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# Abstract Book

# Lasers in Medicine

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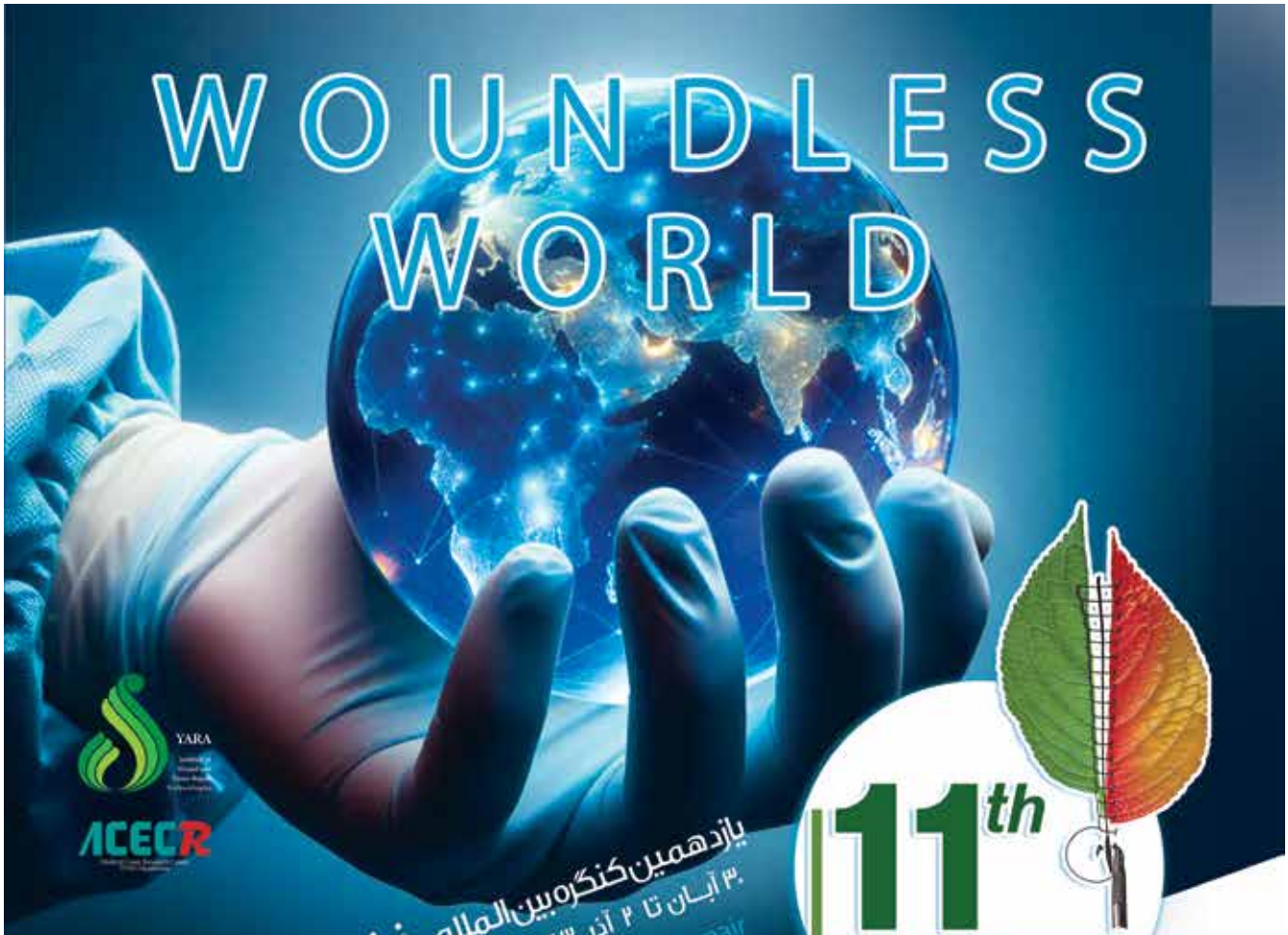
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# Oral Presentations

## Suplement in Wound Healing

**Seyed Mehdi Tabaie**

***Associated Professor of Dermatology, Medical Laser Research Center, YARA Institute, ACECR, Tehran, Iran***

Nutritional supplements can play a role in wound healing, particularly when deficiencies are present. Here's an overview of key nutrients and their impact on the healing process: Vitamin C Essential for collagen formation, vitamin C deficiency impairs wound healing. Supplementation has shown benefits, especially after severe stress or injury. For instance, surgical patients with pressure sores experienced accelerated healing with high doses of ascorbic acid. Vitamin AThis vitamin enhances collagen cross-linking and increases wound strength. It also boosts the inflammatory response, aiding in healing. Even in non-deficient states, vitamin A supplementation can positively affect wound healing. ZincCrucial for protein and DNA synthesis, zinc deficiency can delay wound healing. However, oral or systemic zinc supplementation doesn't significantly improve healing in individuals with adequate levels. Topical zinc may offer benefits, but oral supplementation is generally not recommended without a confirmed deficiency. ProteinAdequate protein intake is vital for cell health and development, playing a key role in all stages of wound healing. Ensuring sufficient dietary protein supports tissue repair and recovery. Arginine and Omega-3 Fatty AcidsSome studies suggest that supplements like arginine and omega-3s can improve wound healing, particularly in specific populations such as head and neck cancer patients with surgical wounds. It's important to note that supplementation is most effective when addressing specific deficiencies. For individuals without deficiencies, additional supplementation may not significantly enhance wound healing and could potentially cause harm if taken in excess. Therefore, it's advisable to consult with a healthcare professional before starting any supplementation regimen to ensure it's appropriate for your individual needs.

## The Neuro-engineering of Wound Healing: A Mathematical Perspective on Brain Mapping

**Arian Baymani[1]**

**Maryam Naderi Soorki[2]***

***1. Department of Chemical Engineering, Faculty of Engineering, Shahid Chamran University of Ahvaz, Ahvaz, Iran***

***2. Department of Biology, Faculty of Science, Shahid Chamran University of Ahvaz, Ahvaz, Iran***

The Neuro-engineering of Wound Healing: A Mathematical Perspective on Brain Mapping Introduction The convergence of neuroengineering and advanced mathematics holds great potential for enhancing our understanding of biological processes, particularly in the realm of wound healing. This intricate process is influenced not only by local tissue responses but also by systemic neurological controls. By employing mathematical modeling alongside brain mapping techniques, we can gain new insights into the relationship between neural mechanisms and wound healing dynamics. Wound healing is a complex biological process that comprises several overlapping phases: hemostasis, inflammation, proliferation, and remodeling. Each stage is regulated by a variety of cellular and molecular signals. It involves the concerted action of platelets, immune cells, fibroblasts, and endothelial cells, among others, contributing to tissue repair and regeneration. Recent studies have shown that neural activities significantly influence these biological responses, suggesting an integration between the peripheral and central nervous systems in wound management. Neurons communicate with immune cells, releasing neuropeptides that can modulate inflammation and tissue repair. For instance,

substance P, a neuropeptide involved in pain perception, has been found to enhance the healing process in skin wounds by promoting angiogenesis and collagen deposition. Furthermore, studies show that the autonomic nervous system regulates blood flow and nutrient delivery to wound sites, indicating that psychological stress can negatively affect healing rates. Understanding these neuroimmune interactions is crucial, as it opens up potential therapeutic avenues for enhancing wound healing through neurostimulation techniques. This paper explores this interdisciplinary approach, examining the role of neural pathways in the healing process and how mathematical frameworks can elucidate these interactions. Metod This study was conducted as a review by searching the keywords complex biological process, wound healing dynamics and neural pathways in PubMed, Science Direct, Scopus and Google Scholar search engines. Finally, 128 articles were selected and reviewed. RESULT Mathematical modeling serves as a powerful tool for simulating and analyzing complex biological systems. In the context of wound healing, differential equations can describe the biochemical signaling pathways involved in cell migration, proliferation, and apoptosis. The interaction between growth factors, cytokines, and mechanical stressors can be modeled using partial differential equations to predict healing outcomes under various conditions. For instance, the Fisher - KPP equation can model cell density dynamics and how it changes over time during the healing process. By incorporating variables such as nutrient availability and neuropeptide concentration, these models can offer insights into how specific neurogenic signals modulate healing rates. The development of computational models also allows for the exploration of how external factors, such as stress and environmental conditions, can alter the wound healing trajectory. Advancements in neuroimaging techniques, such as functional magnetic resonance imaging (fMRI) and positron emission tomography (PET), have allowed researchers to visualize brain activity in real-time. Mapping the brain's circuitry can uncover the neurological pathways activated during the wound healing process. By identifying brain areas that respond to surgical wounds or traumatic injuries, researchers can correlate neural activity with healing outcomes. In a study using fMRI, researchers correlated neural activation patterns with healing times in patients. Specific brain regions associated with pain perception and emotional response, such as the anterior cingulate cortex and insula, were found to be activated in relation to slower healing rates. These findings suggest a neurophysiological feedback loop where the brain's processing of stress influences peripheral healing responses, highlighting the importance of considering psychological factors in wound treatment plans. The integration of advanced mathematics with neuroscience and clinical practice can revolutionize our approach to wound healing. Creating predictive models that incorporate patient - specific data, including psychological state, neural health, and biochemical markers, can personalize treatment options. Furthermore, neuroengineering strategies, such as targeted neurostimulation (e.g., transcutaneous electrical nerve stimulation), can be employed to enhance healing through modulation of neural pathways. By understanding how mathematical principles govern the biological processes underlying wound healing and how these processes are influenced by neural activity, we can develop more effective treatment protocols. Coupled with real-time brain mapping, this interdisciplinary approach provides a blueprint for future research endeavors that aim to tackle complex healing challenges. Conclusion The intersection of neuroengineering, advanced mathematics, and the study of wound healing offers a fertile ground for innovative research. Insights gained from mathematical models and brain mapping could significantly enhance our understanding of the neurophysiological aspects of wound healing. As we continue to explore these connections, we pave the way for novel therapeutic strategies that account for both biological and neurological factors in the healing process. Ultimately, this multidisciplinary approach could lead to improved clinical outcomes and a better quality of life for patients recovering from wounds.

Keywords: Complex Biological Process, Wound Healing Dynamics, Neural Pathways In PubMed, Cell Density Dynamics

## Preparation and Characterization of a Thermo-sensitive Hydrogel with Antioxidant Properties Based on Chitosan and Graphene Oxide as Wound Dressing

**Kimia Sharj-Safari[1]**
**Neda Mousavi Niri[1]***
**Ehsan Seyedjafari[2]**

***1. Department of Medical Biotechnology, Faculty of Advanced Science and Technology, Tehran Medical Sciences, Islamic Azad University, Tehran, Iran***

***2. Department of Biotechnology, College of Science, University of Tehran, Tehran, Iran***

Background: As the body's first line of defense, the skin protects us against physical and chemical damage. Wound healing is a complex and dynamic process; conditions such as diabetes or old age can impair this process. Traditional wound dressings have been replaced by more modern ones due to issues like not providing a moist environment for the wound. Hydrogels are used as modern wound dressings because they can provide moisture at the wound site and can incorporate substances aimed at facilitating wound healing. Chitosan is a natural polysaccharide obtained industrially through the deacetylation of chitin. Its key properties include biodegradability, biocompatibility, non-toxicity, appropriate adhesion to wounds, antibacterial and antifungal properties, and a positive effect on blood coagulation. These attributes make chitosan a widely used polysaccharide in the production of wound dressings. Graphene oxide is a two-dimensional material with a honeycomb-like structure derived from the oxidation of graphene. Research has confirmed its proton/ion conductivity due to the presence of functional groups on its surface. The use of conductive wound dressings can enhance cellular activities such as proliferation, migration, and adhesion, either with or without electrical stimulation, thereby facilitating wound healing. Gallic acid is a phenolic acid found in almost all plants, including fruits, leaves, and wildflowers. It facilitates wound healing through its antioxidant activity, which eliminates free radicals at the wound site.

Purpose: Synthesis and characterization of a thermo-sensitive and conductive hydrogel with dual intrinsic and additive antioxidant properties as a wound dressing to facilitate wound healing.

Methods: In this research, Gallic acid was first grafted onto chitosan, and its incorporation was assessed using Fourier-transform infrared spectroscopy (FTIR) and proton nuclear magnetic resonance (H-NMR). The amount of Gallic acid was assessed using the Folin-Ciocalteu reagent. The optimal concentrations of regular chitosan and beta-glycerophosphate, as a cross-linking agent in the hydrogel, were determined by examining the temperature and duration of the sol-gel transition process. The hydrogel was characterized by evaluating its morphology using scanning electron microscopy (SEM), water absorption capacity, porosity, fibroblast cell viability through MTT assay, and antioxidant properties using DPPH assay.

Results: The grafting of Gallic acid onto the chitosan structure was confirmed. The Folin-Ciocalteu assay indicated that 45 mg of Gallic acid is present per gram of chitosan. The final concentrations of 3.5% w/v chitosan and 10% w/v beta-glycerophosphate were selected for the hydrogel. The DPPH assay demonstrated a significant difference in antioxidant properties between the hydrogel containing Gallic acid-modified chitosan with graphene oxide and the hydrogel containing chitosan (p

Keywords: Wound Dressing, Hydrogel, Gallic Acid, Graphene Oxide, Antioxidant, Conductivity

## Investigating The Antimicrobial Activity of Niosome Coated with Chitosan Containing Amikacin Against Clinical Strains Of *Klebsiella Pneumoniae* Isolated From Patient`s Wounds

**Pouria Moulvi[1]**
**Fatemeh Ashrafi[2]***
**Sara Azadbakht[1]**

***1. Master's Degree, Department of Biology, Faculty of Biological Sciences, North Tehran Islamic Azad University, Tehran, Iran***

*2. Associate Professor, Department of Biology, Faculty of Biological Sciences, North Tehran Islamic Azad University, Tehran, Iran*

Introduction and purpose: Klebsiella pneumoniae can cause pneumonia, bloodstream infections, wound or surgical site infections, and meningitis. Some Klebsiella bacteria are becoming increasingly resistant to antibiotics. Considering the antibiotic resistance to amikacin in clinical strains and the resulting nephrotoxicity, as well as the unique antibacterial benefits of chitosan, this study for the first time attempted to synthesize niosomes coated with chitosan containing amikacin and to investigate the antibacterial properties against patients wound isolates of Klebsiella pneumoniae.

Method: In this study, chitosan-coated niosomes containing drug were synthesized by thin layer hydration method and their size and morphology were confirmed by DLS, and SEM techniques, and the drug release rate and stability of niosomes were measured. Antibacterial effects were evaluated using MIC tests, and time kill assay and anti-biofilm effect was evaluated using crystal violet test and changes in fimH gene expression using Real-Time PCR method.

Results: After isolating 20 strains of Klebsiella pneumoniae from patients' wounds, the chitosan-coated niosomes containing drug exhibited the smallest MIC, which was 16-fold lower than amikacin and 4-fold lower than the drug-loaded niosomes. The biofilm study showed that chitosan-coated niosomes containing drug had the most effect in the reduction of biofilm formation compared to free drug and drug-loaded niosomes which was confirmed by the significant reduction in the fimH gene expression.

Discussion and conclusion: As a result, the loading of antibiotics in functionalized structures of niosomes can reduce antibiotic resistance and be a new method to deal with infectious bacteria in wounds.

Keywords: Klebsiella Pneumoniae, Amikacin, Niosome, Chitosan, Biofilm, Wound Infection

## Review the Effect of Lactobacillus Rhamnosus Exopolysaccharide on Pseudomonas Aeruginosa Biofilm Formation

**Paria Zahedi[1]**

**Mohaddeseh Larypoor[2]***

**Mohamad Reza Razavi[3]**

***1. Faculty of Biological Sciences, Tehran North Branch, Islamic Azad University, Tehran, Iran***

***2. Department of Biotechnology, Faculty of Biological Sciences, Tehran North Branch, Islamic Azad University, Tehran, Iran***

***3. Iran Parasitology Department, Pasteur Institute of Iran, Tehran, Iran***

Background: Due to pathogenic bacteria such as pseudomonas aeruginosa have high affinity to forming biofilm, increasing antibiotic resistance inhibition or controlling pathogenicity, dealing with the formation of biofilm with a biological strategy can be considered as a suitable function. In this research, the effective of three different concentrations of 0.1, 0.5 and 1 mg/ml of Lactobacillus rhamnosus EPS on Pseudomonas aeruginosa was studied.

Introduction: Probiotics have health effects on humans, as well as parabiotics derived from them with anti-microbial and biofilm. Biofilm can protect bacteria and having antibiotic resistance. So that, Pseudomonas aeruginosa bacteria cause common infections caused by burns and hospital infections by biofilm formation and antibiotic resistance. So that parabiotic effects can prevent the biofilm formation and can be used as a kind of therapeutic supplement along with antibiotics.

Material and methods: First, a fresh culture is prepared from Rhamnus and Pseudomonas aeruginosa. for extracting and purifying the exopolysaccharide , the method of Abid et al containing dialysis and multiple centrifuges with combination with 4% trichloric acid and absolute ethanol are used. To check effect of biofilm formation, two 96-well microplates are used to perform CV and MTT tests. The first plate used for CV test by 0.1% dye and the second plate used for second test by MTT salt, with three mentioned concentrations of EPS on 100 microliters of Pseudomonas aeruginosa

bacteria with concentration of 0.5 McFarland with three repetitions for each concentration, after 72 hours of incubation and wash, the reading is done at 595 nm for CV and 560 nm for MTT (Giordani et al. 2023).

Result: The result show that, increasing the concentration of EPS reduces biofilm formation, but it does not reach 100% function, and the concentration of 1 mg has the greatest effect on bacterial biofilm.

Conclusion: It can be expected that by increasing the concentration of EPS, more effects on the inhibition of biofilm formation will be included, and also the effect of EPS of different origin can be investigated. Finally, this biological solution can be used along with antibiotics to reduce and inhibit Pseudomonas aeruginosa.

Keywords: Exopolysaccharide, Biofilm, Pseudomonas Aeruginosa, Lactobacillus Rhamnosus

## Prevalence of Surgical Site Infection after Orthopedic Surgery with Two Types of Drainage at Three Public Hospitals in Iran

**Akram Aarabi[1]***
**Sorour Mosleh[1]**
**Fereshteh Baradaranfard[1]**
**Mojgan Jokar[2]**
**Leila Akbari[1]**

***1. Isfahan University of Medical Sciences***
***2. Khomein University of Medical Sciences***

Introduction: Orthopaedic surgical site infections (SSIs) are among the most important and prevalent because implanted devices are used in such surgeries which increase the risk of infection. This study aimed to examine the incidence of infection in orthopaedic surgeries and related factors in a group of public hospitals in Iran.

Methods: This analytical cross-sectional study was condcuted in 2018. Data were collected about the incidence of infection and related factors including use/non-use of drains and well as types of drain . The presence of SSIs were determined using a researcher-devised Wound Infection Checklist (WIC) and microbial cultures.

Results: Of 110 included patients undergoing orthopaedic surgeries, 18.2% had an infection. The highest rate of infection was associated with lower extremity surgeries following tibia and fibula fractures. The incidence of infection among individuals under the age of 35 years was also higher. Emergency procedures demonstrated a higher incidence of infection. No significant relationship was observed between use of wound drains and development of SSIs.

Conclusion: Reducing the incidence of orthopaedic infection can be achieved by focusing more attention on open fractures occurring in the lower extremity. Use of surgical drains for the sole purpose of reducing the rate of infection is not effective. Accordingly, infection provention protocols should be implemented in orthopaedic surgery units to control and reduce rates of infection.

Keywords: Surgical Site Infection, Surgery, Orthopaedics, Incidence, Drain

## Evaluation of Self-care Behaviors in Patients with Diabetic Foot Ulcer

**Firuzeh Hatamirad***
**Faranak Mirzavandiani**
**Mahtab Eskini**
**Faranak Aminifard**
**Atefeh Bajlan**
**Masoumeh Amraei**

***Lorestan University of Medical Sciences, Lorestan, Khorammabad, Iran***

Introduction: Today, diabetes is considered an important global challenge for the health and well-being of human societies, and diabetic foot ulcer are among the most common and severe symptoms of diabetes and the most important, challenging and costly wounds. This complex disease requires multiple and multifaceted medical care beyond a simple blood sugar control. Adherence to self-care behaviors in patients with chronic diseases is very important. Therefore, it is important to encourage patients to participate and accept responsibility in doing them correctly in

improving their health and preventing the recurrence of the disease. Therefore, the present study was conducted with the aim of determining self-care behaviors in diabetic patients with diabetic foot ulcer in Shohada Ashayer Hospital in Khorramabad city in 2019.

Materials and methods: The current study is a descriptive-analytical study that was conducted using available sampling on 110 patients with diabetic foot ulcers hospitalized in the surgical, internal, rehabilitation, and orthopedic departments of Shohada Ashayer Medical Training Center in Khorramabad. A two-part questionnaire including: demographic information and questions related to self-care in diabetic foot ulcer was used to collect data. Data analysis was done with statistical methods of mean, patient deviation, absolute frequency, relative frequency and chi-square test with SPSS software (VERSION 16).

Findings: Only 10% of the studied people had performed self-care behaviors well. Also, self-care behaviors had a significant statistical relationship with the variables of age, level of education, gender, occupation, income, duration of diabetic foot ulcer and hospitalization due to diabetic foot ulcer, but no significant statistical relationship was obtained with married people ($0.05< p$).

Conclusion: The results of the research showed that the knowledge of self-care behaviors was weak in most of the people studied. Since teaching self-care behaviors to patients is one of the main duties of healthcare staff, especially nurses, people with chronic diseases need constant and continuous training. Therefore, self-care training has a great contribution in preventing the recurrence of diabetic foot ulcer.

Keywords: Diabetes, Diabetic Foot Ulcer, Self Care

## Experiences of Nurses in Home Care of Dressing Patient`s Wounds: Qualitative Study

**Mobina Gholami[1]**
**Maryam Maleka[1]**
**Niyayesh Mahmoodi[1]**
**Saba Poolaie[2]**
**Akram Sanagoo[3]***

***1. Bachelor of Nursing Student, Faculty of Nursing and Midwifery, Islamic Azad University, Aliabad Katul Branch, Iran***

***2. Midwifery Student, Student Research Committee, Faculty of Nursing and Midwifery, Golestan University of Medical Sciences, Iran***

***3. Associate Professor, PHD in Nursing, Department of Nursing, Faculty of Nursing and midwifery, Golestan University of Medical Sciences, Iran***

Background and Objective: Home healthcare has emerged as a novel approach within health systems, particularly in wound care, due to the increasing prevalence of chronic wounds and the necessity for specialized care. Nurses play a pivotal role in delivering these care services. However, the experiences of nurses in this domain have not been thoroughly investigated. This study aims to elucidate the experiences of home care nurses regarding wound dressing for patients.

Methods: This qualitative study was conducted in 2024 in Golestan Province. The participants included ten nurses providing wound care for patients at home. Data collection was initiated through structured interviews, beginning with an open-ended question: "Please share your experiences related to wound care." Purposeful sampling was employed. Data analysis was performed using conventional content analysis.

Results: The findings of this study depicted the experiences of wound care nurses across five main themes and fourteen sub-themes. The main themes included: a systematic perspective on wounds, neglected care within medical sciences, the artistry and specialized skills of nurses and the healthcare team, equipment and policies for wound care, and the patient's lifestyle and family acceptance.

Conclusion: The results of this study indicate that wound care in current medical practices appears to be overlooked. The experiences of home care nurses reflect their efforts towards treatment and the development of the care process within the healthcare system. This study highlights the quality of services provided to patients and the challenges faced in home wound care.

Keywords: Wound Care, Home Care Nurse, Qualitative Study

## The Effect of Spiritual Care on the Quality of Life of Lower Limb Amputation Patients Due to Atherosclerosis

**Mohammad Mahdi Pazhavand[1]***
**Mahboobeh Moradi[2]**
**Ehsan Izadipour[3]**

***1. Department of Nursing Namazi Hospital, Shiraz University of Medical Sciences, Shiraz, Iran***
***2. Instructor of Critical care Nursing. School of Nursing Gerash University of Medical Sciences, Gerash . Iran***
***3. Religion and Health Research Center, Mashhad University of Medical Sciences, Mashhad, Iran***

The effect of spiritual care on the quality of life of lower limb amputation patients due to atherosclerosis.

Introduction: Atherosclerosis is the most common cause of amputation surgery. Atherosclerosis often develops in old age, which causes a decrease in blood supply to a part of the body. This study aimed to investigate the effect of multidimensional spiritual care on anxiety, depression and attitude towards self and God in patients with lower limb amputation due to atherosclerosis.

Method: In this research, a pre-test-post-test design was used with two groups. A total of 64 participants (male = 41, female = 23) aged between 47 and 78 years who had an amputation related to atherosclerosis participated in this study. The experimental group was subjected to spiritual support intervention for 10 sessions of 45 minutes, while the control group did not receive any intervention. To collect data, Kettle Anxiety Inventory (CAI), Beck Anxiety Inventory (BAI), Beck Depression Inventory (BDI), Religious Adherence Questionnaire (RAQ) and God Self Concept Questionnaire were used. The obtained results were analyzed using repeated measures analysis and independent t-test using SPSS 23 software.

Results: Spiritual care was effective in the experimental group and there was a significant difference between the control and experimental groups in terms of anxiety , depression, image of God and belief in God.

Conclusion: The results of the study indicate that emphasizing spirituality and providing spiritual support to amputated patients can contribute to their overall well-being, understanding the true nature and purpose of their existence, and their peace. Therefore, managers can improve the health of patients by creating opportunities for spiritual support.

Keywords: Amputation, spiritual care, atherosclerosis, Quality of Life, Spiritual Therapies

## Comprehensive Approach in Management of Radiation-induced Skin Injury: A Systematic Review

**Tannaz Faregh**

***Tehran University of Medical Sciences, Tehran, Iran***

Background: Cancer as a second-leading cause of death and major global public-health crisis is expected to increase within next decades with high mortality rate. Radiotherapy is one of its widely-applied treatment modalities leads to a rise in cancer-survival rates. Despite the proven effectiveness of radiotherapy, extensive concerns around developing adverse effects on irradiated tissues by using this method have emerged. Regarding the significance of the skin as the largest organ and protective body barrier, radiation-induced skin injuries (RSI) are mainly focused. Among these dermatological toxicities, radiodermatitis (RD) is the most common side-effect experienced in 90-95% of patients undergoing radiotherapy, that finally result in treatment breaks, decreases disease control rates, and major life-quality consequences. Hence, its management is crucial but challenging since it ranges from erythema and dry scaling in acute phase to chronic manifestations including skin fibrosis and nonhealing wounds. Considering radiodermatitis pathological mechanisms including vascular injuries and disrupted cell division process, various products and bio-modalities have been studied in the literature to minimize radiodermatitis. Therefore, this study was conducted to review updated research-evidence and serve as fundamental guideline for practical management of RSI.

Methods and materials: An electronic-based literature search was conducted in the databases EMBASE, MEDLINE, and SID besides Google Scholar search engine. The Preferred Reporting Items for Systematic Reviews and Meta-analyses 2020 (PRISMA) guidelines were followed. Literature about the subject were searched with proper MESH terms/ keywords in both English and Persian languages for period between January 2020 and January 2024. This review included all abstract-available previously-published articles associated with RSI management in patients with cancers within mentioned period and omitted non-English/Persian studies besides non-human ones. CONSORT and STROBE guidelines were used to evaluate experimental and observational studies respectively.

Results: Based on our inclusion and exclusion criteria, 132 eligible articles were included from retrieved literature which comprise systematic/ narrative reviews, clinical trials, retrospective and prospective cohort studies, case-control studies, and case reports. Generally, the major portion of data was collected from RSI occurrence among patients with breast and head - neck cancers respectively. All studies evaluated efficacy of specific intervention for treatment or prevention of RSI but some methodological challenges resulting in a doubtful quality of evidence. Explored management approaches are categorized in therapeutic strategies including topical applications (pharmaceutical and natural agents), bio-physical therapy, biological methods (Stem cell-based therapies and bio-activators), surgical reconstruction, oral supplements, and herbal formulations alongside with preventive ones comprise radiation-dose control, hygienic options, patient education, self-management, and RSI assessment.

Conclusions: Although substantial progress has been made in clinical exploration of RSI management, only few consensus guidelines are approved. So, this review recommends conducting further studies to investigate the efficacy of some confined preclinical interventions and novel ones in human scale for RSI management. Moreover, a complete diagnosis and treatment system should be established worldwide to promote its outcomes. Also, it is worth-mentioning that non-invasive methods have gained more attention recently as they are more acceptable among patients with cancers afflicted by RSI.

Keywords: Radiation Dermatitis, Radiation-induced Skin Reaction, Radiotherapy, Radiodermatitis Management

## New Case, New Care in Burns Patient

**Mohammadreza Mobayen**

***Burn and Regenerative Medicine Research Center, Velayat Hospital, School of Medicine, Guilan University of Medical Sciences, Rasht, Iran***

Advances in skin substitute technology offer new pathways for effective burn and wound treatment, moving beyond conventional therapies to integrate biologically responsive materials and cellular components that support skin regeneration and reduce scarring. This article reviews recent developments in skin substitutes, highlighting innovative biomaterials, advanced cell integration techniques, and gene-modulating approaches, including the application of hypoxia-inducible factor-1 alpha (HIF-1α), to enhance wound healing outcomes.

Modern skin substitutes often rely on novel biomaterials, including biocompatible hydrogels, bioengineered matrices, and decellularized tissue scaffolds, designed to closely mimic the native extracellular matrix (ECM) and provide a supportive environment for cellular attachment, proliferation, and differentiation. Hydrogels, such as those based on hyaluronic acid or alginate, offer a hydrated matrix that supports cellular integration and allows for sustained release of bioactive molecules. Decellularized matrices, derived from porcine or human skin, provide a scaffold that preserves ECM architecture, promoting host cell infiltration and vascularization. These materials not only provide structural support but can also be loaded with therapeutic agents to accelerate healing and reduce inflammation.

A significant advancement in the field involves the integration of cellular components within these biomaterial scaffolds. Skin substitutes are increasingly

being engineered with keratinocytes and fibroblasts embedded within a synthetic or natural matrix. Some systems incorporate stem cells, particularly mesenchymal stem cells (MSCs), which have demonstrated benefits in wound healing due to their ability to differentiate, modulate inflammation, and release bioactive molecules. The combination of cells and scaffolds results in engineered skin substitutes that can offer enhanced healing compared to acellular alternatives, particularly by promoting rapid re-epithelialization and reducing fibrotic scarring. Despite these advantages, cellularized skin substitutes face challenges, including immunogenicity, sourcing, and regulatory hurdles, limiting their widespread clinical adoption.

Gene modulation represents a growing area of focus for improving skin substitute performance, with HIF-1α standing out as a key factor in promoting tissue survival under hypoxic conditions. HIF-1α is a transcription factor that activates in response to low oxygen levels, upregulating genes associated with angiogenesis, cellular metabolism, and survival pathways. Incorporating HIF-1α or stabilizing agents into skin substitutes has been shown to improve blood vessel formation, reduce cellular stress, and enhance overall healing outcomes. The sustained release of HIF-1α within bioengineered constructs can provide ongoing support for cellular resilience, particularly in large or deep wounds that are prone to ischemia. These gene-modulating strategies offer significant potential for developing skin substitutes that actively support tissue regeneration beyond simple structural support.

In contrast to these advanced skin substitutes, common restorative creams play a different yet complementary role in wound healing. Silicone-based products, widely used for scar management, form a barrier that retains moisture, reduces erythema, and minimizes collagen overproduction, helping to prevent hypertrophic scars. Collagen-rich creams, on the other hand, support ECM integrity and improve skin elasticity by delivering exogenous collagen and promoting fibroblast activity. Creams containing essential fatty acids aid in skin barrier repair and provide antioxidant benefits, which are particularly helpful in managing inflammation and improving wound bed conditions. These creams generally work by reinforcing the natural wound healing process without cellular integration, making them accessible and non-invasive options for wound care.

Integrating advanced skin substitutes with established topical treatments may yield a synergistic effect in wound healing by providing both structural and cellular support alongside barrier protection and hydration. This combination approach could lead to optimized outcomes in burn and wound recovery, offering patients comprehensive options for accelerated healing, minimized scarring, and improved quality of repaired tissue.

## Cell Therapy and Regenerative Medicine for Burn Wounds

**Zahra Pourmohammadi-Bejarpasi**

***Burn and Regenerative Medicine Research Center, Velayat Hospital, School of Medicine, Guilan University of Medical Sciences, Rasht, Iran***

Burn wounds are a significant clinical challenge, especially in severe cases where conventional treatments may not effectively promote healing or restore tissue functionality. Recent advancements in cell therapy and regenerative medicine offer innovative approaches to enhance wound healing, minimize scarring, and improve long-term outcomes for burn patients. This article examines various cell-based and bioengineered therapies, detailing their mechanisms, therapeutic benefits, and current challenges in clinical application.

Mesenchymal stem cell (MSC) therapy has emerged as a promising approach for burn care. MSCs are multipotent stromal cells capable of differentiating into various cell types, including osteoblasts, adipocytes, and chondrocytes, which contribute to tissue repair. Their regenerative potential is largely due to their paracrine activity, whereby MSCs release cytokines, growth factors, and extracellular vesicles that modulate immune responses, enhance angiogenesis, and stimulate tissue regeneration. MSCs derived from sources like bone marrow, adipose tissue, and umbilical cord blood have shown efficacy in animal models of burn injuries, demonstrating reductions in inflammation, faster wound closure, and

improved skin quality. However, clinical application remains challenged by concerns about cell sourcing, immunogenicity, scalability, and potential tumorigenic risks, requiring further study and regulatory scrutiny.

Bioengineered skin substitutes are another major advancement, combining cell-based therapies with scaffold materials that mimic the extracellular matrix (ECM) to promote healing. These substitutes typically embed keratinocytes and fibroblasts within a supportive, biocompatible matrix, providing both cellular components and structural support to the wound bed. Bioengineered skin substitutes range from temporary coverings that facilitate wound healing to full-thickness grafts offering more permanent solutions. Studies have shown that these substitutes improve wound closure rates, reduce infection risks, and minimize scarring compared to traditional autografts. Despite their benefits, high production costs, limited availability, and challenges in replicating the complex architecture of human skin remain barriers to widespread use.

The controlled delivery of growth factors, such as vascular endothelial growth factor (VEGF) and fibroblast growth factor (FGF), is increasingly recognized as essential in modulating cellular activity at the wound site. These growth factors play a critical role in angiogenesis and cellular proliferation. However, direct application faces limitations due to rapid degradation and limited tissue penetration. New strategies, including the use of gene therapy vectors, hydrogels, and nanoparticle carriers, improve local bioavailability and prolong the action of growth factors, resulting in faster healing and better tissue formation.

Exosome therapy represents an innovative, cell-free approach within regenerative medicine. Exosomes, small extracellular vesicles containing bioactive molecules, are secreted by MSCs and other cell types, acting as mediators of intercellular communication. MSC-derived exosomes are rich in proteins, RNA, and other molecules that help regulate inflammation, promote collagen production, and support wound re-epithelialization. Unlike whole-cell therapies, exosome-based treatments may reduce risks associated with immune rejection and tumor formation. However, challenges in standardizing exosome production, dosing, and delivery mechanisms require further research. In summary, while cell-based and regenerative therapies for burn wounds hold great promise, their clinical translation faces obstacles related to immunogenicity, scalability, cost, and regulatory approval. Continued research and clinical trials are essential for optimizing these therapies and making them accessible, with the potential to transform treatment options for patients with severe burn injuries.

## Intraoperative 3D Bioprinting (IOB): Advancing Biomimetic Solutions for Organ and Tissue Repair

**Alireza Feizkhah**

***Burn and Regenerative Medicine Research Center, Guilan University of Medical Sciences, Rasht, Iran***

Intraoperative 3D Bioprinting (IOB) is a cutting-edge approach within regenerative medicine, designed to provide real-time, personalized solutions for organ and tissue repair directly in the surgical environment. Unlike traditional 3D bioprinting methods that require pre-printed tissues prepared in advance, IOB allows surgeons to print biomimetic tissues on demand, tailoring them precisely to the patient's anatomy and specific surgical needs. This process leverages advanced bioinks and materials engineered to replicate the biological and structural characteristics of natural tissues, promoting improved integration and functionality upon implantation.

One of the most promising aspects of IOB is its potential for advancing precision medicine by creating individualized tissue constructs during surgery. In cases where conventional tissue engineering techniques fall short, IOB can be used to address intricate anatomical requirements and provide tailored solutions that would otherwise be challenging to achieve. By enabling immediate tissue repair and organ reconstruction, IOB supports enhanced surgical efficiency and holds the potential to reduce patient recovery times.

The applications of intraoperative 3D bioprinting are broad and impactful, spanning various areas of healthcare. Key uses include organ repair, such as for

the liver, kidneys, or heart, where tissue complexity and availability have historically presented significant barriers. IOB also demonstrates promise in reconstructive surgery, specifically in bone and cartilage regeneration, skin grafting for burn or trauma patients, and vascular tissue replacement for cardiovascular surgeries.

However, while IOB holds considerable promise, several challenges must be addressed before it can be widely adopted in clinical settings. The development of bioinks that provide both biocompatibility and durability within the body remains a critical area of focus. Bioinks must support cell viability and tissue growth, as well as withstand the mechanical demands of implantation. Furthermore, the rapid evolution of IOB technology brings forward regulatory and ethical questions that must be addressed to ensure safe and effective clinical use. Approval processes for new materials and methods in bioprinting, as well as considerations around the ethical implications of real-time tissue creation, are essential steps toward broader acceptance and integration of IOB in healthcare.

As technological advancements continue to push the boundaries of intraoperative bioprinting, future directions include improving printer precision, speed, and scalability to enhance the quality and accessibility of patient care. As the technology matures, it is anticipated that IOB will not only improve surgical outcomes but also redefine regenerative medicine by bridging the gap between complex tissue engineering and clinical applications.

Keywords: Intraoperative 3D Bioprinting (IOB), Regenerative Medicine, Biomimetic Tissues, Personalized Medicine

## The Impact of an Open-label Design on Human Amniotic Membranes vs. Silver Sulfadiazine Dressings for Second-degree Burns: A Randomized Controlled Clinical Trial

**Mehran Tahrekhani[1]***

**Mohammad Hossein Moghimi[2]**

**Mehran Salehiyan[3]**

**Mohammad Abdi[4]**

***1. MScN, RN, Department of Medical-Surgical, Abhar School of Nursing, Zanjan University of Medical Sciences, Zanjan, Iran***

***2. Assistant Professor of Surgery, Department of General Surgery, School of Medicine, Ayatollah Mousavi Hospital, Zanjan University of Medical***

***3. MD, Zanjan University of Medical Sciences, Zanjan, Iran***

***4. Education Development Center (EDC), Department of Emergency and Critical Care Nursing, Zanjan University of Medical Siences, Zanjan, Iran***

Background Burn wounds require optimal medical management due to associated psycho-emotional and socioeconomic impacts, and severe pain. Utilizing synthetic and biological dressings improves healing and reduces burn wound complications. The present study aimed to compare the outcomes of using a human amniotic membrane (HAM) and conventional silver sulfadiazine (SSDZ) ointment as the dressings, in the management of the second-degree burn wound,2018, Zanjan, Iran. Methods Fifty patients participated in this clinical trial and were divided into two groups by simple randomization. The target group (n = 25) was treated with HAM, and the control group (n = 25) was treated with the SSDZ ointment. The researcher-designed checklist was used to determine the clinical performance in the follow-up assessments on days 7, 14, and 30. Results No significant difference was found in terms of gender, age, and the percentage of the burn wound (P > 0.05). Wound epithelialization (days 7,14, and 30), scar and pigmentation of the wound, pain severity, the amount of analgesia required, and the hospital stay length (on day 30) were significantly less in the target group, compared to the control (P

Keywords: Burns, Amniotic Membrane, Silver Sulfadiazine, Clinical Trial

## Effectiveness of Various Methods of Manual Scar Therapy

**Manijeh Soleimanifar**

***Assistant Professor, Lifestyle Medicine Department, Medical Laser Research Center, ACECR, Tehran, Iran***

Background: The skin is a protective barrier of the body against external factors, and its damage leads to a loss of integrity. Normal wound healing results in a correct, flat, bright, and flexible scar. Initial skin damage and patient specific factors in wound healing contribute that many of these scars may progress into widespread or pathologic hypertrophic and keloid scars. Active scars are a model of soft tissue lesions. Soft tissues surround the locomotor system everywhere. These tissues shift and stretch in harmony with joints and muscles. Active scars interfere with this type of movement, thus disturbing the function of the entire motor system

Aim: The aim of this study was to review the effects of physical and manual scar management on pain, scar thickening, surface area and loss of movement due to contracture or adhesion, also explore the possible physiological mechanisms of action. Multi approaches such as dry needling, myofascial release, massage therapy, and Kinesio taping are used to decrease the symptoms of scar tissue.

Conclusion: Manual scar therapy had a significant positive effect to influence on scar symptoms. Following Manual scar therapy, range of motion of the joints involved and the patient's functional outcome improved. In addition, these results show the importance of specific manual management on scar tissue parameters such as scar elasticity, adhesion, and regularity.

Keywords: Manual Therapy, Dry Needling, Scar Taping, Scars, Massage Therapy

## Physiotherapy in Lymph Edema

**Saeedeh Sarli**

***PT, BSc, Instructor of Lymph Edema Training Courses, Private Practitioner***

Physiotherapy plays a crucial role in the management of lymphedema, focusing on reducing swelling, improving lymphatic flow, and enhancing overall function. Lymphedema results from the inability of the lymphatic system to perform one of its basic functions: the removal of water and protein from the tissues of a certain portion of the body. This insufficiency can be caused by developmental abnormalities of the lymphatic system (primary lymphedema) or damage to the lymphatic system such as the removal or radiation of lymph nodes in cancer surgery or infection of the lymphatic system (secondary lymphedema). Lymphedema can present in the extremities, head and neck, trunk, or external genitalia. The accumulation of protein and water in the tissues may be gradual in some patients and sudden in others; the result is always a high-protein edema. The high-protein content in lymphedema can lead to secondary complications, such as hardening of the tissues over time, infections, and increase in volume, especially in untreated or mistreated lymphedema. The goal of lymphedema management is to reduce the lymphedematous swelling to a normal or near-normal size utilizing remaining healthy lymph vessels and other lymphatic pathways. Once the lymphedema is decongested, the secondary goal is to maintain the reduction and to prevent the reaccumulating of lymph fluid. These goals can be achieved with the internationally recognized "gold standard" of lymphedema treatment known as complete decongestive therapy (CDT). CDT is recognized as the therapy of choice for lymphedema by many international and national societies and associations concerned with lymphedema. The only physiological way to achieve this goal is to remove the excess plasma proteins from the tissues via lymph vessels and tissue channels. For a majority of patients, this can be achieved by the skillful application of CDT. CDT shows good long-term results in both primary and secondary lymphedema. CDT consists of a combination of MLD, compression therapy, decongestive exercises, and skin care. Individuals with chronic lymphedema may present with a variety of skin changes, due to trauma, prolong tissue hypoxia, fungal infection, immune system dysfunction, or unknown causes. Physiotherapy is an integral part of a multidisciplinary approach to managing lymphedema. By combining techniques such as MLD, compression therapy, exercise, and education, physiotherapists can help patients achieve better outcomes, improve quality of life, and manage symptoms effectively. If you or someone you know is dealing with lymphedema, consulting a physiotherapist with expertise in this area can be highly beneficial.

## Physiotherapy Modalities in Wound Management

**Soheil Mansour Sohani**

***Associate Professor of Physical Therapy, Iranian Center of Excellence in Physiotherapy, Rehabilitation Research Center, Physiotherapy Dept., School of Rehabilitation Sciences, Iran University of Medical Sciences, Tehran, Iran***

Abstract: Physical scar management represents an important field in science, as scars can negatively impact the quality of life of patients. Disturbing perceptions such as pain, tenderness or itchiness on the one hand, and functional limitations in the form of contractures on the other, are consequences of problematic scars. In addition, scar esthetics can also have a negative influence on psychosocial factors. The restoration of injured skin requires a complex sequence of physiological interactions to form appropriate scar tissue and repair the dermal lesion. Any dysfunction in the wound healing process may result in excessive scar tissue formation. Hypertrophic scars or keloids are the results of such deviant wound healing. Different therapy options, described in the literature include chemical, physical, and surgical methods. The physiotherapist focuses on conservative modalities in the treatment of scar tissue. These physical scar management options can be grouped into mechanotherapy, occlusive and hydrogenatic therapies,light therapy, laser therapy (low level ,high power), photodynamic therapy, or electrical stimulation, among others, whereby often combinations are used. The purpose of physical scar management concentrates primarily on the prevention of an aberrant healing process of the skin. Physical therapy is present in daily clinical consultations and has demonstrated a certain utility in wound healing. Physiotherapy arises as a possible safe complementary treatment that might improve the results of the traditional treatment. Physiotherapy has been demonstrated to improve tissue healing with different grades or evidence; however, further studies are necessary to develop practical protocols in clinical practice based on the theoretical mechanism of action of the therapy.

## Burn Wound Healing: Inpatient Physiotherapy

**Roghayeh Mohammadi**

***PhD PT, Neuromusculoskeletal Rehabilitation Research Center, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran***

Burn injuries are considered the most significant threat to a patient's life. Physiotherapy for burn patients cannot be conducted without understanding the wound healing process. The therapist, as an active member of the treatment team, must be knowledgeable about wound healing and its mechanisms. Therapeutic exercise programs and maintaining proper joint positions and splinting should be aligned with the wound healing process. The healing process for burn wounds often takes longer than for regular wounds. Superficial partial-thickness burns have the potential for spontaneous healing due to the presence of skin appendages, typically healing within 10 to 14 days, leading to new skin formation. Deep partial-thickness burns can also heal spontaneously, but this process takes longer (between 2 to 4 weeks), and hypertrophic scars may form at the site of new skin formation. Full-thickness burns, which damage all layers of the skin, do not have the potential for spontaneous healing and require skin grafting. However, such wounds must be prepared for grafting as soon as possible through appropriate treatments like wound care, dressing changes, debridement, and brushing, typically about a month after the burn incident.

## Electrospun Wound Dressing: Challenges and Opportunity

**Mohamad Pezeshki-Modaress**

***Burn Research Center, Iran University of Medical Science, Tehran, Iran***

***Department of Plastic and Reconstructive Surgery, Hazrat Fatemeh Hospital, School of Medicine, Iran University of Medical Sciences, Tehran, Iran***

Electrospinning is a facile technique employed to produce nanofibrous structures using different process and solution parameters for biomedical applications. It has been known that ECM protein fibers are 1 to 2 orders of magnitude smaller than the cells, therefore they are able to contact directly with the cells in three dimensional orientations which is a crucial factor in the selection of a proper scaffold. In summary, to restore the tissue function,

the micro-environmental features of a tissue-engineered scaffold must be developed to provide appropriate signals to be exchanged between the cells and the cells/environment. Therefore, fabrication of nanofibers with ideal environmental conditions could be a good solution for the development of tissue-engineered scaffolds with nanoscale structure. Electrospun nanofibers for tissue engineering applications face two main challenges. The low thickness of electrospun mats and limited cell penetration. The low thickness is the main reason for their weak load-bearing performance at clinical applications and the limited cell penetration is due to their low fiber-fiber distance during deposition process of nanofibers on collector at electrospinning. We have developed different strategies for improving these limitations of electrospun nanofibers in tissue engineering constructs by developing composite structures from different natural and synthetic biopolymers. Fabrication of multi-layered nanofibrous 3D scaffolds comprising chondroitin sulfate by electrospinning method and attaching layers via non-solvent procedure is introduced as an effective method to enhance the applicability of nanofibers for tissue regeneration applications. While nanofibers prepare an ECM-like substrate for cell attachment and proliferation, the gap between layers provides sufficient cellular infiltration and neovascularization. Core/shell composite nanofibers is another suggestion which could offer significant advantages over monolithic fibers especially for enhancing the mechanical performances. Different nature of core/shell structured nanofibers admits the on-demand features in tissue engineering, drug delivery, and dressing applications.

