which accelerates re-epithelialization and collagen deposition. Furthermore, in murine models, topical CBD accelerated wound closure in diabetic (db/db) wounds by doubling the expression of connective tissue growth factor (CTGF) and decreasing IL-33+ cells by 70%, while exhibiting neutral or slightly delayed effects in normal wounds. Additionally, ex vivo and in vitro data confirm reduced inflammation, improved fibroblast migration, and antibacterial activity against Staphylococcus. As a matter of fact, clinical evidence is emerging: topical CBD reduced digital ulcer size and pain in systemic sclerosis patients and accelerated healing in recurrent aphthous ulcers, with anti-inflammatory effects evident early. No significant adverse effects were reported. **Conclusions:** CBD acts as an effective immune modulator in cutaneous wound healing, which attenuates excessive inflammation while promoting proliferative phases, with robust preclinical efficacy and promising early clinical results. Topical formulations offer targeted therapy with minimal systemic exposure. However, heterogeneity in dosing and models limits conclusions; randomized controlled trials are needed to establish optimal protocols and confirm efficacy in diverse chronic wounds.

Keywords:
Cannabidiol, Cutaneous Wound Healing, Immune Modulation, Inflammation, Topical CBD

Code: wtrc12-04890285
Title:

Evaluation of Postbiotic Lactobacillus acidophilus LA3 Effects on Pseudomonas aeruginosa ATCC 27853 -Induced Wound Infection Model

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Abstract:
The healing of infected wounds is a complex and delicate process that has increasingly become a major clinical challenge due to the rising incidence of chronic and infected wounds. Although standard wound management relies on irrigation, debridement, and antibiotic therapy, the rapid emergence of antibiotic resistance has significantly limited the effectiveness of these approaches, highlighting the need for safe and alternative therapeutic strategies. In this context, probiotics and their postbiotic derivatives have been proposed as natural, low-risk, and promising candidates for controlling infections and modulating inflammation during wound healing. In the present study, postbiotics derived from *Limosilactobacillus reuteri* LRE02, Lactobacillus acidophilus LA3, and Bifidobacterium animalis BB12 were evaluated for their antibacterial activity against Pseudomonas aeruginosa ATCC 27853. Following confirmation of bactericidal activity, their effects at MBC concentration on the viability of P. aeruginosa–infected HaCaT keratinocytes were assessed using the MTT assay. The most effective postbiotic in terms of maintaining cell viability was further examined for its ability to enhance cell migration using the Trans well assay, as well as its anti-inflammatory potential through quantification of IL-6 and TNF-α levels by ELISA. Postbiotic LA3 at its MBC (25 mg/ml) increased the viability of P. aeruginosa–infected HaCaT cells from zero to 76.1 ± 5.9%. Despite bacterial contamination, cell migration reached 35 ± 4.4% following LA3 treatment. Regarding inflammatory markers, IL-6 secretion decreased from 20.6 pg/ml under infection conditions to <0.2 pg/ml after treatment, while TNF-α levels were reduced from 2.7 to 2.4 pg/ml. These findings demonstrate that LA3 postbiotic significantly enhances cell survival, promotes cell migration, and attenuates inflammatory responses, indicating its considerable therapeutic potential for managing infection and inflammation in Pseudomonas-contaminated wound models. Accordingly, LA3 may serve as a complementary or alternative option in the treatment of infected wounds.

Keywords:
Postbiotics, Lactobacillus Acidophilus LA3, Infected Wounds, *Pseudomonas aeruginosa*, HaCaT Keratinocytes, Inflam

Code: wtrc12-04590247
Title:

Nursing Strategies for Biofilm Management in Chronic Wounds: A Narrative Review

Authors:

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Abstract:
Background: Biofilm formation is a major contributor to delayed healing in chronic wounds. Effective biofilm-targeted management requires comprehensive assessment, regular debridement, optimized wound hygiene, and the use of advanced antimicrobial dressings—processes in which wound-care nurses play a central role. To provide a structured narrative synthesis of biofilm-focused interventions relevant to wound-care nursing and to present a practical clinical decision pathway for frontline nurse specialists. **Methods:** A narrative review was performed using literature (2015–2025) from PubMed, Embase, CINAHL, and wound-care guidelines. Studies addressing clinical indicators of biofilm, nursing-led assessment, debridement techniques, wound cleansing approaches, and biofilm-disruptive dressings were included. Evidence was synthesized thematically based on assessment, intervention, and monitoring. **Results:** Biofilm presence can be clinically suspected through characteristic signs such as stalled healing, slough deaccumulation, and increased exudate. Evidence supports the use of mechanical or surgical debridement as a primary intervention, complemented by surfactant-based cleansers and antimicrobial dressings (silver, PHMB, iodine). Effective management requires repeated debridement, standardized cleansing frequency, and close reassessment every 1–2 weeks. Nursing-centered education and consistent wound-hygiene protocols significantly improve outcomes. This review proposes a four-stage nursing algorithm: (1) clinical recognition of probable biofilm, (2) selection of appropriate debridement strategy, (3) application of targeted antimicrobial dressings, and (4) scheduled reassessment. The review also highlights essential patient-education components for home-based care plans. **Conclusions:** Nurse-driven biofilm management is critical for optimizing healing trajectories in chronic wounds. Adoption of structured protocols and regular reassessment can substantially improve clinical outcomes and reduce recurrence.
Keywords:
Biofilm Control in Chronic Wounds; Nursing Interventions and Debridement; Antimicrobial Dressing Strategies

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Code: wtrc12-04350219
Title:

The Effects of Human Umbilical Vein Endothelial Cell Derived Exosomes on Fibroblast Function

Authors:

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Abstract:

Background: Skin ageing progressively impairs fibroblast activity, reduces collagen synthesis, and weakens skin structure, leading to wrinkles, thinning, and delayed wound healing. Recent advances in regenerative medicine highlight the potential of human umbilical vein endothelial cell (HUVEC)–derived exosomes as biocompatible modulators of skin repair. In this study, HUVEC-derived exosomes were isolated, characterized, and evaluated in vitro to determine their ability to enhance fibroblast function and support skin rejuvenation at a cellular level. **Methods:** HUVECs' identity was confirmed by flow cytometry using CD31 and CD34 markers. Exosomes were isolated from HUVEC-conditioned medium and characterized using dynamic light scattering (DLS) for particle size, zeta potential analysis for surface charge, scanning electron microscopy (SEM) for morphology, and flow cytometry for CD9, CD63, and CD81 markers. Three concentrations of HUVEC-derived exosomes were applied to fibroblast cells to assess cell viability by MTT assay, migration by scratch test, and collagen type I and vimentin expression at both gene and protein levels using RT-PCR and immunocytochemistry. **Results:** The identity of HUVECs was confirmed by positive CD31 expression and negative CD34 expression. HUVEC-derived exosomes exhibited an optimal size range of 80 to 130 nm with a negative zeta potential and displayed high expression of typical exosomal markers CD9, CD63, and CD81.Exosomes significantly enhanced fibroblast viability, migration as well as collagen type I and vimentin expression at both gene and protein levels. **Conclusions:** HUVEC-derived exosomes show strong potential as a safe and effective regenerative agent, supporting their future use in advanced anti-aging skin therapies.