## Application of in Situ Gelling Nanofibers for Ocular Drug Delivery Systems

**Ahmad Hivechi**

***Institute of Pharmacy, Martin-Luther-University Halle-Wittenberg, Halle, Germany***

Ocular drug delivery faces significant challenges in passing active substances through biological barriers. Ocular infections, driven by climate and lifestyle factors, are among the most common eye diseases globally. In the Middle East, fungal keratitis is prevalent due to poor air quality, while in developed countries, contact lens use is a major source of infections. A key obstacle in treating these infections is the low bioavailability of drugs, as tear fluid rapidly eliminates most medication within seconds, often leaving no trace in the eye after a few minutes. In situ gelling nanofiber systems offer a promising solution by absorbing eye moisture to form a gel, which increases viscosity and minimizes drug clearance due to eyelid movement. In this study, various nanofibers made of Pullulan and Gellan Gum (GG) are produced employing single-needle electrospinning. The nanofibers were labeled with fluorescein dye to determine drug residence time. Nanofiber morphology was examined via a Zeiss LV-SEM (0.5–1.0 kV) without sputter coating. Data were analyzed statistically in SPSS (v29.0.1.1). Two-way ANOVA with Tukey post-hoc analysis showed that all nanofiber samples remained stable until the third clearance cycle, while approximately 80% of active drugs cleared with traditional eye drops. Modeling indicated that pure Pullulan nanofibers followed first-order removal kinetics, while Pullulan/GG nanofibers showed zero-order kinetics due to GG's gelling in tear fluid. These in situ gelling nanofibers may reduce drug dosage and administration frequency.

## Smart Wound Dressing for Advanced Wound Management: The Future of Wound Care

**Fatemeh Haghdoot**

***Department of Photo Healing and Regeneration, Yara Institute, ACECR, Tehran, Iran***

Most wound care dressings on the market today are passive and unable to react effectively to changes in the wound environment. These passive dressings can occasionally absorb excessive exudate and release angiogenic agents, antibiotics, or antibacterial substances. The incapacity of existing wound care products to offer information regarding the condition of the wound bed and its rate of healing is one of their main drawbacks. Patients must therefore undergo routine screening in order to evaluate the healing process and check for possible infections. The need to regularly monitor the healing process leads to an increase in visits, which raises treatment costs and puts additional strain

on medical facilities. The incapacity of passive wound care products to distinguish between different stages of wound healing is another significant drawback. The concentration of the necessary elements and medications may change over time since physiological processes generally proceed at varying rates during the healing process. The right use of antibiotics is another issue, as poor and preventative use can result in the emergence of microorganisms' resistant to antibiotics. Correct diagnostic and treatment choices for wound repair depend on timely and precise evaluation of wounds throughout the healing process. Recent developments in smart wound dressings that integrate wearable sensors, sophisticated drug delivery systems, and wireless communication technology could enhance wound management by enabling in situ real-time monitoring of wound-related biomarkers, early diagnosis, and on-demand treatment of adverse wound healing events, such as bacterial infection and inflammation. In this review, we gave a summary of biomarkers associated with adverse wound healing events, such as temperature, pH, uric acid, glucose, reactive oxygen species (ROS), oxygen, and enzymes, as well as existing sensors for detecting these biomarkers using colorimetric, fluorimetric, and electrochemical methods.

## Necessary for Complete Skin Regeneration - Study Using Unique Fetal Mice Model

**Kento Takaya**

***MD, PhD, Department of Plastic and Reconstructive Surgery, Keio University School of Medicine***

Regeneration constitutes one of the most critical areas of contemporary medicine. In highly developed organisms such as mammals, when an adult animal sustains a skin injury, the structure rarely undergoes complete regeneration during the healing process, resulting in scar formation. Presently, there exists no clinical methodology to entirely restore scar tissue to its original condition. Conversely, fetal skin wounds can regenerate up to a specific developmental stage without leaving scars. Consequently, there has been considerable interest in identifying the developmental stage during late fetal growth at which the skin loses its capacity for complete regeneration, transitioning instead to a scarring phenotype akin to that of adult mammals. By concentrating on the regeneration of skin texture and dermal structures, we successfully delineated, for the first time, the transition point of wound healing from the fetal to the adult phenotype. Our findings revealed that wounds inflicted before embryonic day (E) 13 achieved full regeneration of the three-dimensional texture, a process that involved the formation of actin cables at the wound margins. However, wounds sustained after E14 failed to regenerate the skin texture. Additionally, we observed that complete regeneration, as seen in E13, necessitates that the wound closes without disrupting the positional relationship between the epidermis and dermis. While dermal structures regenerate up to E16, wounds incurred post-E17 heal as scars characterized by dermal fibrosis and a lack of skin appendages, similar to adult wounds. Thus, to achieve complete skin regeneration akin to early embryonic stages, it is essential to stimulate the interaction between the epidermis and dermis alongside the formation of actin cable on the edge of the wound in later stage. Recently, we have managed to regulate scar formation within the uterus by modulating the activity of Rac1 and AMP-activated protein kinase (AMPK)—molecules integral to cell migration and actin dynamics—through pharmacological administration or genetic manipulation, thereby inducing the formation of actin cables. Moreover, we have been identifying genes, cellular populations, and signaling pathways involved in complete skin regeneration and scarring via comprehensive genetic analyses or single-cell transcriptome analysis. Our discoveries may pave the way for future treatments aimed at achieving complete skin regeneration without scarring.

## The Effect of Oral Bromelain (Pineapple) on Symptoms of Depression, Anxiety and Stress in People with Diabetic Foot Ulcers: A Randomized Controlled Clinical Trial

**Alireza Salmani[1]***

**Shokoh Varaei[1]**

**Hajar Sadeghi**[2]
**Nahid Dehghan Nayeri**[1]
**Alireza Abbassian**[1]

***1. Tehran University of Medical Sciences***
***2. University of Social Welfare and Rehabilitation Sciences***

Introduction: People with diabetic foot are prone to depression anxiety and stress due to the nature of their disease. Considering the importance of controlling depression in this group of patients, this study was conducted with the aim of determining the effect of Berlin on the Symptoms of depression, anxiety and stress in people with diabetic foot ulcers.

Methods and Materials: This double -blind and two-group clinical trial study was conducted in 2023, in which 80 people with diabetic foot ulcers in specialized wound clinics of Tehran University of Medical Sciences, who were eligible to participate in the research, were selected by sampling. were selected and randomly assigned to one of the intervention and control groups. Written consent was received from all the samples to participate in the research. 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. After the intervention, the "Dass-21 Scale" was completed again by the samples and the obtained information was analyzed with the help of chi-square, paired t and independent t statistical tests. This research has a code of ethics IR.TUMS.FNM.REC.1400.237.

Results: The average score of depression, anxiety and stress of people with diabetic foot ulcers in the experimental group before taking the drug was 16.02 ± 1.44, 11.62 ± 1.25, 13.65 ± 1.81 respectively, and after the intervention it was 10.45 ± 1.44, 7.25 ± 1.17, 1.72 respectively. ± 10.80 changed. Also, the average of this index in the control group before the intervention was 15.50 ± 3.25, 11.55 ± 3.43, 13.22 ± 3.33 and after the intervention it reached 15.15 ± 1.87, 12.22 ± 2.15, 13.17 ± 2.34. There was a statistically significant difference between the average indices of depression ($p \geq 0.00$), anxiety (p-≥-0.02) and stress (p-≥-0.00) in the test group before and after the intervention. But this difference was not significant in the control group ($p \geq 0.05$). Also, there was a significant difference between the mean index of depression, anxiety and stress in the test and control groups after the intervention ($p \geq 0.01$).

Conclusion and discussion: According to the results of the research, it seems that this herbal medicine with less side effects can be used to reduce the symptoms of depression, anxiety and stress in people with diabetic foot ulcers.

Keywords: Depression، Bromelain، DFU، Anxiety, Stress

## Fabrication And Characterization Of A Drug-Loaded Conductive Scaffold Based On Chitosan/ Polyaniline Hydrogel For Cardiac Tissue Engineering Application

**Reyhane Royan**

***Amirkabir University of Technology Reyhane***

Heart tissue repair and regeneration remain critical challenges in cardiovascular medicine. Myocardial infarction, heart failure, and cardiac arrhythmias significantly damage heart tissue, impacting its electrical properties and overall function. The main goal of cardiac tissue engineering focuses on developing effective strategies to repair and regenerate damaged cardiac tissue and promote cardiomyogenesis. The hydrogel scaffold can mimic an extracellular matrix environment that shows a porous and interconnected structure, allowing the exchange of nutrients and metabolites, facilitating cell migration, and loading drugs to promote tissue regeneration. Chitosan-based hydrogels have been widely investigated for tissue engineering due to their biocompatibility, biodegradability, and ability to form porous structures. Moreover, chitosan can be combined with other polymers to produce functional composite materials. polyaniline (PANi) offers electrical conductivity, enhancing cell proliferation and differentiation. In this study, we fabricated a conductive hydrogel made of chitosan (CS) and polyaniline (PANI) to present several properties together, and since conventional

polyaniline dopants are toxic, tannic acid as polyaniline dopant, hydrogel crosslinker, which has medicinal and antioxidant properties, has been used for heart tissue engineering. Chitosan was dissolved in a suitable solvent, acetic acid, within 24 hours. Then aniline was added to the mixture and tannic acid was dissolved in water, and then by controlling the pH of the solution, it was added dropwise to the mixture solution, and finally, ammonium persulfate (APS) was introduced to start the polymerization of aniline. Adequate time was given for the polymerization process and resulted in the formation of a conductive chitosan/PANi hydrogel with tannic acid cross-linkers. Various parameters, including polymer concentration and polymerization conditions, were optimized to achieve optimal mechanical strength and porosity. The physicochemical properties of the composite hydrogel were determined using Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM) and conductivity tests. The Cs/PAni hydrogel scaffold exhibited good conductivity and mechanical strength. Characterization confirmed the successful integration of PAni and the structural integrity of the hydrogel. We developed a conductive and biocompatible Cs/PAni hydrogel scaffold doped with tannic acid, presenting a promising candidate for cardiac tissue engineering.

Keywords: Cardiac Tissue Engineering, Chitosan, Polyaniline, Conductive Hydrogel, Tannic Acid, Biocompatible Dopant

## Targeted Treatment Based on Biological Nanoliposome Carrying Collagen and Recombinant Complex: A New Therapeutic Strategy in Wound Healing

**Hamidreza Golian[1]***
**Neda Asl Estiyari[2]**
**Ehsan Mati-Poor[2]**
**Amin Mati-Poor[3]**
**Armin Amiri[3]**
**Shahab Maleki[2]**

***1. Medical University of Tehran***
***2. Medical University of Alborz***
***3. Medical University of Iran***

Background: Bio - nanoliposome carrying fast absorbing collagen and recombination complex is an important biopolymer with a three-dimensional structure produced by modern nanotechnology and has been widely used in medicine. One of the unique characteristics of this nanoliposome is its very high water absorption, which can be used to heal deep and extensive wounds; But after drying, its three-dimensional structure collapses and its water absorption decreases. This research aims to preserve the three-dimensional structure of nanoliposomes with the help of their cross-linking and to improve the water reabsorption properties of this biopolymer. In addition, the survival, proliferation and cell growth rate of the nanoliposome structure carrying these modified and untreated strategic materials was also studied.

Materials and methods: In this research, nanoliposome was produced, purified and neutralized using static culture. Inside this nanocarrier, tissue-absorbing collagen, and tissue-restoring complexes such as minerals, vitamins, and Flaxman recombinant protein were loaded; The design system of nanoliposome surface spikes was based on the Advent Pro method. Then the samples were treated with different concentrations of citric acid/sodium hypophosphite and networked. Finally, the characteristics of processed and raw samples were checked with various tests, including ATR-FTIR, MTT, SEM, water absorption, and in vitro and in vivo tests. 100 mice divided into four groups, 25 mice in the control group, 25 mice receiving nanoliposomes designed to include grade 3 wounds in the femoral area of the hand, 25 mice receiving nanoliposomes designed to include grade 3 wounds in the italic area of the foot, and 25 mice with type 2 diabetic compound wounds in the back area. They were the backbone. Routine serology and blood tests, as well as routine liver enzymes (ALT, AST, ALP) along with an HR-CT scan two days in between with contrast, were performed and the laboratory results of recombinant protein quality tests were performed using ELISA and HPLC.

Results: Based on the obtained results, it was found

that the cross-linking operation prevents the structure from collapsing and not only does not cause toxicity, but in addition to increasing the amount of water absorption, it also increases the viability, adhesion and proliferation of cells in the repaired tissue surface. gives in all three groups that received nanoliposome-based treatment, the rate of wound healing and reduction of tissue infection and inflammation; It was significant (P

Keywords: Targeted Treatment, Biological Nanoliposome, Recombinant Complex, Wound Healing

## Photobiomodulation Therapy Ppromotes Wound Healing via Latent TGF-beta Activation

**Praveen Arany**

***University at Buffalo***

Wounds can arise due to several underlying pathophysiological processes and require immediate care to promote uneventful healing and limiting morbidity. This presentation will focus on brief background and examine evidences for the therapeutic applications of light energy treatments for wound healing. The wound healing effects of low dose laser treatments was amongst the very first therapeutic benefits described over 50 years ago. Various doses ranging from 0.1 to 10 J/cm2 and wavelengths ranging from 405 to 1000 nm appear to provide therapeutic benefits in a broad range of chronic wounds. A range of light energy sources from LEDs to lasers have been used and have specific advantages and limitations. There is a lack of consensus on standardized treatment parameters such as wavelengths, dose and therapeutic outcomes in the reviewed studies preventing direct comparison and clinical protocol recommendation. Our work has outlined the ability of PBM to activate endogenous latent TGF-β1 that has a direct effect on wound healing. This talk will outline the biophysical and biochemical evidence for this mechanism. The use of a non-invasive, economical and multipurpose application with light devices offers an attractive tool for wound management. However, there is an urgent need from the wound care community to develop optimal clinical protocols based on well-designed, rigorous clinical research studies.

## Photobiomodulation a Probable Forth Angle of Tissue Engineering

**Reza Fekrazad**

***DDS, MSc,FLD,FICD.-Founder and Head of Radiation Sciences Research Center, AJA University of Medical Sciences, Tehran, Iran***

***Founder and Director of International Network for Photo Medicine and Photo Dynamic Therapy (INPMPDT), Universal Scientific Education and Research, Network (USERN), Tehran, Iran***

Photobiomodulation (PBM) is a mechanism in which a nonionizing visible or near-infrared light form is absorbed by endogenous chromophores causing photochemical and photophysical reactions on different levels of biological scales without causing any thermal damage. PBM therapy is a photon-based therapy based on the fundamentals of PBM. Various light sources such as lasers, broadband light, and light-emitting diodes (LEDs) in the near-infrared and visible spectrum can be used for this matter. Living organisms' cells need to communicate with each other to thrive. Different pathways are used through direct contact, the nervous system, and secretions (paracrine, autocrine, juxtracrine, and endocrine signaling). The nature of these messages is considered chemical or molecular by conventional medical scientists. We can find different pathways of message transition between cells, such as electrical signaling, bio-resonance signals, low-intensity pulsed ultrasound, and ultra-weak photon emission. A variety of effects of PBM therapy have been discovered, such as inflammation reduction, stifling of pain, downregulation of aberrant immune responses, and diverse metabolic effects. On the other hand, the impact of PBM therapy on tissue regeneration and healing process improvement has been proven. Regenerative medicine has revolutionary potential by combining novel therapies such as PBMT and stem cell therapy, resulting in prompt and complete recovery and decreasing the risk of organ transplantation rejection due to autologous grafts. From my point of view, the triangle of tissue engineering consisting of a cell, scaffold, and chemical growth

factors will change to foursquare, adding a side of physical signals from biophotons shortly. As scientists interested in PBM, we should continue to enhance our understanding of basic and complex mechanisms on subcellular and organismal levels. Much has been done, but there is a lot left to achieve.

## Flexible Oleds in Future Light Based Dressings

**Ezeddin Mohajerani**

***Laser and Plasma Research Institute, Shahid Beheshti University***

Organic Light Emitting Diodes (OLEDs) represent a compelling advancement in lighting technology, introducing a range of captivating features that enhance traditional light sources. The development of blue LEDs marked a significant breakthrough for conventional LEDs, earning recognition with a Nobel Prize, and opening doors to diverse lighting and color applications. In contrast, OLEDs offer unique advantages, such as the ability to create flexible or even stretchable light sources by applying the technology to various substrates. They also enable the achievement of exceptionally high-resolution light sources capable of emitting light from spots as small as a molecule, alongside a broad spectrum of colors due to the capabilities inherent in organic chemistry. These remarkable characteristics make OLEDs particularly appealing for compact biomedical devices, where light is used for probing, imaging, manipulating, or treating biological tissues. The many benefits of OLED technology in this context will be explored, along with recent advancements in the field and ongoing research efforts from our laboratory, which we will discuss in this presentation.

## PBM in Radiation Therapy: Updates and Challenges

**Leila Ataie Fashtami[1,2]***

**Afshan Shirkavand[2]**

***1. Department of Regenerative Medicine, Royan Institute for Stem Cell Biology &Technology, ACECR, Tehran, Iran***

***2.Department of Photodynamic, Medical Laser Research Center (MLRC), Yara Institute, ACECR, Tehran, Iran***

In recent years, photobiomodulation, also known as low-level laser therapy (regardless of whether it is performed using laser light sources or LED lamps), has gained significant popularity in managing, preventing, and alleviating complications associated with cancer treatment. At the same time, concerns have been raised about the safety of using this therapeutic modality in areas where cancer cells are present, with potential risks of increased recurrence or secondary cancer. In this presentation, alongside sharing our laboratory study experience - where we investigated the benefits and drawbacks of combining electron radiation therapy with low-level laser therapy on oral SCC cell cultures - we will provide a comprehensive review of the current knowledge from credible sources regarding the safety of photobiomodulation in cancer care.

## Essential Signaling Pathways in Diabetic Cells are Activated by Photobiomodulation at 660 nm

**Nicolette Houreld**

***Laser Research Centre, Faculty of Health Sciences, University of Johannesburg***

Basic cellular functioning such as cell proliferation, migration, survival, and differentiation are regulated by signal transduction pathways. Underlying pathological conditions such as diabetes mellitus (DM) result in dysfunctional signalling pathways and biological processes that impede wound healing, leading to chronic diabetic foot ulcers (DFUs), which frequently necessitate amputation. Photobiomodulation (PBM) is a non-invasive approach that harnesses the therapeutic properties of light to promote healing, reduce inflammation, and relieve pain for the benefit of patients. Despite the medical advancement and increasing acceptance of PBM, the underlying cellular and molecular mechanisms are still not fully understood. This in vitro study aimed to determine the cellular and molecular effect of PBM at 660 nm with 5 J/cm2 on signal transduction pathways in diabetic fibroblast cells.

Proteins involved in the Wnt/β-catenin pathway, JAK/STAT pathway, and PI3K/Akt/mTOR were assessed. All three signaling pathways were triggered following PBM at 660 nm, which accelerated biological processes like cell migration and proliferation. This study clearly demonstrates that PBM mediates its effects by activating signal transduction pathways, allowing for the enhancement of wound healing, particularly under pathological conditions such as diabetes.

## Therapeutic Values of Exosomes in Cosmetics, Skin Care, Tissue Regeneration, and Dermatological Diseases

**Ehsan Taghiabadi**

***Skin and Stem Cell Research Center, Tehran University of Medical Sciences, Tehran, Iran***

***Skin Repair Research Center, Jordan Dermatology and Hair Transplantation Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran***

Exosomes, which are nanoscale vesicles secreted by almost all cell types via paracrine pathways, play a crucial role in intercellular communication. Exosomes are small extracellular nanovesicles that are released by cells, and their potential has been explored for use in cosmetics, skincare, tissue regeneration, and dermatological diseases. Exosomes have been widely exploited for nearly a decade to develop novel biological therapeutic strategies for recalcitrant clinical problems. The therapeutic value of exosomes lies in their ability to modulate the microenvironment of cells, regulate gene expression, and induce cell differentiation, which can positively impact skin health. In terms of cosmetics, exosomes have been used to reduce wrinkles, improve skin texture and hydration, enhance skin elasticity, and reduce inflammation and damage caused by UV radiation. Furthermore, exosomes have been used to promote tissue regeneration in skin wounds and to treat dermatological diseases such as systemic lupus erythematosus, psoriasis, atopic dermatitis, systemic sclerosis, pigment regulation, vitiligo, and hair growth. The existing literature demonstrated that with further research, exosomes may become a viable therapeutic option for many skin conditions.

## Wound Healing in Women Reproductive Health

**Nahid Nasiri**

***Department of Photo Healing and Regeneration, Medical Laser Research Center, Yara Institute, ACECR, Tehran, Iran***

Wound healing within the female reproductive system, encompassing the cervix, uterus, and ovaries, is critical for maintaining reproductive health and function. In the uterus, efficient healing is essential to prevent complications such as intrauterine adhesions which can impair fertility. The ovaries, subject to cyclical ovulation-related injuries, rely on precise healing mechanisms to maintain ovarian reserve and function. Additionally, emerging evidence suggests that impaired ovarian wound healing may play a significant role in the pathogenesis of Polycystic ovary syndrome (PCOS). Similarly, the cervix, often injured during childbirth or surgical procedures, requires effective repair to prevent cervical insufficiency and subsequent pregnancy complications. Key molecular players, including cytokines like TGF-β and growth factors, orchestrate these healing processes by regulating cell proliferation, angiogenesis, and extracellular matrix remodeling. Hormonal influences, particularly estrogen and progesterone, are pivotal in modulating these responses, enhancing tissue repair, and reducing fibrosis. Advances in therapeutic strategies, such as stem cell therapy and targeted molecular treatments, offer promising avenues to improve healing outcomes and reduce scarring. This review underscores the importance of understanding and optimizing wound healing mechanisms to enhance reproductive health and address related pathologies.

## Cell Therapy in Diabetic Foot Ulcer

**Nasser Aghdami**

***Department of Regenerative Medicine, Cell Science Research Center, Royan Institute for Stem Cell Biology and Technology, ACECR, Tehran, Iran***

Diabetic foot ulcers (DFUs) present a significant challenge in healthcare due to their chronic nature and the complex disruptions they cause in the wound healing process. DFUs commonly result

from an impaired healing cascade, affecting critical phases such as hemostasis/inflammation, reepithelialization, and tissue remodeling. These non-healing wounds not only diminish patients' quality of life but also place a substantial burden on healthcare systems worldwide. In recent years, stem cell therapy has emerged as a promising frontier in the treatment of chronic wounds, including DFUs, leveraging the immunomodulatory and regenerative capacities of stem cells and their derivatives. In this context, we conducted a Phase I clinical study to evaluate the safety and preliminary efficacy of placenta-derived stromal cells, embedded within an alginate hydrogel, for DFU treatment. Alginate hydrogel was selected as the cell carrier due to its excellent biocompatibility, which supports cell viability, proliferation, and differentiation. These placenta-derived stromal cells, known as DestroCell, have shown the potential to modulate inflammation, promote angiogenesis, and support tissue repair. Our trial enrolled seven DFU patients, divided into a treatment group receiving stromal cell-loaded alginate hydrogel and a control group receiving alginate alone. The results revealed that after three months, patients in the treatment group experienced an 80% reduction in wound size, with most wounds progressing to the granulation or epithelialization phase, highlighting the effectiveness of cell therapy in advancing wound repair. By contrast, the control group saw a 50% reduction in wound size, with some wounds remaining in the pre-granulation stage, indicating a higher likelihood of recurrence. Histopathological analyses demonstrated that the cell-based treatment was well-tolerated, with no signs of severe inflammation or adverse tissue responses, and the healing process was marked by the formation of collagen—a key factor in effective wound repair. This study underscores the promise of cell therapy in addressing the challenges associated with DFUs and highlights the potential of placenta-derived stromal cells within a supportive hydrogel matrix to promote meaningful clinical improvements. While these early results are promising, further investigations with larger sample sizes are necessary to confirm the full therapeutic potential of this approach and establish cell therapy as a standard treatment for DFUs.

## Automating Wound Assessment: Convolutional Neural Network Interface for WIFI and SINBAD Classification Systems

**Farideh Mostafavi**

Background: This study aimed to develop a mobile application incorporating the SINBAD and WIFI classification systems for diabetic foot ulcers, targeting healthcare professionals in wound care clinics to facilitate accurate and efficient diagnosis and management.

Methods: A total of 233 pictures of patients with diabetic foot ulcers, labeled by physicians and nurses from an outpatient wound clinic, were included in the analysis. We implemented a multitask, multi-output Convolutional Neural Network (CNN) model, utilizing the MobileNetV3 Small pretrained model as its base to assess the components of the SINBAD and WIFI scoring systems.

Results: The CNN model yielded promising performance across several metrics, including accuracy, F1 score, precision, recall, and AUC (Area Under the Curve). For the SINBAD system, the model achieved F1 scores of 100%, 95.0%, 98.0%, and 95.0% for the "Ischemia," "Bacterial Infection," "Area," and "Depth" components, respectively. In the WIFI system, it achieved 100% across all metrics for "Gangrene" and "Ischemia," with an F1 score of 97.0% for "Wound" and 88.0% for "Foot Infection"

Conclusion: The CNN model demonstrated high performance in classifying wound-related conditions, suggesting its potential for integration into clinical diagnostics to enhance decision-making in patient care. Additionally, the user interface of the application is designed for the easy classification of diabetic foot ulcers using the trained model, providing immediate feedback and improving accessibility for healthcare professionals, thus serving as a valuable tool for real-time assessment and clinical decision-making.

# Immune Priming of *Lucilia Sericata* Larvae with Leishmania Major Parasites to Elevate Anti-Leishmanial Properties for Use in The Treatment of Cutaneous Leishmaniasis

**Azam Malekian**
**Naseh Maleki-Ravasan***
**Parviz Parvizi**

***Department of Parasitology, Pasteur Institute of Iran, Tehran, Iran***

Introduction: Insects possess a simple yet specialized immune system against various pathogens. The routes and productions of their immune system against diverse pathogens and the way they enter are different. These strategies can be recruited to stimulate the immune system of therapeutic larvae of Lucilia sericata, aiming to isolate antimicrobial peptides (AMPs) against the Leishmania parasite. The aim of this study was to compare the leishmanicidal activities of two groups of larvae immunized with Leishmania and non-immunized.

Methods: In this study, second instar larvae of L. sericata and metacyclic promastigotes of L. major parasite were used. L. sericata larvae were immunized via oral feeding or subcuticular injection with the L. major in 12, 24 and 36 hours. Then, the proteins of the larvae of the treated and control groups were extracted at different time intervals and confirmed by Bradford and vertical electrophoresis methods. The anti-leishmanial effects of the fractions of two larval groups with L. major parasite strain were investigated in 5 consecutive dilutions of 0.05 to 500 mg/ml. Bioassay results were determined through microscopic observation tests, MTT and OD reading.

Results: The proteins of both immunized and non-immunized larval groups showed anti-leishmanial activities. The highest anti-leishmanial properties of both groups were determined 24 hours post immune priming with the parasite, compared to other periods. Immunized larvae showed significant leishmanicidal effects at all times compared to non-immunized ones. LC50 of protein fractions in the treatment group and the control group were calculated as 94 and 254 µg/ml, respectively.

Discussion: In recent years, maggot therapy has appeared as a complementary method in the treatment of chronic cutaneous leishmaniasis wounds. Herein, for the first time, the Leishmania- challenged larvae were used to investigate their anti-leishmanial properties. Immunized larvae showed higher leishmanicidal effects than non-immunized larvae, which is most likely related to the produced AMPs. Larvae immunized by both oral and injection routes will be new targets for drug discovery in the coming years.

Keywords: insect innate immune system, antimicrobial peptides, Zoonotic Cutaneous Leishmaniasis, maggot therapy, immune challenge

# Poster Presentations

## Platelet-rich Plasma (PRP) in the Treatment of Open Heart Wounds in the Sternum Area

**Seyed Mohammadreza Miryani**
**Zahra Amirkhani***

***Student Research Committee, Larestan University of Medical Sciences, Larestan, Iran***

Introduction: Median sternotomy and steel wires for sternum fastening is the standard approach to heart surgery. Incomplete repair combined with the movement of the chest wall, especially in the presence of predisposing factors, can lead to life-threatening deep-wound sternum infection, also known as mediastinitis, in 2 to 5 percent of cases. Despite current antibiotic and surgical treatments, mediastinitis is associated with a mortality rate of 10 to 40 percent and a significant increase in complications and hospitalization, mainly due to the entry of pathosenas through postoperative ulcers. One of the new ways to treat these wounds is to use PRP.

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 " Platelet-rich plasma(PRP)", " Open heart ulcers in the sternum area" and " Prevention of mediastinitis".

Result: PRP is a biological product made from the patient"s blood and collected through centrifuges. That makes it possible to extract plasma with platelet concentrations up to five times higher than normal blood.In tissue repair and wound healing, which is based on the fact that protein substances such as cytokines, interlokines, platelet growth factor, insulin-like growth factor, fibroblast growth factor and other growth factors present in this solution can contribute to the phenomenon of repair in body tissues and angiogenesis. This process is guided by substances secreted from platelets. It also plays a role in this type of gel treatment in bone repair. PRP gel ensures a slow release of growth factors, an increase in mesenchymal stem cells, and a safe stern healing process. In addition, when PRP is combined with fibrin or thrombin along with calcium, it provides a lower rate of infections without side effects.

Conclusion: According to the review, utilizing PRP to treat wounds post cardiovascular surgery significantly decreases the likelihood of Mediastinitis in patients, while remaining cost-effective and user-friendly. Despite these promising findings, the limited number of studies available, coupled with small group sizes, raises concerns regarding the potential for bias and limits the level of evidence. To ensure the validity and effectiveness of this treatment, additional research must be conducted, including larger and higher - quality studies.

Keywords: Platelet - rich Plasma (PRP), Open Heart Ulcers in the Sternum Area, Prevention of Mediastinitis

## Phototherapy Technologies and Nanostructured Dressings for the Treatment of Infected Wounds

**Akram Nadi**

***Stem Cell Biology Research Center, Yazd Reproductive Sciences Institute, Shahid Sadoughi University of Medical Sciences, Yazd, Iran***

Introduction: Wound infections are a major problem in clinical practice because they can cause tissue damage, delayed healing, and even systemic infections. Antibiotics and other traditional treatment methods are losing their effectiveness, so researchers are looking into alternative therapies like phototherapy and nanostructured wound dressings. Phototherapy, which includes photodynamic therapy (PDT) and photothermal therapy (PTT), uses light energy to destroy microbes without damaging healthy tissue. Nanostructured dressings improve wound healing by acting as an antimicrobial, stimulating tissue regeneration, and delivering therapeutic agents.

Material and Methods: This brief review paper

demonstrates how nanostructured dressings and phototherapy technology can effectively heal infected wounds.

Results and Discussion: There is great hope for the treatment of infected wounds with the combination of phototherapy and nanostructured dressings. When dressings containing silver nanoparticles were applied in conjunction with photodynamic treatment, the antibacterial activity against germs that were resistant to several drugs was significantly increased. Reducing bacterial load and stimulating tissue regeneration were both achieved using photothermal therapy with hydrogel dressings loaded with gold nanoparticles. To top it all off, the nanostructured dressings enhanced moisture retention and allowed for the regulated release of therapeutic chemicals, making for an ideal wound healing environment. Ensuring the nanomaterials" stability and safety over the long term and improving phototherapy dosage and light exposure are also ongoing challenges.

Conclusion: An innovative and efficient method for treating infected wounds is the combination of phototherapy technology with nanostructured dressings. Wound healing outcomes can be improved with the help of these therapies, which not only fight antibiotic resistance but also promote tissue regeneration and increase the effectiveness of antimicrobials. Optimization of treatment procedures and assurance of biocompatibility should be the primary goals of future research into the practical application of these technologies in combination. Patients suffering from chronic and infected wounds may find new hope in the potential for these advanced therapies to be widely used in wound care in the future.

Keywords: Photothermal Therapy; Wound Healing; Nanomaterials

## An Electrospun Nanofiber with Vessel-derived Extracellular Matrix for Wound Healing Application

**Khadijeh Baaji[1]**
**Maryam Tamimi[2]**
**Fahimeh Sangsefidi[3]**
**Sara Rajabi[4]**
**Tayyeb Ghadimi[5,6]**
**Mohamad Pezeshki-Modaress[5,6]***

***1. Soft Tissue Engineering Research Center, Tissue Engineering and Regenerative Medicine Institute, Central Tehran Branch, Islamic Azad University, Tehran, Iran***

***2. Department of Tissue Engineering and Regenerative Medicine, Faculty of Advanced Technologies in Medical Science, Iran University of Medical Sciences, Tehran, Iran***

***3. Department of Polymer Engineering, Faculty of Engineering, Qom University of Technology, Qom, Iran***

***4. Department of Cell Engineering, Cell Science Research Center, Royan Institute for Stem Cell Biology and Technology, ACECR, Iran***

***5. Burn Research Center, Iran University of Medical Sciences, Tehran, Iran***

***6. Department of Plastic and Reconstructive Surgery, Hazrat Fatemeh Hospital, School of Medicine, Iran University of Medical Sciences, Tehran, Iran***

The design of tissue engineering composites has introduced a promising strategy for skin substitutes and overcoming the limitations of autologous grafts. The ideal skin substitute should be permeable, biocompatible, and biodegradable while creating a physical barrier against damage and the entry of microorganisms. In this study, we aimed to construct and investigate three-dimensional biological scaffolds based on aortic Extracellular matrix(ECM) and hybrid polymeric nanofibers for repairing full-thickness wounds. Therefore, we developed hybrid polymeric nanofibers, followed by incorporating vessel-derived ECM into the composition. Having created the construct, its associated effect on the structure of hybrid polymeric nanofibers was investigated, and our findings showed that the electrospun nanofibers showed favorable mechanical performance and cell compatibility. In addition, dynamic cell cultures of human fibroblast cells (HDF) on composite were given to be interpreted by a professional expert in this area. A cell culture study showed that the proliferation of HDF cells was enhanced, and the cell attachment and viability were improved significantly. These findings suggested that scaffolds can be an appropriate choice for wound healing.

Keywords: Wound Healing, Electrospinning, Extracellular Matrix, Hybrid

## Effect of Chitosan-based Hydrogel Injection on Repair of Spinal Cord Injury

**Zahra Niknam[1]**
**Hakimeh Zali[2]***

***1. Neurophysiology Research Center, Cellular and Molecular Medicine Research Institute, Urmia University of Medical Sciences, Urmia, Iran***

***2. Department of Tissue Engineering and Applied Cell Sciences, School of Advanced Technologies in Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran***

Spinal cord injuries (SCIs) often result in debilitating neurological deficits and pose significant challenges for effective treatment and rehabilitation. This study investigates the therapeutic potential of hydrogel injection as a strategy to promote recovery following SCI in rats. We developed a biocompatible hydrogel formulation based on chitosan polymer, designed to mimic the extracellular matrix and provide a supportive environment for cellular infiltration and regeneration. In a controlled preclinical SCI rat model, we administered hydrogel injections at the injury site and assessed outcomes through behavioral tests, histological analysis, and immunohistochemistry. Our results demonstrate that hydrogel injection significantly enhances functional recovery, reduces inflammation, and promotes axonal regeneration compared to control groups. Furthermore, the hydrogel effectively delivered neuroprotective factors, facilitating neuronal survival and tissue repair. These findings suggest that hydrogel injection represents a promising approach to augment recovery after SCI, highlighting its potential for clinical translation. Future studies will focus on optimizing hydrogel properties and delivery methods to maximize therapeutic efficacy in human applications.

Keywords: Spinal Cord Injury, Chitosan, Hydrogel, Regeneration, Inflammation

## Fabrication and Evaluation of Electrospun Polycaprolactone / Gelatin Scaffolds Containing Multi-Walled Carbon Nanotubes Applicable for Nerve Tissue Engineering

**Samin Jafarpour***
**Mohsen Shahrousvand**
**Soroosh Shams**
**Jamshid Mohammadi Roshandeh**
**Payam Zahedi**

***University of Tehran***

Electrospinning - based polymer scaffolds represent a promising avenue for addressing nerve tissue damage, particularly over extended distances, by furnishing a nanostructured environment that mimics natural extracellular matrix (ECM) features. This study aimed to develop a scaffold possessing requisite nerve tissue characteristics. Poly (ε-caprolactone) (PCL), chosen for its biocompatibility, flexibility, mechanical strength, and drug delivery capabilities, was combined with gelatin to counteract PCL"s hydrophobic nature and slow degradation rate. Various PCL/gelatin scaffold compositions were prepared, and SEM, mechanical, and contact angle tests were conducted to assess scaffold properties. Optimal composition (PCL:gelatin at 70:30 ratio) was determined. Next, multi-walled carbon nanotubes functionalized with hydroxyl groups (MWCNT-OH) were added to enhance conductivity and decrease fiber diameter. SEM, mechanical, and conductivity tests were performed, revealing an optimal MWCNT-OH concentration (0.5%). Subsequently, retinoic acid was incorporated with polyvinyl alcohol (PVA) into the scaffold to bolster nerve differentiation, biodegradability, biocompatibility, and cell adhesion. Drug release and biodegradability tests demonstrated satisfactory results, with the PGCR1 scaffold exhibiting notable improvements. MTT and cell staining assays confirmed biocompatibility across all samples, with PGCR1 demonstrating enhanced cell adhesion attributed to retinoic acid"s

influence on cellular processes. Overall, these findings highlight the potential of electrospun PCL/gelatin scaffolds supplemented with MWCNT-OH and retinoic acid for nerve tissue engineering applications.

Keywords: Poly (E-caprolactone), Gelatin, Nerve Tissue, Nanofibers, Retinoic Acid

## Review of Biodegradable Dressings for Chronic Wounds

**Pouya Saber Farzam**
**Alireza Salmani**
**Sara Javanmardi***

***Faculty of Veterinary Medicine, University of Tabriz, Tabriz, Iran***

Introduction: Chronic wounds represent a heavy burden in health care, with continuously increasing prevalence and treatment costs. Traditional wound dressings are most often produced using synthetic polymers and face important environmental issues due to their nonbiodegradable character. Biodegradable wound dressings offer an environmentally friendly alternative while also providing essential properties like maintaining moisture, being antimicrobial, and compatible with healing processes. This review covers recent developments concerning biodegradable dressings, particularly focusing on starch/polyvinyl alcohol (PVA) - based films combined with additives like nano-zinc oxide (nZnO) to enhance antibacterial and mechanical properties.

Methods: Biodegradable dressings were investigated through critical review of scientific literature and case studies carried out on wound healing. Some of the key parameters like water vapor transmission rate (WVTR), swelling index, and mechanical strength, and other criteria like antibacterial activity, were evaluated in some of the biodegradable dressings, such as the starch/PVA blend. The approach included spectroscopic analysis to determine the ultra-violet light protection provided by the dressings, scanning electron microscopy (SEM) analysis to study the surface morphology of the dressing films, and bacterial inhibition test using Staphylococcus aureus and Escherichia coli.

Results: Results have proved that the biodegradable dressings, in particular, the ones reinforced with nZnO, ensured superior performances. Optimal WVTR was obtained with these materials that provided the right moisture at the wound site without promoting infection. Swelling and solubility showed high fluid intake, essential for wound exudate absorption. Mechanical tests confirmed the enhancement in tensile strength with the addition of nZnO. Antibacterial tests showed that there is distinct inhibition of bacterial growth, especially E. coli and S. aureus, thereby increasing the rate of wound healing. Biodegradation testing further confirmed these dressings for ecological acceptability by their efficient degradation without toxic residues.

Conclusion: Biodegradable dressings, mostly based on starch/PVA films enriched with nZnO, seem to be promising candidates for the treatment of chronic wounds, while they provide all the main benefits of maintaining moisture, antibacterial protection, and mechanical resilience apart from answering ecological challenges. Long-time efficacy and optimization of the formulation against different types of wounds should be researched further.

Keywords: Review of Biodegradable Dressings For Chronic Wounds

## Wound Healing Efficacy of Henna (Lawsonia Inermis) Extract in Chitosan and Alginate Natural Polymers

**Tayyebeh Ghaffari[1]***
**Mohammad Nouri[2]**

***1. Azerbaijan Student Research Center***
***2. Stem Cell Research Center***

The critical importance of wound healing in human health underscores the pressing demand for developing novel substances with wound-healing properties. The present study aimed to assess the effectiveness

of henna (Lawsonia inermis) extract in chitosan and alginate natural polymers for wound healing. In recent years, several methods for synthesizing nanocarriers have emerged. These methods focus on utilizing smart nanocarriers that can respond to their surroundings and deliver their payload in a controlled manner when triggered by internal or external stimuli. In our study, we have successfully created polymeric nanocarriers (PNCs) based on chitosan/alginate loaded with henna extract. The synthesized PNCs were characterized using SEM, DLS, and TEM techniques. The SEM size of the nanoparticles was $10.32 \pm 1.5$ nm. The henna extract content of the PNCs was 89 mg g−1 with a drug loading efficiency of 71%. The in-vitro cytotoxicity of henna extract, PNCs, and henna extract-loaded PNCs on the HFF-2 cell line was determined by MTT assay. The IC50 concentrations for henna extract and henna extract-loaded PNCs were 82.86 and 91.7 µg mL−1, respectively. Cell migration assay was determined by scratch test on HFF-2 cell line. Our results showed that henna extract-loaded PNCs prompted cell proliferation and migration capability in 24 and 48 hours. The results suggest that henna extract-loaded PNCs could be a potential source for promoting skin wound healing.

Keywords: Lawsonia Inermis, Polymeric Nanocarriers, Wound Healing

## The Role of Gold Nanoparticles in Wound Healing: A Review Article

**Niyaz Gharooni**
**Elmira Roshani Asl***
**Hamidreza Zeratie**

***Saveh University of Medical Sciences***

Background and Objectives: Wound healing continues to pose significant challenges that remain unsolved. Researchers have shown a growing interest in gold nanoparticles (AuNPs) over other types of nanoparticles due to their unique size-dependent chemical, electrical, and magnetic properties, which hold potential for various biological applications. Additionally, AuNPs offer several benefits for wound healing, including antioxidant, anti-inflammatory, and antibacterial properties, as well as the ability to neutralize free radicals, thereby reducing inflammation and enhancing the healing process.

Material and Methods: In this review, article published from 2020 to 2024 were searched in Pubmed, Google scholar and Web of science. The subject search was done through Mesh.

Results: In wound management, gold nanoparticles (AuNPs) play a crucial role due to their antioxidant and antibacterial properties, which have proven to be effective in the wound healing process. The anti-inflammatory and anti-angiogenic effects of AuNPs promote the release of proteins vital for healing. Their action is linked to metabolites from the bacterial cell wall, which in turn stimulates the enzyme ATP synthase. This stimulation results in a depletion of cellular energy, leading to the death of bacterial cells. Additionally, nanoparticles support the regeneration of damaged collagen tissues and facilitate collagen deposition, promoting re-epithelialization. AuNPs are advantageous in biomedical applications, as they can incorporate various biomolecules. The incorporation of the gold surface does not alter the structure of collagen or collagen crosslinks, allowing for synergistic interactions with polysaccharides, growth factors, peptides, and other molecules that enhance cellular adhesion. These modified AuNPs exhibit biocompatibility and biodegradability, making them suitable for a variety of wound healing applications. Similar to collagen, chitosan, and gelatin, these substances can also be combined with AuNPs, yielding positive results in accelerating the healing process.

Conclusion: Nanoparticles hold significant promise as components of wound dressings, serving as an alternative to antibiotics. Unlike traditional antibiotics, nanoparticles are associated with fewer side effects and a reduced risk of developing microbial resistance. This characteristic enables their use in combating the growth of drug-resistant bacteria. Advanced hydrogel formulations have incorporated nanoparticles such as silver, zinc oxide, and gold, which have shown remarkable therapeutic properties that aid in the healing of wounds.

Keywords: Nanoparticles, Wound Healing, Gold, Gold Nanoparticles

## Application of Natural Hydrogels in Preventing Adhesions After Surgery in Recent Years: A Review

**Afsaneh Nemati**
**Simzar Hosseinzadeh***

***Department of Tissue Engineering and Applied Cell Sciences, School of Advanced Technologies in Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran***

Intruduction: In recent years, natural hydrogels have attracted significant attention as an effective solution for preventing postoperative adhesions, a common complication following surgical procedures. This review article examines recent findings and advancements in the application of natural hydrogels for adhesion prevention.

Characteristics and Mechanisms of Hydrogels: Hydrogels are recognized as three-dimensional networks of hydrophilic polymers that can swell in water, mimicking the properties of soft tissues. Their ability to retain moisture and create a biocompatible environment makes them ideal candidates for surgical applications. Recent studies emphasize the role of hydrogels in accelerating wound healing, as these materials minimize tissue trauma and inflammation by maintaining moisture and providing optimal conditions for drug delivery.

Preventive Strategies: The application of hydrogels in reducing adhesion formation involves creating physical barriers that separate healing tissues while also delivering anti-inflammatory agents directly to the surgical site. Existing evidence indicates that hydrogels not only function as barriers but also facilitate localized drug release, thereby reducing inflammation and promoting tissue regeneration.

Recent Innovations: Recent innovations have led to the development of advanced hydrogel formulations. For instance, the introduction of sprayable hydrogels demonstrates how these materials can be applied directly to surgical sites, providing immediate protection against adhesion formation. This method allows for ease of application and ensures that the hydrogel conforms effectively to irregular surfaces.

Natural Biomaterials: The significance of using natural polymers such as hyaluronic acid and chitosan in hydrogel formulations is noteworthy. These materials exhibit excellent biocompatibility and possess intrinsic anti-inflammatory properties that contribute to adhesion prevention. The synergistic effects of these natural components enhance the mechanical stability and degradation profiles of hydrogels, making them suitable for prolonged use post-surgery.

Conclusion: Ultimately, the use of natural hydrogels is recognized as a promising strategy for preventing postoperative adhesions. The integration of advanced hydrogel technologies with natural biomaterials offers a multifaceted approach to improving surgical outcomes. Future research should focus on optimizing these formulations for specific surgical contexts while ensuring their efficacy and safety in clinical environments. As our understanding of hydrogel mechanisms deepens, their role in postoperative care is expected to expand, potentially revolutionizing standard practices in surgery.

Keywords: Natural Hydrogels, Prevent, Adhesion, Surgery

## Wounds Caused by Pathogenic Parasites and Parasitic Infections and Methods of Healing Wounds and Damaged Tissues

**1. Mohammad Taghi Ahady[1]***
**2. Ailar Abyari[2]**

***1. PhD of Parasitology, Department of Biology, Faculty of Basic Sciences, Ardabil Branch, Islamic Azad University, Ardabil, Iran***

***2. Undergraduate Student of Microbiology, Department of Biology, Faculty of Basic Sciences, Ardabil Branch, Islamic Azad University, Ardabil, Iran***

Abstract Background: Wounds are one of the most important problems threatening human health throughout the world. Many causes and factors can cause wounds and lesions in the skin and internal tissues of the body. One of the important factors underlying and aggravating the wound is microbial infections. The purpose of this systematic review was to identify and introduce the types of pathogenic parasites and parasitic infections that are the cause of various skin lesions and

wounds. Also, introducing effective methods of healing wounds and internal tissues damaged by parasitic infections was one of the aims of this study.

Methods: In this systematic review, in order to access scientific resources and collect specialized articles, various sites and data banks including Google Scholar, PubMed, SID, magiran, Elsevier, and Web of sciences were referred to. The key words and phrases that used in the internet search were: wound and pathogenic parasites, wound and protozoan parasites, wound and multicellular parasites, wound and parasitic infections, wound healing and parasitic infections.

Results: Among 98 articles collected, 31 articles were selected for study due to the specialization of their content. The results of this study showed that some parasitic infections caused by protozoan, multicellular (helminthic) parasites and ectoparasites lead to the creation several kinds of wounds and lesions on the skin and internal tissues. The most important protozoan parasites are Leishmania (leishmaniasis), Trypanosoma (trypanosomiasis), and Plasmodium (malaria), which cause skin and mucocutaneous lesions, ulcers, necrosis, and tissue and skin scars. Among the pathogenic multicellular (helminthic) parasites, Ascaris, Schistosoma and Filaria cause wounds, ulcers and skin lesions, granulomatous lesions, severe lymphatic and skin inflammations and inflammation in internal organs such as intestines, liver and bladder. Ectoparasites such as mites, ticks and lice can also cause a range of wounds and skin lesions such as nodules, granulomas, dermatitis, and hemorrhagic wounds. Today, various methods and techniques are available to repair damaged tissues and wounds caused by pathogenic parasites and parasitic infections. These include use of anti-parasitic drugs such as albendazole and praziquantel, anti-inflammatory drugs, traditional skin wound care methods, bioactive dressings, tissue regeneration techniques such as the use of stem cells, tissue engineering, and the use of vaccines and Immunotherapy indicated.

Conclusion: Some protozoan, helminths, and ectoparasites can damage the skin tissue, and internal organs of the body and cause various skin wounds. Applying multiple and combined methods and measures to treat and repair wounds and skin lesions caused by parasitic infections can be very effective.

Keywords: Wound and Pathogenic Parasites, Wound and Protozoan Parasites, Wound and Multicellular Parasites, Wound and Parasitic Infections, Healing of Wound and Damaged Tissues Caused by Parasitic Infections

## Application of Titanium Dioxide Nanoparticles in Wound Treatment

**Mehdi Gharehbaghi[1]**
**Pouya Saber Farzam[1]**
**Poorya Babaei Tarkami[1]**
**Sara Javanmardi[2]***

***1. Doctor of Veterinary Medicine student , Faculty of Veterinary Medicine, University of Tabriz, Tabriz, Iran***

***2. Department of Clinical Science, Faculty of Veterinary Medicine, University of Tabriz, Tabriz, Iran***

Background: The use of Titanium dioxide nanoparticles is known for its antimicrobial effect, excellent biocompatibility, and enhancement in tissue regeneration, finding its place in wound treatment. In this regard, the possible alternative use of Titanium dioxide nanoparticles (TiO2-NPs) because use of rising antibiotic-resistant infections has great potential in the treatment of infection to accelerate wound closure and tissue repair.

Materials and Methods: The present review combines the results of studies using both animal models and clinical trials in which Titanium dioxide nanoparticles applied to the wounds alone or with the help of a carrier like gelatin. Different models of wounds were studied-infected excision wounds being among them- on the effectiveness of wound healing, including microbiological studies, measurement of wound contraction, and histopathology. In vitro testing of antibacterial efficacy by agar diffusion tests and the process of wound healing were followed by reduction in wound area, histopathological studies, and quantification of hydroxyproline content to demonstrate accumulation of collagen.

Results: It showed that there is considerable antimicrobial activity of titanium dioxide nanoparticles, especially against Methicillin-resistant Staphylococcus aureus (MRSA) the most common isolated bacterial microorganism from infected wounds, which will reduce bacterial counting in the tissues of wounds compared to the control or gelatin-treated group. It was found that in the TiO2-NPs-treated wounds, there was acceleration of wound contraction and epithelization, improved fibroblast proliferation, collagen synthesis, and less infiltrated inflammatory cells. The combination of TiO2-NPs with gelatin was proved to enhance wound healing considerably compared to its standalone components.

Conclusion: Titanium dioxide nanoparticles represent an important alternative in wound management because of the antimicrobial defense properties combined with the process of accelerating wound healing. Supplementation with TiO2-NP, especially when transported by biocompatible gelatin carriers, improves wound contraction and epithelization, with increased collagen synthesis, avoiding infection. These findings support the role of TiO2-NPs as a potentially active therapeutic agent in the management of chronic infected wounds.

Keywords: Titanium Dioxide, Wounds Treatment, TiO2-NPs, Antimicrobial Activity, Treatment of Infection

## Review of Nano Technology Advances in Wound Treatment: Electrospun Nanofibers

**Poorya Babaei Tarkami[1]**
**Mehdi Gharehbaghi[1]**
**Pouya Saber Farzam[1]**
**Sara Javanmardi[2]***

***1. Doctor of Veterinary Medicine Student, Faculty of Veterinary Medicine, University of Tabriz, Tabriz, Iran***

***2. Department of Clinical Sciences, Faculty of Veterinary Medicine, University of Tabriz, Tabriz, Iran***

Background: Nanotechnology has been a great development significantly enabled in wound management. In this respect, the Electrospun Nanofibers (will be referred as EN hereafter) hold huge importance because of their potential to mimic the skin"s natural extracellular matrix (ECM) and their considerable role in ensuring wound healing. The specific features of those biomaterials offer a high level of the ratio between surface area and volume with tunable mechanical properties, which ensures enhanced cell activities toward fastening healing. It is now possible to perform various drug delivery systems and stem cell-based therapies, facilitated by such fibers that are changing the face of wound management.

Materials and Methods: This review intends to summarize some of the current lab and animal studies and emphasize approaches based on Electrospinning Techniques for the fabrication of Nanofiber Scaffolds for wound repair. The preparation mechanisms, material composition, and bioefficacy of Scaffolds for Tissue regenerative and pharmaceutical delivery applications are discussed in some detail. A wide variety of natural and synthetic polymers reviewed on the subject is used during the fabrication of Electrospun Nanofiber Scaffolds by different mono-axial, coaxial, and emulsion Electrospinning Techniques. It provides, in great detail, the directions in which such material is engineered to mimic the ECM and applies to drug delivery by incorporating stem cells for enhanced Wound healing.

Results: Electrospun Nanofibers enhanced Wound healing significantly. In vitro studies showed that ENs can realistically mimic the ECM, making cell adhesion, migration, and proliferation possible. Because of the porous architecture significantly designed for this purpose, there is optimum oxygenation and nutrition exchange without allowing microbial invasion; thus, it is highly suitable for Wound dressings. Animal models indicated that, compared to controls, in vivo studies with significant acceleration of Wound closure by ENs were associated with improved tissue organization. Several bioactive agents like curcumin, antibiotics, and growth factors impregnated within the Electrospun Scaffolds had shown sustained drug release, less inflammation, and faster healing. Stem cell-laden EN Scaffolds demonstrated improved tissue regeneration by improved angiogenesis and deposition of collagen, hence stronger and more functional tissue repair. The

ENs provided an excellent transport vehicle for the stem cells, maintaining their viability and embedding them within the injured tissue.

Conclusion: Electrospinning obtained Nanofibers represent the future of medical treatment related to Wound care: multi-functional Scaffolds for tissue regeneration, giving the right drug delivery enabling treatments with stem cells. Future investigations should be oriented toward optimizing the clinical applicability of these materials, meanwhile the intelligent concept of wound dressings toward real-time monitoring and adequate treatment.

Keywords: Electrospun Nanofibers, Wound healing, Tissue regeneration, Nano Technology

## The Healing Power of Bromelain: Innovations in Burn Treatment

**Dorsa Miri[1]**
**Setare Abolghasemi[1]**
**Mobina Tajdari[1]**
**Amir Rezazadeh[2]***

***1. Clinical Pharmacy, Faculty of Pharmacy, Azad Islamic University of Medical Sciences, Tehran, Iran***
***2. Clinical Pharmacy, Faculty of Pharmacy, Iran University of Medical Science, Tehran, Iran***

Background: Burn injuries are a significant global health concern, leading to substantial morbidity and mortality. Scarring, a common complication of burns, can significantly impair function, appearance, and quality of life. While various therapeutic strategies exist, the search for effective and safe scar management approaches continues. Bromelain, a proteolytic enzyme derived from pineapple stem, has shown promise in wound healing and anti-inflammatory activities, sparking interest in its potential for scar reduction.

Methods: A comprehensive search of relevant databases (PubMed, Google Scholar, Cochrane and scopus) was conducted using keywords such as "bromelain," "burn," "scar," "wound healing," and "skin regeneration" from 2000 up to October 2024.

Result: Following a burn injury, there is an increase in proteolytic activity at the site of the wound. Bromelain as a proteolytic enzyme, has been specifically utilize to debride burn wounds and facilitates wound healing. It also preserves the integrity of the surrounding healthy tissue so the application of bromelain for the debridement of eschar in deep burns is regarded effective and can reduce the autografting. NexoBrid a concentrate of proteolytic enzymes enriched in bromelain is a product designed for topical application and can dissolve burn eschar. Early debridement is considered a crucial component in the management of deep partial and full thickness burns. This procedure is intended to manage wound bioburden effectively and facilitate prompt wound closure. The preservation of viable dermis, along with early wound closure, is viewed as an essential measure to minimize complications associated with scarring. Eearly removal of eschar within 72 hours enhances the results of burn wound management by decreasing bacterial colonization, minimizing the risk of infection, and shortening the duration of hospitalization. NexoBrid achieves early complete eschar removal (ER) in over 90% of burn patients, while also decreasing the median time to ER, minimizing blood loss, reducing the area of burns excised, and lowering the necessity for surgical intervention. Oral Bromelain has shown the potential effect on alleviate pain following free gingival grafting and may additionally promote the healing of wounds but the significant pain levels reported with the NexoBrid™ procedure and subsequently its need for local anesthesia, have posed considerable obstacles to the integration of this procedure into standard burn management practices. Bromelain may serve as a therapeutic option for Peyronie's disease by disrupting collagen within the bloodstream. Bromelain can digest collagen by stimulating of collagenase and cleaving of peptide bonds that maintain the integrity of collagen.

Conclusion: The available evidence suggests that bromelain may play a significant role in mitigating the development of excessive scarring after burns, reduction of pain and inflammation, and promotion of wound healing. Also its ability to modulate collagen deposition and promot cell migration offers a promising avenue for improved scar management. However, the current research base remains relatively small, and further investigation is required to establish optimal dosage, administration routes, and long-term efficacy

in humans. Larger-scale, well-designed clinical trials are necessary to evaluate the potential of bromelain as a therapeutic option for burn scar reduction and improve its integration into standard clinical practice.

Keywords: Bromelain, Burn, Scar, Wound Healing, Skin Regeneration

## Telenursing and Telerehabilitation: New Additions to Wound Management

**Moein Sheikh Ahmad Saffari[1]**
**Amirhosein Altafi[1]**
**Adel Eftekhari[2]***

***1. Nursing Student of Meybod Nursing School, Shahid Sadoughi University of Medical Sciences, Yazd, Iran***

***2. PhD in Health in Emergencies and Disasters, Department of Nursing, Meybod School of Nursing, Shahid Sadoughi University of Medical Sciences, Yazd, Iran***

Introduction: In general, the policy of dealing with wounds can be summarized in a continuous hierarchy of preventive, therapeutic, care and rehabilitation measures. care and rehabilitation measures, as an important part of the challenging path of wound management, include axes such as education, evaluations, follow-ups, and alleviation of possible complications. this stage of actions actually pursues the ultimate goal of improving the quality of life of the patient and the end of the wound healing process; due to this colorful role, there is a constant need for excellence and progress of its implementation methods. in this study, some of the new methods of care and rehabilitation in wound management have been investigated.

Methods: In the present study, keywords Wound care, Telenursing, Rehabilitation, Telerehabilitation were searched in PubMed, Google Scholar, Scopus in the time range from 2014 to 2024.

Results: Telenursing and telerehabilitation are examples of integrating technology with health services. the introduction of these innovative methods in the wound field has created a good platform for increasing the quality of care and patient satisfaction. for example, studies have shown that wound field specialist nurses can carry out their educational mission remotely; This style of education, in addition to leading to the continuation of communication between nurses and patients, is more useful for those patients who are involved in chronic wounds and can reduce the pressure of treatment caused by the need for frequent visits. also, nurses can be in a position to be aware of all the actual and potential complications of all kinds of wounds and, if possible, on this platform and from a distance, provide counseling to adjust these complications. in another study, referring to the long-term process of healing some wounds and that the rehabilitation program should be implemented in parallel; A proposal to implement a part of the program in absentia has been proposed, during which if the infrastructure is available The possibility of documenting wound healing under the electronic file, There are also continuous evaluations of the wound and the adequacy of the rehabilitation program.

Conclusion: The use of remote care technologies in wound management has already been done successfully. Although it still has limitations such as the lack of infrastructure, the concern of protecting the privacy of patients, etc.; But fortunately, until now, an effective method has been found in the matter of wound health, and it is also cost-effective in terms of costs and time, and it is constantly being developed.

Keywords: Wound Care, Telenursing, Rehabilitation, Telerehabilitation

## Parsley Exosomes for Wound Healing Application

**Somayeh Alimohammadi[1]***
**Masoumeh Rezaei Sume Lu[1]**
**Leila Roshangar[2]**

***1. Biotechnology Research Center, Tabriz University of Medical Sciences, Tabriz, Iran***

***2. Department of Anatomical Sciences, Faculty of Medicine, Tabriz University of Medical Sciences, Tabriz, Iran***

Exosomes are extracellular nanovesicles that resemble plasma membranes and are released by various cells to

facilitate intercellular communication and modulate immune responses against pathogens. Their internal contents are safeguarded by a bilayer membrane. Plant-derived exosomes have distinct characteristics, and given the challenges and costs associated with extracting human exosomes—along with their potential to activate the immune system—plant exosomes may be a more advantageous alternative. This study is the first to extract and characterize exosomes from parsley, focusing on their morphological features and effects on healthy human fibroblast cells. The ultracentrifugation method was employed to isolate the exosomes, which were then prepared for dynamic light scattering (DLS) and scanning electron microscopy (SEM) analysis. The findings indicated that parsley exosomes are quite small, measuring approximately 70 nm, with a negative zeta potential. Subsequent tests, including the Bradford assay, were conducted to assess the presence of proteins within the exosomes, revealing a significant protein content. Additionally, polysaccharide compounds and freeze-drying techniques were utilized to stabilize the exosomes. Ultimately, the positive effects on fibroblast cell proliferation suggest that these exosomes hold great promise for wound healing applications.

Keywords: Exosome, Wound Healing, Parsley

## Fear of Amputation and Perceived Stress and Depression in Patients with Diabetic Foot Ulcers: A Rreview Study

**Mohammad Javad Aminifar**

***Iran University of Medical Sciences***

Introduction: Diabetes mellitus leads to serious complications like diabetic foot disease (DFD). DFD can result in lower limb amputation (LEA), which has severe emotional and physical consequences. LEA rates are high, with an estimated amputation occurring every 20 seconds globally due to diabetes. Diabetic foot ulcers (DFU) management imposes a heavy economic burden on healthcare systems globally. Patients with DFU are at increased risk of depression and anxiety. DFU also increases hospital admissions and emergency room visits.DFU have severe psychological and social consequences, including depression, anxiety, and reduced quality of life. These ulcers disrupt daily activities, lead to financial strain.Despite advancements in treatment, DFU patients continue to suffer from poor quality of life, especially when ulcers recur or do not heal. Therefore, the present study is important in order to investigate the anxiety, depression and stress of amputation, as well as increasing the understanding of the effect of psychological and functional complications among patients with DFU.

Methods: In order to find related articles, Google Scholar, PubMed and SID databases were used. In the search, a combination of keywords including diabetes, diabetic foot ulcer, amputation, depression, fear and stress were used. Finally, 18 studies were reviewed during the years 2014 to 2024.

Results: Diabetic patients are afraid of the complications of this disease, especially limb amputation, which affects their quality of life.DFU increases the risk of depression and anxiety and significantly reduces the quality of life of patients. These mental complications can worsen the symptoms of DFU and disrupt the treatment. In fact, depression weakens the immune system, prevents wound healing and increases the risk of infection in diabetic patients. It is also associated with reduced life expectancy and a higher risk of amputation. Depression and diabetes have a mutual relationship and depression increases the risk of complications. Therefore, addressing physical and psychological factors is very important for the effective management of DFU.

Conclusion: Based on the upcoming research, it seems that DFU causes emotional distress and can eventually lead to depression. Understanding these factors helps healthcare providers address patient concerns and develop effective intervention strategies. Social support and positive coping mechanisms are effective for managing depression and improving health outcomes. Timely rehabilitation programs can improve activities of daily living and quality of life. Treatment of DFU should focus on wound healing and psychological factors. Examining factors affecting quality of life, including anxiety, depression, and adherence to self-care, is essential for designing

appropriate treatment strategies. Implementation of appropriate psychological interventions can improve the overall well-being of DFU patients.

Keywords: Diabetes, Diabetic Foot Ulcer, Amputation, Depression, Anxiety, Fear

## A Comprehensive Comparison on Hemostatic Performance of Natural and Synthetic Nanoclays Embedded in Modified Cellulose-based Sponge for Non-compressible Massive Bleedings

**Roya Salehi[1]***

**Shabnam Sadeghi[2]**

**Somayeh Alimohammadi[3]**

***1. Department of Medical Nanotechnology, Faculty of Advanced Medical Sciences, Tabriz University of Medical Sciences, Tabriz, Iran***

***2. Drug Applied Research Center and Department of Medical Nanotechnology, Faculty of Advanced Medical Sciences, Tabriz University of Medical Sciences, Tabriz, Iran***

***3. Biotechnology Research Center, Tabriz university of Medical Sciences, Tabriz, Iran***

The importance of managing severe bleeding is crucial for patient rescue in both clinical and unexpected emergency situations. In this context, achieving rapid hemostasis with no stimulation of immune responses is essential. Although natural clays demonstrate high performance in controlling severe hemorrhage and have a low stimulatory impact, their large particle size and potential risk of thrombosis are considered significant drawbacks when compared to synthetic nanoclays. Conversely, the complex and costly synthesis process of synthetic nanoclays limits their scalability for commercial applications. To address these limitations, a novel approach using glow discharge plasma irradiation was applied to convert natural kaolin, sourced from the Marand mine in East Azerbaijan, into pseudohexagonal-shaped kaolin nanoparticles (30 to 150 nm) following planetary ball milling. This study represents a comprehensive comparison between hemostatic performance of natural and synthetic nanoclays embedded in modified cellulose-based sponge for non-compressible massive bleedings. Additionally, plasma irradiation may directly enhance the specific surface area and pore volume of nano kaolin, thereby improving the hemostatic performance of the nanocomposite aerogels. The triple-network carboxymethyl cellulose aerogels, crosslinked with $Ca^{2+}$, citric acid, and nano kaolin, exhibited a highly porous structure (~80%) and remarkable absorption of phosphate-buffered saline (PBS) (~3250%), which is effective in concentrating hemostasis-inducing proteins. Furthermore, these aerogels demonstrated high adhesion ability to wet tissue surfaces. The aerogels showed excellent performance in forming stable clots (BCI < 14%), with approximately 91% red blood cell attachment and 95% platelet aggregation. The in vivo host response, assessed through hematological, pathological, and biochemical parameter tests, revealed no systemic or significant local inflammatory response. The nanocomposite aerogels demonstrated superior performance, achieving a 2.5-fold and 2-fold reduction in hemostasis time and blood loss, respectively, in a rat femoral artery bleeding model compared to commercial hemostatic sponges (P-values < 0.01), respectively. Consequently, this innovative treatment of natural clays offers a viable solution by producing low-risk materials with reduced synthesis costs compared to synthetic nanoclays. The engineered nanocomposite aerogels, through the combination of optimized chemical properties and physical design, exhibited a synergistic effect by simultaneously activating the coagulation cascade and forming a physical barrier at the bleeding site, thereby minimizing side effects and mitigating the risk of thrombosis.

Keywords: Nano-kaolin, Plasma Glow Discharge, Superabsorbent, Aerogels, Hemostasis

## Mussel-Inspired Modified Regenerated Cellulose as Tissue Adhesive and Antibacteria Gauze: A Promising Approach for Rapid Hemostasis in Non-compressible Hemorrhage

**Roya Salehi[1]***

**Nastaran Alipour[2]**

**Somayeh Alimohammadi[3]**

***1. Department of Medical Nanotechnology, Faculty of Advanced Medical Sciences, Tabriz University of Medical Sciences, Tabriz, Iran***

***2. Drug Applied Research Center and Department of Medical Nanotechnology, Faculty of Advanced Medical Sciences, Tabriz University of Medical Sciences, Tabriz, Iran***

***3. Biotechnology Research Center, Tabriz University of Medical Sciences, Tabriz, Iran***

Uncontrollable hemorrhage leads to high mortality rates; thus, engineering effective hemostatic materials is crucial for rapid hemostasis. Developing hemostatic materials for rapid coagulation, antibacterial activity, and easy removal without compromising clot integrity remains a challenge. Herein, a multifunctional hemostatic gauze was engineered by modifying regenerated cellulose textile through multiple sequential chemical reactions, including carboxymethylation, crosslinking with CaCl2/ZnCl2 solution, oxidation, and polymerization with dopamine. Provided gauze demonstrated remarkable wet-tissue adhesion (890 KPa) that physically sealing the area to prevent blood loss. The engineered gauze exhibits excellent antibacterial activity (against S. aureus and E. coli) and enhanced hemostatic ability (clotting time (20S), attachment of red blood cells (~93%) and platelets (~80%)). The complete hemostasis and stable clot formation without secondary bleeding were achieved by synthesized gauze in 20s, 50s, and 100s for the rat and rabbit liver, and rat femoral artery injury models, respectively. That was significantly faster hemostasis (4–14-fold reduction in time) and lower blood loss (3-fold reduction) compared to the commercial hemostatic textiles ($p < 0.001$). Biochemical, hematological, and pathological examinations revealed no evidence of systemic and local inflammation or toxic effects in the rat organs. The engineered hemostatic gauze exhibits outstanding characteristics of a hemostatic material for clinical applications

Keywords: Hemostatic, Regenerated Cellulose, Wet-tissue Adhesion, Antibacterial

# Fabrication and Characterization of a Gelatin-based Hydrogel Incorporating Mesoporous Bioactive Glass Nanoparticles for Tissue Regeneration

**Maryam Alizadeh**

**Mohammad Jafar Abdekhodaie**

***Department of Chemical and Petroleum Engineering, Sharif University of Technology***

Introduction: In recent decades, tissue engineering has demonstrated significant potential for regenerating damaged tissues. Hydrogel scaffolds have gained particular importance as they mimic the extracellular matrix (ECM) and create an optimal environment for cell survival and proliferation. Developing multifunctional bioactive hydrogels with tunable physical and biological properties is crucial for advancing tissue engineering applications. Mesoporous bioactive glass nanoparticles (MBGNs) have attracted considerable interest because of their excellent textural properties and ability to release biologically active ions beneficial for regenerating various tissues, including bone and skin. The release of silicon and calcium ions from MBGNs has been shown to promote skin regeneration by stimulating collagen production and enhancing neovascularization. Incorporating MBGNs into hydrogels enhances bioactivity and significantly affects their physical and mechanical properties, enabling the creation of bioactive and tunable hydrogels for tissue regeneration. This study developed an enzymatically cross-linked nanocomposite hydrogel using gelatin-tyramine and MBGNs as a novel scaffold for skin regeneration, aiming to evaluate how different MBGN concentrations affect the hydrogel"s physical and biological properties.

Methods: A sol-gel technique was employed to synthesize the MBGNs. The morphology and porosity of the nanoparticles were evaluated using scanning electron microscopy (SEM) and Brunauer-Emmett-Teller (BET), respectively. A successful modification of gelatin molecules was confirmed by the 1H NMR spectrum of gelatin-tyramine, which was synthesized via carbodiimide chemistry to enable enzymatic crosslinking of the hydrogel. Hydrogels with MBGN

content of 0, 0.25, 0.5, and 1% were prepared and assessed for swelling, enzymatic degradation, microstructure, and compressive modulus. Human adipose-derived mesenchymal stem cells (hASCs) were seeded on the hydrogels, and the dose-dependent impact of MBGNs on cell metabolic activity was measured using the MTT assay over 1, 3, and 7 days.

Results: MBGNs with a diameter of 78±9 μm were confirmed by SEM images, and BET results indicated high porosity of nanoparticles. The 1H NMR spectrum of gelatin-tyramine confirmed the successful modification of gelatin molecules. Adding MBGNs to gelatin-based hydrogels significantly reduced the degradation rate in a dose-dependent manner. SEM images showed an interconnected porous structure in all hydrogel groups. At 0.25% and 0.5% w/v, MBGNs decreased the pore diameter compared to the MBGN-free hydrogel, but increasing the concentration of MBGNs to 1% w/v resulted in larger pores. The compressive modulus of hydrogels did not show a statistically significant difference between the groups. However, adding MBGNs up to 0.5% w/v slightly increased the compressive modulus compared to the MBGN-free group. The compression modulus decreased with the addition of higher concentrations of MBGNs. The metabolic activity of the hydrogels with up to 0.5% w/v MBGNs was not statistically different compared to the control group in all time points. However, adding 1% w/v MBGNs revealed a significant cytotoxicity compared to other groups.

Conclusion: The results of this study indicate that the gelatin-tyramine/MBGN hydrogel has great potential as a scaffold for tissue regeneration. Its physical and biological properties can be effectively controlled, allowing for the development of a bioactive hydrogel suitable for various tissue engineering applications, including skin tissue engineering.

Keywords: Hydrogel, Mesoporous Bioactive Glass, Tissue Engineering, Skin

## The Role of Hematopoietic Stem Cells in The Healing Process of Diabetic Wounds: A Systematic Review

**Fatemeh Shaban[1]**
**Hassan Hajihassan[2]**
**Tahouranatasha Shahnavaz[2]**
**Morteza Nasiri[2]***

***1. Mashhad University of Medical Science***
***2. Tehran University of Medical Science***

Introduction: Type 2 diabetes is a common disease whose prevalence is increasing. It is predicted that by 2030, the number of people suffering from this disease will reach 440 million people from 350 million people. One of the most serious complications of this disease is delayed wound healing. which is associated with chronic inflammation, oxidative stress and disruption of epithelial regeneration. Despite the significant societal burden and severe clinical consequences associated with this disease, the underlying mechanisms of diabetic wound healing remain largely unknown. Consequently, the development of new therapeutic methods to accelerate wound healing is of great importance. One of the new methods that has attracted the attention of researchers is the use of stem cells, which are considered a powerful tool for wound healing due to their multifaceted therapeutic effects, including the capacity to reduce inflammation and self-renewal and differentiation. One of these cells that has recently been studied in this field are hematopoietic stem cells (HSCs), which with their properties can be effective in the healing process of diabetic wounds. In this article, we are going to investigate the role of HSCs in the healing process of diabetic wounds.

Method: Articles were searched based on the Prisma checklist. The search was conducted in three databases: PubMed, Scopus and Web of Science. Search terms included "diabetes", "wound healing", "Wound Regeneration", "wound management", "wound repair" and "hematopoietic stem cells". The search was limited to articles published between 2014 and 2024. In total, 26 articles were identified through the primary search. After removing duplicates, titles and abstracts, taking into account the inclusion criteria, including articles focusing on hematopoietic stem cells and diabetic wound healing and their synonyms, compliance with the specified period of publication, RCT articles, having an ethical code, availability The full text of the

article and the exclusion criteria include: lack of focus on the topic, failure to comply with the publication period, lack of complete text, failure to comply with ethical standards, failure to provide experimental data and exclusion of review articles, low quality of the study; 7 articles reviewed by two referees in this The research was entered.

Results: Five animal studies demonstrated positive results in improving diabetic wound healing through key mechanisms such as pterostilbene restoring estrogen receptor β expression in hematopoietic stem cells (HSCs), reducing oxidative stress and inflammation, CXCR4 antagonists like AMD3100 activating the BMP signaling pathway to accelerate healing, biomaterial scaffolds increasing epidermal thickness and enhancing neovascularization, improved macrophage recruitment through epigenetic regulation, and enhanced collagen deposition supported by acellular dermal matrix (ADM) with CXCR4 antagonists. In contrast, two human studies showed negative outcomes, with plerixafor-induced stem cell mobilization reducing wound healing rates and adverse effects from mobilization disrupting the healing process in diabetic conditions.

Conclusion: Despite positive findings, the effects of hematopoietic stem cells are accompanied by negative outcomes, including the disruptions diabetes causes in their function and the wound healing process. Further research, particularly in human studies, is crucial for understanding these complexities and developing more effective treatments for diabetic wounds.

Keywords: Hematopoietic Stem Cells, Diabetic Wound, Diabetic Ulcer, Wound Healing, Wound Management

## Gene-activated Matrices (GAMs) in Regeneration of Wound Healing

**Maryam Karkhane**

***Student Research Committee, Department of Tissue Engineering and Applied Cell Sciences, School of Advanced Technologies in Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran***

Gene-activated matrices (GAMs) represent an cutting edge advancement in regenerative medicine, combining gene therapy with tissue engineering to improve wound healing and tissue regeneration. This approach focuses to restore the structure and function of damaged tissues by transporting therapeutic genes directly to the position of injury, offering a promising solution for different types of wounds, containing chronic and acute injuries. GAMs function through several key mechanisms including: DNA Incorporation by Therapeutic plasmid DNA which integrated into a scaffold made from biocompatible materials like hydrogels or sponges, Sustained Release of DNA in controlled manner maintaining a localized concentration of therapeutic genes within the wound environment, gene expression of essential growth factor for tissue repair and regeneration and promoting of proliferation, migration and differentiation. Applications in Wound Healing GAMs demonstrated markedly potential in different wound healing applications such as chronic and acute wound. GAMs are particularly useful for chronic wounds, where traditional healing processes are impaired. GAMs can deliver genes that promote angiogenesis (the formation of new blood vessels) and collagen synthesis, significantly enhancing the healing process. In acute injuries, GAMs can accelerate healing by representing sustained release of growth factors that stimulate rapid tissue regeneration. Advantages Over Traditional Methods The use of GAMs showed several advantages in contrast to conventional wound healing techniques: By targeting gene delivery directly to the wound site, GAMs decrease the need for systemic treatments and associated side effects in localized treatment manner. Unlike traditional methods that may require repeated applications of growth factors, GAMs provide prolonged and sustained gene expression, leading to more effective healing outcomes. The ability to tailor GAMs with specific genes allows for personalized treatment approaches based on individual patient needs and types of wounds. Challenges and Future Directions Despite their potentials, some obstacles remain in the development and application of GAMs: The integration of gene therapy into clinical practice faces stringent regulatory requirements that must be navigated. Issues related to the stability of gene vectors within matrices and their efficient delivery

into target cells need further research. Future research directions include exploring new biomaterials for improved biocompatibility and functionality, as well as developing advanced delivery systems that enhance gene transfer efficiency. Additionally, ongoing studies are investigating the use of novel dressing scaffolds that serve as both wound protectors and vectors for therapeutic gene delivery.

Conclusion: In summary, gene-activated matrices demonstrated a transformative approach in regenerative medicine that holds markedly potentials for improving wound healing through targeted gene delivery and sustained therapeutic effects. Continued research in this field may be cause to more effective treatments for different types of wounds and injuries, subsequently improving patient outcomes and quality of life. As the technology advances, there is potential for GAMs to become a standard component in the toolkit for regenerative therapies.

Keywords: Gene-activated Matrices, Wound Healing, Regenerative Medicine

## Integration of Innovative Biomaterials and Stem Cell Therapy to Improve Wound Healing: A Systematic Review of Clinical Applications and Mechanistic Insights

**Mehdi Mashayekh[1]***
**Samad Farashi Bonab[2]**
**Amirhossein Karimi[3]**
**Khashayar Moarefian[4]**

***1. Department of Pathobiology, Faculty of Veterinary Medicine, Islamic Azad University, Garmsar, Iran***

***2. Department of Medical Laboratory Sciences, School of Allied Medicine Sciences, Tehran University of Medical Sciences, Tehran, Iran***

***3. Department of Basic Sciences, Faculty of Veterinary Medicine, Islamic Azad University, Garmsar, Iran***

***4. Department of Basic Sciences, Faculty of Veterinary Medicine, Islamic Azad University, Sanandaj, Iran***

Background: Chronic wounds present a significant challenge in healthcare, affecting millions globally and leading to increased morbidity and healthcare costs. Traditional management strategies often fail to address the underlying biological mechanisms involved in healing. Recent advancements that combine innovative biomaterials with stem cell therapy represent a transformative approach that not only promotes healing but also modulates immune responses critical for recovery through specific immunological pathways. This systematic review aims to evaluate the clinical applications and mechanistic insights of integrating innovative biomaterials with stem cell therapy, focusing on their immunological interactions and effects on wound healing outcomes.

Methods: A comprehensive literature search was conducted across three major databases: PubMed, Scopus, and Web of Science. Keywords used included “biomaterials,” “stem cells,” “wound healing,” “tissue regeneration,” “clinical applications,” and “inflammatory cytokines.” The search was limited to studies published between January 2020 and September 2024 to capture the latest advancements. Inclusion criteria encompassed clinical trials, observational studies, and preclinical studies that integrated biomaterials and stem cell therapy in wound healing, involving human participants or relevant animal models. A total of 45 studies were selected based on defined inclusion and exclusion criteria, with data extracted regarding study design, patient demographics, interventions, and outcomes measured. The quality of included studies was assessed using the Cochrane Risk of Bias Tool.

Results: The review revealed a diverse range of biomaterials, including hydrogels, nanofibers, and bioactive scaffolds, integrated with various stem cell types, such as mesenchymal stem cells (MSCs), adipose-derived stem cells (ADSCs), and induced pluripotent stem cells (iPSCs). The meta-analysis indicated a statistically significant improvement in healing outcomes, with a pooled effect size of 0.75 (95% CI: 0.60–0.90; $p < 0.001$), suggesting that the integrated therapies lead to meaningful enhancements in wound healing compared to standard treatments. Major mechanistic insights included cellular proliferation driven by IL-1 stimulation, angiogenesis facilitated by vascular endothelial growth factor

(VEGF), extracellular matrix remodeling, and anti-inflammatory effects vital for successful healing.

Conclusions: This systematic review underscores the transformative potential of combining innovative biomaterials with stem cell therapy in wound healing. These findings suggest that the integration of biomaterials and stem cell therapy can significantly advance regenerative medicine and improve patient outcomes in wound healing.

Keywords: Wound Healing, Tissue Regeneration, Biomaterials, Stem Cell Therapy, Clinical Applications, Molecular Mechanisms

## Conductive Hydrogels Based on Alginate/Polyaniline for Tissue Engineering Applications

**Mozhdeh Talebian[1]**
**Zohreh Daraeinejad[2]**
**Iman Shabani[1]***

*1. Amirkabir University of Technology*
*2. University of Tehran*

Introduction: Tissue engineering requires scaffolds that mimic the extracellular matrix to support cell growth and tissue regeneration. Hydrogels, with their high water content and biocompatibility, are commonly used in these scaffolds. Sodium alginate (SA), a biopolymer derived from brown algae, is favored for its non-toxic nature and ability to form stable gels via ionic cross-linking. However, traditional hydrogels lack conductivity, which limits their applications in tissues like nerve, muscle, cardiac and bone tissue, where electrical signals play a crucial role. By incorporating conductive polymers such as polyaniline (PANI), the hydrogels gain electroactive properties, which can stimulate cell proliferation and differentiation, enhancing their potential for general tissue engineering applications.

Materials and Methods: Sodium alginate (SA) was dissolved in deionized water, followed by the addition of a therapeutic drug with conductive and dopant properties, enhancing the hydrogel's bioactivity. Two different concentrations of aniline were then introduced to evaluate the effect on the hydrogel"s conductivity and overall performance. Polymerization was initiated by adding ammonium persulfate (APS), which led to the crosslinking of aniline within the hydrogel matrix. The polymerized aniline acted as the crosslinking agent, eliminating the need for additional crosslinkers. The hydrogel's formulation and polymerization parameters were optimized, and the composite was characterized using Fourier-transform infrared spectroscopy (FTIR), swelling ratio analysis, and conductivity tests to assess the impact of varying aniline concentrations.

Results: The SA/PANI hydrogels exhibited excellent conductivity, which increased with higher aniline concentrations due to enhanced polyaniline formation. This increased conductivity is crucial for tissues that require electrical stimulation, such as nerves and muscles. The swelling ratio analysis demonstrated that the hydrogel exhibited an appropriate swelling behavior, indicating its suitability for tissue engineering applications. FTIR analysis further confirmed the successful polymerization of aniline and the gelation of sodium alginate within the composite hydrogel. Shifts and broadening of the characteristic peaks of sodium alginate indicated structural rearrangements and hydrogen bonding interactions with the polymerized aniline, contributing to the hydrogel"s stability and functionality.

Conclusion: Alginate/PANI conductive hydrogels offer significant potential for tissue engineering applications due to their combined biocompatibility and electroactivity. The ability to enhance conductivity through aniline concentration allows these hydrogels to be tailored for use in a variety of tissue types, especially those requiring electrical stimulation. The structural and conductive properties of the hydrogel make it a promising candidate for future research regenerative medicine.

Keywords: Alginate, Polyaniline, Tissue Engineering, Conductive Hydrogel

## The Potential of Seashell Powders as Marine-derived Biomaterials for Wound Healing Applications

**Aysa Esmaeelzadeazar**
**Afra Hadjizadeh***

***Amirkabir University of Technology***

The utilization of seashell powders in wound dressing formulations presents a novel approach to enhancing wound healing processes. This study investigates the potential of seashell-derived materials, particularly focusing on their biocompatibility, antimicrobial properties, and ability to promote tissue regeneration. Seashell powders are rich in calcium carbonate and chitin. The calcium carbonate structure of seashell powders changed to calcium oxide (CaO) and calcium hydroxide (Ca(OH)2) at 900˚C using a calcination process. The results of the Fourier-transform infrared spectrometry data, showed a C–O stretching peak indicative of a calcite structure. Additionally, the presence of Ca=O and O–H stretching peaks suggested the formation of CaO and Ca(OH)2 structures. The antibacterial evaluations demonstrated that the calcined seashell powders significantly inhibited bacterial growth and reduced inflammation. The findings suggest that seashell powders can be effectively utilized in wound care applications, offering a sustainable and biocompatible alternative to synthetic materials. This research highlights the potential of marine-derived biomaterials in advancing wound management technologies through their antibacterial activity. These powders can also be incorporated into various polymeric matrices, including chitosan and alginate hydrogels, to develop composite wound dressings.

Keywords: Seashell Powders, Calcium Carbonate, Wound Dressing

## Investigating The Effect Of Education On Self-Care Of Diabetic Foot Ulcers In Patients With Diabetes: A Review Article

**Roghaye Alidoust**
**Ermia Maghsoodloo***

***Aliabad Katul Islamic Azad University***

Introduction: Diabetes is a significant global health challenge today, with diabetic foot ulcers being a major complication. Promoting self-care in patients with chronic diseases, especially diabetes, can help control the disease and improve quality of life. Furthermore, educational interventions are cost-effective. Therefore, the aim of this study was to systematically review the impact of education on self-care of diabetic foot ulcers in patients with diabetes.

Methods: In this review, articles were searched from reliable databases including Pubmed, Google Scholar, magiran and sid. The keywords that were searched included diabetes, self-care, education, diabetic foot ulcer, patients with diabetes. The search included published articles from 2009 to 2024. Articles that investigated the effect of education on self-care of diabetic foot ulcers.

Results: Twelve articles were reviewed in this study. The review of the conducted research indicates that education for patients with diabetes can have a positive impact on the promotion of self-care for diabetic foot ulcers. Moreover, it can enhance patients" self-efficacy and quality of life.

Conclusion: This literature review suggests that educational interventions have the potential to empower diabetic patients to better manage their foot ulcers through increased self-care behaviors.

Keywords: Diabetes, Diabetic Foot Ulcers, Self-care, Education And Patients With Diabetes"

## The Role of Trace Elements Especially Zinc on Wound Healing

**Nahid Dezvaree**

***Kharazmi University***

Introduction: Trace elements or minerals (TEs) especially zinc play a crucial component in many physiological functions of life, including but not limited to: enzyme systems, energy metabolism, and the transport of oxygen. At the cellular level, TEs are integral in maintaining structural integrity in cutaneous cells as well as neutralizing oxidative damage. Zinc is an essential trace element in the human body and

its importance in health and disease is appreciated. It serves as a cofactor in numerous transcription factors and enzyme systems including zinc dependent matrix metalloproteinases that augment auto debridement and keratinocyte migration during wound repair. Wound healing is a complex process that is critical in restoring the skin"s barrier function. This process can be interrupted by numerous diseases resulting in chronic wounds that represent a major medical burden. Such wounds fail to follow the stages of healing and are often complicated by a proinflammatory milieu attributed to increased proteinases, hypoxia, and bacterial accumulation. The comprehensive treatment of chronic wounds is still regarded as a significant unmetmedical need due to the complex symptoms caused by the metabolic disorder of the wound micro environment.The nutritional importance of trace elements has recently grown rapidly due to better understanding of their vital biological functions. In wound healing the most important trace element is zinc, which probably is one of the most important and interesting inorganic elements related to health sciences.

Methods: This study is a systematic review based on internal databases including sid, iranmeddex, magiran and authentic english databases including scopus, pubmed, as well as articles and reviewed the letters that have met the inclusion criteria, were examined.

Results: Zinc is a transitional metallic element known from ancient times. It is widely distributed in the human environment, being found in water, air, and virtually all foodstuffs. Zinc confers resistance to epithelial apoptosis through cytoprotection against reactive oxygen species and bacterial toxins possibly through antioxidant activity of the cysteine-rich metallothioneins. Patients require supplementary oral or topical zinc if normal wound healing is to occur in the face of a pre-existing deficiency state. Difficulties arise in the diagnosis of hypozincemia, and serum zinc may not be an accurate monitor of subnormal zinc. Evidence is presented here to show that zinc delivered locally provides therapeutic advantages in treatment of not only zinc-deficient chronic wounds but also of surgical wounds, including pilonidal sinus lesions. Topical zinc oxide treatment increases local bio available zinc concentrations to fairly constant levels of 1,000–3,000 μmol/L. These zinc ion levels are atoxic and protective to host cells but sufficiently high to augment antibacterial mechanisms in addition to MMP-mediated elimination of necrotic tissue and facilitation of keratinocyte migration.

Conclusion: In conclusion, Zinc deficiency of hereditary or dietary cause can lead to pathological changes and delayed wound healing. Oral zinc supplementation may be beneficial in treating zinc-deficient leg ulcer patients, but its therapeutic place in surgical patients needs further clarification. Topical administration of zinc appears to be superior to oral therapy due to its action in reducing super-infections and necrotic material via enhanced local defense systems and collagenolytic activity, and the sustained release of zinc ions that stimulates epithelialization of wounds in normozincemic individuals. Zinc oxide in paste bandages (Unna boot) protects and soothes inflamed peri-ulcer skin. Zinc is transported through the skin from these formulations, although the systemic effects seem insignificant. This review article suggests that topical zinc therapy is underappreciated even though clinical evidence emphasizes its importance in autodebridement, anti-infective action, and promotion of epithelialization.

Keywords: Trace Elements ,Zinc, Wound Healing

## Innovative Approaches for Stabilizing Recombinant Growth Factors in Diabetic Foot Ulcer Treatment

**Hassan Rassouli***
**Fereshteh Sarafrazi**
**Armin Nazemi Zadeh**
**Mahdi Hesaraki**

***Department of Photo Healing and Regeneration, Medical Laser Research Center, Yara Institute Academic Center for Education, Culture and Research (ACECR), Tehran, Iran***

Diabetic foot ulcers are a common and serious complication in diabetic patients, significantly impacting their quality of life and requiring effective treatment strategies for healing. In this context,

recombinant growth factors have emerged as potential tools to accelerate the wound healing process. This review examines various methods for stabilizing growth factors, including biocarriers, nanoparticles, and microencapsulation techniques. Biocarriers, such as hydrogels and natural polymers, have garnered significant attention for their ability to maintain moisture and provide a conducive environment for wound healing. Incorporating growth factors into these carriers can facilitate a controlled and sustained release, thereby enhancing the healing process. Nanoparticles, due to their small size and unique properties, can effectively deliver growth factors to target cells, reducing their degradation in the wound environment. Furthermore, nanoparticles may possess antimicrobial properties, which are crucial in preventing infections in diabetic wounds. Microencapsulation techniques create protective layers around growth factors, preventing their degradation in adverse conditions and providing better control over their release. These approaches can significantly improve the healing process of diabetic foot ulcers and reduce associated complications. In conclusion, this review suggests that combining these methods could lead to the development of smarter and more effective wound dressings, enhancing the health outcomes of diabetic patients.

Keywords: Recombinant Growth Factors, Recombinant DNA Technology, Wound Healing, Diabetic Foot Ulcers

## Application of Federated Learning in Chronic Wound Detection: A Distributed Approach to Patient Privacy Preservation

**Haleh Fateh***
**Mojtaba Khayat Ajami**
**Hesameddin Allameh**

***Lifestyle Medicine Research Group, Academic Center for Education, Culture and Research (ACECR), Tehran, Iran***

Diagnosing and managing chronic wounds presents considerable challenges in healthcare due to the complexity of tissue changes and the need for extended care. Recent advancements in artificial intelligence, particularly deep learning, have demonstrated significant potential for accurate analysis and automated diagnosis of medical images. However, concerns regarding the privacy and security of sensitive medical data—such as patient records and high-resolution imaging—pose substantial obstacles to the broader adoption of these technologies, particularly in distributed clinical environments. This study introduces Federated Learning (FL) as an innovative distributed approach for chronic wound diagnosis, enabling the training of AI models without the need to transfer sensitive patient data to centralized servers. By leveraging local model aggregation and distributed data processing across multiple healthcare institutions, this approach enhances diagnostic accuracy while ensuring robust protection of patient data. Unlike traditional centralized methods, FL preserves data locality, enabling scalable development of sophisticated diagnostic models within decentralized healthcare systems. The results demonstrate that FL-based models significantly outperform centralized approaches in terms of diagnostic accuracy while simultaneously reducing diagnostic errors. Additionally, integrating optimization algorithms and advanced security mechanisms strengthens the model"s resistance to security threats, including cyberattacks targeting medical data. This research underscores the transformative potential of Federated Learning in advancing chronic wound diagnosis, with a strong emphasis on patient privacy in clinical settings.

Keywords: Artificial Intelligence, Chronic Wound Classification, Federated Learning, Data Privacy

## Bioelectric Wound Dressings

**Seyedeh Fatemeh Azghadi***
**Seyed Javad Hoseini**
**Hengameh Dortaj**

***Mashhad University of Medical Sciences***

Wound healing has always been a matter of concern in the medical community. Whether the wound is acute or chronic, proper care can reduce the risk of

infection and further complications, accelerate the healing process, and alleviate the patient's discomfort. A necessity in most wound treatments is an efficient dressing capable of providing a suitable environment for healing. The said environment requires adequate moisture, controlled pH, and proper gas exchange. It should be bacteria-free, as well, to keep away infection. Over the years, various dressings have been devised to cater to these requirements. Among the recent trends in wound healing methods, modern dressings are of notice, which come in several forms and materials. A promising type of such dressing is bioelectric dressing, which benefits the wound through electrical stimulation (ES). Numerous studies have indicated that exogenous and endogenous electrical fields aid the processes of cell proliferation and migration, leading to re-epithelization, which is a significant stage of wound healing. In this review, we gathered the literature surrounding the aspects of bioelectric dressings involved in real-time wound monitoring, targeted therapy delivery, tissue regeneration stimulation, and personalized treatment. Bioelectronic wound dressings have the potential to revolutionize the way we treat wounds by providing real-time feedback on wound healing progress, allowing for targeted and personalized treatment. We hope to provide an overview that could aid researchers in delving deeper into creating bioelectronic devices that can monitor wound healing progress, stimulate tissue regeneration, and deliver therapeutic agents. The concept of bioelectronic wound dressings is still in its early stages but has the potential to lead to significant breakthroughs in wound healing and tissue regeneration.