Keywords:

Human Umbilical Vein Endothelial Cells (HUVECs), Exosome, Fibroblast, Collagen, Vimentin

Code: wtrc12-03420214
Title:

Effectiveness of Chitosan-gelatin Hydrogel Containing Rosemary for Wound Healing Application

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Abstract:
Background: Chitosan-gelatin hydrogels are effective wound dressings owing to their biocompatibility, moisture retention, and ability to produce a favorable healing environment. These hydrogels promote wound healing by supporting hemostasis, reducing excessive inflammation, and possessing antimicrobial properties that prevent infection. Gelatin enhances tissue regeneration by promoting fibroblast proliferation and collagen formation. Together, chitosan and gelatin hydrogels accelerate wound closure, reduce scarring, and improve tissue remodeling. Their inherent properties make them ideal for treating various wounds, with demonstrated faster healing rates and improved quality of repair compared to untreated wounds. **Methods:** Initially, chitosan was dissolved in 5 mL of distilled water containing 1% acetic acid. Subsequently, gelatin was dissolved in 5 mL of distilled water at a specified ratio. Then, vanillin powder was added to the gelatin mixture and stirred on a stirrer for about 1 hour. Subsequently, rosemary extract was added to the above mixture and stirred until completely dissolved. Finally, the chitosan solution was added to the gelatin mixture. Contact angle analysis assesses the hydrophilicity and hydrophobicity of the hydrogel, which is a crucial factor in determining the properties of the hydrogel scaffold. FTIR analysis, a subset of spectroscopic techniques and the equivalent of Fourier transform infrared spectroscopy, was performed to identify the compounds and bonds present in both mineral and organic materials. Tensile strength was assessed by measuring the maximum tensile stress that the hydrogel material could withstand without failure. The SEM images of the obtained hydrogel were taken to capture their structure and morphology. The pore size of the hydrogel samples was measured with ImageJ software. The antioxidant activity of the prepared hydrogels was evaluated by DPPH radical scavenging method. E. coil, and S. aureus employed to determine the surface antibacterial activity of the hydrogels. **Results**: The obtained chitosan/gelatin hydrogel was transparent; however, the other hydrogel were translucent and colored. Among the samples containing different concentrations of rosemary, it was observed that with increasing the extract concentration, the nature of the sample tends to become more hydrophilic with a corresponding decrease in the contact angle. The FTIR results found that the presence of distinguishing peaks from the loaded extract and the biomaterials matrix composed proved the effective combination. Among the five examined samples, the highest elongation was observed in the sample containing 0.5% rosemary extract, exhibiting an elongation percentage of 17.16% and a duration of 10.93 seconds. Overall, increasing rosemary content reduced tensile strength and elongation, while the absence of vanillin enhanced tensile behavior. The porosity of the obtained hydrogels was obtained around 70-75%. The results from DPPH assay that antioxidant activity of rosemary was near that of vitamin C. The inhibition tests on S. aureus and E. coil displayed the obtained hydrogel are satisfactory antibacterial activity. **Conclusions:** In summary, the chitosan/gelatin-based hydrogels containing rosemary extract demonstrated favorable physicochemical and biological properties. The integration of rosemary enhanced hydrophilicity, antioxidant capacity, and antibacterial activity, while influencing mechanical characteristics depending on concentration. These findings suggest that optimized rosemary-loaded hydrogel formulations hold potential for biomedical and wound-healing applications.

Keywords:
Wound Healing, Wound Dressings, Chitosan-gelatin Hydrogels, Rosemary

Code: wtrc12-04180204
Title:

Towards Standardized Assessment of Residual DNA in Human Acellular Dermal Grafts: A Methodological Framework

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Abstract:
Background: Human acellular dermal grafts (HADGs) are widely applied in regenerative medicine and reconstructive surgery due to their structural integrity and biocompatibility. Residual DNA in decellularized grafts may elicit immune responses and compromise clinical safety. Despite extensive research, there is currently no consensus on standardized quantification methods, leading to variability in reported outcomes and challenges for translational application. **Methods:** A methodological synthesis of published studies on residual DNA assessment in HADGs was performed. Analytical approaches reviewed included quantitative PCR (qPCR), fluorescent dye-based assays (e.g., PicoGreen), and spectrophotometric measurements. Methods were evaluated in terms of sensitivity, reproducibility, ease of implementation, and alignment with regulatory quality standards. Key methodological inconsistencies and gaps were identified. **Results:** qPCR consistently demonstrated the highest sensitivity and reproducibility, reliably detecting minimal DNA remnants. Fluorescent dye-based assays offered a practical alternative with moderate sensitivity and acceptable reproducibility. Spectrophotometric methods, although commonly employed, exhibited lower sensitivity and greater variability. Significant inconsistencies were noted across studies regarding normalization strategies, reporting units, and validation procedures. **Conclusions:** Based on the current literature, we propose a methodological framework for the standardized assessment of residual DNA in HADGs, emphasizing the use of sensitive, reproducible, and validated techniques. Harmonization of analytical methods, normalization procedures, and reporting standards will enhance cross-study comparability, support regulatory compliance, and improve clinical safety and efficacy of HADGs. This framework provides a foundation for future guideline development in regenerative medicine and translational research.
Keywords:
Human Acellular Dermal Grafts, Residual DNA, Standardization, Methodological Framework, Regenerative Medicine

Code: wtrc12-03570203
Title:

Management of Hard-to-heal Wounds Using Autologous Punch-grafting: A Case-series

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Abstract
Background: Chronic nonhealing wounds are a main health problem which novel strategies are needed to enhance this situation. Autologous punch-grafting is an alternative treatment that leads to promising clinical outcomes in various wound types. But regarding scarcity of solid-design in previous papers also limited evidence on assessing healing outcomes on nonhealing wounds; reporting the results of patients undergoing this method are still valuable. So, this study aimed to evaluate the effects of punch-grafting in management of chronic hard-to-heal wounds. **Methods:** This study involving 4 patients with chronic hard-to-heal wounds (2 pressure injuries (PI) and 2 diabetic foot ulcers (DFU)) treated with punch-grafting was conducted 2023-2025 in Woundlab clinic. Inclusion criteria were male/female patients aged >18y with chronic nonhealing wounds which were not responded to conventional treatment more than 6 months and exclusion criteria were local infection, untreated osteomyelitis, and critical ischemia. The 2 DFUs were neuro-ischemic on forefoot which one of them was accompanied with burn trauma stage2 and the 2 PIs were both categorized at stage3 which located on bilateral ischial-tuberosity and trochanter. All wound beds were previously prepared using sharp-surgical and autolytic debridement along with vacuum-therapy to obtain the best possible tissue. Then, wounds were grafted with 4mm-punches from the donor site that was in all cases the anterolateral aspect of the thigh. The first 4 dressing-changes carried-out every 3days and in the first one, only secondary dressing was changed. The both donor and grafted wounds were covered with Alginate and absorbent dressings according to wound-exudate amount. Subsequent to this 12day period, all patients were followed up weekly until wound healing (defined as complete epithelization without any drainage confirmed at least 10 days after closure) occurred. **Results:** A total 4patients included in this study were men with chronic nonhealing wounds with using conventional methods for more than 1 year. Using punch-grafting technique was successful in adhering for all 4patients and complete re-epithelization was achieved in all of them with a mean time of 3-4 weeks. The wound area reduction (WAR) was roughly 40% at 4weeks. Moreover, the donor site healed in all patients in a mean time of 15-18days. Besides, no adverse effects related to the ulcer were registered through the follow-up period. **Conclusions:** Although autologous punch-graft is an easy procedure in outpatient settings that enhances healing process and reduce wound-closure time in chronic hard-to-heal wounds and can be considered as an alternative method instead of unsuccessful conservative treatment, further research with high-quality methodologies is still needed to confirm the potential benefits of this procedure.

Keywords:
Case Series, Punch Graft, Nonhealing Wounds

Code: wtrc12-04160202
Title:

The Effect of Bromelain Capsules on the Healing of Diabetic Foot Ulcer in Patients with Type 2 Diabetes: A Double-blind Randomized Clinical Trial Study in Iran

Authors:

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Abstract:
Background: Diabetic Foot Ulcers (DFU) are a major complication of type 2 diabetes, leading to significant morbidity and healthcare costs. Despite advances in wound care, effective treatments remain limited. Bromelain, a natural proteolytic enzyme, has shown potential in promoting wound healing. This study evaluates the effect of bromelain capsules on DFU healing in Iranian patients with type 2 diabetes through a double-blind randomized clinical trial. **Methods:** This study, conducted as part of a larger research project in 2023, employed a double-blind, two-group clinical trial design. A total of 80 patients with Wagner grade 2 diabetic foot ulcers, attending specialized wound clinics at Tehran University of Medical Sciences and meeting the eligibility criteria, were recruited through sampling. Participants were randomly allocated to either the intervention (n=40) or the control (n=40) group after providing written informed consent. The samples of the test group took capsules containing 200 mg (500 GDU) of bromelain 2 times a day for 4 weeks, and the samples of the control group took the same amount and number of placebo. Ulcer assessments and scoring were performed weekly throughout the study period. Data collection included demographic and clinical characteristics checklists alongside a diabetic foot ulcer healing checklist. Statistical analysis was conducted using SPSS version 24, employing descriptive statistics (mean and standard deviation) and inferential tests such as the independent t-test, chi-square test, and repeated-measures analysis of variance. **Results:** At the end of 4th week, there was a significant differences between two groups regarding to 3 parameters of ulcer including degree (P = 0.01), color (P = 0.00) and surrounding tissues (P = 0.03) as well as total status of ulcer (P = 0.02), while related to ulcer drainages no significant difference was seen between the two groups (P = 0.09). At the end of the follow-up, Bromelain Capsules significantly decreased ulcer area (P = 0.02) and depth (P = 0.01) compared with the control group. Complete ulcer healing in the intervention group was significantly greater than in the control group (80.4% vs. 17.6%, P = 0.001) at the end of follow-up. Also, there were no adverse effects to report during the study in the intervention group. **Conclusions:** The findings demonstrate that Bromelain Capsules combined with standard care significantly improve outcomes compared to routine care alone, with no observed adverse effects. This combination treatment appears safe and effective as an adjunct therapy. Nevertheless, confirming these results requires further well-designed studies with larger sample sizes and diverse populations. Future research should also explore the underlying mechanisms to optimize dosage and treatment protocols. Overall, Bromelain shows promise as a complementary intervention; however, broader evidence is needed before recommending its widespread clinical use. Trial registration: IRCT20190708044148N2

Keywords:
Diabetic Foot Ulcer, Ulcer healing, Bromelain, Herbal Products

Code: wtrc12-04090194
Title:

Impact of Probiotic Therapy on Oral Wound Repair: A Scoping Review

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Abstract:
Background: Probiotic treatment has gained momentum as a complementary strategy for oral wound healing, based on using beneficial microorganisms to modify the local microbiota, improve immune regulation, and promote tissue regeneration. Oral wounds can arise from periodontal surgery (including grafting), mucositis, recurrent aphthous stomatitis, and trauma, and pose a significant challenge, especially concerning infection and compromised healing. While traditional therapies focus on controlling microorganisms and decreasing inflammation for healing, probiotics offer a new avenue to enhance clinical and biological healing. **Methods:** This scoping review adhered to PRISMA-ScR and Arksey & O'Malley procedures and comprehensively mapped the existing literature focusing on the use of probiotics in oral wounds. Electronic databases (PubMed, Scopus, Embase, and Cochrane) were searched systematically for studies available until November 2025. Inclusion criteria were for studies employing experimental clinical/translational research examining the use of probiotic treatment (oral or topical) in varied circumstances of oral wounds. Data extraction included bacterial strain, protocol for intervention, outcomes (healing, pain, inflammation, incidence of infection), and safety. Evidence was charted and narratively summarized, including findings and gaps in the knowledge on the topic. **Results:** A total of 104 relevant studies, including randomized controlled trials, animal model research, and systematic/scoping reviews, were identified. Most studies showed that certain probiotic strains (including Lactobacillus reuteri, Bifidobacterium animalis, and Streptococcus salivarius) stimulated oral wound re-epithelialization, ameliorated fibroblast and keratinocyte activation, and inhibited pathogenic biofilm formation and secondary infections. Clinical studies across oral mucositis, periodontitis, and aphthous ulcers indicated less healing time, pain, inflammatory symptoms, and better quality-of-life outcomes with probiotic adjuvant therapy. Safety analyses indicated a good risk profile in the immunocompetent population with rare adverse consequences in the immunocompromised population. Nonetheless, the studies exhibited considerable heterogeneity in study design, identified strains, dosing, and outcomes, highlighting the necessity for overall standardization and for multi-site clinical investigations. **Conclusions:** Probiotic therapy has substantial promise for enhancing oral wound healing through the restoration of microbiota homeostasis, modulation of immune responses, and tissue regeneration support. There is best evidence for the use of probiotics as an adjunct to treatment of oral mucositis, periodontitis, peri-implantitis, and recurrent aphthous stomatitis. However, this field is hampered by methodological heterogeneity and evidence-based clinical studies of high quality and specific to therapeutic target. Future investigations should be designed to develop the best probiotic formulation, delivery, and outcomes indices to support clinical guidelines and move to personalized care of oral wound treatments.
Keywords:
Probiotics, Wound Healing, Oral Mucosa, Periodontal Diseases, Microbiota

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Code: wtrc12-04050188
Title:

Evaluation of an Acellular ECM-Based Regenerative Dressing (Synderm) in Enhancing Healing of Grade II–III Burns and Deep Wounds

Authors:

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Abstract:
Background: Managing deep wounds and grade II–III burns remains challenging due to prolonged inflammation and insufficient structural support for regeneration. Synderm is an acellular extracellular matrix (ECM) dressing designed to create a favorable environment for tissue repair. **Methods:** Synderm was prepared using a controlled decellularization process that preserved key ECM components such as collagen, elastin, and glycosaminoglycans. Its biocompatibility was tested in vitro using fibroblasts and keratinocytes. A dermal acellular matrix was produced using a sugar-based decellularization approach. Tissue samples were exposed to hypertonic sucrose followed by raffinose to induce osmotic cell lysis and remove intracellular components without damaging ECM structure. Intermediate PBS washes were performed, and the final matrix was rinsed, sterilized, and prepared for further testing. The dressing was then evaluated in full-thickness and grade II–III burn wound models. Healing outcomes were measured through wound-closure rate, inflammatory response, angiogenesis, and collagen organization. **Results:** Application of Synderm led to faster wound closure, reduced early inflammation, and enhanced angiogenesis. The regenerated tissue showed improved collagen alignment and more uniform re-epithelialization compared to standard treatment. No adverse immune response was observed. **Conclusions:** The findings suggest that Synderm can effectively support tissue repair in complex wounds and burns by providing a biocompatible ECM scaffold that modulates inflammation and promotes organized healing. This positions acellular ECM dressings as a promising option in advanced wound-care strategies.

Keywords:
Acellular Matrix, Wound Healing, Burn Injury, ECM Scaffold, Regenerative Dressing, Synderm

Code: wtrc12-00760170
Title:

Preparation and Evaluation of Hemostatic Powder Based on Chitosan/Collagen/Alginate Containing Curcumin with Wound Healing Properties

Authors:

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Abstract:
Background: Uncontrolled hemorrhage and delayed wound healing represent two fundamental challenges in modern medicine, contributing significantly to mortality and clinical complications. Existing hemostatic agents often face limitations such as single-mechanism action, potential cytotoxicity, or a lack of active therapeutic properties. This study aimed to design, fabricate, and evaluate a multifunctional, fully bio-based hemostatic powder capable of rapidly controlling acute bleeding while concurrently providing therapeutic benefits to promote successful wound healing. **Methods:** In this research, a novel composite system was developed based on a synergistic combination of three key biopolymers: chitosan (as a constant base), collagen, and sodium alginate, further enriched with the bioactive molecule curcumin. To identify the optimal formulation, a Design of Experiments (DOE) methodology was employed using Response Surface Methodology (RSM) with Design-Expert software. Twenty different powder formulations were prepared via a simple and scalable freeze-drying and milling process. The performance of these formulations was comprehensively evaluated through a series of in vitro assays, including whole blood clotting time for hemostatic efficacy, DPPH radical scavenging assay for antioxidant activity, colony count method against E. coli and S. aureus for antibacterial properties, and the MTT assay on HDF fibroblast cell line for cytotoxicity assessment. **Results:** The findings demonstrated a significant synergistic effect among the three biopolymers in accelerating blood coagulation. The optimized formulation achieved a remarkably rapid blood clotting time of approximately 84 seconds. This superior hemostatic performance was attributed to the simultaneous action of three complementary mechanisms: electrostatic interaction (chitosan), physiological platelet activation (collagen), and physical-ionic action (alginate). The incorporation of curcumin successfully endowed the system with therapeutic properties; the optimized formulation exhibited significant antioxidant activity (scavenging ~63.5% of free radicals) and exceptionally potent antibacterial activity (inhibiting >99% of bacterial growth). All formulations demonstrated excellent biocompatibility, with cell viability exceeding 93%. The optimization process successfully identified a superior formulation (containing 26.6 phr alginate, 15.3 phr collagen, and 6.0 phr curcumin) with the highest overall desirability (0.801). The experimental results for this optimized point showed excellent agreement with the model's predicted values. **Conclusions:** This study successfully developed a multifunctional, biocompatible, and fully bio-based hemostatic powder. The optimized formulation simultaneously possesses rapid hemostatic capabilities, potent antioxidant and antibacterial properties, and excellent biocompatibility. This unique combination of features establishes the developed powder as a highly promising candidate for a new generation of theranostic hemostatic agents, with significant potential for clinical applications in the management of acute and traumatic wounds, particularly those at high risk of infection.