Keywords: Bioelectric, Wound Dressing, Monitoring, Regeneration, Drug Delivery, Personalized Treatment

## Investigating the Performance of Artificial Intelligence in the Diagnosis of Cutaneous Leishmaniasis: A Systematic Review

**Ebrahim Sabari Fard[1]**
**Seyyed Mohammad Ali Hashemi Tameh[1]**
**Maryam Dabiri Fard[2]***

***1. Nursing Research Committee, Islamic Azad University of Kashan, Kashan, Iran***

***2. Department of Nursing, Kashan Branch, Islamic Azad University, Kashan, Iran***

Background and purpose: Cutaneous leishmaniasis is a common skin disease in developing countries that is transmitted by the protozoan Leishmania through the bite of a female phlebotomus and can have different symptoms from a simple skin ulcer to a progressive systemic disease, but due to parasite resistance to common treatments. Control and early diagnosis of leishmaniasis is important. Today, artificial intelligence has been used in the medical diagnosis of different diseases, and the purpose of this study is to investigate the use of artificial intelligence in the diagnosis of cutaneous leishmaniasis.

Methodology: This study was conducted using a systematic review method in October 2023, by searching for the keywords leishmaniasis, artificial intelligence, and diagnosis, along with their English equivalents, in databases such as PubMed, SID, Scopus, ScienceDirect, and the Google Scholar search engine. After applying inclusion and exclusion criteria, 11 English and Persian articles published between 2019 and 2023 were studied and reviewed according to the PRISMA checklist.

Findings: In order to improve the diagnostic methods of cutaneous leishmaniasis, artificial intelligence has provided several solutions in Python, which were fruitful in diagnosing leishmaniasis lesions with high accuracy and sensitivity, such as Yolov5, MLP, and Viola-Jones patterns that use images. Lesion process the diagnostic characteristics of the lesion and by forming integrated images, send the prognosis and proposed treatment plan based on the patient`s profile, drug selection warnings and estimation of the patient"s treatment adherence to the dermatologist for definitive diagnosis. Some protocols require sampling of exudate from the edges of the wound to check factors such as infected macrophages and enzyme activity in the lesion.

Final conclusion: artificial intelligence algorithms can accurately, comprehensively, quickly and cheaply diagnose cutaneous leishmaniasis and it is suggested to conduct similar studies in other skin diseases to create

a comprehensive diagnostic library of skin lesions.

Keywords: Cutaneous Leishmaniasis, Artificial Intelligence, Diagnosis

## Evaluation of The Prevalence of the Patients Hospitalized Due to Infectious Diabetic Foot Ulcer in Imam Khomeini Hospital of Ardabil in 2022 and its Related Factors

**Saeid Sadeghieh Ahari**

***Ardabil University of Medical Sciences***

Background: The prevalence of diabetes is growing all over the world and this disease is becoming a widespread problem with a high social and economic burden. Diabetic foot disease is one of the complications of diabetes, which is associated with major injuries, mortality and reduced quality of life.

Aim: To evaluat the prevalence of the patients hospitalized due to infectious diabetic foot ulcer in Imam Khomeini Hospital of Ardabil in 2022 and its related factors.

Materials and methods: In this descriptive and analytical cross-sectional study, 218 patients with diabetic foot ulcers admitted to Imam Khomeini Hospital in Ardabil were evaluated. The required information, including demographic characteristics, previous disease history, clinical information, necessary wound characteristics, was collected by reviewing the files of patients admitted with the diagnosis of diabetic foot ulcer during 2022 in the hospital archive. Relevant information was evaluated by inserting it into SPSS software version 22 based on the objectives of the study.

Results: A total of 218 patients with an average age of 63.99 years ± 11.56 and 76.6% male were evaluated. 95.4% of the patients had type 2 diabetes. 83.8% of the studied subjects also had a history of diabetic foot ulcer, which led to foot amputation in 20.7%. 44.2% of patients had third degree wounds. The length of hospitalization of the patients increased significantly with the increase in the degree of wound (P

Keywords: Diabetes, Diabetic Foot Ulcer, Duration Of Hospitalization

## Tiny Technology, Big Impact: The Promise Of Skin-on-a-chip Models

**Ahmad Vaez***

**Hengameh Dortaj**

***Tissue Engineering Research Group, Department of Anatomy and Cell Biology, Mashhad University of Medical Science, Mashhad, Iran***

In vitro, human skin models have come a long way in the last few years to test medicinal and cosmetic products. These static skin models, however, do poorly depict how the human body normally functions. Excitingly, skin-on-a-chip (SoC) and other microfluidic devices have recently been the focus of research into creating in vitro 3D vascularized skin models. These cutting-edge methods allow for more efficient physiological nourishment transfer and the cost-effective evaluation of potential toxicity, efficacy, and delivery of drugs. These devices provide the modeling of essential mechanical, functional, and structural characteristics of human skin, therefore more accurately replicating the original microenvironment. Unlike traditional cell culture methods, SoC devices may perfuse skin tissue by incorporating perfusable lumens or using microfluidic channels that function as designed vasculature. Furthermore, incorporating sensors inside the SoC device allows real-time, non-invasive assessment of skin functionality and the impact of topical and systemic pharmaceuticals. This viewpoint explores the most recent developments in creating HSEs, SoC transfers, and in situ SoC, which are dynamic human skin models used in vitro testing. In addition, the article delves into the techniques for incorporating skin cells onto microfluidic chips, as well as the present uses and potential future advancements in this fascinating area of research.

Keywords: Skin-on-a-chip, Microfluidic, Microenvironment

## The Effect of Vacuum Therapy in the Healing Process of Diabetic Foot Ulcers: A Systematic Review

**Mahsa Zaki Nejad***

**Omid Heydari**

***1. Ph.D. Candidate of Nursing, School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences,Tehran, Iran***

***2. (ICW)Specialized wound and ostomy nurse, official member of the European International Wound Specialist Association***

Introduction and purpose: One of the most important complications of diabetes is diabetic foot ulcer, which puts the patient at risk of amputation. One of the common treatments to prevent limb amputation is the use of dressings or appropriate treatment methods .The aim of this study is to investigate the effect of vacuum therapy on wound healing in people with diabetic foot ulcers.

Materials and methods: A search was made in PubMed, Scopus, Medscape, and Embase databases in 2024 without considering the time limit with the keywords of Vacuum therapy, diabetic foot ulcer, improvement , Nursing and finally 10 articles were examined Findings: In this article, 10 studies were selected based on the research objectives. A review of the literature on vacuum therapy in this profession shows that compared with standard therapy in patients with diabetic foot ulcers, The examined data revealed that vacuum sealing drainage had significantly lower wound healing, duration of therapy and complication rates, as well as higher wound size reduction, compared with standard therapy in patients with diabetic foot ulcers. Also, other results indicated that between the two methods of vacuum therapy and new dressing in the healing of diabetic foot wounds, vacuum therapy compared to new dressings can cause better and faster healing of diabetic foot wounds, and vacuum therapy is a fast and safe method to achieve to a healthy endpoint in diabetic foot ulcers compared to conventional dressings.

Discussion and conclusion: Patients with Diabetes, as a vulnerable group, need educational planning and counseling services regarding treatment and recovery. Since nurses are the main individuals who can provide the required services in the field of planning and caring for a patient with Diabetes, they can play a key role in guiding the patient to choose the appropriate treatment for the type of wound at the onset of the treatment process.

Keywords: Vacuum Therapy, Diabetic Foot Ulcer, Improvement, Nursing

## The Effect Of Royal Jelly On Diabetic Foot Ulcers: A Scoping Review

**Zahra Gharagozloo[1]**

**Ali Akbari[2]***

**Mahdieh Motie[2]**

***1. School of Nursing and Midwifery, Iran University of Medical Sciences, Tehran, Iran***

***2. Department of Nursing, University of social welfare and rehabilitation science, Tehran, Iran***

Introduction: Diabetes mellitus is one of the main risks for human health in today"s world. Diabetes mellitus is an urgent global health problem that is exacerbated by lifestyle changes, urbanization, and population aging. Foot ulcers and the resulting infections are one of the main pathogenic factors in people with diabetes mellitus. Dealing with this problem requires a combination of individual changes in lifestyle, improving health policies and increasing public awareness in order to prevent its complications and reduce its impact on society. Royal jelly, as a bee product, with many therapeutic properties and few side effects, is a suitable alternative to other drugs in healing wounds caused by diabetes. This review study comprehensively investigated the effect of royal jelly on diabetic foot ulcers.

Materials and methods: This study is a scoping review. The study has been done in five stages, which are: designing the research question, searching and extracting related studies, selecting related studies, tabulating and summarizing information and data and reporting the results in foreign and domestic databases including: Information Bank Publications of the country (MagIran), Scientific Information Database of Academic Jihad (SID), Research Institute of Science and Information

Technology of Iran (IranDoc), Web of Science, Science Direct, PubMed, Google Scholar, Scopus.

Findings: Among 5100 articles, after targeting duplicate articles, 3346 duplicate articles were removed. By carefully studying the title and abstract of articles with inclusion criteria by the researcher, 1398 articles were removed due to being unrelated to the purpose of the study, and finally after studying the summary and full text and analyzing the articles, 241 articles were removed and 15 related articles. A review was included. These studies were reviewed to organize the findings into nine specific domains.

Conclusion: The findings of this study showed that the use of royal jelly has a significant effect on the healing of diabetic wounds and will be an effective step in improving the health of these patients.

Keywords: Royal Jelly, Diabetic Foot Ulcer, Diabetes Mellitus

## Evaluation and Measurement of Health Literacy in Group Training Sessions on Wound Management (Foot Care in Diabetic Patients) by Providing Support Packages and the Reaim Health Education Model

**Manizheh Soleimani[1]**
**Salva Ilkhani[2]***

***1. Vice President of Health, University of Medical Sciences, expert in charge of health education and promotion, Tabriz, Iran***

***2. Student Research Committee, medical student of Tabriz University of Medical Sciences, Tabriz, Iran***

People with diabetes may experience various foot problems. Even minor injuries can worsen and lead to serious complications. Lower limb amputations in diabetic adults increased by 50% between 2009 and 2015. Amputation in diabetics can be prevented by proper training in foot care methods. Diabetic people are exposed to foot problems due to nerve damage and reduced blood flow, and this is the reason why 1 out of every 5 diabetic people go to medical centers.

Materials and methods: The present study was conducted with the aim of evaluating and measuring health literacy in group training sessions for wound management (foot care in diabetic patients) by providing support packages and the Reaim health education model in all health centers and health centers of East Azerbaijan province. This descriptive research was conducted using a researcher-made questionnaire. To select the samples, Morgan"s table and purposive and theoretical sampling method were used. Descriptive statistical methods and spss software were used to analyze the data.

Findings: The findings of the research show that the evaluation of group training sessions for wound management (foot care in diabetic patients) in East Azerbaijan Province showed that by providing support packages to diabetic foot ulcer patients (identified with financial problems), their participation rate in the training sessions was 75%. And the rate of healing and wound care by patients increased by 50%. Evaluation questionnaire of group training sessions in the form of 16 questions, which was obtained in 89.8% of cases of knowledge transfer, in 68.6% of cases of change of attitude and 49.7% of cases of behavior change.

Conclusion: The response rate of patients with diabetic foot ulcers to questions (1 to 5) in the knowledge area was 89.8%, which showed that the training sessions were effective and knowledge was transferred, and in 10.2% of the cases, knowledge was not transferred. The response rate of patients with diabetic foot ulcers to questions (6 to 10) in the attitudinal range was 73.9%, which showed that the training process led to a change in attitude, and in 26% of the cases, attitude change did not take place. The response rate of patients with diabetic foot ulcers to questions (11 to 16) in the skill area was 59.6%, which showed that the process of training and providing support packages (food and dressings) has led to wound healing, and 17.4% of The cases of support packages were not delivered and 33% of the cases had not sold and consumed the support packages due to addiction.

Keywords: Evaluation, Health Literacy Assessment, Group Training, Wound Management, Foot Care in Diabetic Patients, Support Packages, Reaim Model

# Crosslinked Hydrogel Loaded with Chitosan-supported Iron Oxide and Silver Nanoparticles as Burn Wound Dressing

**Mina Borhani[1]***
**Saba Dadpour[2]**
**Atoosa Haghighizadeh[3,4]**
**Leila Etemad[4]**
**Vahid Soheili[3,4]**
**Omid Rajabi[3,4]**

***1. Department of Pharmaceutical Control, Student Research Committee, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran***

***2. Nanotechnology Research Center, Pharmaceutical Technology Institute, Mashhad University of Medical Sciences, Mashhad, Iran***

***3. Department of Pharmaceutical Control, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran***

***4. Pharmaceutical Research Center, Pharmaceutical Technology Institute, Mashhad University of Medical Sciences, Mashhad, Iran***

Introduction: Burns can result in infection, disability, psychosocial and economic issues. Traditional wound dressings adhere, dry up, shed particles and necessite frequent changes. Advanced wound dressings like hydrogel absorb exudate and maintain moisture. Considering the antimicrobial properties of silver nanoparticles and iron oxide nanoparticles, this study formulated and examined a cross-linked cellulose hydrogel containing chitosan-supported iron oxide (IONPs) and silver nanoparticles (AgNPs).

Methods & Materials: Hydrogel containing 2% w/v carboxymethyl cellulose and hydroxyethyl cellulose with varying concentrations of citric acid (CA), predried at 40°C and crosslinked at 80°C.Physicochemical properties investigated by Fourier-Transform Infrared spectroscopy (FTIR), Differential Scanning Calorimetry (DSC), Thermogravimetric Analysis (TGA) and Scanning Electron Microscope (SEM). The swelling ratio of cross-linked hydrogel containing 5% w/v glycerin was determined in citrate-phosphate buffer. IONPs and AgNPs synthesized by chemical reaction and electrochemical reduction, respectively. Physicochemical properties were investigated by Dynamic Light Scattering (DLS) and Transmission Electron Microscopy (TEM). The antimicrobial effects of nanoparticles were analyzed by Minimum Inhibitory Concentration (MIC) test and Checkerboard Assay (on Staphylococcus aureus and Pseudomonas aereginosa), separately and in mixtures. Cytotoxicity test was conducted on NIH/3T3 cell line. In a 14-day animal burn model study, macroscopic effects of five different formulations were compared to silver sulfadiazine and simple ointment: crosslinked hydrogel without nanoparticles (H), with 12.5 ppm AgNPs (ANP), with 100 ppm IONPs (FNP), with 6.25 ppm AgNPs and 50 ppm IONPs (LM), and with 12.5 ppm AgNPs and 100 ppm IONPs (HM). In addition, Histopathological examination was conducted.

Results: The FTIR, DSC, TGA and SEM data revealed that increasing the amount of CA causes more esterification, thermal stability, crosslinking and coarser platelet-like crystallites. The swelling test showed that a rise in CA decreases the swelling index while increase in the pH raises it. 20% CA crosslinked Hydrogel was selected for further studies due to the results. AgNPs and IONPs size were 60.76±4.2 and 125.9±5 nm, with a zeta potential of -20±5 and -25±10 mV respectively, determined by DLS. The TEM pictures demonstrated that both nanoparticles are spherical in shape and the size results matched with the DLS reports. The MIC of AgNPs and IONPs were 12.5 and 100 ppm respectively. Also, MIC of tested mixtures were 3.125+25 ppm AgNPs+IONPs (in Staphylococcus aureus, Synergy: FIC=0.5) and 6.25+50 ppm AgNPs+IONPs (in Pseudomonas aereginosa, Additive: FIC=1). The result of MTT assay showed that cell exposure to samples containing both AgNPs at concentration lower than 25 ppm and IONPs at concentration lower than 100 ppm resulted in 80 percent or more viability and therefore was considered as nontoxic concentration. In animal experiments, the HM group significantly improved the wound healing process in comparison to other groups. The result of pathological findings also confirmed these results.

Conclusion: In conclusion, a crosslinked cellulose hydrogel wound dressing contains 12.5 ppm AgNPs and 100 ppm IONPs had a substantial influence on tissue repair and expedite burn wound healing in

animal study. Further research is needed to assess clinical outcomes and longer-term adverse effects.

Keywords: Burn Wound, Hydrogel, Cross-linked Hydrogel, Silver Nanoparticles, Iron Nanoparticles, Chitosan

## Accelerating the Healing of Internal Tissue Wounds Using Biosensors and Microcontrollers

**Arian Baymani**[1]

**Maryam Naderi Soorki***[2]

***1. Department of Chemical Engineering, Faculty of Engineering, Shahid Chamran University of Ahvaz, Ahvaz, Iran***

***2. Department of Biology, Faculty of Science, Shahid Chamran University of Ahvaz, Ahvaz, Iran***

The healing of internal tissue wounds remains a significant challenge in modern medicine, often leading to extended recovery times and increased healthcare costs. With advancements in technology, particularly in biosensors and microcontrollers, there is growing potential to enhance the speed and efficiency of wound healing. This article explores the implications of integrating these technologies into wound care, emphasizing how they facilitate real-time monitoring, patient engagement, and tailored treatment strategies.

Introduction: Internal tissue wounds may arise due to surgical interventions, traumatic injuries, or chronic conditions such as diabetes. Unlike superficial wounds, these injuries often require comprehensive management strategies to prevent complications and ensure timely healing. Traditional methods of monitoring wound recovery can be limited, typically relying on periodic evaluations that may not capture dynamic changes in wound conditions. The advent of biosensor technology combined with microcontroller systems offers a transformative solution for improving wound healing outcomes. Understanding Biosensors and Microcontrollers: Biosensors are analytical devices designed to detect specific biological markers or physiological changes. When coupled with microcontrollers—compact computing devices that operationalize data collection and processing—these biosensors can provide invaluable insights into the wound healing environment. By continuously monitoring parameters like temperature, pH levels, moisture content, and inflammatory markers, healthcare providers can obtain nuanced information that traditional assessments may overlook. Mechanisms of Action: 1.Continuous Real-Time Monitoring: One of the most significant advantages of using microcontrollers in wound care is their ability to continuously monitor key variables. This real-time feedback allows healthcare professionals to detect changes immediately, whether indicative of healing progress or signals of potential complications such as infection. 2.Data Integration and Analysis: Microcontrollers process data from multiple biosensors, offering a comprehensive view of the wound"s status. Advanced algorithms can analyze trends in the gathered data, helping clinicians understand the healing trajectory and make informed decisions about interventions. 3.Alerts and User Notifications: Many modern microcontroller systems are equipped with alert mechanisms that notify medical staff of abnormal readings. For instance, an unexpected rise in temperature could indicate infection, prompting timely clinical actions that could significantly alter patient outcomes. 4.Enhanced Patient Engagement: Microcontroller-based systems can also enhance patient involvement in the healing process. By providing real-time updates and reminders regarding wound care protocols, these systems empower patients to take an active role in their recovery, which can positively impact adherence to treatment regimens. Innovative Applications and Case Studies: Recent research has showcased several applications of biosensors and microcontrollers in clinical settings that demonstrate their efficacy. For example, smart bandages have been developed that incorporate these technologies, allowing for continuous monitoring of wound healing parameters while simultaneously delivering therapeutic agents. Clinical trials have shown that patients utilizing these smart bandages experience a significantly reduced healing time compared to traditional dressing methods. Moreover, specialized devices tailored for high-risk patient groups, such as individuals with diabetes, have shown promise. These systems not only monitor

wound conditions in real-time but can also adjust the local environment of the wound—regulating factors like humidity and temperature to create optimal healing conditions. Challenges and Future Directions: Despite the promise of biosensor and microcontroller technology in wound healing, several obstacles must be addressed. Ensuring biocompatibility of materials, managing power supply logistics, and safeguarding data security are critical challenges that must be overcome. Additionally, the integration of these newer technologies into standard medical practices requires thorough training for healthcare providers. Future research should focus on enhancing the sensitivity of biosensors, improving energy efficiency, and exploring the application of artificial intelligence (AI) and machine learning algorithms to predict healing outcomes. AI could analyze vast datasets collected from wound monitoring, potentially providing insights that further refine treatment approaches.

Conclusion: The integration of biosensors and microcontrollers into the management of internal tissue wounds signifies a major advancement in wound care. By facilitating continuous data monitoring, real-time feedback, and personalized treatment options, these technologies have the potential to significantly accelerate the healing process and improve patient outcomes. As research continues to evolve and these technologies become more prevalent in clinical applications, we can expect a paradigm shift in how internal wounds are managed, leading to better recovery experiences for patients. The future of wound care is poised for innovation, driven by the intelligent use of technology that bridges the gap between patient needs and medical solutions.

Keywords: Microcontrollers, Internal Tissue Wounds, Biosensors

## The Effects of 2% Topical Herbal Gel on Healing of First and Second-degree Pressure Ulcers Among Hospitalized in the Intensive Care Unit

**Yasamin Sadeghi**

**Elahe Aleebrahim-Dehkordi**
**Ali Hasanpour-Dehkordi***
**Sayed Lotfollah Afzali-Brojeni**
**Elham Saghaei**
**Behnam Shakerian**

***Shahrekord University of Medical Sciences***

Background: Pressure ulcers are common and debilitating problems that lead to increased hospitalization time, pain, infection, chronic wounds, sepsis, and death. Therefore, pressure ulcer is an important diagnosis and nursing care need in patients. Considering the high prevalence of pressure ulcers in patients admitted to the intensive care units (ICUs), this research sought to determine the effectiveness of using Lawsonia inermis and Calendula officinalis L. gel to prevent pressure ulcers in patients.

Methods: This research was a double-blind clinical trial, in which 40 patients with bedsores of the I and II grade were selected and included in the study by means of available sampling among the patients admitted to the ICUs of educational-therapeutic hospitals in Shahrekord. 40 participants were randomly divided into two control groups (Gel without herbal composition) and intervention (Gel containing hydroalcoholic extract of Lawsonia inermis and Calendula officinalis L.). The intervention continued for one month (4 weeks). The evaluation of the healing process of wounds on days 0, 7, 14, 21, and 28 was done by the wound evaluation tool, Pressure Ulcer Scale for Healing (PUSH). Data were analyzed using SPSS version 18 statistical software and descriptive and analytical statistics tests. A significance level of 0.05 was considered.

Results: The results of this research showed that two groups were almost identical in terms of demographic characteristics (P>0.05). Repeated Measures Analysis of Variances about the wound surface showed that the average wound surface in the control group did not show a significant difference on the days studied (P>0.05), but in the intervention group, the average surface of the wound on day 28 significantly decreased days 0 and 7 (P

Keywords: Pressure Ulcer, Herbal Gel, Wound Healing

## How Well Do Nurses Manage Diabetic Foot Care? A Cross-Sectional Study of Knowledge, Attitudes, and Screening Behaviors in Teaching Hospitals

**Aylar Moghadam[1]**
**Vahid Zamanzadeh[2]**
**Ahmad Mirza Aghazadeh Attari[3]**
**Mojgan Lotfi*[1]**

***1. Nursing Faculty of Tabriz University***
***2. Shahid Beheshti University of Tehran***
***3. Paramedical Faculty of Tabriz University***

Aim: To investigate the knowledge, attitudes, and screening behaviors of Iranian nurses regarding DFC management in four teaching hospitals of Tabriz, Iran. Design: A descriptive cross-sectional study.

Method: A total of 284 nurses participated in this study in 2022. Data were collected using a four-part questionnaire and analyzed using SPSS 22 software via descriptive statistics.

Results: The results showed that 55.6% of the nurses had a good level of knowledge about DFC, although approximately half of them had a history of previous education on this topic. The overall attitudes of 49.3% of the nurses regarding DFC were positive. However, the total scores of the nurses on diabetic foot screening were very poor, and only 6% of them had a very good practice.

Conclusion: This study revealed a concerning gap between the knowledge and practice of the nurses regarding DFC, as well as a lack of positive attitudes and motivation among them. The study suggested some implications and recommendations for improving the quality and outcomes of DFC in the teaching hospitals of Tabriz, Iran. Public contribution: This study assessed the knowledge, attitude and performance of nurses regarding diabetic foot care and screening, which are essential for preventing and treating diabetic foot ulcers. A random sample of nurses from different teaching hospitals participated in the study after giving informed consent. Keywords: diabetic foot ulcer; knowledge; attitude; practice; diabetic foot screening; risk assessment; nurses

Keywords: Diabetic Foot Ulcer, Knowledge, Attitude, Practice, Diabetic Foot Screening, Risk Assessment, Nurses

## A Comparative Study of the Capabilities of Artificial Intelligence Models in Differential Diagnosis of Pressure Ulcers

**Hamidreza Hamidian***
**Fatemeh Shirazi**

***Shiraz University of Medical Sciences***

Introduction: Pressure ulcers, caused by prolonged pressure on the skin and tissues, can lead to serious complications such as damage to tissues and even sepsis or tissue necrosis. Therefore, timely diagnosis and treatment of these ulcers are of great importance, as they can prevent the progression of tissue damage and improve patients" quality of life. In today's modern world, the use of artificial intelligence (AI) in healthcare is rapidly expanding, and various models of AI have been developed for the diagnosis and treatment of these ulcers. Given the rapid increase in the number of AI tool users, it is expected that different individuals will use these tools as diagnostic aids and sources of information. The aim of this studywas to compare three AI models—ChatGPT, Gemini, and Bing—in the differential diagnosis of various types of pressure ulcers.

Methodology: This comparative study focuses on evaluating the differential diagnostic power of three AI tools—ChatGPT, Gemini, and Bing—regarding various types of pressure ulcers based on their stages. Each model was assessed using a dataset containing 15 images. These images included pressure ulcers ranging from stage one to stage four, unstageable ulcers, and deep tissue injuries. The classification was conducted according to the guidelines provided by the National Pressure Injury Advisory Panel and under the supervision of a wound care nursing expert. Images from different stages of pressure ulcers were selected to accurately assess the diagnostic capabilities of the AI tools in relation to the identification of pressure ulcers.

Findings: The results of the comparison between the three chatbots indicate significant differences in accuracy and performance in diagnosing pressure ulcers. Among the chatbots studied, GPT-4 emerged as the most accurate system, with an accuracy rate of 86.66%. Following that, Bing also demonstrated acceptable performance with an accuracy of 66.66%, although it showed lower accuracy in diagnosing advanced stages of pressure ulcers. Lastly, Gemini identified pressure ulcers with an accuracy of 53.33%, highlighting the need for improvements in its diagnostic algorithms.

Conclusion: The results of this study demonstrated that the capabilities of artificial intelligence models in the differential diagnosis of pressure ulcers are not the same. Based on the findings, GPT-4 exhibited the highest level of accuracy in diagnosing pressure ulcers at various stages, making it the most precise tool in this field. Bing and Gemini ranked second and third, respectively. It is recommended to focus on integrating AI tools with telehealth systems in future studies, which could facilitate the management of pressure ulcers in situations where access to resources and specialized personnel is limited.

Keywords: Pressure Ulcer, Diagnosis, Artificial Intelligence

## Hydrogel-based Silicone Dressings with Gelma and Collagen Incorporating Human Fibroblast Cells: In Vitro and In Vivo Evaluation for Enhanced Wound Healing

**Kimia Rouzbeh[1]***
**Maryam Saber[2]**
**Zahra Khalajasadi[3]**
**Nasrin Fallah[3]**
**Seyedeh Maryam Zarghami[3]**
**Seyedeh Nafiseh Hassani[3]**

***1. Department of Developmental Biology, University of Science and Culture, ACECR, Tehran***
***2. Department of Stem Cells and Developmental Biology, Cell Science Research Center, Royan Institute for Stem Cell Biology and Technology, ACECR, Tehran, Iran***
***3. Advanced Therapy Medicinal Product Technology Development Center (ATMP-TDC), Cell Science Research Center, Royan Institute for Stem Cell Biology and Technology, ACECR, Tehran, Iran***

The present work investigates the development of innovative wound healing dressings utilizing silicone sheets incorporating fibroblast cells derived from human foreskins. These cells were combined with two distinct hydrogel matrices, namely Gelatin Methacryloyl (GelMA) and Collagen. The primary objective of this study is to examine the impact of biological dressings on the wound healing processes, particularly the effectiveness of the measures following the freezing and thawing procedure. Full-thickness wounds were inflicted on rats in an in-vivo experiment to measure the wound closure rate over 21 days. The study results revealed that the GelMA-based dressing has a remarkable effect on the wound healing process by promoting faster re-epithelialization, higher collagen deposition, and better skin structure, which, in turn, makes it a potential solution for wound care.

Keywords: Wound Healing, Gelatin Methacryloyl (GelMA), Fibroblast, Collagen, Silicone Dressing, Re-epithelialization, Full-thickness Wound, In Vivo Wound Model, Hydrogel

## Investigating the Role of Nursing in Wound Repair and Rehabilitation: Review Studies

**Fateme Rezaei*1**
**Zahra Gharibi2**
**Raziea Saffar3**
**Mehri Gholipor2**
**Arezo Kordian4**
**Ziba Akbari5**

***1. Islamic Azad University of Babol***
***2. Faculty of Nursing and Midwifery***
***3. Imam Khomeini Hospital***
***4. Sari School of Nursing***
***5. Vertical Surgery Center***

Introduction: Nursing and rehabilitation is one of the vital aspects of health care that helps to improve the quality of life of patients. Zakhmehatha memi"ntnnnd nanashi ayez a Alahtelfi memannnd jarahi, thahadah or beimari"ahay memzmen bashnd. In this study, the important examination of nursing and rehabilitation, different treatment methods and the role of nurses in this process will be discussed.

Materials and methods: In this review study, a manual search was conducted in Google Scholar from 2014 to 2024 using the Persian keywords of nursing, wound repair, rehabilitation separately and combined in Farsi academic Jihad databases, medical science publications of the country, and international authoritative databases of PubMed and Google Scholar from 2014 to 2024. 30 articles were analyzed according to the topic.

Findings: The studies showed that nurses play a key role in wound management. They are responsible for assessing the condition of the wound, selecting the appropriate dressing, and educating patients about wound care. Also, nurses should collaborate with the medical team to achieve the best results for patients

Conclusion: Nursing care and rehabilitation are integral components of effective wound and tissue repair strategies. By combining traditional nursing practices with advanced therapeutic techniques, healthcare professionals can significantly improve patient outcomes after surgery or traumatic injury. Continued research and innovation in this area will increase our understanding of optimal care practices and ultimately lead to better recovery experiences for patients.

Keywords: Nursing, Wound, Rehabilitation, Review Studies

## Investigating the Effect of Student-centered Teaching on Communication Skills with Diabetic Patients with Diabetic Foot Ulcers in Nursing Students

**Shima Daman[1]***
**Hajar Ebrahimi[2]**

*1. Jahrom University of Medical Sciences*
*2. Shahid Beheshti University of Medical Sciences*

Background: Communication skills with diabetic patients who have diabetic foot ulcers are considered as one of the quality standards of nursing care. Diabetes is a common chronic metabolic disease characterized by long-term hyperglycemia leading to long-term health consequences. Impaired diabetic wound healing is estimated to affect approximately 25% of all patients with diabetes, often resulting in lower limb amputation and high economic and psychosocial costs. Therefore, communication skills with diabetic patients who have diabetic foot ulcers are considered as one of the quality standards of nursing care. As a result of this study, the aim of this study was to investigate the effect of student-centered education on communication skills with diabetic patients with diabetic foot ulcers in nursing students. became.

Methods: This research is a semi-experimental study, the research community consisted of 42 third-year nursing students of Jahrom Nursing and Paramedical Faculty in 2019; who were selected by the census method and randomly assigned to the student-centered and lecture teaching groups; Communication skills training was held during 3 two-hour sessions during three weeks for both groups. Data were collected using the communication skills checklist before and one month after the intervention and analyzed using independent t, paired t, Mann-Whitney, Wilcoxon and chi-square tests and in spss version 21 software.

Results: The mean scores of patient communication skills in the student-centered and lecture-based educational groups were not statistically significant before the intervention ($P > 0.05$). However, after the intervention, the mean scores of patient communication skills in the students of the student-centered education group ($67.38 \pm 8.71$) was higher compared to students of the lecture-based education group ($47.00 \pm 12.82$) and this difference was statistically significant (p

Keywords: Student-centered, Education, Patient Communication Skills, Nursing Students, Diabetic Patients, Diabetic Foot Ulcer

## Investigation of the Effect of Dressing by Using of Hydrogel Products Compared to Simple Dressing Method on the Wound Healing Process Caused by Pilonidal Cystectomy: One Blind Clinical Trial

**Leila Sadati**

***Alborz Unversity of Medical Sciences***

Background: The choice of a suitable and ideal dressing for managing of pilonidal cystectomy wound with open technique is very valuable. Therefore, the present study was carried out to Investigation of the effect of dressing by using of hydrogel and alginate products compared to simple dressing method on the wound healing process caused by pilonidal cystectomy, the pain experienced by patients when changing dressing, the cost of treatment and the length of their absence from work.

Methods: The present study is part of a clinical trial study. That was performed on 40 patients who were candidates of pilonidal. After random sampling, patients were randomly assigned to one of two groups, simple or alginates groups. After using two methods, the length and depth of the wound, each week, were measured and recorded for one month. Data were analyzed using SPSS 19 software with descriptive and inferential statistics.

Results: The wound healing from the third week in the modified modern dressing group showed a significant growth compared to the simple group (p

Keywords: Simple Dressing, Sinus Pilonidal, Alginate, Hydrogel

## The Effect of Vitamin E on the Healing of Burn Wounds

**Mehran Beiranvand[1]***
**Seyed Amirhossein Mousavi[2]**
**Simin Valinezhad Alvar[3]**
**Maryam Babaei Khomeini[1]**

***1. Lorestan University of Medical Sciences***
***2. Department of Nursing, Khorramabad Branch, Islamic Azad University***
***3. Faculty of Nursing, Islamic Azad University***

Background: Vitamin E is a fat-soluble agent that protecting cells from free radicals with its antioxidant properties. Previous studies have shown that oxidative stress plays an important role in the damage of burn wounds. This study was conducted with the aim of determine the effect of vitamin E on the healing of burn wounds.

Metods: The study conducted is a quantitative systematic review. In this study, by using the keywords of Vitamin E, Burns, Wound Healing and Patient were used from reliable databases such as PubMed, SID, Science Direct, Scopus. The acceptance criteria of the articles were that the articles were only in English and Persian languages; and that the articles were published in the years 2010 - 2020. Among the searched databases and sites, 83 articles were obtained that 18 articles were used.

Results: Most studies have said about the effect of oral vitamin E on the healing process of burn wounds and there is little research on the topical effect of vitamin E on burn wounds. The current studies obtained show the effect of vitamin E orally on blood supply to the wound and its antioxidant effect on the wound healing process.

Conclusion: The result of this study showed that the oral consumption of vitamin E has a positive effect on burn wound healing and can accelerate the healing process of burn wounds. Therefore, a patient with a burn wound can take vitamin E orally under the doctor's supervision to speed up the healing process of the burn wound. There are few studies on the effect of topical vitamin E on burn wounds. So it needs more research in the future.

Keywords: Burns, Wound Healing, Vitamin E

## Comparative Effect of Platelet-rich Plasma, Platelet-poor Plasma and Fetal Bovine Serum on Biological Characteristics of Human Adipose-derived Stem Cells and Preserving their Stemness

**Mostafa Khalili*[1]**
**Shima Abbasi[2]**

*1. Arak Blood Transfusion Center*
*2. Islamic Azad University Arak Branch*

Introduction Human adipose - derived stem cells (hADSCs) represent a promising autologous cell source in tissue engineering. However, the application of hADSCs requires ex vivo expansion, to achieve enough cell numbers and improve cellular characteristics such as cell adhesion and spreading. Nevertheless, xenogeneic supplements, such as FBS, are susceptible to possible hazards, such as the risk of infection and immunological reactions. Given the several growth factors found in platelet-rich plasma (PRP) that can promote cell growth and cellular activities, the use of PRP has been proposed as a viable substitute for FBS. However, due to a shortage of knowledge, plasma or platelet-poor plasma (PPP) is frequently produced and utilized instead of PRP. Hence, this study aimed to examine the comparative impact of PRP, PPP, and FBS on stimulating cell proliferation, spreading, adhesion, and preserving stemness in hADSCs. Methods hADSCs were isolated and characterized from human adipose tissue. PRP and PPP were produced from human peripheral blood. hADSCs (P3) were cultured in DMEM supplemented with two concentrations of activated PRP (10%) and PPP, against FBS-supplemented media. The cell proliferation rate was analyzed using the MTT assay. The number of attached cells (flat and rounded) per surface area and the percentage of spread cells (flat and spread) (the number of spreading cells/the number of attached cells × 100) were counted randomly in multiple areas using a phase-contrast microscope. The gene expression of stemness markers (Nanog and Klf4) was analyzed using qRT-PCR. Results The results showed a significant increase in proliferation, adhesion, and spreading of hADSCs cultured in PRP compared to PPP and FBS. The changes in proliferation over different times can be seen in more detail in Figure B. Moreover, PRP-expanded cells compared to PPP and FBS-expanded cells showed statistically significant up-regulation of stemness gene expression. Conclusion The results showed that using PRP instead of PPP led to significant differences in the biological characteristics of stem cells. Hence, it is essential to use standard guidelines and well-trained individuals while producing PRP.

Keywords: Adipose-derived Stem Cells, Platelet-rich Plasma, Platelet-poor Plasma, Regenerative Medicine

## Establishing an Interdisciplinary Wound Management and Care Team at Tabriz University of Medical Sciences: Enhancing Education, Research, and Patient Care

**Ahmad Kousha[1]**
**Mojgan Lotfi[2]***
**Mohammad Reza Mirzaei[3]**

***1. Professor of Infectious Disease, Department of Multidisciplinary Wound Management, Department of Health Promotion and Education, School of Health, Tabriz University of Medical Sciences.***

***2. Mojgan lotfi. Professor of Nursing Education, Department of Multidisciplinary Wound Management, Department of Medical-Surgical and Operating Room, Nursing and Midwifery Faculty, Tabriz University of Medical Sciences***

***3. Assistant Professor of Traditional Medicine. Department of Multidisciplinary Wound Management, School of Traditional Medicine, Tabriz University of Medical Sciences***

Background and Aim: The prevalence of acute and chronic non-healing wounds is a significant clinical concern, requiring a unified approach to service delivery. The WHO emphasizes that interprofessional collaboration in education and practice is crucial for optimizing patient care, improving outcomes, and strengthening health systems. In response, Tabriz University of Medical Sciences established an interdisciplinary group focused on wound management and care to achieve educational, research, and therapeutic objectives across its treatment, education, and health sectors.

Methodology: A participatory research method was employed in four stages: planning, implementation, evaluation, and reflection. Initially, a group of experts in treatment, education, and research in wound management and care, including specialties in infectious diseases, nursing, and complementary medicine, was formed. After a literature review and reflection sessions, draft objectives were developed and discussed in meetings with key university leaders and field experts, leading to the formation of a Department of Excellence. A broader group of stakeholders then analyzed the current situation, identifying weaknesses,

strengths, threats, and opportunities. Notices were issued to members based on their roles, forming three groups: scientific, executive, and strategic. The strategic and operational plans were developed and approved in the University President's office with the presence of vice presidents and strategic committee members.

Results: 1. Interdisciplinary Group: Established a virtual group with specialists in various medical fields. 2. Clinic and Wound Department: Set up for educational and therapeutic services. 3. Training Program: Developed and implemented for wound therapists, with Level 2 certification. 4. Community Training: Implemented a wound prevention program at the community level. 5. EBM Collaboration: Formulated standards and guidelines for wound care. 6. Educational Activities: Conducted community-oriented activities in wound care. 7. Journal Club and Conferences: Organized sessions and conferences at medical centers. 8. Continuous Training: Participated in ongoing training for nurses in wound management. 9. Curriculum Analysis: Aligned general medicine and nursing courses with wound care education.

Conclusion: The establishment of a multidisciplinary wound management team serves as a model for enhancing the education of healthcare workers and therapists in medical sciences, while also providing a robust scientific platform for research and community-oriented service delivery. Effective wound management as a team necessitates the integration of various specialties, the creation of a supportive and healthy psychological environment, and robust support for both the hospital and the patient. Further evidence is required to fully understand the impact of this specialized team within the university. We remain committed to advancing our efforts in this direction, continuously improving processes, and gathering evidence to support our initiatives.

Keywords: Medical Education, Nursing Education, Wound Management, Wound Care, Networking, Interprofessional Communication

## Wound Healing and Distribution of Cell Cycle Phase in Venous Ulcer Patients

**Mahdi Hesaraki[1]***

**Fatemeh Abdivazvani[2]**

**Hananeh Abdivazvani[3]**

***1. Department of Photo Healing and Regeneration, Medical Laser Research Center, Yara Institute, ACECR, Tehran, Iran***

***2. Department of Molecular Medicine, University of Pavia, Pavia, Italy***

***3. Department of Microbiology, Faculty of Biological Sciences, Alzahra University, Tehran, Iran***

Objective: Maintaining skin integrity following trauma, whether accidental or intentional, relies on a crucial physiological process of wound healing. This process unfolds in three consecutive yet overlapping stages. The most common cause of lower-extremity ulcers is venous disorders, which result in constant elevation of venous pressure. Ulcers account for 1% of the general population. Currently, the mechanisms underlying wound healing in humans are not well understood. To elucidate the spatial and temporal patterns of the cell cycle phase distribution during human wound healing, we analyzed an appropriate GEO (gse265972) dataset to determine the cell cycle phase distribution in patients with venous ulcers.

Materials and Methods: The dataset contained samples from four individuals with venous ulcers (VU) and five healthy subjects. High-throughput sequencing techniques were employed in this study. We focused on examining the cell cycle phases and analyzing the transcriptomic data. Initially, researchers utilized GEO to search for the dataset. Subsequently, they employed the ggplot2 library in R to create a bar chart comparing the cell cycle stages of normal and injured venous cells.

Result: Our analysis revealed a similar number of cells in the G1 phase in the normal and wounded groups. We noted a slight increase in the number of cells in the G2M phase in the wounded groups compared to that in their normal counterparts. In the S phase, the normal group exhibited a cell count that was approximately equal to that of the wounded cells.

Conclusion: The results of this study highlighted that the wound group exhibited a greater proportion of cells in the G2M phase, potentially indicating enhanced cellular proliferation, which is crucial for wound repair. Further research and more sophisticated analytical techniques could potentially uncover

the specific cellular processes involved in wound healing and identify possible targets for therapeutic interventions.

Keywords: Wound healing, Venous ulcer, Cell cycle, G2M

## Investigating the Value of Procalcitonin in the Diagnosis of Diabetic Foot Ulcer Osteomyelitis

**Sara Mohammadnia**
**Mehdi Ghomi**
**Soheil Ebrahimpour**
**Mostafa Javanian***

***Babol University of Medical Sciences***

Introduction: Since the diagnosis of osteomyelitis in patients with diabetic foot ulcer is important, in this study we decided to examine the effectiveness and value of procalcitonin in the diagnosis of this condition.

Method: During a cross-sectional study, the researcher examined the patients by referring to the Babol Rouhani hospital and clinic. After checking the entry and exit criteria, patients were included in the study. Demographic information including gender, age, marital status, education level and occupation were recorded. Then, they were divided into two categories: diabetic foot ulcer without Osteomyelitis and diabetic foot ulcer with osteomyelitis, and they were followed up for one year during treatment. Also, other information including examinations, laboratory tests and imaging documents were recorded. All information was entered into SPSS V22 software and analysis was done.

Results: 128 people entered. 56.3% of participants were male. 57% of people were in the age range of 61-80 years. 57.8% of people had osteomyelitis. 10.9% had a history of kidney disease, 39.8% had a history of heart disease, 45.3% had a history of hyperlipidemia, 57% had a history of hypertension, and 33.6% had grade 3 diabetic foot ulcer. There was a significant relationship between age and blood pressure with osteomyelitis (P value < 0.05), but there was no significant relationship between sex, kidney disease, heart disease and hyperlipidemia with osteomyelitis. All PCT, WBC, HbA1C, ESR, CRP, Cr, Cholesterol tests were significantly higher in people with osteomyelitis than in the other group. ESR and CRP and PCT were effective predictors of osteomyelitis. There was also a borderline positive correlation between PCT and ulcer grade and CRP. Also, at 0/085 ng/ml, PCT was 95/9% sensitivity and 83/3% specifity.

Conclusion: Considering the high sensitivity and specificity of procalcitonin compared to other investigated factors, this factor can be useful in the diagnosis of osteomyelitis caused by diabetic foot ulcer.

Keywords: Procalcitonin, Diabetic Foot Ulcer, Osteomyelitis

## Does Nanofiber Stem Cell Scaffold Promotes Signaling Pathways During Wound Healing!?

**Kimia Esmaeilzadeh**
**Mohammad Seyedhamzeh***
**Abdolreza Esmaeilzadeh**
**Aziz Maleki**

***Zanjan University of Medical Sciences***

Background: Wound healing is a complex and dynamic process comprising several overlapping stages, including inflammation, cellular proliferation, migration, and tissue remodeling. Notwithstanding considerable progress in wound management, chronic wounds continue to pose a significant clinical challenge. Stem cells, possessing the distinctive capacity for self-renewal and differentiation into diverse cell types, have surfaced as a promising therapeutic approach for improving wound healing. The incorporation of stem cells into viable therapeutic solutions necessitates supportive scaffolding materials that replicate the natural tissue environment. Nanofibers, owing to their biomimetic characteristics, provide an optimal scaffold to enhance stem cell functionality and facilitate more effective wound healing.

Introduction: Nanofibers replicate the natural extracellular matrix, offering a supportive framework for cell adhesion, proliferation, and differentiation,

which are critical processes in wound healing. Nanofibers, when integrated with stem cells, establish an environment that promotes expedited tissue regeneration. Despite preliminary studies indicating potential, the precise mechanisms by which this combination improves wound healing, especially the involvement of signaling pathways in regulating cellular behavior, remain ambiguous. Comprehending these mechanisms is essential for enhancing the development of optimized stem cell-nanofiber scaffolds and improving therapeutic results in wound care.

Materials and Methods: This study examines the essential function of signaling pathways in the wound healing process, specifically regarding stem cell-nanofiber scaffolds. Existing literature is analyzed to explore the influence of key classical signaling pathways, including Wnt, TGF-β, and Notch, on cell behavior and tissue regeneration. The potential of hydrogel-based scaffolds to modulate these pathways is examined, with the objective of enhancing stem cell function and facilitating wound healing. The research investigates the engineering of nanofiber properties to enhance scaffold performance, thereby promoting improved integration with stem cells for therapeutic purposes in chronic wound healing.

Results: The amalgamation of stem cells with nanofiber scaffolds has shown significant enhancements in wound healing, especially via the modulation of critical signaling pathways including Wnt, TGF-β, and Notch. Research indicates that hydrogel-based nanofibers offer a structural scaffold for cell adhesion and proliferation while also modulating cellular behavior through pathway activation. This leads to improved tissue regeneration, diminished inflammation, and expedited wound closure in chronic wounds. Furthermore, the capacity to refine the physical and biochemical characteristics of nanofibers enhances their therapeutic efficacy, resulting in more effective and prolonged healing outcomes.

Conclusion: The integration of stem cells and nanofiber scaffolds offers a promising strategy for improving wound healing, especially in chronic and difficult-to-treat wounds. Utilizing the biomimetic characteristics of nanofibers and comprehending the regulatory function of essential signaling pathways can facilitate the creation of more efficient therapeutic scaffolds. This study emphasizes the necessity for ongoing investigation into the interplay among nanofibers, stem cells, and signaling mechanisms to enhance these scaffolds for clinical use. Future developments in this field are expected to yield more efficient, targeted therapies that facilitate accelerated and comprehensive tissue regeneration, resulting in enhanced patient outcomes.

Keywords: Nanofiber, Stem Cell, Signaling, Wound Healing

## Sonopizo Healing: Modern and Effective Approach for Wound Healing

**Mohammad Seyedhamzeh**
**Kimia Esmaeilzadeh***
**Mehrdad Hamidi**
**Aziz Maleki**

***Zanjan University of Medical Sciences***

Background: Wound healing is a multifaceted biological process encompassing tissue repair and regeneration. This process may be impeded by factors including infection, inflammation, and compromised cellular functions, resulting in prolonged recovery. Conventional treatments frequently fail to adequately resolve these underlying complications, underscoring the necessity for more efficacious therapeutic strategies.

Introduction: Wound healing is an essential biological process, yet it is frequently hindered by factors such as infection, inflammation, and compromised cellular functions, which can prolong or complicate recovery. Traditional therapies frequently prove insufficient in managing these complexities, resulting in prolonged healing and increased likelihood of complications. Innovative therapies are being developed to expedite tissue repair and address these limitations. The integration of piezoelectric nanozymes with sonodynamic therapy (SDT) is among the most promising strategies. Sonodynamic therapy (SDT) is a non-invasive method employing ultrasound waves

to activate sonosensitizers, which produce reactive oxygen species (ROS) that can selectively eradicate bacteria and damaged cells. SDT is especially efficacious in the treatment of infected wounds, where traditional methods may be inadequate. In contrast to photodynamic therapy (PDT), which necessitates light activation, sonodynamic therapy (SDT) provides enhanced tissue penetration via sound waves, rendering it more appropriate for addressing extensive, intricate wounds. The synergy of SDT and piezoelectric nanozymes presents novel opportunities for enhanced and expedited wound healing.

Materials and Methods: This review examines the integration of piezoelectric nanozymes with sonodynamic therapy (SDT) to improve wound healing. Sonodynamic therapy (SDT) utilizes ultrasound waves to activate sonosensitizers, resulting in the generation of reactive oxygen species (ROS) that specifically target and eliminate damaged cells and bacteria. SDT's distinctive characteristic, in contrast to photodynamic therapy (PDT), is its utilization of sound waves, facilitating deeper tissue penetration and rendering it appropriate for larger and more intricate wounds. Piezoelectric nanozymes are employed to augment therapeutic effects by converting mechanical energy from ultrasound into electrical signals, thus enhancing reactive oxygen species (ROS) production. This multimodal strategy enhances cellular proliferation, diminishes inflammation, and more effectively addresses infections. The review also addresses critical elements such as enhancing sonosensitizer design, regulating drug release, and choosing suitable wound dressings to augment overall treatment efficacy.

Results: Research indicates that the incorporation of piezoelectric nanozymes with sonodynamic therapy markedly enhances the wound healing process. This combination accelerates tissue repair, diminishes inflammation, and effectively combats infections, surpassing conventional methods. SDT's capacity to infiltrate deeper tissues renders it especially beneficial for addressing larger, more intricate wounds.

Conclusion: Despite the significant potential of SDT in conjunction with piezoelectric nanozymes to transform wound healing, obstacles persist. These encompass optimizing sonosensitizer efficacy, improving drug delivery mechanisms, and creating sophisticated wound dressings. Resolving these issues will be essential for the extensive clinical implementation of this novel therapy.

Keywords: Sonosensitizer, Woundhealing, Sonodoynamictherapy

## A Rare Case Report of a Grade 3 Pressure Ulcer in a Diabetic Patient After Coronary Artery Bypass Surgery with Complete Healing in a Short Period Despite the Patient`s Mobility

**Azin Rajari[1]**
**Saba Poolaie[1]**
**Nasrin Noori[2]**
**Akram Sanago*[3]**

***1. Student Research Committee***
***2. Azar Hospital***
***3. Golestan University of Medical Sciences***

Introduction and Objective: Immobility can lead to pressure ulcers and skin breakdown, which can hinder mobility during treatment and recovery. Lack of movement while resting in bed can lead to bone loss, increased calcium excretion, and changes in the balance of electrolytes necessary for normal muscle function. Blood sugar levels increase when skeletal muscles are at rest, and insulin sensitivity decreases. One of the complications after surgery is pressure ulcers. The aim of this study is to present a rare case report of a Grade 3 pressure ulcer in a patient after coronary artery bypass surgery, which completely healed in a short period of time despite the patient being mobile.

Case Report: The patient was a 60-year-old female with a history of diabetes. The patient had no mobility issues. During hospitalization after coronary artery bypass surgery, despite being mobile and getting out of bed for 7 days in the hospital, she developed a pressure ulcer measuring 66 cm with a depth of 4 cm, Grade 3, with an irregular margin in the sacral area. At the

time of presentation, the patient's wound was necrotic and very dry, and due to the patient's high blood sugar levels, the treatment process was not good initially. She was then referred to an endocrinologist, and after the prescription of Lantus and NovoRapid insulin, it had a positive effect on the patient's recovery. The patient had no mobility issues during treatment and cooperated well with the therapist in the recovery process. The patient's wound completely healed after 45 days and she had no complaints.

Conclusion: The results of this case report indicate that one of the rare complications in patients with a history of diabetes after heart surgery, despite the patient having no mobility issues and being out of bed, is the development of a deep wound in the sacral area. The short-term recovery of this patient could be due to her mobility compared to other patients with larger wounds.

Keywords: Pressure Ulcer, Diabetes, Complications of Bypass Surgery, Case Report

## Investigating the Postbiotic Effects of Enterococcus Faecium Strain Kch-1 on Viability of Normal Human Skin Cells Based on the Process of Apoptosis

**Fozhan Fallahi**
**Sepideh Khaleghi***
**Neda Mousavi Niri**

***Tehran Medical Sciences, Islamic Azad University, Tehran, Iran***

Introduction: Regeneration and tissue repair processes consist of a sequence of molecular and cellular events which occur after the onset of a tissue lesion in order to restore the damaged tissue (1). Postbiotics, the newest member of the biotics family, are valuable functional bioactive substances produced by probiotics through their metabolic activity, which have several beneficial properties, including immunomodulatory, anti-inflammatory, antimicrobial, and angiogenesis characteristics, resulting in acceleration of wound healing (2). Postbiotic strain significantly decreased the skin wound size (3). In this study we consider the effect of Enterococcus faecium strain KCH-1 postbiotic on Normal human skin cells.

Methods: The postbiotic was collected using bacteria precipitating by centrifugation and providing supernatant medium. Due to evaluating the effect of the postbiotics on viability and angiogenesis of Normal human skin cells, MTT assay and apoptosis assay were done by several postbiotic concentration.

Results: The results show the postbiotic is biocompatible and without cytotoxicity on HFFF-1 cell line. The Apoptosis assay confirmed the postbiotic is biologically safe. There’s no cell cycle arresting by postbiotic treatment. Moreover, there is no significant ROS production in postbiotic treated cells.

Discussion: According to the results, the postbiotic provided by Enterococcus faecium strain KCH-1 can be a safe and biocompatible reagent on normal human skin fibroblast cell line. This can be effective in wound healing and anti-aging products. For these aims more experiments are needed.

Keywords: Postbiotics, Enterococcus Faecium Strain KCH-1, Wound

## The Effect of Education on the Prevention of Diabetic Foot Ulcers

**Mahsa Sharifi Nodehi***
**Masoumeh Khavari**
**Fatemeh Ammarlo**

***Islamic Azad University, Semnan, Iran***

Introduction and Objective: Diabetic foot ulcer is one of the most expensive chronic wounds that leads to a lot of pain and suffering and will involve high cost of treatment and sometimes leads to limb amputation. Therefore, strategies such as prevention and education to clients and their families can largely prevent the occurrence of this complication.

Methodology: This study is a systematic review and about 30 articles from different websites such as Pubmed, Google scholar, tyepest, Magiran, Sid, using the Persian keywords of diabetic ulcer prevention, education, diabetic foot ulcer, and keywords English,

Diabetic foot ulcer, Education, Diabetic ulcer prevention was used. The inclusion criteria of the articles included all the researches that were published in Farsi and English, and their content was education and prevention of diabetic ulcer, and the exclusion criteria were the articles that dealt with the repair and healing of diabetic ulcer findings: Studies in the found articles show that due to the prevalence of diabetes and its problems, including diabetic wounds and delayed healing, the complications and costs involved in prevention and education to patients and health service providers, such as showing them risky behaviors and teaching self-care. And careful and daily observation of the feet and regular visits for examination and control of blood sugar play a significant role in reducing the incidence of diabetic ulcers and preventing the progression of the disease.

Conclusion : From the results of the studies, it can be concluded that increasing awareness in preventing the occurrence of diabetic ulcers and teaching patients and their relatives through various ways such as classes and educational programs, encouraging patients to self-care and taking the necessary care for them leads to a reduction in the incidence of diabetic ulcers. amputation and also leads to reduction of care and rehabilitation costs.

Keywords: Diabetic Foot Ulcer ,Education ,Diabetic Ulcer Prevention

## Synthesis of Chitosan-alginate Hydrogel Wound Dressing Loaded with Tpgs-curcumin Nanomicelles and Investigation of its Antibacterial Properties

**Atieh Talaei***

**Seyede Zohreh Mirahmadi - Zare**

***1. ACECR Institute of Higher Education (Isfahan Branch), Department of Animal Biotechnology, Reproductive Biomedicine Research Center, Royan Institute for Biotechnology, ACECR, Isfahan, Iran***

***2. Department of Animal Biotechnology, Reproductive Biomedicine Research Center, Royan Institute for Biotechnology, ACECR, Isfahan, Iran***

Background: Infection in chronic wounds is a significant clinical challenge that often leads to delayed healing and increased treatment costs. Chronic wounds are characterized by prolonged inflammation and a high likelihood of bacterial colonization, which can result in systemic complications. The use of antibacterial wound dressings can be an effective strategy to reduce the risk of infection and accelerate the healing process. Hydrogel dressings, such as alginate-chitosan, are a type of wound dressing that not only meets the complex needs of chronic wound healing—such as moisture retention and water vapor permeability—but can also be combined with various nanoparticles to prevent infection and inflammation in chronic wounds. Curcumin and copper oxide, which are used in traditional medicine, can be loaded into these hydrogels to enhance the wound healing process.

Methods: In this study, the chitosan-alginate hydrogel loaded with TPGS-Curcumin nano-micelles was synthesized. The effective formation of nano-micelles by the thin-film method was assessed through transmission electron microscopy (TEM), FTIR spectroscopy, dynamic light scattering (DLS), and zeta potential measurement. Additionally, the physicochemical properties of the chitosan-alginate hydrogel wound dressing containing TPGS-Curcumin nano-micelles, such as morphology, degradation rate, release pattern, and vapor adsorption, were investigated. The antibacterial properties of the wound dressing were also evaluated against two bacterial strains: Gram-positive (Staphylococcus aureus) and Gram-negative (E. coli) using the disk diffusion test.

Results and Conclusion: While TEM and DLS confirmed the spherical shape and size in the range of 55 ± 3 nm for TPGS-Curcumin nano-micelles, FT-IR and UV-visible spectroscopy confirmed the loading of curcumin inside the micelles and the presence of TPGS on the surface of the micelles, respectively. These nano-micelles were stabilized by a zeta potential of 57 mV at the surface. Appropriate porosity for the chitosan-alginate hydrogel wound dressing containing TPGS-Curcumin nano-micelles was observed in the SEM images. Additionally, the physicochemical properties of the loaded hydrogel were similar to the intrinsic properties of the chitosan-alginate hydrogel

wound dressing. Furthermore, the disk diffusion test confirmed the antibacterial properties of the chitosan-alginate hydrogel, which have been significantly enhanced by the loading of TPGS-Curcumin nano-micelles. In conclusion, it is expected that this wound dressing will be effective in promoting wound healing and preventing bacterial infection.

Keywords: Hydrogel, Chitosan, Alginate, Antibacterial, Curcumin, Wound Dressing

## Investigation of the Effect of Total Extract of Falcaria Vulgaris on Burn Wounds in Mice

**Mohammad Abbas Sheikholeslami***
**Sara Shojaei Zad**
**Mohammad Reza Zamani**
**Malek Zarei**

***Department of Pharmacology, School of Medicine, Shahid Beheshti University of Medical Sciences***

Introduction: Burn wounds are among the most common skin injuries, particularly in children. Burn injuries, especially severe ones, can lead to the failure of multiple organs and are associated with significant mortality. In addition to physical health, burn injuries also affect the mental health and quality of life of patients. In Iran, approximately 725,000 burn incidents are reported annually, with 48,000 of those cases requiring hospitalization. Although current treatments often lead to recovery, healing from burns remains a significant medical challenge. Continued research into new compounds and treatment methods is crucial in this field. The plant Falcaria vulgaris, commonly known as "Gaze Yaghi," is an annual plant from the Umbelliferae family, traditionally used in western Iran to treat skin wounds. In this project, we scientifically examined the effect of this plant on the treatment of burns.

Materials and Methods: First, a hydroalcoholic extract of the plant was obtained using the percolation method. According to previous studies (the effect of plant extract on wounds caused by cuts) and in order to comply with the ethical principles of working with animals and in order to reduce animal groups, 10% ointment containing plant extract was prepared. 20 Syrian mice weighing 32 to 35 grams were obtained from the animal house of the Pharmacology Department of Shahid Beheshti Medical School. The animals were divided into four groups as follows: • Control group: Burn injury was created, but no treatment was given. •Control group: After the burn injury, the mice were treated with the ointment base. • Positive control group: After the burn injury, the mice were treated with silver sulfadiazine ointment. •Treatment group: After the burn injury, the mice were treated with 10% Falcaria vulgaris extract ointment. Burns were induced using the hot plate method. Wounds were photographed on days 1, 3, 5, 7, 10, and 14, and the size of the wounds was analyzed using the Image J software. The data were statistically analyzed using one way ANOVA and Turkey's test.

Results: The 10% Falcaria vulgaris extract ointment significantly improved the healing time of burn wounds in the treatment group compared to the control groups.

Conclusion: Falcaria vulgaris plant has been proven to have anti-inflammatory and analgesic effects, and these effects are probably effective in the effect of this plant in the treatment of burn wound model.Further studies on different doses and mechanisms of action are recommended.

Keywords: Falcaria Vulgaris, Burn Wound, Mice

## The Role and Importance of Exosomes in Diabetic Wounds

**Fahimeh Hajizadeh***
**Sepideh Mokabberi**
**Aref Madady**

***Department of Cellular& Molecular Biology, Comprehensive Health Resaerch Center,Islamic Azad University, Babol Branch, Babol, Iran***

Diabetic wounds, due to delays and deficiencies in healing, pose a significant burden on global healthcare. Numerous studies have indicated that exosomes may be a potential solution for treating diabetic wounds. Exosomes are lipid bilayer structures secreted by nearly all cells. They can act as messengers between various cells, inducing functional changes in recipient cells,

which suggests their ability to treat various diseases, including chronic diabetic wounds. In this research and review, we aim to gain a deeper understanding of therapeutic exosomes and their remarkable prospects for enhancing wound healing and advancing their clinical application. This review is based on articles from reputable journals and various databases from 2020 to 2024. Due to their structural characteristics, exosomes have a high engineering potential. Studies have shown that certain molecules found in exosomes are particularly beneficial for wound treatment; thus, enhancing these molecules in exosomes through engineering technology can improve their functionality. Some studies report that exosomes can address specific issues related to diabetic wounds, such as angiogenesis, nerve damage, and certain inflammatory problems. Research indicates that exosomes can promote the survival and inhibit apoptosis of endothelial cells (ECs), fibroblasts, keratinocytes, and neurons. Exosomes transfer proteins, metabolites, and nucleic acids to recipient cells, which can significantly alter their biological response capabilities. These exosomal reactions can either promote or inhibit disease progression and also offer promising prospects in disease diagnosis. Our goal is to develop exosome-based therapeutic strategies for managing diabetic wounds. Scientists confirm all the functions of exosomes for wound healing in diabetes. However, there is still a need for deeper foundational research and further testing to enhance the therapeutic effects of exosomes from unique sources in improving and reconstructing diabetic wounds.

Keywords: Exosomes, Wounds, Diabetic

## Identification and Isolation of Protease Producing Bacteria From Diabetic Foot Ulcers

**Melika Farzin**

***Shahid Beheshti Medical University***

Introduction:This reading was conducted to detect bacterial causative pathogens in patients with diabetes foot ulcer infections and determine the protease enzyme.

Material /Meethods: Samples were collected from 75 swabs were collected from patients suffering from diabetic foot ulcers referred to The Diabetic Center. Data collected from patients included: age, gender and Period of infection. The results revealed that positive bacterial growth appeared in 54 (72 %) of diabetic foot ulcer specimen, and the most common isolates were Enterobacter cloaca 15(27.77%), followed by proteus mirabilis 12 (22.22%), Staphylococcus aureus 10 (18.51%), Escherichia coli 8 (14.81%), for each one Klebsiella pneumonia, Pseudomonas aeruginosa and Streptococcus pyogens 3(0.84%). The results of the Protease enzyme test were performed for all 54 isolates to determine the variable ability of these bacterial species isolated from didactic foot ulcers to produce this enzyme.

Conclusion:The highest percentage production protease enzyme was 100 % for Pseudomonas aeruginosa, Staphylococcus aureus and 76.92% for proteus mirabilis, while the isolates showed a low production of 20.0 % for Enterobacter cloaca.

Keywords: Foot Ulcer, Proteus Mirabilis, Enterobacter Cloaca, Staphylococcus Aureus, Protease Enzyme, Infections, Isolation

## A Creative “Fistula-Vac” Technique in Management of Open Abdomen with Multiple Entero-atmospheric Fistulas: A Case-report

**Mohammadreza Ajam*[1]**

**Tannaz Faregh[2]**

**Farzad Aramesh[1]**

**Ali Ghasemi[3]**

***1. Shahid Sadoughi University of Medical Sciences, Yazd, Iran***

***2. Tehran University of Medical Sciences, Tehran, Iran***

***3. Islamic Azad University Yazd Branch***

Introduction: The open abdomen (OA) is an important approach for managing intra-abdominal catastrophes and continues to be the standard of care. Despite this, challenges are associated with high incidence of complications and poor outcomes. Moreover, entero-atmospheric fistula (EAF) adds difficulties to management through wound bed

effluent-contamination which increases the morbidity and mortality rate. Breaking the cycle of tissue inflammation, infection, and sepsis, resulting from enteric contents leakage, should be a major goal in approach to these complex patients. Fistula-VAC method affords wound bed with all vacuum-therapy benefits besides diverting enteric content into an ostomy-appliance over fistulas. This study presents a fully- healed complex case of OA with multiple juxtaposed EAFs at wound bed center which make its management more challenging.

Case-presentation: A 35-year-old man developed a vertical wound from epigastric to hypogastric areas of abdominal-wall divisions due to bowl perforation and adhesions following appendectomy with multiple high-output (2-3 liters/day) EAFs were refractory to medical therapy. this method was used to control fistulas-effluent and mature wound bed then he went under bowl-reconstruction surgery. The work was reported with the CARE 2023 criteria.

Methods and Materials: Wounds were first cleaned with saline irrigation and VAC sponge was tailored to precisely fit wound bed without overlapping skin. Two holes were cut in sponge to match enteric openings. Then, high-elasticity substance (cleft-palate teat ring) were put within holes to exclude fistulas and facilitate reestablishment sealing with placement of vacuum-assisted closure. The sponge covered by polyurethane drape subsequently to apply 105 mm Hg continuous negative pressure. Lastly, the stoma-appliance and bag were placed over fistulas and connected to a Foley bag to allow for gravity drainage. The fistula-VAC was changed every 5 days.

Results: The fistula-VAC creates a barrier between the open abdominal wound bed and the enteric opening via confluent negative pressure, resulting in complete isolation of the fistula and diversion of enteric contents into the ostomy bag and gravity drainage system. The patient had full intestinal drainage diversion using fistula-VAC after the first dressing-application. Healthy granulation tissue surrounding the enteric fistula ensued in patient by the end of first session. After 5-session fistula-VAC wound size reduced as much as patient could go under late-primary intention operation to close wound completely and reconstruct bowl integrity.

Conclusions: According to successful results of this patient, application of the fistula-VAC should be considered a useful option in treating patients with intestinal fistulas in open abdominal wounds. Furthermore, it is recommended to investigate the efficiency and safety of this method in randomized clinical trials. It is worth-emphasizing application of cleft-palate teat ring has offered a creative sealing approach around fistulas without need of further protective barriers.

Keywords: Intestinal Fistulas, Open Abdominal Wounds, Vacuum Assisted Closure

## Application of Artificial Intelligence in Wound Care: A Systematic Review

**Tannaz Faregh**

***Tehran University of Medical Sciences, Tehran, Iran***

Background: Wound healing is a complex process and wound care is one of the major concerns in the current medical field as management of both acute and chronic wounds is challenging and burden to healthcare. Inappropriate management leads to hard-to-heal wounds and other life-threatening outcomes. Comprehensive assessment and regular documentation are integral components of good management to promote complete and timely healing wounds and prevent complications through helping wound-specialists to develop the best treatment strategy. Furthermore, considering shortage of well-trained wound-specialists in primary and rural healthcare settings, vast majority of patients do not have access to specialized wound care and updated guidelines systems. Recently, innovative technologies such as artificial intelligence (AI), defined as the incorporation of human intelligence into machines, have revolutionized wound care, providing more effective solutions including remote diagnosis and treatment system and tailored education for healthcare professionals. Therefore, this study purposed to analyze AI using effectiveness in wound care extensively through literature.

Methods and Materials: An electronic-based literature search was conducted in the databases EMBASE,

MEDLINE, and SID besides Google Scholar search engine. Literature about the subject were searched with proper MESH terms/keywords in both English and Persian languages for period between January 2020 and January 2024. This review included all abstract-available previously-published articles about AI effectiveness in wound care and its education within mentioned period and omitted non-English/Persian studies. CONSORT and STROBE guidelines for evaluating experimental and observational studies and the Preferred Reporting Items for Systematic Reviews and Meta-analyses 2020 (PRISMA) guidelines were followed.

Results: Eventually, 136 eligible articles were included from retrieved literature according to our inclusion and exclusion criteria which consist of systematic/narrative reviews, clinical trials, retrospective and prospective cohort studies. Generally, AI technology methods in wound care involve Rule-based algorithms, Machine learning, and Deep learning. Moreover, wound features extraction for diagnosis wound types and severity besides suggesting effective treatment is obtained from extended datasets of photographs or texts in trained AI models. Remarkable role of AI system in monitoring wound healing progress, predicting outcomes, and optimization medical treatment has been proved. Additionally, generative AI marks a pivotal shift towards enhancing clinical decision support and e-learning platforms. However, transparency in AI-models is crucial to understand rationale behind AI-recommendation and there is no thorough AI-trainings by wound-specialists besides doubting feature for data clarification. On the other hand, Incorporating AI into wound care education demands careful consideration of ethical aspects.

Conclusions: In overall, AI technology through wound measurement, diagnosis, and prognosis saves lots of clinician's time, reduces economic burden and improves patient's life-quality and plays a significant role in the future of healthcare education as a transformative trend. Thus, this study suggests further AI using in greater scale with creating a universal software tool which can be used with certain variations for the whole variety of pathological conditions besides as AI shapes the educational landscape, addressing data privacy and bias is crucial for a responsible integration that ensures both educational excellence and ethical approval.

Keywords: AI, Wound Management, Wound Care, Artificial Intelligence

## The Effect of Spiritual Care on the Quality of Life of Lower Limb Amputation Patients Due to Atherosclerosis

**Mohammadmahdi Pazhavand[1]***
**Mahboobeh Moradi[2]**
**Ehsan Izadipour[3]**

***1. Department of Nursing Namazi Hospital, Shiraz University of Medical Sciences, Shiraz, Iran***

***2. Instructor of Critical care Nursing.School of Nursing Gerash University of Medical Sciences. Gerash, Iran***

***3. Religion and Health Research Center, Mashhad University of Medical Sciences, Mashhad, Iran***

The effect of spiritual care on the quality of life of lower limb amputation patients due to atherosclerosis Introduction: Atherosclerosis is the most common cause of amputation surgery. Atherosclerosis often develops in old age, which causes a decrease in blood supply to a part of the body. This study aimed to investigate the effect of multidimensional spiritual care on anxiety, depression and attitude towards self and God in patients with lower limb amputation due to atherosclerosis.

Method: In this research, a pre-test-post-test design was used with two groups. A total of 64 participants (male = 41, female = 23) aged between 47 and 78 years who had an amputation related to atherosclerosis participated in this study. The experimental group was subjected to spiritual support intervention for 10 sessions of 45 minutes, while the control group did not receive any intervention. To collect data, Kettle Anxiety Inventory (CAI), Beck Anxiety Inventory (BAI), Beck Depression Inventory (BDI), Religious Adherence Questionnaire (RAQ) and God Self Concept Questionnaire were used. The obtained results were analyzed using repeated measures analysis and

independent t-test using SPSS 23 software.

Results: Spiritual care was effective in the experimental group and there was a significant difference between the control and experimental groups in terms of anxiety , depression, image of God and belief in God.

Conclusion: The results of the study indicate that emphasizing spirituality and providing spiritual support to amputated patients can contribute to their overall well-being, understanding the true nature and purpose of their existence, and their peace. Therefore, managers can improve the health of patients by creating opportunities for spiritual support.

Keywords: Amputation, Spiritual Care, Atherosclerosis, Quality of Life, Spiritual Therapies

## Tele-Rehabilitation in Burn Wounds Management

**Razieh Shokoohi*[1]**

**Fateme Shirazi[2]**

***1. Student Research Committee, Shiraz University of Medical Sciences, Shiraz, Iran***

***2. Associate Professor, Department of Nursing, School of Nursing and Midwifery, Shiraz University of Medical Sciences, Shiraz, Iran***

Introduction: Burn wounds weaken the patient's body and mind. Every year 100 to 150 thousand people suffer from burn accidents in Iran. Burn wounds have many complications and prevention of these complications is essential. Rehabilitation in these patients should be followed from the beginning of treatment in order to reduce complications. But the lack of access to specialized service centers makes the person abandon rehabilitation. In these cases, tele-rehabilitation can be very efficient in many ways.

Method: Organized search in various PubMed, Web of Science and Google scholar databases and review of articles with PRISMA guidelines, the desired articles were extracted and evaluated with inclusion and exclusion criteria. Review articles, meta-analysis, clinical and cross-sectional trials were examined in this review study and 15 articles were selected for full review. Finally, 5 articles were selected for inclusion in the review study according to the objectives of the study. The articles are from 2020 to 2024.

Result: By studying and summarizing the selected articles, it was found that various methods have been taken into consideration in remote rehabilitation and management of burn patients. In recent years, the use of applications and tools based on artificial intelligence has been considered for the evaluation and management of any kind of wound, both to help the treatment personnel in estimating the level and depth of the burn, and for the use of patients for rehabilitation and evaluation of the wound at home. The use of virtual reality tools and smart phone applications in burn patients and the use of social media such as WhatsApp are other methods of remote rehabilitation in burn patients that have increased the quality of life and reduced burn complications in patients. It seems that convenience of use, reduction of commuting costs, better access to rehabilitation programs and most importantly, increasing the quality of life (QOL), are among the strengths of remote rehabilitation. The negative points of using the above methods include lack of access to smart phones and the Internet, difficulty in installing and setting up applications, inability to use applications due to lack of education and storing photos and videos of patients in the medical team's equipment.

Conclusion: The use of remote rehabilitation programs has been the focus of many researchers in the last few years, which seems to have positive consequences in the process of managing the complications caused by burn wounds, especially for patients who do not have proper access to specialized treatment centers, along with have However, clinical trial studies in this field are limited and most of the studies were conducted on patients with burn percentage less than 20% or burn wounds were not examined in a specialized way. In this regard, it seems that more studies on the application of artificial intelligence applications in burn wound rehabilitation are still needed

Keywords: Tele-rehabilitation, Burn Wound, Social Media, Artificial Intelligence, Virtual Reality, Application, Smart Phone

## The Effect of Technology-based Interventions in the Management of Diabetic Foot Ulcers: A Systematic Review of Clinical Trials

**Amir Hossein Dehghan***
**Ali Karimi Rozve**
**Matineh Sadat Tabatabaei**

***Tehran University of Medical Sciences***

Introduction: Chronic wounds, including diabetic foot ulcers, impose a significant burden on patients and healthcare systems. Optimal management of diabetic foot ulcers requires input from multiple healthcare specialists, which does not always yield favorable outcomes for patients living in remote areas. This is where telehealth emerges as a popular solution to enhance wound management. Therefore, this study aims to investigate the impact of technology-based interventions in the management of diabetic foot ulcers. Search Strategy: A thorough search of the literature was conducted in line with PRISMA guidelines. Various databases, such as PubMed, Embase, and Web of Science, were searched for studies relating to wearable devices used in wound care. Keywords such as "of technology-based," "diabetic," "remote monitoring," "foot ulcers," and "telehealth" were used to find relevant articles published between January 2019 and July 2024. To ensure unbiased results, a double-blinded screening process was applied. After eliminating duplicate and irrelevant studies, the remaining articles were selected based on their focus on clinical applications of technology-based clinical interventions in the management of diabetic foot ulcers. And 14 articles were included in the study according to the inclusion criteria Result: Evidence from studies indicates the effectiveness of a combination of technology-based interventions. These interventions include email, telephone, and video conferencing to facilitate the implementation of telemedicine using specialized systems, tablets, mobile phones, and applications such as Skype and specialized interactive systems. Improvements were observed in long-term wound healing, a reduction in lower limb amputations, and decreased mortality rates among telehealth and technology-based care groups in the target community. Overall, patient and physician perceptions of telehealth have been positive.

Conclusion: Technology-based interventions have been well accepted by both patients and healthcare providers, demonstrating positive efficacy along with good efficiency and safety.

Keywords: Technology-based, Diabetic, Remote Monitoring, Foot Ulcers, Telehealth

## Evaluation of Postbiotic Antibacterial Effects of Pediococcus Acidilactici Strain B27-1 on Common Pathogenic Bacteria Causing Skin Infections

**Sepideh Khaleghi***
**Shakiba Papar**

***Department of Biotechnology, Faculty of Advanced Sciences and Technology, Tehran Medical Sciences, Islamic Azad University, Tehran, Iran***

Background/Introduction: Postbiotics are preparations of non-living microorganisms and are beneficial for health, with various biological activities including antimicrobial, antioxidant, anti - inflammatory, antiproliferative, and immunomodulating properties. The evolution of postbiotics has led to increased research on their production, classification, mechanisms of action, and potential clinical applications. Recent studies have shown the beneficial effects of postbiotics on wound healing and skin reconstruction. Postbiotics, produced during probiotic bacteria fermentation, have similar benefits to probiotics when fed certain fiber molecules. They consist of non-living bacterial forms, cells, cell fractions, and cell metabolites with stable, non - toxic properties suitable for functional foods and wound healing. In this study we evaluate the antimicrobial effects of Pediococcus Acidilactici Strain B27-1 postbiotics on common wound-causing bacteria to develop effective infection management and wound recovery strategies.

Methods: The focus of the study was the probiotic

bacteria Pediococcus acidilactici strain B27-1, which was cultivated in MRS medium and the postbiotic was collected using bacteria precipitating by centrifugation and providing supernatant medium. The study utilized the disk diffusion method to determine the antimicrobial effects of the postbiotic and the antibacterial effect was considered by MIC/MBC as well as the anti - biofilm formation was assessed too.

Results: The results showed, the postbiotics provided by Pediococcus acidilactici strain B27-1 bacteria have antibacterial effects on Staphylococcus aureus, Streptococcus pyogenes, Escherichia coli and Pseudomonas aeruginosa. Moreover, the postbiotic have anti-biofilm formation effect on common wound-causing bacteria too. Conclusion: As a conclusion, the postbiotic of Pediococcus acidilactici strain B27-1 bacteria can be used as antibacterial reagent in wound healing process.

Keywords: Postbiotic, Probiotic, Pediococcus Acidilactici Strain B27-1, Wound Infection.

## The Role of Nutritional Care in Preventing and Healing of Chronic Wound: The Neglected Care in the Chain - A Systematic Review

**Hamed Razaghpour[1]***
**Negar Rahimi[2]**

***1. Qazvin University of Medical Scinces***
***2. Zanjan University of Medical Scinces***

Introduction: Wounds are a common and complex issue in healthcare, often requiring multidisciplinary collaboration for effective management. Achieving successful wound healing involves multiple physiological and immunological processes, alongside physical, social, and sociological factors. Treatment typically includes topical and oral therapies, adjustment of mechanical factors, and modification of behaviors and lifestyles. Although the causes of wounds in dermatology are highly diverse, the importance of nutrition plays a crucial role in all stages of wound healing. Nutrition is a key component of health, and impaired nutritional status is associated with an increased risk of wound formation, difficulty in management, and slower wound healing. Malnutrition weakens the immune system, reduces collagen synthesis, and diminished tensile strength during the wound healing process. Therefore, assessing and optimizing nutritional status should be included as part of a comprehensive treatment plan for individuals with wounds. Since the existing studies in this field are scattered, there is a need for a systematic review to collect and evaluate the scientific evidence.

Methods: A search was conducted in the PubMed and Scopus databases up to August 2024. A total of 180 articles were reviewed. The inclusion criteria consisted of randomized clinical trials, observational studies, and interventional studies that examined the impact of nutrition on wound healing.

Results: The results indicated that omega-3 fatty acids and specific amino acids were associated with improved wound healing and immune function. Vitamins A, B, and C, as well as zinc, positively impacted the healing stages, while vitamin E showed variable results. Vitamin C, also known as ascorbic acid (AA), plays a role in all phases of wound healing. During the inflammatory phase, it is necessary for the apoptosis and clearance of neutrophils. In the proliferation phase, AA assists in the synthesis, maturation, secretion, and degradation of collagen. Deficiencies during the maturation phase affect collagen production and scar formation. The body strives to maintain AA homeostasis, ensuring its availability for collagen synthesis. After injury, plasma and tissue levels of AA decrease, suggesting that supplementation may be beneficial for healing, although excess amounts are excreted. Polyphenol compounds demonstrated anti-inflammatory effects that were beneficial for healing. Protein loss can negatively impact the overall immune process, while adequate carbohydrate intake is essential for fibroblast migration during the proliferation phase. Additionally, micronutrients such as arginine, glutamine, and iron are essential for the inflammatory process and collagen synthesis. Notably, the anti-inflammatory and antioxidant properties of curcumin may reduce the expression of tumor necrosis factor alpha (TNF-α) and interleukin-1 (IL-1), and restore the balance between reactive oxygen

species (ROS) production and antioxidant activity. Since curcumin induces apoptosis in inflammatory cells during the early stages of wound healing, it can accelerate the healing process by shortening the inflammatory phase. Malnutrition was associated with increased postoperative complications and infections while preoperative nutritional support was linked to reduced hospital stay and related complications.

Conclusion: A proper and balanced diet, particularly those rich in protein, vitamin C, zinc, and omega-3 fatty acids, can significantly accelerate the wound healing process. In contrast, unbalanced and high-fat diets may lead to ineffective wound healing and an increased risk of infection. Careful nutritional planning for patients with chronic or acute wounds can serve as an effective adjunct in their treatment.

Keywords: Nutritional Care, Preventing, Healing, Chronic Wound

## Smart Hydrogels: A Promising New Treatment for Diabetic Foot Ulcers

**Aref Madady**
**Sepideh Mokabberi***
**Fahimeh Hajizadeh**

***Department of Cellular& Molecular Biology, Comprehensive Health Resaerch Center, Islamic Azad University, Babol Branch, Babol, Iran***

The healing of a wound is a dynamic and coordinated process involving stages of hemostasis, inflammation, proliferation, and remodeling. This process is disrupted in individuals with diabetes, leading to pain, suffering, and chronic diabetic ulcers. In recent years, polymer hydrogels with prominent hemostatic properties have garnered significant attention from researchers for their role in infection clearance and inflammation reduction in wounds. This review explores the advances in smart hydrogel innovations for improving diabetic ulcers, based on articles from reputable journals. A review study was conducted by searching for specialized keywords in various databases from 2020 to 2024. Researchers evaluated the performance of hydrogels in experiments on diabetic mouse models. The findings after 15 days on diabetic mice showed that the utilized hydrogel had a positive impact of approximately 41.5% on wound closure. Hydrogels are a primary choice for wound healing due to their adjustability, biological degradability, better biological compatibility, and excellent capacity for loading antibiotic drugs. Meanwhile, for improving diabetic ulcers, drug resistance against bacteria remains one of the major challenges. Studies suggest that antibacterial metallic and non-metallic nanoparticles like silver, copper, zinc oxide, and graphene nanoparticles can be incorporated into hydrogel systems, providing broad-spectrum superb antibacterial activity without inducing drug resistance. Additionally, biopolymers with antibacterial properties can also be utilized. There exist smart hydrogels capable of regulating their chemical structure to exhibit responsive properties to stimuli, injectability, self-healing, and conductivity. Effective antibacterial hydrogels can prevent antibiotic resistance, reduce pain, and inflammation in diabetic wounds by reducing antibiotic consumption. Based on review studies, advanced hydrogels for diabetic wound treatment are highly effective and recommended, as these bio-polymer-based hydrogels offer advantages such as easy preparation, high economic benefits, and tremendous development prospects.

Keywords: Hydrogels, Diabetic, Foot Ulcers

## Physiotherapy for Scar Management, a Rapid Review

**Fateme Bokaee**

***Department of physical therapy, School of Rehabilitation Sciences, Isfahan University of Medical Sciences, Isfahan, Iran***

Background: The skin provides a protective barrier against external factors. Skin damage leads to loss of its integrity. scars may progress into pathologic hypertrophic and keloid scars. Continuing pain, loss of movement due to adhesion or contracture and changes in cosmetic appearance can significantly affect psychological recovery and quality of life of the patients post injury. different treatment methods can manage scars. Physiotherapy techniques are one of these methods. The aim of this review was to describe the potential of physiotherapy in scar management.

Method: search was conducted in Pubmed, Scopus, PEDro, Embase, Cochrane Library, and Web of science to find studies considered physiotherapy techniques in scars management.

Result: the results indicated that there are effective types of physiotherapy techniques for scar management.

Conclusion: physiotherapeutic techniques (electrotherapy, taping, phonophoresis, manual therapy...) are effective and non-invasive methods for scar management. It can be recommended to consider physiotherapy as an effective method in scar management.

Keywords: Scar، Physical Therapy، Electrotherapy، Manual Therapy

## Chronic Infections and Their Effect on Diabetic Foot Ulcer Healing Process: A Systematic Review

**Mostafa Rajabzadeh[1]***
**Aynam Niroomand Toumaj[2]**
**Snam Moghadam[3]**
**Maryam Memarzadeh[4]**
**Kiarash Sabet[1]**

***1. Student Research Committee, Torbat-e Heydariyeh University of Medical Sciences, Torbat-e Heydariyeh, Iran***

***2. Member of Young and Elite Researchers club of Islamic Azad University, Zahedan, Iran***

***3. Student Research Committee, Zanjan University of Medical Sciences, Zanjan, Iran***

***4. Student Research Committee, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran***

Introduction: Chronic infections significantly impair diabetic foot wound healing. Diabetic wounds are more susceptible to sustained bacterial infections, particularly Staphylococcus aureus, leading to delayed healing compared to non-diabetic wounds. The most common type of infection in diabetic patients is diabetic foot ulcer (DFU), which is followed by the first organ that leads to amputation in 40-70% of The aim of this study is to investigate diabetic ulcers and chronic and long-term tissue infections in these patients and to investigate the relationship between the two in order to prevent irreversible damage to patients and even human societies with awareness and health policy planning.

Methods: A review was performed independently by two people based on the PICO criteria aligned to the research objective and based on the PRISMA checklist. Articles were searched in PubMed, CINAHL, Medline, Web of Science, SID databases Google Scholar search engine, and operators. The time limit between 2018 and 2023. was determined using the MESH keywords “Chronic infections”, “diabetic foot ulcer” and “healing process”. After checking the entry and exit criteria and critically evaluating the quality of the selected articles, a total of 9 articles were included in the study.

Results: The results of the studies show that the delay in the healing process of diabetic wounds is influenced by infectious microbes and fungi that grow inside the protective biofilms. These structures often lead to chronic infections and require antimicrobial intervention to accelerate the healing process. Biofilm formation is an important pathophysiological step in DFU, which plays a key role in disease progression, chronicity of the lesion, antibiotic resistance, and difficulty in wound healing. In the present study, infected diabetic wounds and factors associated with chronic infections, such as alterations in the osmolarity of substances and ions, oxidative stress, changes in cellular phenotype, vasculopathy, neuropathy, and other factors leading to infections and chronic inflammations, were examined.

Conclusion: As a result of the studies conducted in connection with the subject, it is stated that the infection acts as a primary inhibitory factor for recovery. Understanding these complex interactions between chronic infections, impaired immunity, and wound healing processes is crucial for developing effective therapeutic strategies for diabetic foot wounds.

Keywords: Chronic Infections, Diabetic Foot Ulcer, Healing Process

# Evaluation of Exopolysaccharide of Limosilactobacillus SP. Utmc 3823 as Potential Biomaterial for Wound Healing Applications

**Sepidar Fouladdel[1]**
**Ladan Delphi[2]**
**Sarvenaz Falsafi[1]**
**Javad Hamedi[3]***

***1. Department of Microbiology, Faculty of Advanced Science and Technology, Tehran Medical Science, Islamic Azad University, Tehran, Iran***

***2. Department of Animal Biology, School of Biology, College of Science, University of Tehran, Tehran, Iran***

***3. Department of Microbial Biotechnology, School of Biology, College of Science, University of Tehran, Tehran, Iran***

Background: The process of wound healing is intricate and dynamic, characterized by the interactions of various cell types, e.g. fibroblast cells. Re-epithelialization phase encompasses a sequence of events involving the migration, proliferation, and differentiation of fibroblasts present at the wound site. Exopolysaccharides (EPS) are soluble and insoluble biopolymers, produced by a range of microorganisms including fungi, bacteria, microalgae, and yeast. The production of microbial EPS frequently escalates in response to environmental stressors, serving as a mechanism to cope with such challenges. These biopolymers are characterized by their high molecular weight, consisting of smaller sugar units known as monosaccharides that are linked together via glycosidic bonds. Due to their distinct structures and properties, microbial EPS have various scientific and medical applications, including regenerative medicine and wound healing. In the current research, we studied the effect of an EPS produced by a GRAS (generally regarded as safe) lactic acid bacterium, designated Limosilactobacillus sp. UTMC 3823 on the migration of Human Foreskin Fibroblast cells (HFF-1) in vitro.

Methods: The strain Limosilactobacillus sp. UTMC 3823 was cultivated in MRS broth supplemented with 10% sucrose at pH 5.7, 37°C, 48 h for EPS production. After removing the biomass through centrifugation at 2500 g, 20 min, the supernatant was mixed with equal volume of ethanol at 4°C. The precipitate was separated and considered as crude EPS. Further purification was done by trichloroacetic acid, and the purified EPS was freeze-dried and kept in - 76 o C before use. MTT test was performed to evaluate the toxicity of 0-5 mg/ml concentrations of EPS against human foreskin fibroblasts (HFFs) cells. Also, the effect of EPS on cell migration was evaluated by scratch wound assay. The HFF fibroblast cells were seeded in 24 wells plates and were allowed to proliferate and adhere to the plate overnight. Then, vertical wounds were created at the cell surface by a sterile 10 µl pipette tip. The EPS was added to cells and incubated at 37 °C for 48 h. The cells incubated with the medium were used as negative controls. The results were expressed as percentages of wound area for each well. All tests were done in triplicates.

Results: The findings demonstrated that treatment of Human Foreskin Fibroblasts (HFFs) with all studied concentrations of EPS (0-5 mg/ml) did not exhibit any toxic effects on the cells after a 48-hour period. These concentrations of EPS were found to possess toxic effects on cancerous skin cells. Furthermore, the EPS did not impede the migration of HFFs in the scratch assay.

Conclusion: The findings indicated that the exopolysaccharides produced by the lactic acid bacterium Limosilactobacillus sp. UTMC 3823 can enhance the proliferation and motility of normal fibroblast cells, thereby can help in the closure of scratches in vitro. Consequently, it can be inferred that the EPS of Limosilactobacillus hold promise for wound healing by promoting cell migration. However, further in vivo investigations are essential to validate this potential.

Keywords: Exopolysaccharides, Human Foreskin Fibroblast, Limosilactobacillus, Migration, Wound healing

# From Nano to Macro: The Influence of Graphene Oxide Nanostructures on Biological Pathways in Wound Healing

**Setayesh Ziaolhagh[1]**
**Alireza Khodadad[1]**
**Mohammad Arad Zandieh[2]***
**Romina Rajabi[1]**

***1. Islamic Azad University***
***2. Tehran University***

Introduction Wound healing, a critical process involving a sequence of biological events, is now being revolutionized by the potential of nanomaterials, particularly graphene oxide (GO). This innovative material, with its exceptional mechanical strength, high surface area, and biocompatibility, offers significant advantages for wound healing applications. Its interaction with key biological pathways can enhance cellular activities like migration, proliferation, and differentiation, thereby accelerating tissue regeneration. This review delves into how GO modulates significant pathways, including the Wnt/β-catenin, TGF-β, MAPK/ERK, and PI3K/Akt signaling pathways, to improve wound healing outcomes. Methods Our comprehensive review of the role of graphene oxide in wound healing, conducted by analyzing published literature from Google Scholar, PubMed, and Science Direct from 2016 to 2024, was a thorough and meticulous process. We selected studies that explored the interaction between GO and biological pathways, with a focus on the molecular and cellular impacts of GO in vitro or animal wound healing models. Our main focus was on the influence of GO on cellular signaling pathways like Wnt/β-catenin, TGF-β, MAPK/ERK, and PI3K/Akt, which are critical for tissue repair. Results Graphene oxide nanostructures have demonstrated a solid ability to modulate several key biological pathways in wound healing, influencing cellular behavior and promoting faster tissue regeneration. First, GO significantly enhances the Wnt/β-catenin signaling pathway, which is crucial for cellular proliferation and differentiation. Activation of this pathway promotes the proliferation of fibroblasts and their differentiation into myofibroblasts, which are vital for collagen synthesis and extracellular matrix (ECM) remodeling. Studies indicate that GO's interaction with this pathway improves wound closure, increases tensile strength, and reduces scarring. Secondly, TGF-β pathway regulates tissue remodeling and inflammation. GO has been shown to modulate TGF-β activity, balancing its dual role in inflammation and fibrosis. By limiting excessive TGF-β activation, GO prevents hypertrophic scarring while promoting normal tissue regeneration. This effect is particularly beneficial in reducing fibrotic tissue formation and enhancing the quality of healed skin. Thirdly, GO's influence on the MAPK/ERK pathway is crucial in accelerating cell migration and proliferation, such as keratinocytes and fibroblasts. Activation of this pathway leads to enhanced re-epithelialization and wound closure. The increased cellular migration towards the wound site reduces healing time and improves the overall quality of tissue regeneration. Finally, GO interacts with the PI3K/Akt pathway, which promotes cell survival and angiogenesis. This pathway is critical for supplying oxygen and nutrients to the wound site via new blood vessel formation. Studies show that GO enhances angiogenesis by activating the PI3K/Akt pathway, ensuring proper vascularization and tissue nourishment during the healing process. Additionally, GO's antimicrobial properties contribute to a lower wound infection risk, creating an ideal environment for uninterrupted healing. GO can be further functionalized to deliver bioactive molecules or drugs directly to the wound site, ensuring controlled and sustained therapeutic effects. Conclusion Graphene oxide is a highly promising nanomaterial for advancing wound healing technologies. Its unique ability to modulate critical biological pathways like Wnt/β-catenin, TGF-β, MAPK/ERK, and PI3K/Akt positions it as a powerful tool for enhancing cellular activities necessary for tissue repair. GO not only accelerates healing through these pathways but also reduces complications like scarring and infection due to its antimicrobial and biocompatible properties. Future research should aim to optimize GO-based wound care systems, focusing on tailored functionalization for targeted therapeutic applications. The integration of GO into wound dressings, scaffolds, and drug delivery platforms offers significant potential to revolutionize the treatment of acute and chronic wounds.