Keywords:
Hemostatic Powder, Chitosan, Collagen, Sodium Alginate, Curcumin, Hemostasis, Wound Healing, Design of Experiments

Code: wtrc12-00890163
Title:

Alginate-gelatin Semi-IPN bio-ink with Curcumin-Loaded Nanoparticles for the Bio Fabrication of Drug-Releasing Living Tissue Equivalents

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Abstract:
Background: 3D bioprinting is a versatile technique that allows the fabrication of living tissue analogs through the layer-by-layer deposition of cell-laden biomaterials, viz. bioinks. **Methods:** In this work, composite alginate-gelatin hydrogel-based bioinks reinforced with curcumin-loaded particles of CUR@PVA and laden with mouse embryo fibroblast (MEFs) cells are developed and 3D bioprinted. The addition of the CUR@PVA particles, with sizes of 499 ± 235.36 nm, improves the rheological properties of the inks, increasing their shear stress and viscosity, while preserving the recovery rate and the mechanical and viscoelastic properties of the resulting fully cross-linked hydrogels. Moreover, the presence of these particles reduces the degradation rate of the hydrogels from 16.1 ± 0.6 % (ALG-GEL) to 10.5 ± 1.1 % (ALG-GEL-CUR@PVA_10%) after 3 days in the culture medium. The 3D structures printed with the ALG-GEL-CUR@PVA inks reveal increased printing definition and the ability to release curcumin (with nearly 80% of cumulative release after 24 h in PBS). **Results:** After being laden with MEFs cells (1.4 × 106 cells mL−1), the ALG-GEL-CUR@PVA bioinks can be successfully 3D bio printed, and the obtained living constructs show good dimensional stability and high cell viabilities at 7 days post-bioprinting (nearly 90%), confirming their great potential for application in fields like wound healing. Furthermore, in vivo experiments confirmed that the ALG-GEL-CUR@PVA hydrogel dressing demonstrates superior wound healing performance compared to the control group. **Conclusions:** In conclusion, the ALG-GEL-CUR@PVA hydrogel shows potential application prospects as a burn wound dressing.
Keywords:
Biocompatible Materials, Hydrogels, Curcumin, Bioprinting, Fibroblasts Burn, Alginates, Viscosity, Gelatin, Cell Survival, Ink, Wound Healing, Culture Media, Bandage Printing, Three-Dimensional

Code: wtrc12-03610146
Title:

A Predictive Probe for Pressure Injury Risk Based on the Photoplethysmography Principle

Authors:

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Abstract:
Pressure injuries (bedsores) are common among immobile and bedridden patients and can have significant consequences for both the patient and the healthcare system. Preventing the occurrence of pressure injuries, predicting them earlier, and monitoring their healing or deterioration process can substantially reduce treatment costs and associated health complications. To prevent pressure injuries, a portable and lightweight device can be used for daily and intermittent skin assessment. This device utilizes the principle of photoplethysmography to measure blood flow in superficial and deep vessels. By placing the device about one centimeter from the skin at pressure points, green light is projected onto the area, and tissue blood flow can be estimated from the reflected light. The data is then transferred to a microprocessor. Photoplethysmography is a simple, low-cost optical technique that can detect changes in blood volume within the tissue's microvascular bed. The underlying theory of photoplethysmography is the Beer-Lambert law. This law states that the absorption of light by a material is directly proportional to its concentration and the path length of the light through it. In photoplethysmography, infrared light and lights from the green, red, and blue spectra are generally used. To measure the blood flow through vessels and tissues, it is necessary to calculate and report the absorption by oxygenated hemoglobin and deoxygenated hemoglobin. The daily data obtained from this device can be transferred to a comprehensive system so that, using artificial intelligence, the best available treatment methods for the wound can be applied, and the progression of healing or deterioration can be predicted, enabling appropriate corresponding actions. Applications: This tool can be used by wound care specialists or family members at home to assess the progression or improvement of pressure injuries in patients with limited mobility. Pressure points on the patient's body are recorded using data stored in the device and evaluated over time. Furthermore, by transferring the data from the device to the patients' electronic records, we can create a large and valuable database of information for research in this field.

Keywords:
Pressure Injury, Photoplethysmography, Bedsore

Code: wtrc12-03610145
Title:

Therapeutic Potential of Omega-3-Loaded Biopolymer Hydrogels in Cutaneous Tissue Restoration

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Abstract:
Background: Skin regeneration remains a medical challenge, particularly for full-thickness injuries requiring bioactive dressings that mimic the extracellular matrix (ECM). Hydrogels derived from natural polymers are recognized for their ability to support cellular activities such as proliferation and migration while maintaining a moist healing environment. Gelatin provides an ideal scaffold for cell adhesion and granulation tissue development, whereas carboxymethyl cellulose (CMC) contributes to structural integrity and hydrophilicity. Omega-3 fatty acids, extracted from fish oil, possess anti-inflammatory and antimicrobial properties that accelerate tissue repair and limit infection at wound sites. **Methods:** Hydrogels composed of CMC and gelatin containing varying concentrations of Omega-3 were synthesized via an oil-in-water microemulsion approach using Tween 20 as a surfactant. The fabricated hydrogels were characterized through scanning electron microscopy (SEM) to assess surface morphology, along with water absorption, weight loss, and blood compatibility tests. Cytotoxicity and cell viability were evaluated using the MTT assay, while the healing potential was examined through an in vivo rat full-thickness wound model over 14 days. **Results:** The developed hydrogels exhibited a porous and interconnected microstructure, with mean pore sizes around 83 μm, favoring nutrient diffusion and cellular infiltration. The dressings demonstrated high water uptake, retaining approximately 60% of their weight after 24 hours, and gradual degradation compatible with tissue remodeling. MTT results confirmed that the scaffolds were non-cytotoxic within optimal Omega-3 concentrations, though elevated doses induced hemolysis and reduced cell viability. In vivo assessments revealed more than 91% closure of the wound area within two weeks of treatment, with notable formation of organized granulation tissue. Histopathological evaluations confirmed accelerated tissue regeneration and reduced scarring in groups treated with Omega-3 hydrogels. **Conclusions:** The combination of carboxymethyl cellulose and gelatin hydrogels enriched with Omega-3 provides a promising biomaterial for topical wound healing. Its structural and biological characteristics support controlled degradation, cell compatibility, anti-inflammatory activity, and efficient tissue restoration, indicating potential for advanced clinical applications in regenerative skin therapy.
Keywords:
Natural Polymer, Wound Dressing, Oil/Water, Emulsion

Code: wtrc12-03180104
Title:

Redefining of Cross-Leg Flap–Reverse Sural Axial Flap Versus Broad Base Randomized Flap in High-Voltage Electrical Burn Management