Keywords: Graphene Oxide, Nanostructures, Biological Pathways, Wound Healing

## Novel Therapies Against Glioblastoma: The Role of Oncolytic Virology

**Marriam Matash Borujerdi[1]**
**Mehdi Totonchi[2]***
**Fattah Sotoodehnejadnematalahi[1]**

***1. Department of Biology, Science and Research Branch, Islamic Azad University, Tehran-Iran***
***2. Department of Genetics, Reproductive Biomedicine Research Center, Royan Institute for Reproductive Biomedicine, ACECR, Tehran, Iran***

Glioblastoma, which is the most aggressive kind of malignant brain tumor, poses considerable therapeutic problems because of its fast development, complicated tumor microenvironment, and blood-brain barrier. Traditional treatments, including as chemotherapy, radiation, and surgery, frequently have little effectiveness, spurring the investigation of novel techniques that involve oncolytic virotherapy. In clinical studies, oncolytic viruses have showed promise for selectively targeting and destroying tumor cells while preserving organs in good condition. This review examines how oncolytic viruses such as vaccinia virus, can induce tumor cell lysis and change the tumor microenvironment from cold to hot, leading to improved immune response. The tumor microenvironment plays an essential role in glioblastoma growth and treatment resistance. This is frequently inhibiting immune responses through a variety of ways. Recent improvements in customized treatment, notably the utilization of 3D cell culture techniques like organoids, provide a more precise simulation of the glioblastoma microenvironment. This allows researchers to personalize oncolytic viral therapeutics to specific patient characteristics, potentially increasing therapy success.

Keywords: Oncolytic Virus, Immunotherapy, Tumor Microenvironment, Glioblastoma, Novel, Virus, Virotherapy, Cell Culture, Cell, 2D Cell Culture, 3D Cell Culture

## Efficacy of Fractional Co2 Laser Resurfacing in Burn Scars

**Muhammad Maleki***
**Yasaman Zeynalou**
**Hossein Hasani**

***Taranom Wound Clinic***

Aim: Burn scars represent a major challenge in clinical and aesthetic dermatology. In addition to their significant morbidity, the side effects and lengthy courses of many therapeutic modalities for the treatment of burn scars place an additional burden on the patients. Fractional Carbon Dioxide (C02) Laser is one of the treatment options used to removes layers of skin tissue in a fractionated method to help reduce scarring.

Method: This review study was conducted by reviewing and summarizing interventional articles from authoritative scientific sites PubMed, Cochrane, PMC and Elsevier with key words of CO2 laser, burn wound and burn scar during 2015 to 2019.

Results / Discussion: CO2 laser energy is well absorbed in water. As skin contains a very high water percentage, this makes the CO2 laser ideal for precise, safe ablation with good haemostasis. In addition to its efficacy in ablating benign raised lesions, the CO2 laser has been reported to be effective in the field of aesthetic dermatology in the revision of acne scars as well as in photo rejuvenation. The commonest site of scarring treated was the face followed by hands. Response to treatment was rated as excellent in patients. Majority of the patients were highly satisfied with the treatment offered. No long-term adverse effects were noted in any patient.

Conclusion: Although many clinical studies have reported Fractional carbon dioxide laser use is an effective and safe method for treating burn scars with a significant change in the opinion of the patients about their scar appearance but for greatest efficacy, the selection of laser delivery parameters and co-treatments must account for variability in scar properties, including thickness.

Keywords: CO2 Laser, Burn Wound, Burn Scar

## Biology of Wound Healing in Pregnancy

**Fatemeh Ahmadi Aghdash**

***Student Committee, Ardabil Branch, Islamic Azad University, Ardabil, Iran***

Pregnancy induces a multitude of physiological and

hormonal changes that can significantly influence the body's wound healing capabilities. Understanding the biology of wound healing during pregnancy is crucial for optimizing maternal healthcare and developing targeted treatments for wound management in pregnant women. This study explores the intricate biological processes involved in wound healing during pregnancy, with a focus on hormonal, immunological, and cellular dynamics. We conducted an extensive review of existing literature and combined it with experimental research involving pregnant animal models. Our study analyzed the stages of wound healing: hemostasis, inflammation, proliferation, and remodeling, with particular attention to how pregnancy-specific changes in estrogen, progesterone, and other hormone levels impact these processes. Our findings reveal that elevated estrogen levels enhance angiogenesis and epithelialization, leading to faster wound closure and improved tissue regeneration. Conversely, progesterone was observed to modulate inflammatory responses and promote effective collagen deposition, thereby strengthening the healing tissue. Additionally, pregnancy-associated immunological adaptations appear to influence leukocyte function and cytokine profiles, which contribute to a unique inflammatory environment that may either facilitate or impede healing, depending on the context. Furthermore, our research identified key pregnancy-related cellular mechanisms, such as enhanced fibroblast activity and altered extracellular matrix composition, as critical factors in wound healing. The interplay between hormonal shifts and immune responses creates a distinctive healing environment that requires specialized clinical approaches for effective wound management in pregnant women. These insights provide a comprehensive understanding of the biological underpinnings of wound healing in pregnancy, highlighting the need for tailored medical strategies. Future research should aim to translate these findings into clinical practice, ensuring that interventions are designed to support optimal wound healing outcomes in pregnant patients. Our study underscores the importance of interdisciplinary research in improving maternal healthcare and encourages the development of evidence-based guidelines to manage and expedite wound healing in pregnancy effectively.

Keywords: Biology, Wound Healing, During Pregnancy

## The Effect of Estrogen and Progesterone Hormones on Wound Healing in Pregnancy

**Fatemeh Ahmadi Aghdash**

***Student Committee, Ardabil Branch, Islamic Azad University, Ardabil, Iran***

During pregnancy, the body undergoes significant hormonal changes that can influence various physiological processes, including wound healing. This study aims to investigate the effects of estrogen and progesterone, two pivotal hormones in pregnancy, on the wound healing process. A comprehensive review of current literature was undertaken, focusing on experimental and clinical studies that examine the molecular and cellular mechanisms by which these hormones affect the wound healing phases: hemostasis, inflammation, proliferation, and remodeling. Notably, estrogen is known for its anti-inflammatory properties and its role in promoting angiogenesis and re-epithelialization. Progesterone, on the other hand, has been shown to modulate immune responses and enhance collagen deposition. In our study, we analyzed the healing patterns of incisional wounds in pregnant rodent models treated with varying levels of exogenous estrogen and progesterone. Results indicated a marked improvement in wound closure rates and histological quality of the regenerated tissue in the hormonal treatment groups compared to controls. Specifically, estrogen-treated groups demonstrated accelerated re-epithelialization and increased capillary density, while progesterone-treated groups showed enhanced collagen fiber alignment and tensile strength of the healed tissue. These findings suggest that the elevated levels of estrogen and progesterone during pregnancy may confer a beneficial effect on wound healing, potentially through synergistic actions on various cellular pathways. Understanding these mechanisms can provide insights into therapeutic strategies for improving wound healing outcomes in pregnant patients and possibly other populations with impaired healing capabilities. Our research highlights the necessity for further clinical studies to validate these preclinical findings and explore potential applications in obstetric practice, particularly in the management of surgical and traumatic wounds during pregnancy.

Keywords: Hormones, Estrogen, Progesterone, wound healing, during pregnancy

## Systematic Review: Nanotechnology in Tissue Engineering and Wound Management

**Iman Vazifeparast[1]**
**Fatemeh Khorashadizadeh[2]***

***1. Student Research Committee, Department of Nursing, Bojnurd School of Nursing, North Khorasan University of Medical Sciences, Bojnurd, Iran***

***2. Department of Nursing, Bojnurd School of Nursing, North Khorasan University of Medical***

Nanotechnology is one of the emerging branches of science that has wide applications in medical science and especially tissue engineering. This systematic review aimed to describe the advances in applications of nanotechnology in tissue engineering and wound management. The work has been performed by assessing in the selected studies tissue engineering and wound healing based on nanotechnology. The protocol was developed following the Preferred Reporting for Items for Systematic Reviews and Meta-Analyses-Protocols (PRISMA-P) guidelines. A multistep search of the PubMed, MEDLINE, Scopus database, and google scholar databases has been performed to identify papers on nanotechnology, wound, wound healing, wound engineering, bio- particle, micro-particle. Of the 1253 articles initially identified, 213 articles focusing on nanotechnology in wound management were selected and, consequently, only 115 articles that apparently related to the aim of this study were analyzed. Of these Only 38 original articles which strictly and exclusively focused on wound management. The included studies had to match predetermined criteria according to the PICOS (patients, intervention, comparator, outcomes, and study design) approach. The identified studies described the application nanotechnology in wound dressing for ultra - fast wound healing time especially at burn, Dentistry and Oral Surgery, and pressure wounds, control bacterial growth in chronic wound, and prevention scare in deep and chronic wound. Collected data confirmed the safety and efficacy of nano-particle such as ceo2, silver, polycaprolactone, starch-borne fibers, silk- fibroin, Polycaprolactone/ Gelatin, Chitosan, Hydrocolloid, collagen, polyettilen oxide, Trigonella foenum, Polycaprolactone / Gelatin / Polydimethylsiloxane Hybrid Nanofibers. This study showed that nanotechnology is very useful, effective, and cost benefits at wound management and wound healing

Keywords: Nanotechnology, Tissue Engineering, Wound Management

## Evaluating the Role of Wearable Devices in the Remote Management of Wound Care and Healing Outcomes: A Systematic Review

**Matineh Sadat Tabatabaei***
**Amirhossein Dehghan**

***Tehran University of Medical Sciences***

Introduction: Chronic wounds being one of the major health challenges, with numerous economic and social impacts, causing long-term chronic difficulties, require continuous and thorough management. Trauma intensive care has limitations in providing immediate and accurate monitoring of recovery. Wearable devices have been introduced as a new solution to facilitate healing chronic wounds. These devices are capable of real-time monitoring of biomarkers and provide detailed information on the state of injury and wound healing. The purpose of the study was to investigate the capabilities of these devices in providing remote monitoring and reducing the risk of further chronic injuries. Search Strategy: A thorough search of the literature was conducted in line with PRISMA guidelines. Various databases, such as PubMed, Embase, and Web of Science, were searched for studies relating to wearable devices used in wound care. Keywords such as "wearable devices," "wound healing," "remote monitoring," "bioelectronics," and "chronic wounds" were used to find relevant articles published between January 2019 and July 2024. To ensure unbiased results, a double-blinded screening process was applied. After eliminating duplicate and irrelevant studies, the remaining articles were selected based on their focus on the clinical applications of wearable technologies in wound care.

Results: After screening the titles and abstracts of the articles, 28 articles were carefully based on

inclusion and exclusion criteria. The studies reviewed emphasize the growing role of wearable technologies, like biosensors, hydrogel patches, and bioelectronic systems, in managing wound care. These devices allow real-time monitoring of important wound factors such as pH, oxygen levels, and moisture, providing healthcare providers with up-to-date information for timely interventions. Some wearable devices also include drug delivery mechanisms that can release medication directly to the wound which reduces the need for more invasive treatments resulting in a better patient satisfaction. Additionally, certain devices can stimulate healing through electrical impulses or by maintaining an optimal environment for tissue repair. These technologies reduce hospital visits, support care from home, and decrease the risk of errors caused by delayed treatment.

Conclusion: The utilization of wearable devices in wound care presents exciting possibilities for improving how wounds, particularly chronic ones, are managed. These technologies offer remote, real-time monitoring, enabling quicker, more personalized treatments that can improve healing and reduce healthcare financial challenges. Consistently tracking wound conditions and delivering proper treatments, wearables could revolutionize wound care. However, issues such as improving the technology's accuracy, along with ensuring patients are comfortable with using them, still need to be addressed before they can be widely adopted in everyday clinical practices. Further research will help refine these devices and unlock their full potential for wound management plans.

Keywords: Wearable Devices, Wound, Outcome

## Healthy Lifestyle: An Approach to Prevent Diabetic Foot Ulcers in Patients with Diabetic Peripheral Neuropathy

**Soraya Soheili***
**Reza Nematollahi Maleki**

***Tabriz University of Medical Sciences***

Introduction Diabetes mellitus (DM) is one of the biggest diseases in the world. Public Health Emergencies of the 21st Century Approximately 415 million adults have diabetes, and by 2040 this number will increase to 642 million. Diabetic neuropathy is the most common type of neuropathy in developed countries, with a prevalence of approximately 60%, and may affect up to half of diabetic patients, leading to significant economic morbidity and mortality. The most common form is symmetrical diabetic peripheral neuropathy (DPN), which mainly affects the lower extremities and is a major cause of morbidity due to its effects on the risk of subsequent ulceration, amputation, and disability. It is accompanied by an increase in the risk of foot wounds, infection, cellulitis, loss of balance, amputation, an increase in financial burden, and a defect in the quality of life. Diabetic peripheral neuropathy is responsible for 50 to 75 percent of non-traumatic amputations. Materials and methods In this review study, the articles registered in Pubmed and ScholarGoogle databases were searched using the keywords diabetic neuropathy, prevention, life style and their equivalents in MeSH. The criteria for entering this study were English and Persian articles related to the title that were published from 2012 until now, and a total of 20 articles were examined. Findings Findings from this review study show that unhealthy behaviors (such as convenience eating, poor dietary choices, smoking, and physical inactivity) are responsible for 40 percent of premature deaths in the United States and lead to persistent health disparities. In the context of the decisive role of lifestyle in the production of diabetes, it has been shown that the lowest rate of prevalence of type 2 diabetes was in rural communities where people have maintained a traditional lifestyle. Also, surprising changes in the prevalence and incidence of type 2 diabetes have occurred in communities. who have experienced major changes in the type of nutrition consumed, from native diet to western diet. Conclusion Considering the importance and fundamental role of lifestyle in diabetes and its complications such as diabetic foot ulcers and the resulting burden, it seems that managers and policy makers should plan and take more measures to improve the lifestyle of people with diabetes.

Keywords: Lifestyle, Diabetic Peripheral Neuropathy, Foot Ulcer

## Examining the Knowledge and Performance of Nurses and Effective Factors in Preventing Pressure Ulcers in Intensive Care Units: A Narrative Review Study

**Mohadeseh Ebrahimi***
**Zeinab Kuchaki**

***Ilam University of Medical Sciences***

Introduction: Pressure ulcers are one of the most well-known avoidable safety issues worldwide. Preventive measures are the most efficient way to reduce their incidence, and the correct determination of risk factors for the development of pressure ulcers is the first step in prevention, and its therapeutic activities are more expensive than preventive interventions. Patients hospitalized in intensive care units are more susceptible to complications due to invasive care measures/central vascular lines/mechanical ventilation. Care and prevention of pressure ulcers are among the duties assigned to nurses. The lack of knowledge and performance of nurses can be associated with an increase in the prevalence of pressure ulcers. According to the researcher's experience as a special ward nurse, the present study was conducted with the aim of reviewing the literature related to the attitude and performance of nurses in the prevention of pressure ulcers, as well as investigating the factors affecting the occurrence of pressure ulcers in special departments.

Materials and methods: By searching in databases using a narrative review method, Google Scholar, Cochrane, Clinical Key, Medline, Megiran, and SID databases were selected to search for keywords. The keywords Nursing, Prevention, Knowledge, Nursing care, Pressure ulcer, Bed sore, Icu were determined and searched based on that. After searching the aforementioned databases, 77 studies related to the subject were found. Among these studies, 10 studies were selected according to the inclusion criteria.

Findings: The main factors mentioned in causing pressure injuries in intensive care patients include mechanical ventilation with a ventilator, patient nutrition, Gcs scores, examination based on the Braden scale, infection, albumin levels, hemoglobin levels, mobility, receiving massage, humidity. Skin, duration of hospitalization of patients. Preventive interventions included: skin care assessment/ nutritional assessment/position change/use of supportive surface systems to reduce pressure on the skin. According to the studies conducted, there was a significant relationship between gender, working hours per week, work experience of nurses in the intensive care unit, age and performance of nurses in this field. Also, there was a significant relationship between the performance of nurses working in the surgical intensive care unit and nurses working in these units. They did not work, the statistically significant difference is mentioned. The findings have shown that the awareness of nurses in the field of pressure sores is at an unfavorable level, which indicates the lack of attention to the prevention of bed sores in the training programs of students and in-service. According to the findings, there was a statistically significant difference between the nurses' knowledge scores in most cases before and after the training. The reviewed study 2 showed that most of the nurses had not participated in any previous training course on pressure ulcer prevention.

Conclusion: According to the studies conducted in special departments, the knowledge and performance of nurses in this field is low, and this can be an alarm bell in the lowering of quality and care indicators in patients, especially special department patients. This should raise a big question mark for planners, nursing student educators, and nurse retraining officials

Keywords: Prevention, Knowledge, Nursing Care, Pressure Ulcer, Bed Sore, Intensive Care Unit, ICU

## Preparation of a New Moisturizing Cream with Wound Healing and Anti-inflammatory Effects

**Ali Javid[1]***
**Maryam Tehranipour[2]**
**Mobina Gafourian Vand[1]**
**Ahmad Alimirzai[1]**

*1. Department of Chemistry, Faculty of Science, Mashhad Branch, Islamic Aazad University, Mashhad, Iran*

*2. Department of Biology, Faculty of Science, Mashhad Branch, Islamic Aazad University, Mashhad, Iran*

Cosmetic products are one of the important items in the shopping basket of families and individuals. So, cosmetic companies have tried to make the products they produce have several features at once instead of one feature. Skin care products, especially creams and moisturizers, are among the most widely used cosmetic products [1]. One of the goals of cosmetic formulators is to add various features to these products. Today, due to people's approach to using herbal products, attention to the medicinal effects of plants and their use in cosmetic products has been given serious attention [2]. Wound healing is one of the major problems and costly events with a huge global market for wound care products. It was reported that this market exceeded US$ 27 billion for wound care products and treating wound scarring [3]. The process of wound healing is an innate physiological process that ultimately leads to the reconstruction of damaged skin. However, the acceleration of recovery with the goal of preventing wound complications is an essential and inevitable necessity [4]. One of these consequences is inflammation, which, if continued, can lead to a weakening of the immune system. Drugs used to treat inflammation, such as nonsteroidal anti-inflammatory drugs (NSAIDs), often have known side effects, which can include problems in digestive, renal and respiratory system, and also drug dependence [5]. Today, it has been proven that natural-derived drugs improve wound healing and reduce inflammation, but instead, show fewer side effects. Phlomis fruticosa, is a species of flowering plant in the family Lamiaceae and a small evergreen shrub, native to Greece, Turkey, and Iran [6]. So far, various effects have been reported for this plant; such as antineurodegenerative and antioxidant activities [7], antimicrobial, anti-enzymatic, and cytotoxic properties [8, 9]. Following our systematic studies and researches in the field of preparing cosmetic products using medicinal plants and natural ingredients, this study was conducted with the aim of investigating Phlomis fruticosa extract as a possible wound healing and anti-inflammatory agent.

Methods: For this purpose, four samples of moisturizing cream were prepared. The first sample had no herbal extract. In the second sample, one percent of the extract was used, in the third sample, three percent of the extract, and in the fourth sample, five percent of the extract was used. In this study, 16 male Wistar rats weighing between 180 and 200 grams, were divided into 4 groups of 4 and maintained under controlled conditions of light (12 hours light/dark cycles), room temperature (23 ± 1 °C) and relative humidity (50 % ± 10 %) with free access to food and water ad libitum. Also, all the rats were wounded on the back of the shoulder, then they were treated with moisturizing cream.

Results: Studies have shown that the moisturizing cream enriched with plant extracts of Phlomis fruticosa has good effects of wound healing and anti-inflammatory. Comparative studies are ongoing to determine the exact amount of extract required for the industrialization of the production of this type of cream.

Keywords: Wound Healing, Anti-Inflammatory, Phlomis Fruticose, Herbal Cosmetic, Medicinal Effect

## Investigating the Effect of Training Caregivers on the Level of Care and the Healing Process of Pressure Ulcers in Children with Cerebral Palsy Admitted to Shahid Sadoughi Hospital in Yazd Province in 1403

**Fatemeh Zare[1]***

**Abolfazl Barzegari[2]**

**Armin Ayatollahi[2]**

**Elahe Morovati[1]**

***1. Shahid Sadoughi Hospital***

***2. Yazd Islamic Azad University***

Introduction: Cerebral palsy is the most common movement disorder that is associated with disability and lifelong motor impairment and can lead to disabilities such as lesions, functional limitations,

and participation limitations. Occurrence of motor-psychological disorders leads to non-use of limbs, more weakness and paralysis, disruption in performing daily life activities, more dependence and ultimately causes pressure ulcers in patients. Considering that educational programs are a way to convey basic information to caregivers, the present study was conducted with the aim of determining the effect of education on the level of awareness of caregivers and the healing process of pressure ulcers in these patients.

Methods: In this semi-experimental study (before and after), the studied population consisted of all cerebral palsy children with pressure ulcers under home care, which were 20 people. Individual characteristics and clinical characteristics and the level of awareness of their caregivers were collected using a questionnaire through face-to-face interviews. The wound care observation review form based on the guidelines of the Institute of Health Care and Research (AHCPR) and the wound assessment review form based on the Wound Status Measurement Tool (PSST) were developed and evaluated before and after the training. Data analysis was done using SPSS statistical software at a significance level of $P \leq 0.05$.

Findings: In order to determine the effect of training on the pressure ulcer healing process, the pressure ulcer evaluation form (in terms of wound color, condition of the surrounding tissue, secretions and dimensions of the wound) was observed at intervals of 3 days before and after the training for 11 days and the changes was registered; The comparison of the average scores of the pressure ulcer assessment in the first round before and after the test did not show any significant difference; Only about the amount of secretions, the difference was close to significant (P=0.05). The comparison of the average scores of the pressure ulcer assessment in the second time before and after the training did not show any significant difference; But regarding wound color, secretions and wound dimensions, the mean scores before and after training showed a significant difference (P

Keywords: Pressure Ulcer, Education, Cerebral Palsy

## Fabrication and Evaluation of Photothermal Smart Wound Dressing Based on Bacterial Cellulose to Inhibit Cancer Recurrence and Antimicrobial Behavior after Melanoma Surgery Wounds

**Mostafa Kord Noghabi**
**Seyede Zohreh Mirahmadi-Zare***
**Soraya Zahedi Estahbanati**

***Department of Animal Biotechnology, Reproductive Biomedicine Research Center, Royan Institute for Biotechnology, ACECR, Isfahan, Iran***

Background: Despite promising advancements in surgical methods for the removal of various types of skin melanomas, undetectable residual microtumors remain a significant concern, increasing the risk of cancer recurrence. Therefore, a treatment that can effectively eliminate residual microtumors left after surgery and exhibit regulated performance in angiogenesis, tissue regeneration, and antibacterial effects in response to the complex and diverse microenvironments of the wound is of utmost importance.

Introduction: This study aims to investigate the potential of photothermal therapy using PEGylated graphene oxide nanosheets as near-infrared light-responsive agents for localized heating, and calcium peroxide-dopamine nanocomposites as pH-responsive agents to regulate the acidic microenvironment caused by lactic acid, Inhibition of immunosuppression, and inhibit metastasis of residual microtumors post-surgery.

Materials and Methods: PEGylation of graphene oxide nanosheets was performed through amide coupling reactions between carboxyl and amine groups and was characterized using Fourier-transform infrared spectroscopy (FTIR) to confirm the bonds. Subsequently, GO-PEG nanosheets were in-situ loaded into bacterial cellulose fibers and analyzed by X-ray diffraction (XRD). The scaffold microstructure was assessed using scanning electron microscopy (SEM), and the concentration of loaded nanoparticles was evaluated using simultaneous thermal analysis (STA). In the next stage, calcium

peroxide and polydopamine nanocomposites were synthesized in-situ in a hydrogel and evaluated using transmission electron microscopy (TEM) and FT-IR.

Results: Cross-linking of carboxylic acid groups of GO and amine groups of PEG was confirmed through FT-IR, XRD, and thermogravimetric analysis/differential scanning calorimetry (TGA/DSC). The structural and mechanical properties of the hydrogels, including porosity and strength, were demonstrated using SEM and swelling/stretch tests. The average size of calcium peroxide nanocrystals was determined to be 10.52 nm via TEM analysis. Photothermal performance under 808 nm near-infrared laser irradiation showed that the composite reached 50°C in less than 15 minutes. Moreover, polydopamine nanocomposites exhibited a nanomesh structure in an acidic environment, enhancing the photothermal performance of the wound dressing. Calcium peroxide, through the generation of reactive oxygen species (ROS) and oxygen release, exhibited significant anti-cancer and antibacterial activity. The photothermal performance of the wound dressing displayed considerable antibacterial effects against both Gram-positive and Gram-negative bacterial cells. Biocompatibility and cell proliferation of the wound dressing were confirmed using the MTS assay on NIH3T3 mouse fibroblast cells, with cell viability exceeding 80%. Furthermore, the MTS assay on the B16F10 cancer cell line indicated a notable anti-cancer effect. The results demonstrated a positive effect on fibroblast migration in the scratch test, indicating the potential for skin regeneration, new tissue formation, and faster wound healing. In contrast, cancer cells showed heightened sensitivity to heat and ROS, leading to their irreversible elimination. In the absence of cancer cells, localized heat and oxygen also contributed to enhanced angiogenesis.

Discussion: The synergistic integration of mild hyperthermia photodynamics and the pH-responsive chemical kinetics of the wound dressing shows significant potential for regulating wound healing performance based on the wound conditions. This system exhibits high efficacy in tissue regeneration, angiogenesis, and anti-cancer and antibacterial activities, allowing complex wounds to heal in a controlled manner.

Keywords: Cancer Wound Dressing, Bacterial Cellulose, Graphene Oxide, Photothermal Therapy, Smart Drug Delivery, Calcium Peroxide, PH-responsive Agents, Inhibition Of Immunosuppression

## Methods of Wound-induced in Animal Research on Rats

**Laya Ghahari***
**Mitra Yousefpour**

***Aja University***

Wound healing in rats is often used as a preclinical model to study the biological processes involved in tissue repair and regeneration. The rat model provides a controlled environment to observe wound healing mechanisms that are similar to those in humans. Common types of wound healing models in Rats are Incisional, Excisional, Burn, Diabetic, and Ischemic Wound Models. In these models, Wound Closure Rate, Histological Analysis, Biochemical Assays, Immunohistochemistry, and Mechanical Testing were evaluated. In preclinical studies using rats, the number of wounds created on the back depends on the type of wound-healing model, the study design, and the goals of the experiment. Typically, researchers try to maximize the number of wounds while ensuring the health and well-being of the animal and minimizing stress or infection. Usually, 2 to 4 full-thickness excisional wounds are created on the dorsal (back) area of the rat. The size of each wound can vary, but a common size is a 6–10 mm diameter circular wound or a 1–2 cm2 wound. Larger burns may limit the number of wounds due to the increased risk of systemic effects (e.g., infection, dehydration). In diabetic or ischemic rats, wound healing is slower, so researchers may limit the number of wounds to 1 or 2 to avoid excessive stress on the animals. There are ethical considerations, and institutional animal care dictates the number of wounds allowed based on the animal's well-being. Some studies might require more wounds to study different treatments (e.g., using different dressings or drugs on each wound), while others may focus on fewer wounds for more detailed monitoring.

Keywords: Wound, Rat, Model

## Amniotic Membrane: A Revolutionary Approach to Wound Healing

**Fatemeh Bahramali[1]**
**Maliheh Gharibshahian[2]***

***1. Student Research Committee, Semnan University of Medical Sciences, Semnan, Iran***

***2. Department of Tissue Engineering and Applied Cell Sciences, School of Medicine, Semnan University of Medical Sciences, Semnan, Iran***

Background: Wound management is a major challenge worldwide, placing a huge financial burden on governments in every country. In the United States alone, these injuries affect approximately 2.4 to 4.5 million people. Foot and leg ulcers affect many adults with diabetes or vascular disease and are often attributed to muscle weakness, arterial disease, or chronic venous insufficiency prolonged neuropathy or pressure. Wound dressing that can aid in wound healing has been the subject of researches for a long time. Conventional dressings, such as hydrogels, bandages, and foam, do not help heal wounds as effectively as previously thought because they cannot respond well to the wound healing process. Various biomaterials have been used as biological medications for wound regeneration. For several decades, human amniotic membrane (hAM) transplantation has been widely used to treat acute and chronic wounds. The amniotic membrane (AM) or amnion is a thin membrane located in the fetal placenta; it completely surrounds the embryo and limits the amniotic cavity, which is filled with amniotic fluid. AM is an attractive graft method for wounds because it has unique properties, including anti-inflammatory, bacteriostatic, wound protection, scar and pain reduction, as well as ability to initiate epithelialization. It also has low immunogenicity, biocompatibility, suitable mechanical properties and good cellular adhesion and it is a source of cytokines, growth factors, and hAM cells with stem cell properties.

Methods: The studies published in PubMed, google scholar, Scopus, and Web of Science databases from 2016 to 2024 was used. Keywords included Amniotic membrane, Wound healing, Tissue injury and Tissue engineering. Selection criteria included studies evaluating an AM-based product for wound regeneration in clinical or animal evaluations, such that at least the authors stated that the product was useful for wound healing.

Results: This important source of scaffold material has been widely studied and used in many areas of tissue repair: corneal repair, chronic wound treatment, tendon repair, genital reconstruction, nerve repair, microvascular reconstruction and intraoral reconstruction. Depending on the intended application, hAM was used as a simple scaffold or seeded with different types of cells capable of growth and differentiation. In the early eighties, the AM was used as an adjuvant to auto grafts in chronic skin ulcers and to prepare for subsequent skin auto graft applications, resulting in successful skin healing. Since the second half of the 20th century, amniotic/chorionic tissue auto transplants have also been used for the treatment of chronic neuropathic wounds, superficial corneal lesions as well as for dental and neurosurgical applications. Although the amniotic membrane has been used to treat wounds since the last century, new studies have shown its benefits. Consequently, the participation of the industry in the field of tissue engineering is highly anticipated.

Conclusion: Finally, the general results of the studies have shown that AM this natural biomaterial gives an extensive variety of applications in tissue engineering applications. And for better understanding of AM, more research is needed to examine and understand the mechanism of the amniotic membrane to heal wounds and injuries.

Keywords: Amniotic Membrane, Wound Healing, Tissue Injury, Tissue Engineering

## Investigating the Effect of Vitamin C on the Healing of Burn Wounds

**Fariba Alizadeh***
**Leyli Shabani Osgoue**
**Zeynab Honarvar**

***Department Of Nursing, Marand Branch, Islamic Azad University, Marand, Iran***

Background: Burns are injuries caused by heat, chemicals, electricity or radiation. Healing of burn wounds is one of the major problems of medical sciences , and finding a drug or substance that can heal these wounds with minimal side effects is very valuable. According to the estimate of the World Health Organization, 265 thousand people die worldwide every year due to burns. The percentage of death from burns to total deaths in Iran is almost three times that of Eastern Mediterranean countries and twice the global rate. Burn injury is characterized by the release of inflammatory mediators that disrupt the normal capillary barrier and cause rapid movement of intravascular fluid and protein into the interstitial spaces, ultimately leading to shock and death. As such, large volumes of intravenous fluid are required to ensure adequate end-organ perfusion. Considering that the burned tissue is a non-living tissue without blood supply, as a result, white blood cells, antibodies and antibiotics cannot reach that place through the blood stream; Therefore, they are a suitable place for the growth of microorganisms, which leads to a delay in wound healing. This condition has led researchers to search for drugs that promote recovery and reduce treatment costs. Vitamin C is an inexpensive antioxidant that decrease oxidative stress and fluid injection in high doses and can increase the protective mechanism of the immune system and provide wound healing by stimulating the collagen genes for the synthesis of collagens. It protects against ultraviolet rays, free radicals and damage, and in addition to its anti-inflammatory effect, it is a factor for depigmentation of the skin.

Materials and Methods: The present study is of descriptive-analytical and library type, and the collection of materials has been done using articles and researches related to the research topic in SID, Google scholar, Scopus, Pubmed sites.

Results: The findings of this study show that the topical use of vitamin C causes more and faster healing of burn wounds and granulation tissue . vitamin C administration significantly reduces post-burn lipid peroxidation, reduces microvascular fluid leakage by preventing endothelial dysfunction, and minimizes edema formation in burned tissue. Local use of this vitamin will also reduce the inflammatory reaction. Also, vitamin C alone reduces the need for fluid resuscitation in burn patients. Treatment with high-dose vitamin C is significantly associated with a reduction in in-hospital mortality.

Conclusion: Vitamin C is a key component in the treatment and care of burn patients, which helps to reduce the complications caused by burns and improve treatment results.

Keywords: Vitamin C, Wound Healing, Burn

## Investigating the Effect of Santolina Hydroalcoholic Extract on Leishmania Major Promastigotes In Vitro

**Seyed Arastou Fathi***
**Fatemeh Ziaiefar**

***Student Research Committee of Saveh Faculty of Medical Sciences***

Introduction: Leishmaniasis is one of the most common parasitic diseases in tropical and subtropical regions of the world and is considered a threat to public health. Our country is also one of the endemic areas of cutaneous leishmaniasis in the world. About 20-40 cases of leishmaniasis per 100 per year. It is reported that this trend is increasing. The causative agent of cutaneous leishmaniasis is a protozoan from the Kintoplastid family, the causative agent of which in Iran is Leishmania major (rural type) and Leishmania tropica (urban type). More than 70% of leishmaniasis cases in Iran Leishmaniasis is major. The reservoir of the disease is human in the urban type and field rodents in the rural type, such as mice and rabbits, and also the vector of the disease is the female mosquito of the genus Phlebotomus. Pentavalent anti-leishmaniasis, the problems of disease recurrence, drug resistance, drug side effects and long treatment period It has been a long time, so research on new drugs, especially herbal compounds without side effects, is necessary. The present study was conducted by investigating the effect of the hydroalcoholic extract of Santolina plant on the promastigote form of Leishmania major

in laboratory conditions and the wound caused by it in Balb/c mice.

Methodology: different dilutions of the hydroalcoholic extract of Santolina plant were prepared by maceration method. RPMI culture medium containing 5x100,000 Leishmania major promastigotes was added to 09 house culture plates and the extract was added with different concentrations. MTT solution was added and light absorption was done. It was read at a wavelength of 005 nm. 95 heads of Balb/c mice after inoculation of Leishmania major promastigote at the base of the tail and creation of leishmaniasis lesion, different concentrations of the extract were injected into the test groups every other day for 25 days. The diameter of the wounds and the parasite load before and after treatment in All groups were determined and the results were recorded and analyzed with SPSS software.

Results: The findings showed that the effect of Santolina extract on the inhibition of parasite growth is dependent on the dose and treatment time. And all concentrations of the extract could cause reduce the diameter of the wound and reduce the parasite load.

Discussion: According to the report of the World Health Organization, leishmaniasis is declared as one of the six parasitic infectious diseases. In the absence of an effective vaccine against Leishmania parasites, the use of chemical drugs including pentavalent antimonial compounds such as pentostam, Glucantim, amphotericin miltifosine is the only way to treat this disease. However, due to the inherent resistance of some parasite strains to drugs, the toxicity and side effects of chemical drugs, the return of the disease, the high cost, and the long treatment period, the tendency to use herbal products with less side effects as drugs in the treatment of leishmaniasis has increased. Recently, research on the use of medicinal plants for the purpose of alternative treatments has received much attention.

Conclusion: The present study showed that Santolina extract has a high effect in inhibiting promastigote growth in laboratory and animal conditions, and it is recommended that more studies on Santolina plant be investigated in the future.

Keywords: Santolina, Leishmania Major, Promastigote

## A Review of Infection Due to Spinal Surgery Site

**Mohamad Azizkhani[1]***

**Seyedeh Sara Hoseiny Pakdaman[2]**

***1. Arak University of Medical Science***

***2. Iran University of Medical Science***

Context and purpose: Injuries to the spine are one of the main reasons for performing surgeries on patients, which cost a lot of money and energy every year. The infection caused by such surgeries results in long hospitalization, treatment costs, fatigue of the treatment staff and a high financial burden on governments. Therefore, studying infection caused by spinal surgery requires energy and knowledge.

Materials and methods: In this review, Persian and English articles were researched with the keywords surgical wound infection, spine surgery, wound and infection. A total of 17 Persian articles and 10 English articles were found from SID and ScienceDirect databases, among which 16 articles were analyzed in full text.

Results: Infections caused by spine surgery are usually bacterial and require antibiotic treatment. that the use of injectable antibiotics and then orally are effective. Because these infections have a direct effect on the nerves, they can generally be very painful and require palliative treatments. Research has shown that the use of sublingual buprenorphine is more effective than the use of injectable morphine. Also, the use of a pain pump was said to be a suitable palliative method. Infections caused by spine surgery can also cause changes in the function and shape of the structure of the surgical area.

Conclusion: Infections caused by spinal surgeries require palliative and antibiotic treatments both prophylactically and therapeutically. It is better to wash the surgical area several times as close as possible to the surgery. Early diagnosis and treatment according to the type of infection of the operation site has a direct relationship with faster treatment and the absence of deformity and function of the spine.

Keywords: Infection, Spinal Surgery, Wound

## Investigating the Effect of PRP on Diabetic Foot Wound Healing

**Maryam Mirzaei***
**Ghazal Shojaei**

***Islamic Azad University of Kazeroun***

Objective: Diabetes is a chronic metabolic disorder in which the body is unable to produce insulin or use it appropriately. This disease has many complications. Foot ulcers are one of the main problems of diabetes. About 15% of all diabetic patients may complain about these ulcers. Due to the lack of effective treatment and guidelines for the treatment of this type of diabetic ulcer, taking into account the existing methods and treatments and the emergence of the platelet gel method, hope has been provided for the treatment of this type of ulcer. The purpose of this study is to investigate the effects of platelet-rich plasma gel on diabetic wounds in order to find a new safe and effective treatment method.

Materials & methods: This study is a review article that is provided with library and internet resources.

Results: Research results show that platelet-rich plasma can be used as a new adjunctive treatment for patients with chronic wounds, including diabetic wounds. One of the most common causes of wounds is growth factor abnormalities. Platelets are considered a rich source of growth factors. PRP increases wound healing with a barrier effect to prevent bacterial invasion into the wound; it also reduces cytokine release and increases capillary growth and has antimicrobial effects against Candida albicans, MRSA, and E. Coli.

Conclusion: Our findings showed that PRP can facilitate healing and also reduce the risk of amputation. It seems that PRP provides the growth factor needed for healing, as the seven basic activating factors of platelet-secreted protein growth initiate the wound healing process. Platelets also secrete transforming growth factor beta (TGF-beta) and monocyte chemoattractant protein-1 (MCP1), which attract monocytes and neutrophils to the body. If appropriate selection criteria are applied, PRP can be a useful aid for wound healing in people with DFU.

Keywords: Diabetic Foot, Diabetic Ulcer, Platelet-Rich Plasma, Wound Healing, Diabetes

## A Systematic Review of the Efficacy of Wharton'S Jelly-derived Mesenchymal Stem Cells from the Umbilical Cord in the Treatment of Chronic Wounds

**Fatemeh Khosravi**

***Bushehr University of Medical Science***

Introduction: The healing of chronic skin wounds remains a major challenge in current healthcare. Disruption or impairment in any phase of wound healing can lead to chronic wounds. Given the growing population affected (2.5% of the USA population) and the inadequacy of current interventions, new approaches, such as the use of mesenchymal stem cells (MSCs), particularly Wharton's Jelly - derived mesenchymal stem cells (WJMSCs) from the umbilical cord, have been proposed, either alone or in combination with biosynthetic scaffolds. This systematic review aimed to evaluate the efficacy of WJMSCs in the healing of chronic and non-healing wounds.

Methods: This systematic review followed the PRISMA guidelines. Relevant articles were retrieved from Web of Science, PubMed and Scopus databases without time restrictions until September 11, 2024. The search strategy was based on combining two sets of keywords related to Wharton's Jelly stem cells and chronic wounds. Inclusion criteria were English-language studies that examined the efficacy of WJMSCs in healing human, animal, or laboratory models of chronic wounds. Duplicates, review articles, studies without full text, and studies that did not align with the study objective were excluded. The quality of included studies was assessed using the Cochrane Risk of Bias tool.

Results: A total of 1803 articles were retrieved from the three databases. After excluding 631 duplicates and 1154 articles that did not meet the inclusion criteria or had inaccessible full texts, 18 full-text articles were reviewed. Review articles, case reports, and articles

lacking sufficient data were excluded, leaving 6 studies for analysis. In 50% of interventions (n=3), WJMSCs were used alone, and in the remaining 50% (n=3), they were combined with scaffolds, including one study with a silk fibroin scaffold and two with amniotic membrane. Results indicated that WJMSC usage significantly increased the healing rate (n=2), reduced wound area (n=4), accelerated epithelial regeneration (n=3), and improved epidermal and dermal thickness and elasticity (n=2). Additionally, enhanced angiogenesis, reduced scar tissue, decreased inflammatory response, complete epidermal regeneration, collagen formation, reduced fibroblasts, and pain reduction were other observed effects. Overall, WJMSCs demonstrated positive outcomes in the treatment of chronic wounds.

Conclusion: WJMSCs have shown promising results in treating chronic wounds and may serve as a suitable alternative for wounds resistant to conventional therapies. Despite the advantages of WJMSCs, such as easy accessibility, non-invasive collection, and lack of ethical issues or systemic side effects, further studies in human clinical trials are needed to determine the optimal administration method for maximizing efficacy.

Keywords: Mesenchymal Stem Cells, Wharton'S Jelly, Umbilical Cord, Chronic Wounds, Systematic Review

## Comparison of Two Methods of Ozone Therapy and New Dressing in Wound Healing of Patients with Diabetic Foot Ulcer Referred to Selected Therapeutic Centers in Tehran

**Zahra Rooddehghan[1]***
**Mohammad Basatin[1]**
**Morteza Izadi[2]**
**Raoofeh Karimi[1]**

***1. Medical Surgical Department, School of Nursing and Midwifery, Tehran University of Medical Sciences***
***2. Health Research Center, Baqiyatullah University of Medical Sciences***

Background: Diabetic foot ulcer is one of the most important complications of diabetes which new methods such as ozone therapy and new dressings are used to improve it. Therefore, It is necessary to compare their effects.

Objectives: The present study was designed with the aim of investigating and comparing two new treatment methods, namely ozone therapy and the new dressing method in the healing of diabetic foot ulcers.

Methods: This research is a cross - sectional comparative-observational study that sampling was done continuously in two treatment centers (Baqiyatullah Ozone Therapy Research Center and Tehran University Diabetes and Metabolic Diseases Clinic) in 2018. Sampling was convenience until 36 people were included in both groups. Patients in the first group received ozone therapy for 2 to 3 months and in the second group, new dressing along with debridement for 2 to 3 months. Using the recorded images, the size and characteristics of the wound were measured and recorded with a ruler.

Results: The patients of the two groups did not have statistically significant differences in terms of demographic variables and were almost homogeneous (P>0.05). In the ozone therapy group, the average area of the wound at the beginning of treatment was 11.57 cm, which decreased to 2.48 cm at the end of the three-month period (P0.05).

Conclusion: Considering the effect of both methods in diabetic wound healing, these treatment methods can be used for wound healing. It is suggested that due to the lack of significant statistical difference between the two methods in wound healing, the cost benefit of each method and the patient's preference should be taken into account in choosing one of these two treatment methods.

Keywords: Ozone, Diabetic Foot, Dressing, Wound Healing

## Artificial Intelligence in Wound Care: Transforming Diagnosis, Management and Healing Pathways

**Majid Sadeghpour[1]**
**Homa Saadat[2]**
**Ali Bejani[2]***

***1. Isfahan University of Medical Sciences***
***2. Kurdistan University of Medical Sciences***

Introduction Chronic wounds, particularly associated with diabetes and obesity, present major healthcare challenges due to their rising prevalence and financial burden. These wounds are difficult to manage, often leading to infections and delayed healing. The COVID-19 pandemic further strained wound care systems, highlighting the need for remote care solutions such as telemedicine. Meanwhile, the global market for scar treatments is expanding as innovative approaches in wound care continue to evolve. Artificial intelligence (AI) is emerging as a transformative tool in wound care, offering promising applications in wound diagnosis, management, and prognosis. With the ability to recognize, classify, and detect infections in wounds, AI systems predict healing times with impressive accuracy. This technology, enhanced by mobile camera capabilities, enables remote diagnosis and monitoring, particularly in diabetic foot ulcers (DFUs). The pandemic saw the rise of virtual wound clinics, supported by AI-based algorithms that ensure care continuity and improve outcomes. Methods A literature search was conducted using PubMed, Scopus, and Web of Science databases, covering articles published up to September 2024. Keywords such as "wound healing," "Wound assessment," and "artificial intelligence," were used Results The implementation of AI in wound care has led to significant improvements, especially in chronic conditions like DFUs. AI-based algorithms have demonstrated increased diagnostic precision, enabling better monitoring and treatment planning. Through mobile technology, remote diagnosis has become more accessible, allowing virtual clinics to thrive during the pandemic. AI's ability to forecast healing times also provides clinicians with valuable insights for tailoring treatments and managing patient expectations. AI excels in wound recognition and classification through image analysis and segmentation, which helps identify key features like blood vessels and tissue types. This automated process surpasses manual methods, offering more consistent and accurate wound assessments. Additionally, AI-based clinical decision support systems analyze large datasets, aiding in decision-making and treatment recommendations. This technology saves clinicians time and helps standardize care, ultimately reducing the economic burden of wound management. AI's role in burn wound care has also proven impactful. By analyzing wound depth and severity, AI systems improve diagnostic accuracy and enable personalized, cost-effective treatment plans, contributing to better patient recovery and reduced healthcare costs. Conclusion AI offers a promising future in acute and chronic wound care by improving diagnostics, predicting healing outcomes, and personalizing treatment. The COVID-19 pandemic accelerated the adoption of AI in telemedicine, further demonstrating its value in remote care. Despite ongoing challenges related to data and ethics, AI's role in wound care is poised to expand, benefiting both patients and healthcare providers. However, challenges such as data quality, biases, ethical considerations, and the integration of AI into current systems still pose obstacles.

Keywords: Wound Healing, Wound Assessment, Artificial Intelligence

## Necrotizing Fasciitis in a Child Following a Traumatic Injury: A Case Report

**Mehdi Akbarzadeh Amirdehi[1]**
**Alireza Abasi Niasar[2]**
**Somayeh Kiani[3]***

***1. Tarbiat Modares University Mehdiakbarzadeh***
***2. Baqiyatallah University of Medical Sciences***
***3. Iran University of Medical Sciences***

Background: Necrotizing fasciitis is a severe and rapidly progressive bacterial infection in soft tissues that without proper diagnosis and treatment, can lead to extensive tissue necrosis, sepsis, and death. Rapid surgical debridement is essential to reduce morbidity and mortality. In this case report, a 10-year-old girl with no history of medicine and surgery after an accident and an injury in the left lower leg was diagnosed

with a splinting, but due to continued fever, lack of improvement in pain, and development of erythema and swelling, she referred to the clinic. During the visit, he was diagnosed with necrotizing fasciitis.

Methods: Due to limited movement, great pain and the possibility of sepsis, the abscess and infections were drained. The place is disinfected and with the referral and consultation of the infectious disease specialist, antibiotic therapy was started for the patient. 3 sessions per week for 2 months new dressings and LLLT were used for wound management.

Results: After 2 months, the symptoms of fasciitis improved and the redness and swelling of the site disappeared, the patient was able to walk normally, and the patient's pain was completely relieved.

Conclusion: Necrotizing fasciitis in children is a rare and life-threatening condition that requires prompt diagnosis and immediate treatment. This case report highlights that timely diagnosis, along with aggressive surgical management and appropriate antibiotic therapy, can lead to positive outcomes and patient recovery. Clinical awareness of this disease and close monitoring of early symptoms in children are crucial to prevent rapid progression and severe complications.

Keywords: Necrotizing, Fasciitis, Infection, Early Diagnosis

## Vacuum Therapy and its Impact on Wound Healing

**Zainab Honarvar***
**Laily Shabani Osgoue**
**Fariba Alizade**

***Department of Nursing, Marand Branch, Islamic Azad University, Marand, Iran***

Background and Objective: Delayed wound healing in patients, particularly among the elderly with underlying conditions such as diabetes, is a significant medical concern. This can lead to pain, complications, prolonged treatment, and even the need for reconstructive surgery, imposing a considerable social and financial burden on individuals and society. Preventing and reducing healthcare-associated infections and ensuring rapid, complication-free wound healing are top priorities for any health ministry, requiring significant effort and resources. Various methods are employed worldwide for wound healing, among which vacuum therapy stands out. By applying negative pressure to the affected area, it is recognized as a non-invasive approach to wound treatment and has become a contemporary topic in medicine. It is utilized by physicians and wound care specialists for various types of wounds, including surgical wounds, diabetic foot ulcers, and pressure sores. However, vacuum therapy is not suitable for infected wounds, cancerous wounds, or those in areas with poor blood supply.

Material and method: This research is descriptive-analytical and library-based. Data collection was conducted using articles and studies related to the research topic from websites such as SID, Google Scholar, Scopus, and PubMed.

Results: Clinical studies have shown that vacuum therapy reduces interstitial fluids, thereby decreasing swelling. It prevents the drying of the wound surface, provides mechanical stability at the wound site, and removes harmful exudates that could impede healing. By increasing blood flow to the wound area, it creates optimal conditions for the formation of granulation tissue. However, if the suction pressure is not appropriate for the wound, it can lead to bleeding and complications for the patient.

Conclusion: Despite the higher costs compared to other wound healing methods, vacuum therapy creates favorable conditions for the formation of granulation tissue and accelerates wound healing.

Keywords: Vacuum Therapy, Healing, Wound

## Exciting Advances in Nanoengineering of Zinc Oxide Nanoparticles - based Composites for Enhanced Wound Healing

**Azizeh Rahmani Del Bakhshayesh[1]***
**Maryam Ghahremani-Nasab[2]**
**Soraya Babaie[3]**
**Mahdiyeh Rahmanidel Bakhshayesh[4]**

*1. Kidney Research Center, Tabriz University of Medical Sciences, Tabriz, Iran*

*2. Stem Cells and Regenerative Medicine Institute, Tabriz University of Medical Sciences, Tabriz, Iran*

*3. Physical Medicine and Rehabilitation Research Center, Aging Research Institute, Tabriz University of Medical Sciences, Tabriz, Iran*

*4. Al-Zahra Technical & Vocational College, Tabriz, Iran*

The wound healing process is a complex biological process requiring therapeutic interventions to accelerate it. Due to their unique antibacterial and anti-inflammatory properties, zinc oxide nanoparticles have a high potential for promoting better wound healing. Due to these unique features, zinc oxide nanoparticles can control the infection of the wound site and, as a result, its effective regeneration, when they are integrated into the composition of biocompatible composites. This feature makes nanocomposites based on zinc nanoparticles a suitable alternative for traditional wound care methods [1]. In many chronic wounds, the wound-healing process is delayed or not done at all due to infections or metabolic disorders such as diabetes. Zinc oxide nanoparticles have emerged as a valuable solution to the challenges of wound healing due to their reaction with cellular processes and the ability to combat bacterial infections [2]. On the other hand, incorporating these nanoparticles with many biocompatible polymers such as collagen, gelatin, chitosan, and polyethylene glycol improves the physico-mechanical properties of wound dressings and strengthens their bioactive properties. To prepare Zinc Oxide NP-based composites, methods, such as electrospinning and chemical deposition, should be used that provide precise control over the dispersion of nanoparticles. The dispersion of nanoparticles in composites directly affects their performance. Zinc oxide nanoparticles prevent infection in the wound site by creating reactive oxygen species, and by accelerating the activity of fibroblasts and keratinocytes, they improve wound closure and tissue repair. Various studies have shown the efficiency of these structures in various wound-healing applications. It has been demonstrated that these materials enhance wound healing by reducing the risk of infection and accelerating the healing process. Additionally, they enhance collagen deposition, which is essential for tissue regeneration [3]. Among the various types of nanostructured composites, films and hydrogels based on zinc oxide nanoparticles are particularly effective in wound healing due to their sustained antibacterial function and the creation of a favorable healing environment. Also, in many studies, to increase the therapeutic output, in addition to zinc oxide nanoparticles, various restorative and bioactive agents such as growth factors are used [4]. In conclusion, significant advancements have been made in the field of wound care using Zinc Oxide NP-based composites. These nanostructured composites offer a multi-functional approach to treating severe and chronic wounds by combining the antibacterial benefits of zinc oxide nanoparticles with the structural and physical support of polymers.

Keywords: Wound Healing, Zinc Oxide Nanoparticles, Composites, Nanoengineering

## Combination Therapy with Blood Derivatives is a Promising Frontier in Wound Healing

**Majid Zamani[1]**

**Saeid Kaviani[1]***

**Mehdi Yousefi[2]**

**Saeid Abroun[1]**

**Mohammad Hojjat-Farsangi[3]**

**Behzad Pourabbas[4]**

*1. Department of Hematology, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, Iran*

*2. Immunology Research Center, Tabriz University of Medical Sciences, Tabriz, Iran*

*3. Bioclinicum, Department of Oncology-Pathology, Karolinska Institute, Bioclinicum, Stockholm, Sweden*

*4. Department of Polymer Engineering, Sahand University of Technology, Tabriz, Iran*

Every year, many people around the world suffer from wounds due to causes such as burns, diabetic wounds, accidents, and surgeries. Improper wound treatment causes scars and even chronic or infected wounds. Wound treatments are different and have different effectiveness. Different types of dressings, drugs, scaffolds, hydrogels, cell therapy and the

use of blood derivatives are used to treat wounds. The aim of the treatments is to prevent infection and chronicity of the wound, create a suitable environment, growth factors, and cytokines for cell proliferation, differentiation, growth, and migration, and as a result, promote wound healing and scar reduction. The use of blood derivatives such as autologous conditioned serum, platelet lysate, platelet-rich plasma and plasma rich fibrin can promote wound healing. Blood derivatives are used alone or in combination with other treatments for wound healing. If these products are used in combination with other treatments, the effectiveness of the treatment can be increased. The combined use of blood derivatives can have various advantages. The use of blood derivatives with hydrogels, in addition to providing growth factors and cytokines effective in wound healing, can increase the effectiveness of the treatment by releasing them more slowly in the wound environment. The use of blood derivatives with stem cells, in addition to the effect of the product on wound healing, can improve the conditions for the proliferation and regenerative capacity of stem cells and promote wound healing. Combination therapy with blood derivatives and stem cells can increase angiogenesis, epithelialization rate, collagen deposition, wound closure, reduced inflammation, increase the expression of VEGF, p-STAT3, and SDF-1, and modulate Notch 1 signaling compared to treatment with blood derivatives or stem cells alone. Combination therapy with blood derivatives and stem cell-derived exosomes is another therapeutic solution in wound healing. The combination of platelet lysate or autologous conditioned serum with exosomes can be a cell-free treatment for wound healing. Using different blood derivatives in combination with other treatments such as stem cells treatment can increase the effectiveness of the treatments, trigger epidermal cell proliferation, increase re-epithelialization, endothelial cell proliferation, epidermal thickness, collagen deposition, wound closure, angiogenesis, and ultimately promote wound healing and scar reduction.

Keywords: Blood Derivatives, Platelet, Plasma, Combination Therapy, Wound Healing, Regenerative Medicine

## Advancements in 3D/4D Bioprinting: Designing Customizable Bio-scaffolds with Responsive Materials for Enhanced Wound Healing

**Azizeh Rahmani Del Bakhshayesh[1]***
**Maryam Ghahremani-Nasab[2]**
**Mahdiyeh Rahmanidel Bakhshayesh[3]**
**Mohammad-Amin Mokhtari[4]**

***1. Department of Tissue Engineering, Faculty of Advanced Medical Sciences, Tabriz University of Medical Sciences, Tabriz, Iran***

***2. Stem Cells and Regenerative Medicine Institute, Tabriz University of Medical Sciences, Tabriz, Iran***

***3. Al-Zahra Technical & Vocational College, Tabriz, Iran***

***4. Department of Basic Sciences, Faculty of Veterinary Medicine, Semnan University, Semnan, Iran***

In recent years, 3D and 4D bioprinting has emerged as a new revolution in tissue engineering. This technology offers innovative solutions to complex medical challenges, especially wound healing. One is the ability to design and create personalized bio-scaffolds that support tissue regeneration. Due to its importance, this technology has become the main focus of today's tissue engineering and regenerative medicine research. An appealing approach in this field involves integrating 3D printing technology with advanced materials that can respond to environmental stimuli, known as 4D printing technology. With this approach, constructs are created that can dynamically react to the environmental conditions of the wound. Responsive materials, also known as smart materials, are sensitive to environmental changes such as temperature, pH, or mechanical stress. In the context of wound healing, these structures are designed and programmed to release therapeutic or biological factors, change structure, or undergo controlled destruction under specific environmental conditions. This dynamism and adaptability of these structures provide the potential for targeted support during different phases of wound healing, resulting in more effective tissue regeneration. In addition, along with this technology, researchers utilize precise 3D

modeling techniques to create structures with unique characteristics in terms of porosity, mechanical strength, and surface performance. This is essential for developing optimal biological characteristics, such as proper cell attachment, proliferation, and differentiation, to facilitate effective wound healing. Somehow, scientists combine computational models with experimental tests to design structures that can meet the specific needs of a patient or a particular wound. This represents a significant advancement in personalized medicine. Responsive printed structures, unlike traditional structures, are actively sensitive to the physiological conditions of the wound site, and in this way, in addition to speeding up wound healing, they also reduce the possibility of some complications such as infection and scarring. In conclusion, a new generation of bio-constructs has been created by integrating 3D printing technology with smart materials that respond to environmental conditions, revolutionizing wound healing. The advancing research in this area leads to the development of highly efficient and patient-specific treatments, and ultimately, through improved wound healing, enhances the quality of life for patients with severe wounds.

Keywords: Wound Healing, Bioprinting, Responsive Materials, 3D Modeling Techniques

## A Study on a Chitosan-based Powder Wound Dressing for the Treatment of Pressure Ulcers

**Parnaz Mohseni**
**Ghazal Shariat Panahi**
**Majid Deilami**
**Mohammad Raoufi***

***Nano Narin Teb***

Background: Effectively addressing pressure ulcers is essential to prevent complications such as infection, sepsis, and extended hospital stays. A chitosan-based powder dressing was designed for complicated cavity pressure ulcers, offering accelerated skin regeneration and antibacterial and anti-biofilm properties. This study aims to assess the performance of the NanoExpo powder dressing (Nano Narin Teb Co., Iran) in managing pressure ulcers.

Methods: This study enrolled 17 patients with pressure ulcers of varying stages. Their wounds were treated over 12 weeks, with assessments of wound volume, tissue type, infection rates, and exudation recorded weekly using wound evaluation forms and digital photography.

Results: After an average of 70.12±42.04 days, half of wounds were completely healed. There was a significant reduction in wound volume ($p < 0.05$), decreasing from 300.78±39.78 ml at week zero to 4.28±0.86 ml by the study's conclusion. The proportion of epithelialized tissue increased significantly ($p < 0.05$), from 11.17±6.73% initially to 75±30.66% after 12 weeks. Slough tissue decreased from 48.82±26.37% at week zero to 5.58±6.25% at week 12. The NanoExpo dressing reduced the percentage of infected wounds from 94% to 23.52% ($p < 0.05$) and decreased exudate levels by 67.85%.

Conclusion: The multifunctional NanoExpo powder dressing improved wound healing parameters, demonstrating its potential as an effective therapeutic intervention for pressure ulcers.

Keywords: Wound Care, Infection, Antibacterial, Biofilm, Exudate

## Diabetic Wound Healing Potential of Medicinal Plants Found in Iran and Their Bioactive Components Role

**Fatemeh Zamani Babgohari***
**Fatemeh Alavikia**
**Hiva Hosseininasab**

***Kerman University of Medical Sciences***

According to the WHO, from 1980 to 2014, the number of individuals diagnosed with diabetes increased from 108 million to 422 million. Importantly, countries with poor or medium economies, like Iran, have seen a quicker rise than those with greater incomes. Diabetes can develop diabetic, neuropathic, neuroischemic, and other wounds. There are several biological mechanisms

that impede the healing process of diabetic foot ulceration, such as hyperglycemia-induced oxidative stress, disrupted blood supply to tissue, infection, and abnormal inflammatory responses. Since diabetic ulcers heal slower than healthy ulcers and can lead to infection or amputation, which causes psychological, economic, and social burdens, exploring other ways to accelerate diabetic wound healing is an urgent need. Taking into account the various articles that have been published up to now about the effectiveness of plants in promoting and accelerating wound healing, besides their minimal complications and cost-effectiveness, we selected eight Iranian plants that have received less research in this area than other plants like Aloe vera from the list provided by Jivad et al. (2016) to explore their potential for diabetic-induced wound healing, including Myrtus communis (L.) (in the Persian language Mourd found in Mobarakeh, Iran), Glycyrrhiza glabra/Licorice (Shirinbian - Sirjan), Origanum ulgare/Oregano (Marzanjoush - Arasbaran), Althaea officinalis/Marshmallow (Khatmi - Lorestan), Teucrium polium (Maryam nokhodi - khuzistan), Plantago major L. (Boz rishi - Sardasht) , Achillea millefolium (Boumadaran - Bandar Genaveh), Olea europaea (Zeytoun - Khuzistan). A comprehensive literature search was performed in PubMed, Scopus, and Web of Science using keywords such as ' Diabetic wounds,' Neuropathic wounds,' and ' Diabetic patients' in regard to each plant. Relevant in vitro, in vivo, and clinical studies were analyzed, and all (n = 31) concluded the therapeutic potential of these plants in diabetic ulcers even more than standard treatments, which may be due to their bioactive components; for example, Myrtle essential oil suppresses LPS-stimulated macrophages' NO generation without altering cell survival. The extracts also lower ROS and inflammatory cytokine gene expression. Carvacrol and thymol-rich oregano essential oil (OvEo) is antibacterial, anti-inflammatory, and antioxidant. It damages bacterial cell membranes, increases IL-10, decreases proinflammatory cytokines, reduces edema, and promotes tissue remodeling. Glycyrrhizic acid from licorice inhibits cyclooxygenase, and like hydrocortisone, it inhibits phospholipase A2, which causes several inflammatory processes. Glycyrrhizin and 18-β-glycyrrhetenic acid suppress viral gene expression and HMGB1 DNA binding. Hispaglabridin A, glabridin, and 30-hydroxy-40-methylglabridin are antioxidants that scavenge free radicals, donate hydrogen, and reduce free radicals. Chlorogenic acid and flavonoids make Achillea millefolium antioxidant. phenolic acids, terpenoids, flavonoids, and polysaccharides in plantago major cause wound healing, antidiabetic, and antibacterial effects. It speeds wound closure by promoting collagen synthesis and tissue regeneration. Olea europaea leaf extract shows promise for wound healing by reducing TNF-α and IL-1β levels, increasing collagen deposition, and reepithelializing. In conclusion, this study provided underresearched plants found in Iran and their bioactive components in the field of diabetic ulcers to inspire researchers, especially Iranian researchers, to develop new and more effective drugs by using these plants directly or extracting their main bioactive components.

Keywords: Wound, Diabetes, Diabetic Ulcers, Neuropathic wounds, Medicinal Plants, Iran, Bioactive Components

## The Effect of Lifestyle on The Management of Burn Wounds in Patients after Leaving the Hospital

**Mahsa Goharara**

***Imam Musa Kazem Hospital***

Burn wound management after hospital discharge requires special attention to lifestyle and daily care. Some important aspects include wound hygiene, burn wounds should be cleaned regularly and proper dressings should be used to prevent infection. Avoiding exposure to direct sunlight. New and sensitive skin needs protection. Using sunscreen and proper coverage can help. Adhering to a healthy diet of proper nutrition with proteins, vitamins and minerals helps to heal the wound and improve the condition of the skin. Managing pain and discomfort and taking medications regularly as prescribed by your doctor and using pain management techniques such as relaxation techniques can be effective. Exercise and rehabilitation, performing stretching and physical exercises according to the

training given by the physiotherapist to the patient and the patient's family during hospitalization can prevent muscle wasting and return the muscles to their original state. Regular medical follow-ups are necessary to monitor the healing process and supplemental texts. All the mentioned items help to speed up the healing process and reduce complications. Burn wound management after hospital discharge requires attention to various aspects in which psychological issues play an important role. The impact of psychological issues on burn wound management shows itself in different ways, including recovery process, special and special care with the patient, acceptance and adaptation, social support, pain management.

Keywords: Lifestyle, Wound Management, Burns, Psychological Effects, Wound Dressing, Sepsis

## Innovative Technologies for Chronic Wound Healing: Exploring the Role of Nanotherapeutics-Based Strategies

**Maryam Ghahremani-Nasab[1]***
**Azizeh Rahmani Del Bakhshayesh[2]**
**Hamed Valizadeh[1]**
**Diba Ghasemi[1]**
**Abolfazl Barzegari[1]**
**Mohammad Piruzpanah[1]**

***1. Stem Cells and Regenerative Medicine Institute, Tabriz University of Medical Sciences, Tabriz, Iran***

***2. Department of Tissue Engineering, Faculty of Advanced Medical Sciences, Tabriz University of Medical Sciences, Tabriz, Iran***

Wound healing is a complex and dynamic process essential for the repair of injured tissue. Incomplete or improper healing can lead to abnormal scar formation and chronic wounds, which increase susceptibility to infections and negatively impact patients' quality of life. Chronic wounds also impose significant financial burdens on healthcare systems worldwide. Effective management of these wounds necessitates specialized biomedical treatments due to the intricate nature of the healing process and the need for long-term care. Current therapeutic options, including skin grafts, wound dressings, growth factor delivery, gene therapy, and cell therapy, vary in effectiveness based on wound type, highlighting the limitations of existing approaches. To address these challenges, there is an urgent need for innovative therapeutic methods that can treat a broader range of wounds effectively. Recent advancements in wound care technologies, such as nanotherapeutics, bioengineered skin grafts, 3D bioprinting, and stem cell therapy, are being explored to enhance skin regeneration with minimal side effects, thus improving outcomes for chronic wound management [1]. Nanotherapeutic strategies have emerged as effective methods for enhancing wound healing through the use of various nanomaterials, such as nanoparticles and nanofibers, loaded with antimicrobial agents and therapeutic agents. These approaches address challenges associated with traditional wound healing, such as infection, poor penetration, and delayed healing. The rapid advancement of nanotechnology has enables improved drug delivery through nanoparticulate systems, which providing sustained release and enhanced bioavailability while reducing the frequency of administration [1]. The small size of nanocarriers facilitates intracellular delivery, maintains a moist environment, and ensures stability. Nanotherapies improve microbial infection management in chronic wounds through enhanced drug delivery and interactions, offering significant advantages over conventional methods. Nanomaterials used in chronic wound management can be broadly classified into two major categories, each possessing unique properties and efficacy [2-3]. The first category includes organic nanomaterials, which include solid-lipid nanoparticles, nanosheets, liposomes, micelles, nanoemulsions, nanofibers, and polymeric nanoparticles. The second category consists of inorganic nanomaterials, such as magnetic nanoparticles, carbon nanotubes, quantum dots, and metal nanoparticles. Nanoparticles composed of metals and metal oxides, including gallium, copper oxide, iron oxide, titanium dioxide, aluminum oxide, zinc oxide (ZnO), zinc, and gold, exhibit outstanding antibacterial properties that facilitate the enhancement of wound healing [4-6]. Furthermore, materials such as bioactive glass, nitric oxide (NO) nanoparticles, cerium, and carbon-based nanoparticles, which

have inherent bioactivity, have also been used in the management of chronic wounds [7].

Keywords: Wound Healing، Nanotherapeutic، 3D Bioprinting، Stem Cell Therapy

## Rehabilitation Nursing in Life Challenges of Patients with Cancer and with Ostomy; A Review Study

**Masome Rafat[1]**
**Ali Pourhabib[2]***

***1. Student Research Committee, Ramsar Fatemeh Zahra School Of Nursing and Midwifery, Health Research Institute, Babol University of Medical Sciences, Babol, Iran***

***2. Nursing Care Research Center, Health Research Institute, Babol University of Medical Sciences, Babol, Iran***

Introduction: With the increase in the prevalence of pelvic and intestinal cancers, the use of ostomy as a treatment method has become popular. This change in lifestyle, especially in physical, mental, and social aspects, affects the quality of life of patients. Therefore, managing the challenges caused by ostomy is essential for these patients. Rehabilitation nurses can effectively improve patients' quality of life by identifying these challenges and providing solutions such as comprehensive training, continuous follow-up, creation of support groups, etc. This review study was conducted with the aim of investigating the effect of rehabilitation nursing on managing the challenges of cancer patients with ostomy.

Methodology: This review study was searched using the keywords "rehabilitation nursing", "challenges", and"ostomy" and their English equivalents, in PubMed, Embase, Scopus, ScienceDirect, Irandak, SID, and Mogiran databases in the period from 2014 to 2024. Clinical trial articles published in English or Farsi and focused on cancer patients with ostomy were included in the study. For data extraction, a standard data extraction form was used, which includes information such as study characteristics, study population, interventions,The results and methodology were quality. The research team jointly participated in all stages of the study.

Findings: The results of this review study showed that rehabilitation nursing has a positive effect on improving the quality of life of patients with ostomy. Rehabilitation nursing interventions, including comprehensive training, psychosocial support, and continuous follow-up, have significantly helped to reduce anxiety, and depression and increase patients' ability to manage ostomy. Also, studies show that these interventions have led to the improvement of the overall quality of life of patients, including physical, psychological, and social aspects. However, the studies conducted in this field have been limited to a certain number of countries and different methods, Therefore, the need to conduct more studies with stronger design and larger sample size is felt.

Conclusion: The results of this review study emphasize the importance of rehabilitation nursing in improving the quality of life of cancer patients with ostomies and show the necessity of developing and implementing comprehensive rehabilitation nursing programs for these patients.

Keywords: Rehabilitation Nursing, Nursing Interventions, Ostomy, Patient Education

## Magnetic Nanoparticle-based Smart Wound Dressing for Bacterial Detection

**Hadis Aboheidari**
**Zahra Mohammadi***

***Tehran University and Tehran University of Medical Sciences***

Early diagnosis and identification of bacterial infections is one of the main clinical challenges, and traditional methods are time-consuming and tedious. Metals and metal oxide nanoparticles (MNPs) have been used for antibacterial treatment and diagnosis, and their combination in wound dressings can create smart dressings. Magnetic nanoparticles (MNPs) have potential antibacterial applications due to their unique structural features that can be controlled by various parameters. MNPs can induce magnetic resonance relaxation, making

them useful contrast agents in Magnetic Resonance Imaging (MRI). Various methods for bacterial detection include surface-enhanced Raman scattering (SERS), colorimetric detection, fluorescent detection, and nuclear magnetic resonance (NMR). Surface-enhanced Raman Scattering (SERS) is a new method for bacterial identification, combining Raman spectroscopy and magnetic materials for rapid identification and antibiotic susceptibility testing. It can detect several target bacteria, such as E. coli, Enterococcus faecalis, and S. aureus, with high reliability and sensitivity. Colorimetric detection involves the observation of color changes in bacteria, allowing qualitative or quantitative analysis using UV-visible spectroscopy. Combining Au nanoparticles with magnetic materials improves detection sensitivity by achieving bacterial aggregation and isolation. Fluorescent detection offers high sensitivity and detection limit, combining dyes with MNPs for a method that integrates magnetic adsorption, fluorescent labeling, and detection. Nuclear magnetic resonance (NMR) converts nuclear resonance information into electrical parameters, providing biochemical and pathological conditions for early detection of edema, infection, inflammation, and degeneration. Advances have been made in MNPs for bacterial detection, but challenges like stability remain. Surface modification can improve stability and selectivity, enabling multifunctional MNPs for simultaneous diagnosis and therapy, image-guided therapy, and a new direction in nanomedicine.

Keywords: Magnetic Nanoparticles, Bacterial Infection, Detection, Wound Dressing

## Inflammetry, Anti-bacterial and Anti-cancer Behavioure of Two Layers Wound Healing Dress Based on Silicon/Alginate Hydrogel Dressings Enriched With Chitosan-cuo Nanosystem in the Healing of Post-Melanoma Wounds in a Mouse Model

**Fatemeh Mohammadi**

***Isfahan University Jihad Institute of Higher Education/ Royan Biotechnology Research Institute of Isfa***

Background: Melanoma is the most serious type of skin cancer and surgery is an effective way to treat melanoma. Therefore, the formulation of hydrogel wound dressings based on chitosan or in combination with other polymers such as alginate can improve wound healing after surgery and reduce adverse factors affecting its healing. One of the nanoparticles that are loaded in wound dressings to improve hydrogel properties is copper oxide nanoparticles.

Methods: Copper nanoparticle was chemically synthesized and analyzed by XRD, DLS, Zeta, FTIR, TEM, then the nanoparticle was loaded in chitosan-alginate hydrogel and analyzed by EFSEM, FTIR, as well as anti-inflammatory, anti-cancer and antimicrobial behavior. , cell toxicity and adhesion, cell migration in vitro, wound healing in vivo, histology of skin wounds, cancer gene disruption, water vapor permeability test, drug release test, hemolysis and blood coagulation dynamic evaluation, measurement Mechanical properties (Young's modulus and modulus of elasticity) will be evaluated.

Results: We developed a biological hydrogel wound dressing enriched with copper nanoparticles, which can effectively inhibit local tumor recurrence and tumor metastasis, and in addition, it induces angiogenesis and cell adhesion, has antimicrobial and anti-inflammatory properties.

Conclusion: Wound dressings consisting of biopolymers as regenerative components and natural anti-cancer agents as preventive components of cancer recurrence can be ideal candidates for regenerative applications in skin cancer.

Keywords: Wound Dressing, Alginate-chitosan Hydrogel, Copper Oxide Nanoparticles, Melanoma Cancer

## Exploring Co-expression Modules-traits Correlation Through Weighted Gene Co-expression Network Analysis: A Promising Approach in Wound Healing Research

**Mansoureh Farhangniya[1]***
**Ali Samadikuchaksaraei[2]**
**Farzaneh Mohamadi Farsani[3]**

***1. Health Metrics Research Center, Iranian Institute for Health Sciences Research, ACECR, Tehran, Iran***
***2. Iran University of Medical Sciences***
***3. Department of Biology, Naghshejahan Higher Education Institute, Isfahan, Iran***

Background: The skin is the biggest organ in the body and has several important functions in protection and regulation. However, wound development can disrupt the natural healing process, leading to challenges such as chronic wounds, persistent infections, and impaired angiogenesis. These issues not only affect individuals' well-being but also pose significant economic burdens on healthcare systems. Despite advancements in wound care research, managing chronic wounds remains a pressing concern, with obstacles such as persistent infection and impaired angiogenesis hindering the healing process. Understanding the complex genetic pathways involved in wound healing is crucial for developing effective therapeutic strategies and reducing the socio-economic impact of chronic wounds. Weighted Gene Co-Expression Network Analysis (WGCNA) offers a promising approach to uncovering key genes and modules associated with different stages of wound healing, providing valuable insights for targeted interventions to enhance tissue repair and promote efficient wound healing.

Methods: Data collection involved retrieving microarray gene expression datasets from the Gene Expression Omnibus website, with 65 series selected according to inclusion and exclusion criteria. Preprocessing of raw data was performed using the Robust MultiArray Averaging approach for background correction, normalization, and gene expression calculation. Weighted Gene Co-Expression Network Analysis was employed to identify co-expression patterns among genes associated with wound healing processes. This involved steps such as network construction, topological analysis, module identification, and association with clinical traits. Functional analysis included enrichment analysis and identification of hub genes through gene-gene functional interaction network analysis using the GeneMANIA database.

Results: The analysis using WGCNA indicated significant correlations between wound healing and the black, brown, and light green modules. These modules were further examined for their relevance to wound healing traits and subjected to functional enrichment analysis. A total of 16 genes were singled out as potential hub genes critical for wound healing. These hub genes were then scrutinized, revealing a gene-gene functional interaction network within the module network based on the KEGG enrichment database. Noteworthy pathways such as MAPK, EGFR, and ErbB signaling pathways, as well as essential cellular processes including autophagy and mitophagy, emerged as the most notable significant pathways.

Conclusion: We identified consensus modules relating to wound healing across nine microarray datasets. Among these, 16 hub genes were uncovered within the brown and black modules. KEGG enrichment analysis identified co-expression genes within these modules and highlighted pathways most closely associated with the development of wound healing traits, including autophagy and mitophagy. The hub genes identified in this study represent potential candidates for future research endeavors. These findings serve as a stepping stone toward further exploration of the implications of these co-expressed modules on wound healing traits.

Keywords: Wound Healing, Gene Expression, Network Analysis, Autophagy, Mitophagy

## Evaluation of the Postbiotic Regenerative Effect of Pediococcus Acidilactici Strain B27-1 on Normal Human Skin Cell Line

**Niusha Bakhshande**
**Sepideh Khaleghi***
**Neda Mousaviniri**

***Department of Biotechnology, Faculty of Advanced Sciences and Technology, Tehran Medical Sciences, Islamic Azad University, Tehran, Iran***

Introduction: A wound is defined as any disruption or damage to living tissue, particularly skin, mucous membranes, or internal organs. Wounds heal through a series of stages: hemostasis (stopping the bleeding), inflammation, proliferation (tissue formation), and remodeling (1). Infection is a significant risk associated

with wounds, particularly open wounds. Chronic wounds present numerous challenges for healthcare providers, patients, and the overall healthcare system. Postbiotics are non-viable bacterial products or metabolic byproducts produced during fermentation by probiotics. They include substances like cell wall components, short-chain fatty acids, and other metabolites that can exert beneficial effects on the host without the presence of live microorganisms. In this study, we consider the effect of Pediococcus acidilactici strain B27-1 postbiotic on normal human skin fibroblast cell line.

Methods: The postbiotic was separated after overnight culturing in MRS medium. The pH of postbiotic was adjusted on 7 by NaOH 1N and 10% Inulin was added the postbiotic then lyophilized for 24 h. The effect of Postbiotic on HFFF-1 Cell viability was evaluated by MTT in 24h, 48h and 72h by several concentrations' of 1000 µg/ml, 500 µg/ml, 250 µg/ml, 125 µg/ml and 65 µg/ml. The apoptotic effect of postbiotic was considered by Annexin v/PI method. The cell cycle analysis was assessed by PI coloring and flowcytometry analysis. The ROS assessment was done by Flowcytometry too.

Results: The results show the postbiotic is biocompatible and without cytotoxicity on HFFF-1 cell line. The Apoptosis assay confirmed the postbiotic is biologically safe. There's no cell cycle arresting by postbiotic treatment. Moreover, there is no significant ROS production in postbiotic treated cells.

Discussion: According to the results, the postbiotic provided by Pediococcus acidilactici strain B27-1 can be a safe and biocompatible reagent on normal human skin fibroblast cell line. This can be effective in wound healing and anti-aging products. For these aims more experiments are needed. References 1.Teller P, White TK. The physiology of wound healing: injury through maturation. Perioperative Nursing Clinics. 2011;6(2):159-70. 2.Siddiqui AR, Bernstein JM. Chronic wound infection: facts and controversies. Clinics in dermatology. 2010;28(5):519-26. 3.FrykbergRobert G. Challenges in the treatment of chronic wounds. Advances in wound care. 2015. 4.Golkar N, Ashoori Y, Heidari R, Omidifar N, Abootalebi SN, Mohkam M, et al. A novel effective formulation of bioactive compounds for wound healing: preparation, in vivo characterization, and comparison of various postbiotics cold creams in a rat model. Evidence-Based Complementary and Alternative Medicine. 2021;2021(1):8577116.

Keywords: Pediococcus Acidilactici Strain B27-1, Wound, ROS, Postbiotic

## Antibacterial Efficacy of Metal-Phenolic Networks: Novel Solution for Wound Care

**Shaghayegh Kohzadi**
**Zahra Mohammadi***

***University of Tehran***

Antibacterial metal-phenolic networks (MPNs) have emerged as a promising innovation in the field of wound care, combining natural polyphenols and multivalent metal ions to address the challenges posed by chronic wounds. Chronic wounds often suffer from bacterial infections, delayed healing, and persistent inflammation, leading to significant morbidity and increased healthcare costs. Traditional treatment options frequently encounter issues such as bacterial resistance and adverse effects, signaling the need for advanced therapeutic materials. MPNs represent a novel approach by synergistically integrating the antimicrobial properties of metal ions with the healing-promoting attributes of polyphenols. MPNs are formed through the coordination of multivalent metal ions such as silver, zinc, and copper with polyphenolic compounds, primarily sourced from natural plants. These networks possess unique structural properties, allowing for versatile applications such as hydrogels, coatings, and nanoparticles. The intrinsic properties of MPNs facilitate the controlled release of metal ions, leading to sustained antibacterial activity targeting a broad spectrum of pathogens, including methicillin-resistant Staphylococcus aureus (MRSA) and Escherichia coli. The antibacterial mechanisms of MPNs are multifaceted. Metal ions disrupt bacterial cell membranes, generate reactive oxygen species (ROS), and modulate inflammatory responses. Dependent on the metal ion concentration and the type of polyphenol, these materials can weaken the biofilms

formed by bacteria, further enhancing their therapeutic efficiency. In addition, interaction between MPNs and biological tissues promotes wound healing through antioxidante effects and modulation of inflammation. Polyphenols in MPNs have demonstrated the ability to scavenge excess ROS and promote the activation of healing-associated macrophages, thereby improving the wound microenvironment and fostering tissue regeneration. Fabrication of MPNs typically involves straightforward methodologies, such as "one-step" or "multi-step" assembly processes, enabling scalability and adaptability for clinical applications. Flexibility in design allows optimization of physical characteristics including porosity, mechanical strength, and drug delivery capabilities. Recent advances in nanotechnology have further enhanced the performance of MPNs, positioning them as multifunctional materials capable of integrating various therapeutic modalities, such as photothermal therapy, chemodynamic therapy, and anti-inflammatory treatments. In vivo studies have validated the biocompatibility and safety of MPNs, revealing significant improvements in wound closure rates compared to traditional dressings. The presence of bioactive components facilitates the optimal healing pathway, reduces scar formation, and improves overall patient outcomes. Furthermore, ongoing research aims to elucidate the optimal combinations of metal ions and polyphenols to maximize synergistic effects and minimize cytotoxicity. In conclusion, antibacterial metal-phenolic networks represent a significant advance in wound dressing technology, offering a robust solution to the persistent problem of chronic wounds and associated infections. Incorporation of antibacterial metal ions with polyphenolic compounds not only enhances antimicrobial activity but also promotes wound healing through anti-inflammatory and antioxidant mechanisms. This innovative approach has the potential to revolutionize chronic wound management, ultimately improving patient care and reducing healthcare burden. Future directions in research will focus on refining the design and composition of MPNs, aiming for greater therapeutic efficacy and expanded clinical applications.

Keywords: Metal-phenolic Networks (MPNs), Chronic Wounds, Antibacterial, Wound Healing, Polyphenols, Metal Ions

## Innovative Approaches to Wound Healing: The Promise of 3D-Printed Stem Cells

**Mohadeseh Pakroo[1]**
**Sara Hassani[1]**
**Seyed Mehdi Tabaie[2]**
**Mina Sadat Naderi*[3]**

***1. Department of Biology, Science and Research Branch, Islamic Azad University, Tehran, Iran***

***2. Department of Medical Laser, Medical Laser Research Center, Yara Institute, Academic Center for Education Culture and Research (ACECR), Tehran, Iran***

***3. Department of Biology, Faculty of Biological Sciences, North Tehran Branch, Islamic Azad University, Tehran, Iran***

Introduction With the global rise in chronic wound patients, financial and social pressures on these individuals are increasing. Chronic wounds, defined as those taking over twelve weeks to heal, often stem from repetitive skin damage or other pathological factors and frequently complicate chronic diseases like diabetes and cancer. In this review, 3D-printed stem cells are revolutionizing wound healing. This innovative approach merges the precision of 3D printing with the regenerative power of stem cells to create customized treatments. 3D bioprinting allows for precise control over compositions, spatial distributions, and architectural complexities, bridging the gap between natural and artificial skin structures. Methods This study investigates the impact of 3D-printed stem cells on wound healing. A comprehensive literature review was conducted, sourcing articles from multiple databases, including PubMed and Google Scholar. The selected articles were meticulously reviewed and analyzed to extract relevant insights and data. The focus was on identifying the mechanisms by which 3D-printed stem cells contribute to the wound healing process and evaluating their efficacy. Results Stem cells are promising candidates for tissue engineering due to their abundant sources, multidirectional differentiation ability, and high proliferation rate. However, delivering them in vitro for skin injury treatment remains challenging, especially with bacteria from the wound site and environment impacting the

healing process. Over the past decade, 3D bioprinting has significantly enhanced cell delivery systems. The scaffolds produced can be precisely localized within cells and perform antibacterial actions. Stem cells, often derived from adipose tissue or bone marrow, are mixed with a bioink that includes hydrogels to support cell growth and provide a scaffold for tissue regeneration. Advanced 3D bioprinters deposit this bioink layer by layer onto the wound site, creating complex structures that mimic natural skin. Once printed, the stem cells differentiate into various cell types needed for skin regeneration, such as dermal fibroblasts and epidermal keratinocytes, promoting faster and more effective healing. 3D-printed stem cells can significantly accelerate wound healing by promoting rapid cell proliferation and tissue regeneration. The precise application of cells helps form organized tissue structures, leading to reduced scarring compared to traditional treatments. Moreover, treatments can be tailored to the specific needs of the patient, allowing for personalized wound care. Conclusion 3D-printed stem cells present a more advanced and personalized solution, particularly for severe or chronic wounds. This innovative technology not only speeds up the healing process but also enhances the quality of the regenerated tissue, positioning it as a promising option for the future of wound care.

Keywords: 3D Bioprinting; Stem Cells; Wound Healing; Chronic Wounds

## The Effect of Phenytoin Ointment on Healing Pressure Ulcers

**Habib Absari***
**Ayna Nazari**

Background: The skin is the largest organ of the human body, and in today's society, the health of this organ is of great importance. Wound healing is a significant healthcare problem in today’s medical Introduction: Pressure ulcers are a significant health problem worldwide. they also result in longer hospital stays and increase the cost of health care. One of the methods of healing pressure ulcers is the use of phenytoin ointment. Phenytoin ointment with increase in the proliferation of fibroblasts, increased deposition collagen heals wounds.

Material and methods: In this review study conducted in 2024, the study population included articles that investigated the effectiveness of phenytoin ointment in wound healing. A search of articles from Google Scholar, Pubmed, Scopus, SID. was conducted during one month (August 10 to September 10). In this search, words and phrases such as wound, phenytoin ointment, wound repair and diabetes were used in the range of the year after 2015 and nearly 63 articles were selected, which were reduced to 25 articles after careful monitoring and study.

Results: Results We identified 17 human studies and eight mouse studies. The efficacy of phenytoin is also compared with other wound care agents, including tretinoin, silver sulfadiazine, honey, dexamethasone.

Conclusion: This review illustrated the significant effects and rare adverse events of topical phenytoin on wound healing.

Keywords: Skin, Phenytoin, Ulcers, Phenytoin Ointment, Healing Pressure Ulcers

## The Role of Tgf-B Smart Dressing in Wound Healing

**Bita Nazari**

***Nursing Student of Saveh Faculty of Medical Sciences***

The global increase in skin ulcers imposes a great health and financial burden on patients and society. Although, the use of traditional wound dressings contributes to an effective result in wound healing, however, the complexity of the healing process remains a major health challenge. Recent advances in materials and manufacturing technologies have led to the creation of dressings that provide favorable conditions for effective wound healing. Using smart wound dressings is a new method in wound management. As is clear from their name, smart wound dressings are wound dressings that can interact with the wound and use sensors placed inside them or smart materials such as stimuli-responsive materials and self-healing materials. Transforming growth factor beta (TGF-β) as

a multifunctional protein plays a key role in the wound healing process. A balance in TGF-β levels is essential for proper wound healing. This article examines the role of TGF-β in wound healing and its potential as a target for novel therapies in chronic and inflammatory wounds

Keywords: TGF-B, Smart Dressing, Wound, Skin Trauma

## Preoral and Oral Digestion of *Leishmania Major* Parasite by *Lucilia Sericata* Larvae

**Azam Malekian**
**Naseh Maleki-Ravasan**
**Parviz Parvizi***

***Department of Parasitology, Pasteur Institute of Iran, Tehran, Iran***

Background: Zoonotic cutaneous leishmaniasis (ZCL) caused by Leishmania major as the cause of chronic wounds is an increasing problem in tropical and subtropical regions of the world. For many years, Lucilia srricata larvae have been considered as a complementary treatment method for chronic wounds. In previous studies, the anti-leishmanial effects of the whole body of the larvae and their excretion/secretion products have been approved, but the time of the effect and ingestion of the parasite by the larvae has not been investigated. In this study, the exposure of L. major parasite to L. sericata in the environment inside and outside the larva's body was investigated.

Methods: The life cycle of L. sericata was established in insectarium. The L. major parasite was passaged until the logarithmic phase. Larvae-parasites interaction was investigated in various nutritional environments and times. For the interaction outside of the larval body, tracking of parasites and their viability was done by microscopic, MTT and Trypan blue examinations. Parasites were tracked inside the larva's body with microscopic and molecular methods.

Results: Due to the antimicrobial properties of larvae, the parasites were deactivated 4 hours after interacting with the larvae, and after 6 hours in the larval nutritional environment, they were lysed. The absence and inactivity of the parasite in the selective interaction environment were confirmed by the indicated methods. The number of alive cells in the treatment group showed a significant increase compared to the control. The genomic DNA of parasites and not alive parasites was detected in the body of L. sericata larvae through molecular methods.

Conclusion: For the first time, this study displayed that the interaction of L. sericata with L. major for use in leishmaniasis treatment should last at least 6 hours so that the parasites are completely destroyed. In addition, intra- and extra-oral digestion of L. sericata larvae kills L. major. It was also shown that increasing the microbiota in the interaction environment could help suppress the Leishmania parasite population. Considering the removal of parasites by L. sericata larvae, the potential of therapeutic larvae could be used in the treatment of ZCL.

Keywords: Zoonotic Cutaneous Leishmaniasis, Maggot Therapy, Antimicrobial Peptides, Microbiota

## A New Method for Wound Healing without Sutures Using Fibrin and Natural Nanoparticles

**Bahar Rouhani**

***Iran, Ministry of Science, Kashan Azad University***

Every person may deal with wounds and injuries many times during their life. In this article, a new method for faster healing of wounds and injuries without sutures is presented using fibrin polymer as a polymer base and bio-adhesive and natural nanoparticles as antibacterial, anesthetic and speeding up the healing process. The investigated nanomaterials include curcumin, edocin, cocaine, quercetin and chrysin. Each of these nanomaterials is obtained from natural materials such as turmeric, garlic, honey and tree leaves. Nanoparticles are prepared in the laboratory from the active ingredients of natural materials, are combined with fibrinogen and are used in an active form with the help of thrombin enzyme. The use of human protein and natural nanomaterials in the design will result in the maximum adaptation of the body, the least possible side effects and high speed in the

treatment. This proposed material has two important advantages over similar suture remover products; Its most important advantage is the use of nanomaterials, which speeds up the healing process due to its high surface-to-volume ratio, and another advantage is its various methods of use according to the extent of the injury. In general, other biological adhesives such as aloe vera-based plant polymers and other natural and chemical nanomaterials that are effective in accelerating the wound healing process can also be used, which are suggested for future projects

Keywords: Polymer, Fibrin, Natural Nanomaterials

## Lentinula Edodes Polysaccharides and Wound Healing

**Almas Araghi**[1]
**Mohaddeseh Larypoor**[1]*
**Fatemeh Yazdian**[2]
**Maryam Bikhof Torbati**[3]

***1. Department of Microbiology, Faculty of Biological Sciences, North Tehran Branch, Islamic Azad University, Tehran, Iran***

***2. Faculty of New Science and Technology, University of Tehran, Tehran, Iran***

***3. Yadegar-e-Imam Khomeini (RAH) Shahre Rey Branch, Islamic Azad University, Tehran, Iran***

Introduction: Wound healing is an essential process for repairing of damaged tissues and the community Healthcaring. Lentinula edodes (shiitake) is a medicinal and edible mushroom cultivated in East Asia for thousands of years. Polysaccharides, natural and biocompatible components, have significant potential in enhancing of wound healing. In this study, polysaccharides of Lentinus edodes extract was evaluated for its effects as a candidate for wound healing. Materials and Methods Hot water extracted polysaccharide from mycellium of L. edodes was purified by DEAE column chromatography. FT-IR spectroscopy, and thin-layer chromatography was investigated to understanding molecular characteristics. Antibmicrobial effect of polysaccharides was confirmed against S. aureus and E. coli. Results The results indicated that polysaccharides can promote faster wound healing by creating antimicrobial and antioxidant activities. FT-IR spectroscopy, and thin-layer chromatography showed that polysaccharide composed of glucose units. Biological activity assays confirmed that L. edodes polysaccharides have both antimicrobial and antioxidant activities. Conclusion Functional characteristics of polysaccharides can make them as suitable candidates in wound treatment and also modern medicines. Polysaccharides can increase wound healing and also decrease the risk of microbial growth. polysaccharides serve as natural and effective agents in wound healing, showing promise for clinical applications. Further research is needed to optimize formulations and explore their clinical uses.

Keywords: Polysaccharides

## Comparing the Effectiveness of the Combination of Echinacea Calendula Officinalis and Chamomile on Surgical Wounds in Rats

**Aida Keshavarz***
**Ebrahim Nasiri Formi**

***Mazandaran University of Medical Sciences***

Background and Objective: Speeding up the wound healing process is important. The aim of the study was to compare the effects chamomile of and Echinacea, calendula cream on surgical wound healing in rats.

Materials And Methods: 32 male rats were divided into four groups of 8: control, chamomile Cream, Echinacea , calendula cream, and Oserin. Wound area and histopathological findings were examined and compared on days 0, 3, 7, 21 and 7 and 21, respectively.