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Abstract:
Background: High-voltage electrical burns often cause extensive lower-limb damage, requiring complex reconstruction where tissue options are limited. This study compares the redefined cross-leg flap using the reverse sural axial flap (RSAF) with the traditional broad-base pedicled flap to evaluate their outcomes in limb salvage and complications. **Methods:** A retrospective cohort study (2023–2025) analyzed adult patients with high-voltage electrical burns who underwent either redefined cross-leg RSAF or traditional cross-leg flap reconstruction. Clinical, surgical, and functional outcomes were statistically compared, with limb salvage as the primary endpoint and flap complications, healing time, and recovery as secondary measures. **Results:** The redefined cross-leg RSAF achieved the highest limb salvage and lowest complication rates, outperforming both traditional and standalone RSAF flaps. Delayed coverage and larger burn surface area independently predicted limb loss, while traditional flaps had the most necrosis, revisions, and longer hospital stays. **Conclusions:** The redefined cross-leg RSAF proved superior for complex lower-limb electrical burns due to improved vascular reliability and reduced complications. These findings support it as a preferred limb-salvaging option over traditional random flaps, particularly in severe cases where microsurgical reconstruction is not feasible.
Keywords:
Cross-Leg Flap, Sural Axial Flap, Electrical Burn

Code: wtrc12-02920096
Title:

The Latest Approaches to Antibiotic Therapy in Osteomyelitis Associated with Chronic Wounds: From Empirical Treatment to Targeted Precision Therapy

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Abstract:
Background: Osteomyelitis remains one of the most challenging infectious complications in chronic wounds, including diabetic foot ulcers, pressure ulcers, and neuropathic wounds. In recent years, the emergence of antimicrobial resistance, biofilm-related infections, and treatment failures have necessitated a paradigm shift toward individualized and evidence-based antibiotic therapy. This presentation aims to review the most recent advances in systemic and local antimicrobial strategies for wound-related osteomyelitis. **Methods:** A comprehensive literature review was performed using PubMed, Cochrane Library, and UpToDate databases through 2025. The search terms included "osteomyelitis," "antibiotic therapy," "biofilm," "resistance," "chronic wound," and "diabetic foot infection." Current clinical practice guidelines (IDSA 2023; IWGDF 2024) and recent systematic reviews were analyzed and synthesized. **Results:** Bone culture–guided therapy is significantly superior to empirical broad-spectrum treatment; superficial swabs often lead to contamination and misdirection. Biofilm-active antibiotics such as rifampicin, fluoroquinolones, linezolid, and doxycycline improve eradication rates when combined appropriately. Antimicrobial stewardship principles emphasize initiating empiric therapy only with confirmed clinical and imaging evidence of osteomyelitis and re-evaluating therapy after 48–72 hours. Recommended treatment durations are 3 weeks for completely debrided localized infections and 6 weeks for chronic or residual cases. Novel agents including ceftaroline, dalbavancin, ceftazidime–avibactam, and ceftolozane–tazobactam show promising activity against MRSA and multidrug-resistant Gram-negative pathogens. Local delivery systems—antibiotic beads, nanocarriers, and bioactive dressings—serve as valuable adjuncts to systemic therapy. **Conclusion:** Successful management of osteomyelitis in chronic wounds requires a multidisciplinary, precision-based approach integrating surgical debridement, targeted antibiotic selection, biofilm disruption, and optimized treatment duration. The future of osteomyelitis therapy lies in combining systemic and localized antibiotic delivery guided by microbiologic evidence and resistance surveillance.

Keywords:
Osteomyelitis, Antibiotic Therapy, Chronic Wound, Biofilm, Antimicrobial Resistance, Targeted Therapy, Debridement

Code: wtrc12-01080081

Title:

Spectroscopic Differentiation of Oxidative Stress and Glycation in Blood Proteins of Diabetic Patients: Toward Optical Biomarkers for Impaired Wound Healing

Authors:

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Abstract:

Background: Delayed wound healing in diabetes is primarily driven by two concurrent biochemical processes protein glycation and oxidative stress that alter the structure and functionality of blood proteins, especially hemoglobin. Glycation forms glycated hemoglobin (HbA1c) through non-enzymatic attachment of glucose to hemoglobin, whereas oxidative stress leads to the oxidation of ferrous iron (Fe^{2+}) into ferric (Fe^{3+}), forming met hemoglobin (MetHb) through reactive oxygen species (ROS). Both processes disturb oxygen transport and tissue repair, yet they produce distinct optical signatures in the visible spectrum. Conventional biochemical assays cannot dynamically differentiate between these molecular pathways. This study introduces a spectroscopic approach for discriminating glycation and oxidation in blood proteins, providing a potential optical biomarker to predict wound-healing impairment in diabetic patients. **Methods:** Hemolyzed blood samples from healthy, prediabetic, and diabetic individuals were analyzed using UV–Visible absorption spectroscopy within the 350–700 nm range. Key absorbance features at 410 nm (Soret band), 539 nm (Q_1 band), and 575 nm (Q_2 band) were extracted for native hemoglobin (Hb) and glycated hemoglobin (HbA1c), while reference data from the literature were used to represent methemoglobin absorption at 406 nm and 630 nm. Two optical indices were defined to quantify spectral variations: Glycation Index (G): $G = (A_{539} - A_{575}) / A_{410}$ Oxidation Index (O): $O = A_{630} / A_{410}$ A combined ratio $R = G / O$ was introduced to evaluate the relative dominance of glycation versus oxidation. To interpret spectral behavior, a three-component mixture model based on the Beer–Lambert law was used: A_mix=fHb AHb+fG A(A1c)+ fO A(MetHb) where f_G and f_O represent fractional contributions of glycation and oxidation, respectively. Numerical simulations were performed to visualize the evolution of G, O, and R as functions of these fractions. Based on these indices, a three-stage optical sensing concept was proposed 1. Prediction Stage: wearable optical sensor for early risk detection; 2. Active Wound Stage: smart dressing with embedded optical probes to monitor oxidative burden; 3. Follow-up Stage: home-based optical monitoring for recurrence prevention. **Results:** Experimental and simulated spectra revealed distinct differences between glycation and oxidation effects. Glycation primarily induced redistribution between Q_1 and Q_2 bands and a slight decrease in Soret intensity, whereas oxidation caused a hypsochromic shift of the Soret band (~406 nm) and the emergence of a new band near 630 nm, characteristic of MetHb. The Glycation Index (G) showed linear correlation with HbA1c levels ($R^2 = 0.93$), and the Oxidation Index (O) increased proportionally with simulated ROS or MetHb content.. The combined ratio $R = G / O$ effectively separated the dominance of the two processes: $R > 1$: glycation-dominant region (reversible structural modification) $R < 1$: oxidation-dominant region (irreversible oxidative damage) These findings suggest that the spectral behavior of blood proteins can serve as a diagnostic window into the biochemical status of diabetic patients. This differentiation enables clinicians to tailor interventions metabolic control, antioxidant therapy, or combined treatment based on the dominant process **Conclusion:** The proposed spectroscopic framework enables clear differentiation between glycation and oxidative stress in blood proteins using simple optical measurements. By linking molecular alterations to their optical fingerprints, this method offers a noninvasive, label-free biomarker for evaluating oxidative damage and metabolic imbalance related to delayed wound healing in diabetes. Integration of this approach into portable or wearable photonic systems could allow real-time monitoring of tissue oxygenation and healing potential, bridging the gap between biophysical spectroscopy and translational wound diagnostics.

Keywords:

Optical Spectroscopy, Glycated Hemoglobin (HbA1c), Oxidative Stress, Methemoglobin, Noninvasive Diagnosis, Diabetic Wound Healing, Smart Optical Sensors

Code: wtrc12-01550053
Title:

Ameliorative Effect of Hepatocyte Derived Exosomes in Treating CCl_4-Induced Liver Fibrosis in male Wistar Rats

Authors:

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Abstract:
Background: Hepatic fibrosis, resulting from chronic liver injuries, is characterized by excessive extracellular matrix deposition, primarily collagen, due to the activation of hepatic stellate cells. Hepatocyte derived exosomes have demonstrated potential for liver regeneration. **Methods:** Liver fibrosis was induced in male Wistar rats via CCl4 injection. Following eight weeks of exposure, treatment was administered via tail vein injection using hepatocyte derived exosomes dilated in PBS. Control groups received nothing in negative control group, olive oil in sham group, CCl4 for fibrosis group, PBS for positive control after ccl4 injection. Biochemical markers, oxidative stress indices (SOD, GPX, MDA), protein α-SMA, Desmin), and gene MMP2, PDGFRB, TGF-β, TMSB10, TMEM176b) were evaluated. **Results:** The fibrosis group exhibited extensive liver damage, including significant fibrous tissue deposition, elevated liver, metabolic disturbances (increased plasma glucose, uric acid, cholesterol, triglycerides), and oxidative stress (increased MDA, decreased GPX and SOD). Fibrosis markers were highly expressed, including α-SMA and Desmin as well as fibrosis-related genes. Treatment significantly alleviated fibrosis associated damage. Demonstrating reductions in AST, ALT, metabolic markers, oxidative stress, and gene expression of MMP2, PDGFRB, 6th International and 27th National Congress of Physiology and Pharmacology of Iran Mashhad University of Medical Sciences TGF-β, TMEM176b, and TMSB10. Histological analysis revealed minimal residual fibrosis, reinforcing their potential as a promising non cellular therapeutic approach for liver fibrosis. **Conclusion:** Hepatocyte derived exosomes demonstrated therapeutic potential for liver fibrosis, these findings highlight the promise of Hepatocyte derived exosomes as an advanced, non-cellular therapeutic strategy for hepatic fibrosis.

Keywords:
Liver Fibrosis, Hepatocyte, Exosomes, CCl4

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Code: wtrc12-01430048
Title:

The Value of MRI in Tracking Healing and Complications in Chronic Diabetic Foot Ulcers in 1403: A Study at Mousavi Hospital, Zanjan

Authors:

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Abstract:
Background: Chronic diabetic foot ulcers (DFUs) represent one of the most debilitating complications of diabetes mellitus, often associated with prolonged hospitalization, recurrent infections, risk of osteomyelitis, and eventual limb amputation. These ulcers impose a heavy burden on patients' quality of life and healthcare systems worldwide. Early detection of complications and accurate monitoring of wound healing are therefore critical for improving patient outcomes. Magnetic Resonance Imaging (MRI) provides high-resolution visualization of soft tissues and bone marrow, making it a valuable tool for assessing both ulcer progression and therapeutic response. **Methods:** This retrospective study was conducted at the Imaging Center of Mousavi Hospital, Zanjan, during the year 1403. Sixty patients with chronic DFUs, including 38 males and 22 females aged 40–70 years with diabetes duration ranging from 5 to 25 years, were evaluated. Inclusion criteria were patients with ulcers persisting for more than four weeks, complete clinical records, and available MRI studies. Exclusion criteria included previous amputations at the ulcer site, contraindications to MRI, and incomplete imaging or clinical data. Clinical information such as hemoglobin A1c levels, ulcer size, depth, and location, history of infections, previous treatments, and associated symptoms were collected. MRI examinations were performed using a 1.5 Tesla scanner with standard T1-weighted, T2-weighted, STIR, and contrast-enhanced sequences when indicated. Two experienced radiologists independently reviewed the scans, and discrepancies were resolved by consensus. Imaging parameters assessed included the presence of bone marrow edema, cortical bone destruction, soft tissue infection, abscess formation, and signs of healing. Data were analyzed descriptively and correlated with clinical findings. **Results:** MRI demonstrated pathological findings in 48 of 60 patients (80%) that were either undetected or underestimated on clinical examination. Bone marrow edema was identified in 30 patients (50%), cortical destruction in 12 patients (20%), and soft tissue infection or abscess formation in 25 patients (42%). Among patients with treatment-resistant ulcers, MRI provided critical information on the extent of infection and progression, leading to timely modifications in therapy. Additionally, MRI was able to distinguish between granulation tissue and persistent infection, allowing more accurate monitoring of wound healing. Overall, MRI findings showed a strong correlation with ulcer severity and clinical outcomes. **Conclusion:** The findings of this study underscore the significant role of MRI in the follow-up of chronic DFUs. By enabling early detection of bone and soft tissue involvement, MRI improves diagnostic accuracy, guides therapeutic decisions, and reduces the risk of severe complications such as osteomyelitis and amputation. Incorporating MRI into standard follow-up protocols for patients with chronic DFUs is recommended, particularly in specialized centers where advanced imaging facilities are available. Further prospective studies with larger populations are warranted to validate these findings and optimize imaging-based follow-up strategies
Keywords:
Diabetic Foot Ulcer,Chronic Wounds,Magnetic Resonance Imaging, Diabetic Complications, Infection Monitoring, Wound Follow-Up, Osteomylitis

Code: yara12-410

Next-Generation Nanotechnology Approaches for Wound Healing and Tissue Engineering

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Abstract

Wound healing is a highly coordinated, dynamic process involving overlapping phases of hemostasis, inflammation, proliferation, and tissue remodeling. Persistent inflammation, infection and biofilm formation, oxidative stress, impaired angiogenesis, and dysregulated extracellular matrix (ECM) remodeling can disrupt this process, resulting in delayed repair and chronic wounds. Accordingly, wound management is shifting from passive coverage toward multifunctional, bioactive, and regenerative therapeutic platforms capable of modulating the wound microenvironment. Nanotechnology provides versatile strategies to address these challenges through electrospun nanofibers, nanoengineered hydrogels, nanocarriers, stimuli-responsive systems, antimicrobial/antibiofilm nanotechnologies, and theranostic smart dressings. Electrospun nanofibers provide ECM-mimetic architectures with high porosity and surface area, supporting cell interactions and localized therapeutic delivery. Nanoengineered hydrogels offer hydrated, adaptable microenvironments and can integrate bioadhesion, self-healing, antimicrobial activity, and controlled drug release. Stimuli-responsive nanosystems exploit pathological cues, including pH, reactive oxygen species, enzymes, glucose, redox conditions, and temperature, to enable spatially and temporally controlled or on-demand therapy. Antimicrobial and antibiofilm nanotechnologies further enhance infection control through intrinsic antimicrobial activity, improved drug delivery, biofilm penetration and disruption, and multimodal therapeutic mechanisms. Meanwhile, nanoparticles embedded microneedles enable minimally invasive, localized delivery, whereas theranostic dressings integrate sensing, monitoring, and therapeutic intervention for adaptive wound management. Collectively, these technologies extend wound care beyond closure toward functional tissue regeneration. Despite substantial progress, clinical translation requires scalable and reproducible manufacturing, standardized characterization, long-term biosafety, regulatory clarity, cost-effectiveness, and robust clinical validation. Next-generation nanotechnology therefore represents a promising route toward precision, responsive, adaptive, and regenerative wound care, capable of actively directing healing toward functional tissue restoration.

Keywords:

Wound Healing; Nanotechnology; Stimuli-responsive Delivery; Antimicrobial; Theranostics; Tissue Engineering; Regenerative Medicine

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Code: yara12-430

Scarless Healing: Mechanisms and Therapeutic Perspectives

Seyed Mehdi Tabaie

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Abstract:
Scarless healing refers to the process of tissue repair that restores normal structure and function without the formation of fibrotic scar tissue. This phenomenon is naturally observed in early-stage fetal wounds and certain adult tissues, such as oral mucosa, highlighting fundamental differences from typical adult wound healing. Conventional wound repair in adults occurs through overlapping phases of inflammation, proliferation, and remodeling, often resulting in excessive extracellular matrix deposition and permanent scarring. Key mechanisms underlying scarless healing include a reduced inflammatory response, altered cytokine and growth factor signaling, and precise regulation of extracellular matrix components. In fetal wounds, lower levels of pro-inflammatory cytokines such as transforming growth factor-β1 (TGF-β1) and higher expression of TGF-β3 play a critical role in minimizing fibrosis. Additionally, fibroblasts involved in scarless repair exhibit distinct phenotypes with decreased myofibroblast differentiation, limiting wound contraction and collagen overproduction. The immune system also contributes significantly to scarless healing. Reduced macrophage infiltration and a predominance of anti-inflammatory immune signaling promote regenerative repair rather than fibrotic outcomes. Furthermore, enhanced angiogenesis and rapid re-epithelialization support effective tissue regeneration. Understanding the molecular and cellular basis of scarless healing has important clinical implications. Current research focuses on therapeutic strategies such as growth factor modulation, stem cell therapy, biomaterial scaffolds, and gene-based approaches to replicate fetal-like healing in adult tissues. Advancements in this field may lead to improved treatments for surgical wounds, burns, and chronic injuries, ultimately reducing scarring and improving functional and aesthetic outcomes.