Results: There was no difference between the groups on the wound area on the third day, but on the 7th day, there was a significant difference (P=0.020). So that the average wound area in the Echinacea , calendula cream group was significantly lower than the control group (P=0.008) and also compared to the Oserin group (P=0.019). Unlike other groups, wound healing was completely achieved on the 21st day in Echinacea , calendula cream and chamomile cearm. In terms of histopathological indicators, on the seventh

day, in the chamomile cream group, the restoration of the epithelial cells was better than the other groups (0.038). = P)., on the 21st day, in terms of regeneration of the lining cells and the process of fibroplasia of the Echinacea , calendula cream group, and in terms of the extent of the fibrotic reaction, the amount of edema and swelling, and the assessment of both Echinacea, calendula cream and chamomile cream bleeding, it had a significant effect (05 /0P

Keywords: Chamomile, Echinacea , Calendula, Kamil Cream, Calendula, Wound Healing, Surgical Wound

## Accelerating Wound Healing, the Remedial Role of Sea Cucumber Metanolic Extract

**Ghazaleh Fotouhi[1]***
**Mojtaba Naderi[2]**
**Fatemeh Shahbazi[2]**
**Mostafa Alinaghizadeh[2]**
**Mohaddeseh Larypoor[3]**

***1. Azad University International Branch Kish***
***2. Payame Noor***
***3. Islamic Azad University, Tehran North Branch***

Introduction: Wound healing is a physiological and complex process that can be stopped for any reason, leading to chronic infections and prolonged healing. Human attention has been drawn to the use of natural extracts, especially sea creatures such as echinoderms. This attention is due to their important therapeutic properties. This study was conducted with the aim of investigating the effect of methanol extract of sea cucumber on wound healing in rats. In previous research, many bioactive compounds have shown promising potential in the repair and regeneration of various body tissues, including the skin, making the extract of the sea cucumber Holothuria leucospilota promising options to become a tool in wound management and treatment.

Methods: In this experimental study, methanolic extract of *Holothuria leucospilota* was prepared from individuals collected at a depth of 10-15 meters of the Suza coast of the Persian Gulf in Qeshm Island. . Two concentrations of extract (0.5% and 1%) were formulated into an ointment base cream. Fourty male Wistar rats averaging 185 ± 5 grams in weight were divided into four groups; a control group, a sham group treated with base cream, and two treatment groups with remedial ointments containing 0.5% or 1% extract. Wounds of 6±1 mm were created on the dorsal skin of the Wistar rats using punch biopsies. For 13 consecutive days, rats received 1 ml of treatment either of the base cream, or the each extract based ointment. Wound healing was assessed and measured on day 0, before treatment, and on days 4, 7, 10, and 13 with regard to size of the diameter of the wound Results: The results indicate that both treatment groups showed significant improvement in wound healing over the control and sham groups. Also, the 1% treatment group greatly reduced the diameter of wounds at all measurement intervals, from the beginning to days 7, 10, and 13 (P

Keywords: Sea Cucumber, Wound Healing, Bioactive

## Study of Ms c- Gfp + Localization and Fate in Cardiac Micro - Tissue

**Fatemeh Hosseini Ghaemi[1]**
**Mahdi Hesaraki[2]**
**Mahla Chalak[1]**
**Sara Pahlavan[3]**
**Sarah Rajabi[4]***

***1. Department of Developmental Biology, School of Basic Sciences and Advanced Technologies in Biology, University of Science and Culture, Tehran, Iran***
***2. Department of Photo Healing and Regeneration, Medical Laser Research Center, Yara Institute, ACECR,Tehran, Iran***
***3. Department of Stem Cells and Developmental Biology, Cell Science Research Center, Royan Institute for Stem Cell Biology and Technology, ACECR, Tehran, Iran***
***4. Department of Cell Engineering, Cell Science Research Center, Royan Institute for Stem Cell Biology and Technology, ACECR, Tehran, Iran***

Introduction Human cardiac microtissues play a significant role in testing regenerative medicine drugs and remodeling cardiovascular diseases. However, cell tracking approaches have rarely been applied to them so

far. While the development and maintenance of organs is one of the most fundamental problems in biology, our knowledge of it is still limited. Therefore, in this research, cardiac microtissue consists of three cell sources, including cardiac progenitor cells, mesenchymal stem cells, and human umbilical vein endothelial cells, and our goal in this The project is to investigate the role of mesenchymal stem cells (MSCs) through insert GFP to them, and investigating the fate and location of this cell in the cardiac microtissue. Method In this study, the desigened vectors are purified for virus production by Lenti-x cells. Lipofectamine method is used to trnsfect the packaging cell line. After virus production and transduction, GFP+ mesenchymal cells are cultured together with HUVEC cells which extracted from the umbilical cord and cardiac progenitor cells on rat tail collagen for 7 days. Microtissue is used for tracking MSC cells for several days. Immunofluorescence was performed to determine the placement of each cell, and RT-PCR was performed to determine the fate of MSC-GFP+ cells. Result In this context, we successfully formed cardiac microtissue through co-vessel in which MSC-GFP+ cells were present and were examined on different days. The result of live and dead heart microtissue shows that a high percentage of cells are alive, and H&E staining was also done to identify the heart tissue. Conclusion MSC-GFP+ cells were seen in the heart microtissue structure, and based on H&E staining, a large number of cells were observed in the heart tissue structure, and the cardiac microtissue was well formed.

Keywords: Mesenchymal Stem Cells, Self-organization, Cardiac Micro-tissue, Co-culture

## Treatment of Deep Abdominal Wounds Using Negative Pressure

**Sayedeh Tahereh Sadat Ahmadi[1]***
**Abbas Hallaj Karladani[2]**

***1. Teb Tajhiz Paya Company***

***2. Departments of Orthopedics, 1Sahlgrenska University Hospital, Göteborg University, Göteborg, Sweden***

Introduction: Abdominal wall defects may result from trauma, burn, necrotizing soft tissue infection or complications of abdominal surgeries. Reconstruction poses a great challenge for the surgeon in cases of large abdominal wall defects with lack of surrounding tissue. Abdominal wall defects lack a good functional and aesthetic impact and early reconstruction is prudent for better outcomes. This study evaluates the results of Vacuum assisted wound closure (VAC) therapy in patients with large anterior abdominal wall tissue defect which could not be closed primarily otherwise.

Material and methods: A 45-year-old patient underwent gastric and intestinal anastomosis surgery, and after that, due to severe inflammation and secretions, it was not possible to close the abdomen and fascia for surgery, and the patient was treated with negative pressure using a special dressing. he main aim of reconstruction in trauma patient is early recovery with minimal complication and better aesthetic appearance with optimal functionality of reconstructed area. Conventional treatment methods such as frequent wet dressing will be painful and protracted.

Results: Vacuum assisted wound closure (VAC) therapy has been considered an effective method in wound preparation for early coverage. VAC therapy is a worthwhile adjuvant therapy in the treatment of partial thickness, large abdominal wall soft tissue defect which cannot be primarily closed or covered with flap. It not only facilitates the rapid granulation tissue formation but also controls of infection.

Conclusion: Eventually, it reduces the expenses of treatment by decreasing the duration of treatment and hospital stay.

Keywords: Abdominal Wall Tissue Defect, VAC Therapy, Treatment

## Diabetic Wound Healing Based on Stem Cell-based Therapeutic Strategies; A Review Article

**Farhan Heidari***
**Nahid Karami Kabir**

***Islamic Azad University, Hamedan, Iran***

Natural wound healing is a dynamic and complex multistep process that involves coordinated interactions between growth factors, cytokines, chemokines, and

various cells. Any failure in these steps may lead to chronic wound and abnormal scarring. Impaired wound healing, especially diabetic foot ulcers, is becoming an urgent and worsening health care problem that severely affects quality of life and increases the risk of infection and amputation in patients. Dysregulation of blood sugar is known to be the primary factor in poor wound healing. Unfortunately, current treatments are only symptomatic and often fail to completely restore the wound site to its pre-injury state and prevent further recurrence. Therefore, much effort has been focused on the development of new therapeutic approaches for the treatment of diabetic foot ulcers. Therapeutic strategies based on stem cells have been proposed to treat these wounds. They have shown significant potential to improve the speed and quality of wound healing and skin regeneration. However, there are many challenges for using stem cells in skin regeneration, which can be mentioned as limited cell efficiency and low therapeutic potential. Investigating new and advanced treatments to increase the efficiency of stem cells is an urgent need. In this review, a collection of published data on the use of embryonic stem cells, induced pluripotent stem cells, and mature stem cells in wound healing will be presented.

Keywords: Wound Healing، Diabetic Wounds، Stem Cells

## Design, Fabrication and In Vivo Pharmacokinetic Study of Coenzyme Q10/Vitamin C-containing Liposomal Drug Delivery System

**Gita Parviz[1,2]***
**Fatima Khaled Mohammed Abobakr[1,2]**
**Hümeyra Betul Yekeler[1,2]**
**Ece Guler[2,3]**
**Burcu Uner[2,4,5,6]**
**Muhammet Emin Cam[2,3,7,8]**

***1. Department of Pharmacology, Faculty of Pharmacy, Marmara University, Istanbul, 34854, Türkiye***

***2. MecNano Technologies, Cube Incibation, Teknopark Istanbul, Istanbul 34906, Türkiye***

***3. Department of Pharmacology, Faculty of Pharmacy, Istanbul Kent University, Istanbul, 34406, Türkiye***

***4. Department of Pharmaceutical and Administrative Science, University of Health Science and Pharmacy in St. Louis, St. Louis, MO, USA***

***5. Department of Anesthesiology, Center for Clinical Pharmacology, Washington University School of Medicine in St. Louis, St. Louis, 63110, MO, USA***

***6. Department of Pharmaceutical Technology, Faculty of Pharmacy, Istanbul Kent University, Istanbul, 34406, Türkiye***

***7. UCL Division of Surgery and Interventional Science, Royal Free Hospital Campus, University College London, Rowland Hill Street, NW3 2PF, The United Kingdom***

***8. Biomedical Engineering Department, University of Aveiro, Aveiro 3810-193, Portugal***

Background: Systemic inflammatory response syndrome is a chaotic immune response developed by a stressor. Studies show that the prophylactic usage of antioxidant agents, especially correctly combined compositions, can control the underlying biochemical dysregulations and prevent further macrocellular damages. Coenzyme Q10/vitamin C (CoQ10/VitC) composition has been tested successfully against various diseases in which inflammatory response is problematic; however, both drugs are challenged in the terms of pharmacokinetics limiting the clinical effectiveness. Herein, this project aims to resolve these challenges through nanotechnology. Here, CoQ10 / VitC - loaded sunflower - sourced phosphatidylcholine / cholesterol liposomes were designed, fabricated, and tested in vivo.

Methods: Optimization and Design: The desired liposomal model was built based on D-optimal mixture design. Additionally, pharmacokinetic parameters were predicted in silico using ADMET prediction software. Quality Control: Final product was studied chemically and thermally via Fourier transform infrared spectroscopy (FT/IR) and Differential scanning calorimetry (DSC), respectively. The morphological properties were assessed using a cryo-transmission electron microscopy (Cryo-TEM). Particle size and zeta potential were determined with a Zeta Sizer Advance. Long-term stability was tested for 90 days at room and 40 oC temperature conditions. Control parameters were as follows: view, physical state, color, odor, density, and viscosity. Cytosafety: Mouse colon adenocarcinoma (C26),

hepatocellular carcinoma (HCC28), and primary epidermal keratinocytes (HEKa) cells lines were used for cytosafety assay. PrestoBlue HS was the cell viability reagent. Test plates were studied via BioTek microplate reader with Gen Software. Quantitative Analyses: Quantitative analyses were accomplished via liquid chromatography-mass spectrometry performed using a Waters Alliance Radio UPLC system. In Vivo Pharmacokinetics: Sprague-Dawley rats were treated orally with either CoQ10/VitC supplement or liposome. For the next 24 hours, animals were sacrificed at predetermined time intervals and plasma and organ samples were collected for further quantitative analyses.

Results: The optimum range for zeta potential and particle size found in silico were between -35.7 mV to -15.3 mV and 158 to 166 nm, respectively. Cryo-TEM images confirmed that the actual formulation has a particle size of 158.8 ± 3.56 nm. Plus, its zeta potential is -24.4 ± 1.3 mV. Both finding validate the accuracy and reliability of the optimization method. Pharmacokinetic parameters predicted in silico show the superior performance of optimal formulation with enhanced bioavailability and prolonged systemic exposure. FT/IR results show chemical compatibility among utilized ingredients. Also, thermal stability was demonstrated by DSC results. Long-term stability was assured as at the end of the experiment no obvious change was detected in the appearance and other physical parameters. While in vitro data show a dose-dependent reduction in cell survival for cancerous cells, healthy HEKa cells were minimally impacted even at the highest concentration tested, suggesting some degree of selectivity biased toward targeting cancer cells. In in vivo assay, comparing to the supplement, both agents exhibited higher Cmax, extended T1/2, larger AUC0-t, and greater distribution among brain, lung, kidney, and liver in the liposome group.

Conclusion: Final results show high accuracy of in silico predictions. Additionally, enhanced pharmacokinetics achieved by liposomal system is highlighted in vivo. Overall conclusion suggests the feasibility and effectivity of the produced system.

Keywords: Liposomes, Nanocarriers, Pharmacokinetics, Coenzyme Q10, Vitamin C

## Stem Cells: A Revolution in Burn Wound Healing – From Advanced Technologies to Future Innovations

**Mohammad Mehdipour***
**Sepideh Mokabberi**

***Department of Cellular& Molecular Biology, Comprehensive Health Resaerch Center, Islamic Azad University, Babol Branch, Babol, Iran***

Following remarkable advancements in stem cell science, innovative applications of this technology in burn wound treatment have become one of the most advanced and promising areas in medicine. This paper examines recent progress in the use of stem cells, particularly induced pluripotent stem cells (iPSCs) and mesenchymal stem cells (MSCs), in accelerating the healing process of burn wounds. iPSCs, with their extraordinary tissue regeneration capabilities and lack of cellular rejection risk, have significantly contributed to the repair of burn wounds. These cells can generate various types of skin cells and other tissues, thus minimizing the problems associated with hypertrophic scars. Additionally, recent research has shown that preconditioning and labeling of adipose-derived stem cells (ASCs) under hypoxic conditions can remarkably reduce the healing time of acute acid burn wounds, decreasing the recovery period from 24.6 days to 19.8 days. A systematic review of the studies conducted indicates that stem cell treatments have brought significant improvements in both the appearance and microscopic healing of burn wounds, although results in some aspects, such as vascular regeneration and collagen formation, may vary. Furthermore, novel trends such as the use of exosomes and genetic modification methods, coupled with advanced pre-treatments, have shown promising results in animal models and hold great potential for major advances in the treatment of burn wounds and other tissue injuries. This paper, based on the latest research and cutting-edge techniques, explores the crucial role of stem cells in improving burn wounds and analyzes advanced strategies in this field, aiming to highlight the advantages and limitations of these methods compared to traditional treatments

Keywords: Stem Cell,Burn,Wound Healing,Skin

## Mesenchymal Stem Cell - derived Exosomes and Their Effects on M2 Macrophage Polarization and Wound Healing

**Elham Kamalkazemi[1]**
**Effat Alizadeh[2]***

***1. Student Research Committee, Tabriz University of Medical Sciences, Tabriz, Iran***

***2. Department of Medical Biotechnology, Faculty of Advanced Medical Sciences, Tabriz University of Medical Sciences, Tabriz, Iran***

Introduction: Multiple complex stages are involved in wound healing to repair the damaged tissue. Macrophages as heterogeneous cells play a pivotal and significant role in the different stages of wound healing. Two phenotypes of macrophages exist, M1 macrophage (pro-inflammatory) and M2 macrophage (anti-inflammatory). M1 macrophage activation will exert inflammation responses and prevent the wound-healing process, in contrast, M2 macrophage activation eliminates inflammation and promotes tissue repair and wound healing. Exosome, as a nano-scale extracellular vesicle can induce the M2 macrophage polarization from M1 macrophage, reduce inflammation, and improve wound healing. Increasing evidence has shown that exosomes secreted by mesenchymal stem cells (MSCs) can facilitate the M2 macrophage polarization during wound repair and might be a therapeutic target. In the present study, we reviewed the effects of MSCs-derived exosomes on wound healing with a particular focus on macrophage repolarization.

Methods: In this study, the keywords "mesenchymal stem cell", "exosome", "M2 macrophage", and "wound healing" were searched in reliable databases such as PubMed and Google Scholar between 2018 and 2024, and relevant articles were obtained and analyzed.

Result: MSCs-derived exosomes increased the rate of M2 macrophage polarization and induced wound healing by preventing inflammation. In addition, it is demonstrated that MSC-derived exosomes significantly suppressed the pro-inflammatory factors CD86, iNOS, IL-1β, and TNF-α, while increasing the anti-inflammatory factor IL-10 and CD206. Because inflammation is one of the major mechanisms for delaying the wound healing process, considering mentioned outcomes, MSC-derived exosomes can be a potential therapeutic agent for wound healing.

Conclusion: These findings proved that MSCs-derived exosomes could accelerate wound healing by eliciting M2 macrophage polarization. Therefore, exosomes might be an effective and innovative treatment for wound healing.

Keywords: Mesenchymal Stem Cells, Exosomes, M2 Macrophage Polarization, Wound Healing

## Ovarian Follicular Fluid, Promising Therapy in Wound Healing

**Mohammad Morteza Rezaei[1]**
**Fahimeh Esmaeili Karizi[2]***

***1. Yazd University of Medical Sciences***

***2. Islamic Azad University of Mashhad***

Follicular fluid is a complex liquid surrounding the oocyte within the ovarian follicle. It contains various components, including mesenchymal stem cells (MSCs), growth factors, cytokines, and coagulation factors, which play crucial roles in wound healing and tissue regeneration. The growth factors and cytokines in the follicular fluid not only stimulate angiogenesis within the ovarian follicle during ovulation but also provide the necessary stimulation for oocyte maturation and follicle rupture, a fascinating aspect of its potential applications. Reactive oxygen species (ROS) in follicular fluid regulate follicular growth, oocyte maturation, and embryo development. Maintaining physiological levels of ROS is essential for preserving the developmental competency of oocytes. The unique composition of follicular fluid, particularly its MSCs and growth factors, has led to its investigation in various wound healing applications. Incorporating follicular fluid components into bioengineered scaffolds or using them in cellular therapies may enhance tissue regeneration and improve healing outcomes.

Keywords: Follicular Fluid, Wound, Biological Solutions

## Hyaluronic Acid/Chitosan Hydrogel: Biomimetic Wound Dressing Inspired by the Inherent Structure of the Skin on Diabetic Wounds

**Zahra Sadeghian**

***Shahid Beheshti University***

Background and purpose: According to the statistics of the Health Organization (2024), diabetic foot ulcer (DFU) includes a high rate of chronic disorders, which has an increasing trend of complications of limb amputation and death, and will have a high economic effect on the health of society. So far, there have been many studies on dressings, now we have designed a hydrogel inspired by the inherent properties of the skin with a rich source of chitosan and hyaluronic acid, which can play an effective role in better tissue regeneration and the extracellular matrix of wounded skin.

Materials and methods: In this study, we used chitosan/hyaluronic acid/hydroxypropyl methyl cellulose scaffold network to preparation hydrogel. Also, for better drug delivery, we used silver nanoparticle by lipid transfer system. For animal research, 8 male Wistar rats of 200 grams were used by DFU model with 12 mm diameter, which were divided into two subgroups (n=4) and evaluated of wound closure rate, SOD enzyme concentration were performed at different times, as well as antibacterial evaluations using the aura of non-growth and non-toxicity was performed on human skin fibroblast cells. In order to check the inherent properties of the hydrogel, water solubility, water vapor transfer, swelling, degradation tests were performed.

Results: The results showed that the release rate of silver nanoparticles in the hydrogel was continuous and controlled delivery. In the animal evaluation of the closure of the wound surface, a 95% reduction in the level of damage was observed. In the antioxidant evaluation with the DPPH technique, due to the presence of natural polysaccharides, was observed a decrease in reactive oxygen species, and the antioxidant enzyme concentration had a significant level compared to the control group. In the antibacterial evaluation, a non-growth halo was observed, in the cytotoxicity test by the MTT hydrogel method, 126% cell viability and non-toxicity were observed after 48 hours on human skin fibroblast cells. The swelling property of the hydrogel was reported to be 44%. A water vapor transmission rate of 2028 was reported to provide an ideal environment for secretion absorption and cell migration. The degradation rate of the hydrogel also had a good significant level.

Conclusion: In the end, it can be said that by strengthening and simulating the inherent properties of hydrogel, inspired by the natural structure of the skin, it allows diabetic wound tissue to heal with the support of a hydrated environment and cause autolysis and synthesis of growth factors, as well as the use of hyaluronic acid, which is the main component of ECM, in combination with chitosan, creates the best scaffold for skin imitation, reducing toxicity and increasing cross-links, and by cross-linking with reactive oxygen species, it was able to release its therapeutic agent for faster healing. Biomimetic wound dressing with the inherent properties of skin is a new approach to make practical dressings and reduce the complications caused of diabetic wounds.

Keywords: Biomimetic, Diabetic Foot Ulcer, Hydrogel, Chitosan, Hyaluronic Acid

## The Efficacy of Sumac Extract on Wound Healing: A Review

**Seyed Amirmahdi Hejazi Niyaki*[1]**

**Yasaman Bayat[2]**

***1. Semnan University***

***2. University of Mashhad***

Introduction: Wounds are disruptions in the integrity of the skin or mucous membranes caused by various factors. The healing process involves complex stages. In this study the properties and effects of the extract of the plant Rhus coriaria (sumac) on wound healing are investigated. 2.Anti-inflammatory properties: Sumac has attracted attention due to its ability to inhibit pro-inflammatory cytokines such as TNF-α and IL-1β. The extract reduces the MPO enzyme and cathepsin, which reduces inflammation and accelerates wound healing. 3.Antioxidant properties: Sumac, which is rich in phytochemical compounds, has strong antioxidant properties that

reduce reactive oxygen species (ROS) and oxidative stress, thus accelerating the healing process. 4.Antibacterial properties: Sumac is an effective antibacterial agent capable of eliminating antibiotic-resistant bacteria, significantly reducing bacterial presence and fighting infections associated with wounds. In addition, the extract creates a favorable environment for wound healing by preventing the formation of biofilms. 5.Healing properties: The extract promotes collagen deposition and stimulates the formation of myofibroblasts, accelerating wound healing and epithelialization. By reducing inflammation, it provides a favorable environment for epithelial cell migration and proliferation, resulting in a significant improvement in wound contraction.

Conclusion: The use of sumac extract as an effective natural treatment in wound healing can improve the efficacy of pharmaceutical therapies and reduce the side effects of chemical medications. This cost-effective option may improve the quality of patients' life.

Keywords: Wound Healing, Sumac Extract, Anti-inflammatory, Antioxidant, Antibacterial

## Wound Healing Genetics: A Key to Personalized Therapies for Chronic Wounds

**Asma Tarighi**

***University of Tabriz***

Wound healing is a complex, multi-stage process orchestrated by genetics. Recent advancements in genetic engineering and the use of specific biomarkers have enabled researchers to identify key genes and elucidate their molecular mechanisms in wound healing. This study aimed to investigate the precise role of these genes in chronic wounds using novel animal models. Our findings demonstrate that targeted manipulation of specific gene expression can significantly accelerate healing and reduce complication risks. These breakthroughs pave the way for personalized and effective chronic wound therapies, offering promising prospects for improved patient outcomes in the near future.

Keywords: Wound Healing، Genetics، Biomarkers، Chronic Wounds، Gene Expression، Personalized Medicine

## The Effect of Estrogen Hormone on Wound Healing

**Alireza Omidi**

***Mazandaran Institute of Technology***

Post-menopausal women have an increased risk of developing a number of degenerative pathological conditions, linked by the common theme of excessive inflammation. Systemic estrogen replacement (in the form of hormone replacement therapy) is able to accelerate healing of acute cutaneous wounds in elderly females, linked to its potent anti-inflammatory activity. Estrogen protects against the development of chronic non-healing wounds.Estrogen is a key pleiotropic agent Beneficial effect on a range of skin cell types involved in various aspects of wound healing including inflammation, re-epithelialization, angiogenesis, matrix deposition and wound regeneration.Indeed, at the level of gene expression, estrogen is more important than intrinsic aging in the ontogeny of pathological repair. Understanding the role of estrogen on the skin may provide further opportunities for the development of estrogen-related therapy to aid in wound healing.

Keywords: Degenerative, Estrogen, Estrogen Receptor, Wound Healing, Pleiotropic

## The Effect of Honey on Pain Intensity and Improvement of Episiotomy: A Systematic Review of Clinical Trials

**Seyyedeh Adeleh Rahmanian***
**Maryam Aradmehr**
**Morvarid Irani**

***North Khorasan University of Medical Sciences***

Background and purpose: Episiotomy as a method to widen the pelvic outlet is associated

with complications such as pain and injury to the perineum, so the present study aims to evaluate the effect of honey on Pain intensity and healing of episiotomy wound.

Materials and methods: In this systematic review study, the databases of Scopus, PubMed, SID، Medlib، Magiran, Web of Science and Google scholar were searched using the keywords of "pain", "Wound", "Healing", "Episiotomy", " Perineum" and "Hony" by OR and AND without time, language limitation until August 2024. The quality of the studies was evaluated using the JEDAD tool and data were analyzed by qualitatively.

Results: In this study, 208 articles were extracted. Then, seven clinical trials that met the study criteria were included in the study. The articles related to the effect of honey on the pain intensity and recovery of episiotomy wounds with a sample size of 981 were reviewed. The results of these studies show that among the three reviewed studies on the effect of honey on episiotomy pain, only one study of honey reduces episiotomy pain. but regarding the effect of honey on wound healing, out of the five studies reviewed, in four studies, honey had a positive effect on episiotomy wound healing.

Conclusion: honey improves episiotomy healing, and it seems that honey is more effective in healing episiotomy wounds than reducing its pain, although a definitive conclusion requires more studies.

Keywords: Hony, Episiotomy, Pain, Perineum, Systematic Review, Wound

## An Analysis and Survey on Application of Artificial Intelligence Sub-fields in Wound Care

**Zhila Saneipour[1]***

**Mohammad Reza Nami[2]**

***1. Bahman Hospital, IUMS***

***2. QIAU***

Artificial Intelligence (AI) [1], as one of the new technologies, has played a very important role in wound care. Wound care is an essential field of healthcare that involves the proper management and treatment of wounds to promote complete and timely healing and prevent complications that may lead to amputation, infection, and other potentially life-threatening outcomes [2]. While AI tools have been employed to evaluate wound care, efforts are needed to increase their potential impact on wound care education. The integration of artificial intelligence into health education, especially wound care, represents a paradigm shift in the way educational content is presented and processed. AI has some major subfields including Machine Learning (ML) [3], robotics [4], Natural Language Processing (NLP) [5], Virtual Reality [6], expert systems [6], neural network [7], and Augmented Reality (AR) [8]. One of advancement is the integration of AI subfields. For example, Augmented Reality with machine learning algorithms facilitates real-time interventions and diagnostic information. In this paper, we identify and describe which AI subfields has been applied to improvement of wound care. In current year, we created and distributed a special nursing form between 110 nurses occupied in Tehran about current AI branches and their applying in wound care. A total of 94 responses were submitted. We examined AI subfields research topics and designed a questionnaire based on themes mentioned. Nurses with cognition in AI were eligible to participate. Questions asked centered on participants' perspectives of AI within their respective hospitals. We gather their responses on our proposed topics of research trends in AI subfields. From 110 form distributed and 94 responses submitted, the top six reported (n=94, 85%) research areas were as follows: Machine learning (n=40, 42/5%); AR (n=25, 26/6%); VR research (n=12, 12/8%); Robotics (n=12, 12/8%); and Expert systems (n=5, 5/3%). Respondents reported that AI research focusing on education, clinical practice, administration, and theory was limited. Current research shows Iranian nurses to focus on applying machine learning techniques to facilitate earlier identification of wounds at risk of not healing or healing after an abnormally long time, which may improve treatment decisions and patient outcomes.

Keywords: Artificial Intelligence, Wound Care, Nursing

## Improvement of Rat Cervicitis Using Medicinal Smoke Condensate of Jennet Feces: Animal Model Set Up and Vaginal Cream Production; Histopathological Study

**Reza Ganji[1]**
**Zeinab Tavakol[1]***
**Pegah Khosravian[1]**
**Sedighe Jamali Gandomani[1]**
**Dhiya Altememy[2]**

***1. Shahrekord University of Medical Sciences, Shahrekord, Iran***
***2.College of Pharmacy, Al-Zahraa University for Women, Karbala, Iraq***

Introduction: Iranian traditional medicine has recommended the use of smoke from complete burning of jennet feces as a strong anti-inflammatory and wound healing component. Therefore, the present study was done to set up an animal model of cervicitis and production of vaginal cream of this smoke to evaluate anti-inflammatory effects of that in cervicitis.

Materials and Methods: We used 20 female vistar rats weighting 200-250 gr in 4 groups for animal model set up using different dosage of phenol and CMC for the first time. The vaginal cream was containing ٥% jennet faces smoke. Groups were divided in to health, cervicitis model, control (receive base cream) and treatment (receive smoke cream). After induction of cervicitis, control and treatment groups were received base cream and 5% vaginal smoke cream respectively for five days.

Vaginal pH was measured during of study. After 5 days, the cervix organs were examined by histopathological assay.

Result: No significant difference in vaginal pH in all of 4 groups of the intervention. In the model and control groups, we observed inflammatory cell infiltration and some visible epithelial erosion. After treatment with 5% vaginal smoke cream, the pathological features of cervicitis decreased significantly; inflammation ($p = 0,011$), vascular congestion ($p=0,001$) and erosion scores ($p>0,005$).

Conclusion: The smoke of jennet feces has anti-inflammatory effects on phenol-CMC induced cervicitis in rat model.

Keywords: Cervicitis, Feces, Rat Model,Smoke, Vaginal Cream

## The Effect of Collaborative Care Model on Quality of Life in Patients with Diabetic Foot Ulcers

**Zahra Pashaei Nezhad***
**Masoomeh Noori**
**Fatemeh Ostad**

***Mashhad University of Medical Sciences***

Background & Aims: Diabetes is one of the chronic diseases that can disrupt the quality of life of patients with its vascular problems and physical and psychological complications. The chronic complications of this disease, including diabetic foot ulcers, add to the importance of self-care treatment in this disease, which has a profound effect on the quality of life of patients. For this reason, the participation of patients in the treatment process is essential. One of the most important treatments for these patients is the use of participatory care model. The present study was conducted as a clinical test with the aim of determining the effect of implementing a participatory care model on quality of life in patients with diabetic foot ulcers.

Materials & Methods: In this random clinical study, 74 eligible patients were randomly selected from available population and assigned to intervention and control groups. During the first session, for both groups, the standard questionnaires of quality of life of patients suffering from diabetic foot ulcer as well as demographic questionnaires were completed. The program for implementing the participatory care model was held face to face and pamphlet for the intervention group (including steps: motivation, preparation, engagement, evaluation) for seven sessions each for an hour. Three months after the completion of the partnership program, both groups completed the questionnaire again.

Results: Based on the findings, the mean scores of quality of life and its dimensions (except for the

economic component) between both intervention and control groups after the implementation of participatory care model were different (p

Keywords: Participatory Care, Quality Of Life, Diabetes, Diabetic Foot Ulcer

## Hemorrhage Control and Wound Healing Using Decellularized Ecm-derived Hydrogel Scaffold Together with Vitamin K

**Seyedeh_Sara Hashemi[1]***
**Sirus Javadpour[2]**
**Yasamin Fallahi[2]**
**Zahra Shahhossein[1]**

***1. Burn and Wound Healing Research Center, Shiraz University of Medical Sciences, Shiraz, Iran***
***2. Department of Material Science and Engineering, Shiraz University, Iran***

Backgrand: Uncontrolled hemorrhage and infection are the main reasons for many trauma-related deaths in both clinics and battlefields. However, identifying a material with strong biocompatibility and anti-infection properties for skin tissue engineering remains a challenge. Multifunctional hydrogels with excellent adhesion, antibleeding, anti-infection, and wound healing properties are needed. The aim of this study was the use of decellularized extracellular matrix (dECM) with vitamin K for Hemorrhage Control and Wound Healing.

Methods: In the current study, a novel scaffold was created by combining dECM, alginate, chitosan nanoparticles, and vitamin K. We incorporated vitamin K into the hydrogel to control its release and promote blood coagulation. The scaffolds were characterized by FTIR, mechanical test, swelling, degradation, and scanning electron microscopy (SEM). In addition, cell viability and proliferation were evaluated using MTT assay at 24 and 48 hours as well as SEM imaging. The release assay and coagulation test were also carried out.

Results: The results revealed that approximately 98.1% of immunological components, including cells and DNA, were effectively eliminated from the skin tissue. The dECM/alginate/chitosan nanoparticle/vitamin K composite displayed an interconnected pore structure with a porosity of over 90%, which enhances cell proliferation. The presence of dECM significantly improved cell growth. Including chitosan improved the scaffold by providing strong antibacterial properties, high water, and protein absorption ability to prevent wound infection, and ensuring a balance of moisture and nutrients. The coagulation evaluation results showed that adding vitamin K provided the dECM hydrogels with sufficient coagulation properties.

Conclusion: Overall, the dECM/Gel/CS scaffold shows significant promise for use in wound healing due to its suitable mechanical, antibacterial, and coagulant properties with excellent biocompatibility.

Keywords: dECM Hydrogels, Vitamin K, Hemorrhage Control, Wound Healing

## Investigation of Common Pathways and Genes in Glioma

**Fatemeh Abdivazvani[1]**
**Mina Karimpour[2]**
**Mahdi Hesaraki[3]**
**Fatemeh Akbarian[4]**
**Mehdi Totonchi[5]***

***1. University of Pavia***
***2. Tarbiat Modares University***
***3. Medical Laser Research Center, Yara Institute, ACECR***
***4. Ale-Taha Institute of Higher Education***
***5. Royan Institute for Reproductive Biomedicine, ACECR***

Objective: Cancer is a disease in which some of the body's cells grow uncontrollably and spread to other body parts. Glioma is one of the most common primary brain tumors and originates from the glial cells. Brain and other nervous system cancer is the 10th leading cause of death for men and women. Based on the last edition of the WHO for glioma grades, the diagnosis of these patients depends on biomarkers. Because of this, we prefer to compare a suitable GEO (gse147352) and CGGA (CGGA-mRNASeq-693) to figure out

beneficial common genes and pathways for prognosis and early diagnosis.

Materials and Methods: This gse has 85 high-grade and 18 low-grade, moreover, the study type of this gse is high throughput sequencing. CGGA data has 249 high-grade and 443 low-grade, moreover, the study type is mRNA sequencing. In this study, we focus on common biomarkers and analysis of transcriptomic data. First, we started with GEO and CGGA, we searched for gse and CGGA data. Then, we used the ClusterProfiler package in R programming to analyze Gene Set Enrichment (GSE). Third, we did some of the codes in R to identify common Pathways and Genes between the two datasets.

Result: We identified genes and effective pathways. We found 216 common pathways such as IgG immunoglobulin complex, transport, and synaptic signaling. Moreover, we realized 14 genes for instance: IGHG3, IGHG2, CHRND, DKK1, WT1, IGKV4-1, IGHA1, PLSCR2, NPAS4, TRH, SAA1, MIR548P, ANKK1, and LIPN.

Conclusion: The study's outcomes emphasize the intricate connections between the immune system and cancer development, suggesting potential areas for further research and treatment methods. Additional investigations and advancements in single cell sequencing techniques are expected to shed new light on the underlying mechanisms of glioma development and pave the way for more effective diagnostic and therapeutic approaches.

Keywords: Glioma, GEO, Biomarker, Gene Set Enrichment

## Mesenchymal Stem Cell Nanofibers for Skin Repair and Wound Healing

**Fatemeh Haghdoost[1]***
**Nahid Nasiri[1]**
**Sorosh Shams[1]**
**Shaghayegh Gholami[2]**

***1. Department of Photo Healing and Regeneration, Yara Institute, ACECR, Tehran, Iran***

***2. Faculty of Biological Science and Technology, University of Science and Culture, Tehran, Iran***

This novel strategy, which combines MSCs with nanofiber scaffolds, has the potential to improve therapies for wound healing, address underlying pathophysiological problems, and lessen the financial burden of wound care. The integration of mesenchymal stem cells (MSCs) with nanotechnology offers a promising approach for developing new tissue substitutes in the field of tissue engineering. Mesenchymal stem cells (MSCs) are acknowledged as a promising cell therapy for enhancing skin healing. Due to their multipotent differentiation capabilities, MSCs can produce a range of cells involved in the wound healing process, including dermal fibroblasts (DFs), endothelial cells, and keratinocytes. Furthermore, MSCs support tissue repair, cellular regeneration, and neovascularization via paracrine and autocrine signaling pathways. Due to these characteristics, MSCs have been thoroughly investigated in relation to chronic wound healing and burn healing. Additionally, throughout MSC research, their distinct roles in scarless healing and skin aging have been identified. Nanofiber scaffolds and hydrogels loaded with stem cells hold immense potential for improving various stages of wound healing, such as tissue regeneration, angiogenesis and re-epithelialization. The biomimetic characteristics of nanofibers create an optimal environment for the delivery and proliferation of stem cells at the wound site. These nanofibers feature a substantial surface area, variable three-dimensional topography, porosity, and customizable surface functionalities. Nanofibers are produced using various fabrication techniques, including electrospinning, phase separation, physical fabrication, and chemical fabrication. The choice of polymer used in the manufacturing process depends on the intended application of the nanofibers. It includes a range of materials such as natural polymers, semi-synthetic polymers, synthetic polymers, metals, metal oxides, ceramics, carbon, non-porous substances, mesoporous materials, hollow structures, core-shell configurations, bio components, and multi-component materials. Nanofiber composites serve as an effective option for targeted delivery of genes, proteins, peptides, and growth factors. In this review, we outline the mechanisms through which MSCs-nanofibers facilitate wound healing. We also investigate methods to

improve the therapeutic effects of MSCs. Additionally, we address the growing trend of integrating MSCs with tissue engineering approaches, utilizing the benefits of MSCs alongside tissue engineering materials like biodegradable scaffolds and hydrogels to boost the skin repair capabilities of MSCs.

Keywords: Mesenchymal Stem Cells, Wound Dressing, Skin Regeneration, Nanofiber Scaffold

## Harnessing the Immunomodulatory and Regenerative Potential of Mesenchymal Cell-derived Exosomes for Advanced Wound Healing

**Shaghayegh Gholami[1]**
**Nahid Nasiri[2]***
**Masoud Habibi[2]**
**Azam Kouhkan[3]**

***1. Faculty of Biological Science and Technology, University of Science and Culture, Tehran, Iran***
***2. Department of Photo Healing and Regeneration, Medical Laser Research Center, Yara Institute, ACECR, Tehran, Iran***
***3. Reproductive Epidemiology Research Center, Royan Institute for Reproductive Biomedicine, ACECR,Tehran ,Iran azamkouhkan@yahoo.com***

Mesenchymal stem cells (MSCs) have shown tremendous promise in regenerative medicine due to their regenerative, immunomodulatory, and pro-angiogenic properties. More recently, the focus has shifted towards the paracrine effects of MSCs, particularly the role of their secreted exosomes in tissue repair and regeneration. Exosomes are nanosized extracellular vesicles that carry a cargo of proteins, nucleic acids, and lipids capable of modulating the microenvironment and promoting tissue healing. This review discusses the latest advancements in utilizing MSC-derived exosomes as a cell-free therapy for advanced wound care. The unique advantages of exosomes, including their small size, stability, and low immunogenicity, make them attractive candidates for targeted delivery and personalized medicine applications. MSC-derived exosomes have been shown to exert immunomodulatory effects by regulating inflammatory responses and promoting a shift towards a pro-regenerative microenvironment. Furthermore, their ability to stimulate angiogenesis, fibroblast proliferation, and collagen synthesis has been demonstrated in various preclinical wound models. Recent studies have also explored the incorporation of therapeutic cargoes into exosomes to enhance their regenerative potential, such as small interfering RNA (siRNA) or microRNAs. Clinical trials investigating the efficacy of MSC-derived exosomes in chronic wounds, burns, and tissue defects have shown promising results, with accelerated wound closure, reduced scarring, and improved functional outcomes. Challenges remain in terms of standardizing isolation and characterization techniques, optimizing dosing regimens, and ensuring long-term safety. Future directions include the development of engineered exosomes with enhanced therapeutic properties and the exploration of combinatorial approaches with biomaterials or growth factors to further augment wound healing outcomes. Overall, the application of MSC-derived exosomes in wound care represents a cutting-edge strategy with exciting potential for revolutionizing regenerative medicine.

Keywords: Mesenchymal Stem Cell, Conditioned Medium, Exosomes, Wound Healing

## Therapeutic Potential of Adipose - derived Stem Cell - derived Exosomes in Mitigating Photoaging

**Parniya Hemmati**
**Mohammad Hasan Soheilifar***

***Yara Institute of Wound Healing & Tissue Repair Technologies***

Photoaging is a dermatological condition resulting from prolonged UV radiation exposure, primarily from sunlight. It accelerates intrinsic skin aging, leading to collagen and elastin breakdown, the formation of wrinkles, dryness, compromised elasticity, redness from ruptured blood vessels, and moisture loss. These detrimental changes are driven by inflammatory

pathways that increase the production of reactive oxygen species (ROS), induce apoptosis, degrade the extracellular matrix (ECM), and activate autophagy. This study aims to investigate the therapeutic potential of adipose - derived stem cell (ADSC) - derived exosomes (ADSC - Exos) in mitigating photoaging and improving skin health. Exosomes, nanoscale vesicles derived from endocytic membranes, have emerged as a promising intervention for photoaging. They facilitate cellular communication by transferring proteins, lipids, and nucleic acids that modulate recipient cell behavior, impacting both pathological and physiological processes in skin health. Exosomes play a role in key aging processes, including oxidative stress, inflammation, and cellular senescence. Recent studies demonstrate that ADSC - Exos can enhance the functionality of human dermal fibroblasts (HDFs) by reducing cellular senescence, promoting migration, increasing type I collagen synthesis, and decreasing ROS levels and senescence - associated β - galactosidase (SA - β - Gal) activity. In conclusion, exosomes represent a novel and effective therapeutic strategy for photoaging, with potential applications for various skin. Further research into exosome-based therapies may significantly advance dermatological treatments for photoaging.

Keywords: Photoaging, exosomes, UV radiation, adipose-derived stem cells, skin health

## Modern Wound Dressings and their Use

**Elham kheirandish***
**Morvarid Nehi**

***Department of Nursing, Faculty of Nursing and Midwifery, Mashhad Medical Science, Islamic Azad University, Mashhad, Iran***

Introduction: Wounds are a global challenge, imposing significant financial burdens on healthcare systems annually. It is estimated that 1-2% of the population in developed countries will experience chronic wounds in their lifetime. Additionally, the global prevalence of chronic wounds ranges from 1.51 to 2.21 per 1,000 individuals. These numbers are expected to rise with the aging global population. In Iran, the prevalence of chronic wounds is reported to be between 3.6% and 45.7%, with diabetic foot ulcers affecting 1.8% of the population. Recent advancements in medical care have led to the development of smart dressings for various types of wounds. Choosing the appropriate dressing for each specific wound type helps reduce hospitalization costs, accelerate treatment, and promote faster healing. The goal of this study is to provide comprehensive information on different types of wound dressings, enabling the reader to gain a foundational knowledge and apply it to the design of wound dressings. Moreover, it aims to establish a connection between wound types and the selection of the appropriate dressing. Method This study was conducted using a systematic review approach. Keywords such as "wound dressing," "wound healing stages," "bioactive," and "nanoparticle" were used to search both international and domestic databases, including SCOPUS, MEDLINE, CINAHL, WEB OF SCIENCE, MAGIRAN, IRANDOC, SID, Google, and Google Scholar. The data were collected over a 12-year period from 2011 to 2023. In this study, the stages of wound healing and the characteristics of an ideal wound dressing are first presented. Following that, various types of wound dressings and their applications are examined. Wound dressings are either based on natural materials or synthetic and chemical substances. Modern wound dressings not only provide a protective covering for the wound but also engage in physical and chemical interactions with the wound bed. These dressings can carry antibiotics, medications, and nanoparticles, playing a crucial role in maintaining or providing moisture to the wound, all of which can significantly accelerate the wound healing process.

Results: A total of 48 articles were retrieved, and after several stages of elimination, 17 articles were selected for content analysis. The role of modern wound dressings, including semi-permeable film dressings, semi-permeable foam dressings, hydrogel dressings, hydrocolloid dressings, antimicrobial dressings, and bioactive dressings, was examined in various studies. These dressings were evaluated for different purposes, particularly in the treatment of diabetic wounds, burns, infected wounds, and necrotic wounds.

Conclusion: After analyzing the selected studies, our findings indicate that modern wound dressings can accelerate the wound healing process, which in turn reduces the economic burden on society. In recent years, advancements in nanotechnology and biomaterials have led to the development of smart dressings with unique properties, such as antimicrobial effects and the ability to speed up tissue repair. However, no single superior product has yet been developed to fully heal chronic wounds such as venous leg ulcers, diabetic wounds, and pressure sores. In most cases, complete healing is not achieved. Therefore, various materials are being developed for wound dressings to address the key factors involved in the healing process assist both patients and wound care specialists

Keywords: Wound dressing, Bioactive, Nanoparticle, Antimicrobial

## Nanotheranostics in Wound Healing: Revolutionizing Diagnosis and Therapy Through Advanced Biomaterials

**Seyedeh Sara Azadeh[1*]**

**Parniya Hemmati[1]**

**Seyed Hamidreza Azadeh[2]**

***1. Department of Medical Laser, Medical Laser Research Center, Yara Institute, ACECR, Tehran, Iran***

***2. Department of Nursing, Faculty of Islamic Azad University, Sari Branch, Sari, Iran***

Theranostics, an integrated approach combining diagnostics and therapeutics, has emerged as a transformative strategy in wound healing management. Chronic wounds, characterized by prolonged inflammation and impaired healing, present significant clinical challenges. Traditional wound management techniques often fall short in providing accurate diagnostics and effective treatment regimens. Recent advancements in theranostic materials aim to address these limitations by incorporating smart, responsive technologies that monitor critical biomarkers such as temperature, pH, glucose concentrations, and reactive oxygen species (ROS). Innovative wound dressings are engineered using stimuli-responsive biomaterials that not only facilitate the real-time assessment of the wound microenvironment but also deliver therapeutic agents in a controlled manner. This dual functionality enhances therapeutic outcomes by allowing for timely interventions tailored to the wound's specific needs. The incorporation of nanotechnology further elevates the efficacy of these smart dressings. Nanocarriers, including liposomes, micelles, and biodegradable nanoparticles, enable the co-delivery of diagnostic and therapeutic agents, ensuring targeted action at the cellular and molecular levels while minimizing side effects. Despite the promising potential of theranostic materials, several challenges remain. Key issues include the biosafety and biocompatibility of monitoring sensors, which can suffer from altered physicochemical properties upon exposure to wound exudate. Additionally, the reusability and scalability of these advanced systems pose significant barriers to clinical implementation. Future research must focus on improving sensor durability, enhancing the functionality of stimuli-responsive hydrogels, and exploring the integration of telemedicine for remote monitoring. In conclusion, theranostics represents a paradigm shift in wound healing, offering personalized therapies and improving patient outcomes. Continued innovation and interdisciplinary collaboration are essential to overcome existing challenges, ultimately leading to the successful translation of these technologies into clinical practice, thereby revolutionizing wound care management

Keywords: Nanotheranostics ، Wound ، Wound healing ، Biomaterial

# خلاصه مقالات
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