Code: yara12-440

The role of Botulinum Toxin in Scar Prevention and Treatment

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Abstract:
Scars are fibrous tissues that replace normal tissues during wound heading. Based on their appearance, scars are categorized as hypertrophic (HS), keloid or atrophic. Scar can significantly decrease quality of life. The mechanism of HS and keloid induction is incompletely understood. Accumulating evidence indicates that mechanical tension around the wound is the most critical determinant of HS: the higher the pressure, the greater the risk. Invitro, excessive tension inhibits fibroblast apoptosis, promotes migration and drives fibrosis. Botulinum toxin type A (BTX-A) is a potent neurotoxin that acts on cholinergic nerve endings to inhibit muscle fiber contraction and reduce tension at the margins of healing wounds. By modulating TGF-β1 signaling, BTX-A may directly regulate fibroblast activity, altering apoptosis, migration and fibrotic processes, ultimately reducing scar formation. In summary, local injection of BTX-A demonstrate significant efficacy in both the treatment and prevention of hypertrophic scars, with no obvious side effects. Future research needs to further clarify the relevant cellular signaling pathways of BTX-A, explore its mechanisms in treating scars. Research comparing BTX-A with other scar prevention methods can be carried out.

Chapter III

Invited Speakers

New Methods in Predicting Burn Outcomes based on Artificial Intelligence with a Focus on the Support Vector Approach

Reza Zarei

Department of Statistics, Faculty of Mathematical Sciences, Rasht

Abstract:

Accurate prediction of burn outcomes is crucial for improving patient management, optimizing treatment strategies, and reducing mortality rates in burn care. Recent advances in artificial intelligence (AI) have enabled the development of robust predictive models capable of handling complex, nonlinear relationships among clinical variables. This study introduces new methods for predicting burn outcomes using AI techniques, with a particular focus on the Support Vector Machine (SVM) and its advanced variants. Various clinical and demographic parameters, such as age, total body surface area (TBSA) burned, inhalation injury, and biochemical indicators, are used to train and evaluate the models. Comparative analyses are performed between traditional statistical approaches, standard SVM, and enhanced SVM frameworks incorporating kernel optimization, feature selection, and fuzzy logic integration. Experimental results demonstrate that the proposed SVM-based models achieve superior accuracy, sensitivity, and generalization performance compared to conventional methods. The findings highlight the potential of AI-driven support vector approaches as reliable decision-support tools for clinicians in burn prognosis and personalized treatment planning.

Design and Development of an Intelligent Gelatin–Alginate-Based Bio-Scaffold with Controlled Release of ASCs for Damaged Tissue Regeneration

Zahra Pourmohammadi-Bejarpasi

Burn and Regenerative Medicine Research Center, Guilan University of Medical Sciences, Rasht, Iran

Abstract:
Tissue regeneration following severe injury remains a significant clinical challenge due to the limited intrinsic healing capacity of the body and insufficient cellular response at the injury site. To overcome these limitations, bio-scaffolds capable of controlled cell delivery have emerged as a promising strategy in regenerative medicine. In this study, we developed an intelligent gelatin–alginate-based bio-scaffold designed for the controlled release of autologous skin cell suspension (ASCs) to support and accelerate tissue repair. Various gelatin-to-alginate ratios were systematically prepared and characterized in terms of rheological properties, mechanical strength, degradation rate, and hydration capacity to determine the optimal formulation. Incorporation of ASCs into the hydrogel matrix enabled sustained and controlled cell release, enhancing cell viability and proliferation. Our results indicated that higher gelatin content improved biodegradability and cell adhesion, whereas increased alginate content provided greater mechanical stability and slower degradation. The optimized scaffold composition (gelatin:alginate = 70:30) achieved a balanced combination of mechanical integrity, hydration, and controlled cell delivery. In vitro studies further demonstrated improved cellular attachment, proliferation, and extracellular matrix formation. Overall, this intelligent gelatin–alginate-based bio-scaffold represents a robust platform for effective delivery of autologous skin cells, offering a promising approach for the regeneration of damaged skin and soft tissues.

Primary Management in Burns Injuries

Seyed Hamid Salehi

Burn Research Center, Motahari Burn Hospital, Iran University of Medical Sciences

Abstract:
Background: Early and appropriate management of burn injuries is critical to reduce morbidity and mortality. Initial care at the scene and in the hospital determines patient outcomes. **Methods:** This review summarizes the key steps in early burn management from the prehospital phase to initial hospital treatment. **Results:** At the scene, the main priorities include ensuring safety, stopping the burning process, cooling the injured area with running water, maintaining airway and circulation, covering the wounds with clean materials, preventing shock, and arranging rapid transport to a medical facility. In the hospital, management follows the ABCDE approach: securing the airway, providing oxygen, establishing intravenous access, initiating fluid resuscitation (e.g., Parkland formula), controlling pain, preventing infection, and assessing burn extent and depth. Early wound care, tetanus prophylaxis, and continuous monitoring are essential. **Conclusions:** Prompt and systematic burn care beginning at the scene and continued in the hospital—significantly improves survival and functional outcomes. Training first responders and healthcare providers in standardized burn management protocols is crucial.

Next-Generation Polymer Hemostats for Burns: From Rapid Clotting to Pro-Healing Microenvironments

Mohsen Shahrousvand [1], Mohammadreza Mobayen [2], Shiva Bakian [3,4]

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[2] Burn and Regenerative Medicine Research Center, Guilan University of Medical Sciences, Rasht, Iran
[3] Iran University of Medical Sciences, Iran.
[4] Division of Vascular and Endovascular Neurosurgery, Firoozgar Hospital, Tehran, Iran.

Abstract:
Burn wounds present unique clinical challenges due to extensive tissue damage, risk of hemorrhage, and sustained inflammation that hinder effective hemostasis and healing. Traditional hemostatic agents often fall short in these contexts, necessitating advanced solutions that rapidly arrest bleeding while promoting tissue regeneration. This review comprehensively examines the development and application of next-generation polymer hemostats designed specifically for burn care. We discuss the physiological fundamentals of hemostasis in burn injuries and explore the diverse classes of polymer-based hemostats—including natural, synthetic, and composite materials—and their mechanisms of action. Emphasis is placed on innovative design strategies such as shape memory polymers, smart foams, and nanomaterial incorporation that enable rapid clot formation. Additionally, we highlight how these polymers create pro-healing microenvironments by modulating inflammation, delivering growth factors and antimicrobials, and mimicking the extracellular matrix to support cellular regeneration. The review also addresses current challenges, including biocompatibility, biodegradability, scalability, and clinical translation. By integrating rapid clotting capabilities with active healing functions, next-generation polymer hemostats hold significant promise to enhance burn wound management and patient outcomes.
Keywords:
Burn Wounds; Polymer Hemostats; Rapid Clotting; Wound healing; Tissue regeneration; Biomaterials

Clinical Experiences in the Application of Advanced Regenerative Medicine Technologies for Burn Wound Repair

Mohammadreza Mobayen

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Abstract:
Recent advances in regenerative medicine and tissue engineering have significantly improved therapeutic approaches for burn wound management. In this regard, our research group has focused on the development and clinical evaluation of hydrogel, nanofibrous, and silicone-based scaffolds aimed at enhancing the quality and rate of burn wound healing. In the early phases of clinical trials, hydrogel dressings composed of poly (acrylic acid) and xanthan gum demonstrated excellent performance by maintaining wound moisture, reducing local inflammation, promoting epithelialization, and improving the structural integrity of regenerated tissue. Subsequently, biodegradable nanofibrous scaffolds fabricated through electrospinning, which closely mimic the extracellular matrix, facilitated fibroblast and keratinocyte adhesion and proliferation, leading to accelerated tissue regeneration and reduced secondary necrosis in deep burn injuries. In the final stage, domestically engineered medical-grade silicone dressings were successfully developed and commercialized as cost-effective and clinically efficient alternatives to imported products for the prevention and treatment of hypertrophic and keloid scars. Clinical outcomes indicated significant improvements in scar thickness, redness, itching, and recurrence prevention. Preliminary studies on newly formulated regenerative ointments have also shown promising efficacy in enhancing burn wound healing and are currently undergoing ethical review for broader clinical application. Collectively, these findings highlight the potential of integrating tissue engineering, nanotechnology, and reconstructive surgery to achieve safe, effective, and locally sustainable regenerative therapies for burn patients.

Manufacturing Antibacterial Nano-cream for Treating Burn and Wound Infections

Zahraa Neameh Abbas [1], Asad Hameed Alnajar [2]

[1] Department of Medical Techniques, Faculty of Health and Medical Techniques, Middle Technical University, Baghdad, Iraq
[2] Faculty of science /Mustansiriyah University, Baghdad, Iraq

Abstract:
Burn infections are a major challenge in the treatment of burn patients, as infections delay wound healing and increase the risk of complications. Therefore, this research aims to design and manufacture a nano-cream based on the nano-pearl material, where its nano-composition was diagnosed by transmission electron microscopy, and the nano-material showed antibacterial properties to treat burn infections and promote healing, where the manufactured cream was applied to the burned areas in the rabbit's ear. After 4 days, healing began and hair appeared on the rabbit's ear. Nanoparticles were manufactured to evaluate the antibacterial properties of the nano-cream against common strains that cause burn infections and to study the effect of the cream on wound healing and tissue inflammation. Pearl powder was treated using precise mechanical and chemical techniques to produce nanoparticles with a size of less than 100 nanometers, where the cream was prepared by integrating the nanoparticles with a safe medical cream base containing moisturizing and soothing components. Antibacterial activity tests were conducted, and tests were conducted on common bacterial strains such as to evaluate the cream's efficiency. Experiments were explained on laboratory models to test the cream's effectiveness in reducing inflammation and promoting burn healing. The nano-cream showed high efficiency in eliminating bacteria that cause infection and contributed to accelerating healing. Wounds significantly lessened compared to conventional methods Reduced the appearance of inflammation and scarring thanks to its soothing and antioxidant effect Nano-pearl cream provides a promising and effective option for treating burn infections thanks to its antibacterial and wound-healing properties. It is recommended to continue clinical studies to confirm its efficacy and safety in human use.
Keywords:
Nano Cream, Pearl, Antibacterial, Burns, Wound Healing

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Vacuum-assisted Closure (VAC) Therapy

Mahdi Akbarzadeh Amirdehi

Abstract:
Vacuum-assisted closure (VAC) therapy, also known as negative pressure wound therapy (NPWT), has revolutionized post-surgical wound care, particularly in complex abdominal and omental surgeries. Its mechanism (using controlled suction to remove exudate and promote granulation) helps maintain a clean wound bed, reduce edema, and accelerate tissue regeneration. Recent studies underscore its effectiveness in preventing and managing complications such as infection, seroma formation, and delayed healing after omental procedures. Comparative trials found that NPWT significantly outperformed traditional gauze dressings in terms of healing speed, infection control, and patient. Moreover, updated reviews highlight that complications are rare but manageable, usually involving minor air leaks or pain around the seal. Recent guidelines recommend NPWT as first-line therapy for omental or abdominal wounds at high risk of infection or dehiscence, especially in cases involving contaminated fields or delayed primary closure. Ongoing studies are exploring optimal pressure settings and dressing change intervals to balance efficacy with tissue preservation.

Peristomal Skin Complications (PSCs)

Alireza Abasi Niasar

Abstract:
Peristomal skin complications (PSCs) are among the most frequent issues affecting individuals with stomas, occurring in 18–73% of patients depending on the type and duration of ostomy. These complications (ranging from mild irritation to severe ulceration or infection) often result from leakage of stoma effluent, poor appliance fitting, or skin barrier breakdown. Types of PSCs commonly include contact dermatitis, mechanical injury, mucocutaneous separation, and infection. Dermatologists and stoma care nurses should recognize early warning signs like redness, weeping, or pain around the stoma to prevent further deterioration. Best practices in management should be followed based on EBP. Evidence from clinical studies shows that specialized home-care nursing significantly accelerates healing and improves quality of life for patients with PSCs. The importance of nurse training and patient education as key determinants of long-term success in stoma management is well-known. Newer guidelines stress early intervention in early phases. The wound care of PSCs relies on prevention, individualized management, and continuous monitoring. Collaboration between healthcare professionals and patients ensures healthy peristomal skin, better appliance adherence, and improved overall quality of life.

Manufacturing Antibacterial Nano-cream for Treating Burn and Wound Infections

Zahraa Neameh Abbas [1], Asad Hameed Alnajar [2]

[1] Department of Medical Techniques, Faculty of Health and Medical Techniques, Middle Technical University, Baghdad, Iraq
[2] Faculty of Science, Mustansiriyah University, Baghdad, Iraq

Abstract:
Burn infections are a major challenge in the treatment of burn patients, as infections delay wound healing and increase the risk of complications. Therefore, this research aims to design and manufacture a nano-cream based on the nano-pearl material, where its nano-composition was diagnosed by transmission electron microscopy, and the nano-material showed antibacterial properties to treat burn infections and promote healing, where the manufactured cream was applied to the burned areas in the rabbit's ear. After 4 days, healing began and hair appeared on the rabbit's ear. Nanoparticles were manufactured to evaluate the antibacterial properties of the nano-cream against common strains that cause burn infections and to study the effect of the cream on wound healing and tissue inflammation. Pearl powder was treated using precise mechanical and chemical techniques to produce nanoparticles with a size of less than 100 nanometers, where the cream was prepared by integrating the nanoparticles with a safe medical cream base containing moisturizing and soothing components. Antibacterial activity tests were conducted, and tests were conducted on common bacterial strains such as to evaluate the cream's efficiency. Experiments were explained on laboratory models to test the cream's effectiveness in reducing inflammation and promoting burn healing. The nano-cream showed high efficiency in eliminating bacteria that cause infection and contributed to accelerating healing. Wounds significantly lessened compared to conventional methods Reduced the appearance of inflammation and scarring thanks to its soothing and antioxidant effect Nano-pearl cream provides a promising and effective option for treating burn infections thanks to its antibacterial and wound-healing properties. It is recommended to continue clinical studies to confirm its efficacy and safety in human use.

Keywords:
Nano Cream, Pearl, Antibacterial, Burns, Wound Healing

From Molecules to Tissue Regeneration: How Artificial Intelligence Is Transforming Drug Discovery and Therapeutic Design

Sajjad Gharaghani

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Abstract:
Wound healing and tissue regeneration are complex biological processes involving the coordinated regulation of inflammation, cell proliferation, migration, angiogenesis, extracellular matrix remodeling, and tissue repair. The multifactorial nature of these processes makes the identification and development of effective therapeutic interventions particularly challenging. At the same time, the rapid growth of biological and chemical data has created new opportunities for computational approaches to support drug discovery and regenerative medicine. Artificial intelligence (AI) is increasingly changing how potential therapeutic targets and drug candidates are identified, evaluated, and optimized. By integrating molecular, structural, pharmacological, and biological information, AI-based approaches can help uncover previously unrecognized drug–target relationships, predict molecular activity and pharmacokinetic properties, identify opportunities for drug repurposing, and prioritize compounds for experimental evaluation. These approaches are particularly relevant to wound healing, where multiple signaling pathways and cellular processes contribute to the therapeutic response. In this presentation, I will discuss how computational drug discovery approaches, ranging from chemoinformatics, molecular modeling, and quantitative structure–activity relationship analysis to machine learning, knowledge graphs, and generative AI, can be integrated into the study of wound healing and tissue regeneration. Particular attention will be given to the identification of therapeutically relevant molecular targets, prediction of drug–target interactions, repurposing of existing drugs, and AI-assisted design of new therapeutic molecules. I will also discuss the current limitations of these approaches, including data quality, model generalizability, biological complexity, and the need for experimental validation. Ultimately, the integration of AI with molecular and biological knowledge has the potential to move regenerative medicine toward a more systematic and predictive approach to therapeutic discovery, bridging the gap between molecular design and clinically relevant tissue repair.

Keywords:
Artificial Intelligence; Drug Discovery; Wound Healing; Tissue Regeneration