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# TREATMENT OF CHRONIC WOUNDS: STANDARD APPROACHES AND STRATEGIES (A LITERATURE REVIEW)

*Orduyan S.L., Hakobyan E.K., Simonyants L.G.*
*YSMU, Department of Operative Surgery and Topographic Anatomy*

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In the last decade, significant progress has been observed in the organization of wound healing and treatment processes, as well as in the scientific understanding of these mechanisms. However, from the perspective of prevalence and complexity, the issues surrounding the treatment of chronic wounds remain problematic and entirely unresolved, leading to significant clinical challenges. It is estimated that 1-2% of the population in developed countries may encounter this issue at some point in their lives [13,16]. Often masked by underlying diseases, they represent a silent epidemic affecting a large portion of the global population [15]. In the United States, chronic wounds pose a significant public health burden, particularly with specific epidemiological trends. An estimated 6.5 million Americans are affected by chronic wounds, a prevalence anticipated to rise with the aging population and increasing incidence of chronic diseases [16, 29]. Approximately 15% of individuals with diabetes develop foot ulcers, contributing to around 73,000 amputations annually [11]. Each year, pressure ulcers affect about 2.5 million patients, with a higher incidence in nursing homes and hospitals [4]. Venous ulcers of the lower extremities, which are more prevalent in elderly individuals and particularly among women affect approximately 1-3% of the general population and constitute 70% of all chronic wounds [21]. The epidemiology of chronic wounds underscores the need for effective prevention and management strategies, especially in high-risk groups. Understanding these patterns can help healthcare professionals develop targeted interventions to reduce cases and improve outcomes for patients. Given the epidemiological prevalence of chronic wounds, the development of comprehensive, evidence-based treatment guidelines grounded in data from leading research studies is essential. In our previous articles, we have presented the main pathophysiological pathways involved in the development of chronic wounds intending to target those pathways for therapy and propose new treatment methods.

The pathophysiology of chronic wounds involves complex interactions among cellular, molecular, and systemic factors that disrupt the normal healing process. We already know that the healing of acute wounds follows a classic pathway, which includes hemostasis, inflammation, cellular proliferation, and remodeling of the wound [39]. In chronic wounds, these stages may be disrupted or prolonged. During the hemostasis phase, blood vessels constrict, and platelets aggregate to form a thrombus, releasing growth factors. The inflammatory phase involves the recruitment of immune cells (e.g., neutrophils and macrophages) to the wound site, aimed at clearing the area from pathogens and infection. In chronic wounds, this phase may be prolonged due to the presence of a persistent inflammatory response [10, 39].

In the normal healing process, fibroblasts produce collagen and extracellular matrix, while endothelial cells contribute to the formation of new blood vessels (angiogenesis). In chronic wounds, this process can be disrupted, leading to inadequate granulation tissue formation. In the remodeling phase, collagen is reorganized and strengthened, resulting in wound healing. In chronic wounds, this phase may not proceed effectively, resulting in “poor quality” tissue and loss of function [8, 10, 39].

There are specific local and systemic factors that contribute to the chronicity of wounds. These include:

1. **Persistent inflammation**. Chronic inflammation may be caused by ongoing infection, foreign bodies, or underlying diseases (such as diabetes or venous disease) that prevent the resolution of inflammation [41].
2. **Disruption of cellular migration**. Dysfunction of key cells involved in the healing process can lead to impaired healing. For example, an imbalance between

*** ADDRESS FOR CORRESPONDENCE**

**S.L. Orduyan**
*YSMU, Department of operative surgery and topographic anatomy*
**Address:** *RA, Yerevan, 0025, 2 Koryun St*
**E-mail:** *s_orduyan@mail.ru*
**Tel.:** *(+374) 91 43 87 18*

pro-inflammatory and anti-inflammatory cytokines can affect the healing process [18].

3. **Tissue hypoxia and ischemia**. Ischemia or a lack of oxygen due to vascular diseases can impede healing, as oxygen is crucial for cellular functions and collagen synthesis [18, 41].
4. **Extracellular matrix disruption**. Abnormalities in the composition and structure of the extracellular matrix can lead to inadequate support for the formation of new tissues.
5. **Neuropathy and sensory loss**. Often underlying diabetic foot development, resulting in wounds that may go completely unnoticed on the lower extremities, which later have a high potential for chronicity.

Among the systemic factors contributing to wound chronicity, chronic diseases such as diabetes, obesity, and vascular disorders are significant, as they can disrupt the wound healing process. Malnutrition, particularly insufficient nutrients such as proteins and vitamins, can also affect cell proliferation and collagen synthesis. Certain medications, such as corticosteroids, can suppress the inflammatory response and delay healing.

Understanding the pathophysiology of chronic wounds is crucial for developing effective treatment strategies. Interventions should address both local wound care and the underlying systemic factors to promote healing and prevent recurrence.

Thus, the treatment of chronic wounds focuses on addressing underlying causes and promoting healing. Key approaches include [5, 33]:

1. **Accurate assessment and diagnosis**. It is essential to correctly diagnose the type of wound (e.g., diabetic, venous, pressure ulcer) and identify and evaluate underlying causes (e.g., diabetes, vascular issues).
2. **Removal of necrotic or infected tissue**. To promote healing, dead or infected tissues should be removed.
3. **Control of wound infection**. If infection is present, antibiotics or antiseptics should be applied.
4. **Management of wound moisture**. Use dressings that maintain a moist environment for wounds, which can enhance healing.
5. **Proper nutritional support**. Adequate nutrition, including proteins and vitamins, is crucial.
6. **Compression therapy**. For venous ulcers, compression bandaging can help reduce swelling and improve circulation.
7. **Advanced therapies**. In some cases, options such as negative pressure wound therapy (NPWT), skin bioengineered substitutes, or growth factor treatments may be used.
8. **Patient education**. Teaching patients about care regimens, lifestyle changes, and monitoring for signs of complications.
9. **Multidisciplinary approach**. Collaboration with various healthcare professionals, such as dietitians and physiotherapists, can improve treatment outcomes.

## Local (standard) approaches to chronic wound treatment

Local treatment aims to reduce pain, odor, wound infection, and bleeding, as well as to address the underlying chronic issues contributing to the formation of wounds, which affect the patient's physical and, potentially, emotional state. For example, excessive exudate can lead to unpleasant odors. Just as with acute wounds, local care for chronic wounds includes debridement and appropriate wound dressings. Necrotic or non-viable tissues should be removed using surgical methods. Proper local care is a critical element for both the normal healing of the wound and, if necessary, the subsequent surgical reconstruction of the wound defect. Proper cleaning of chronic wounds is essential for effective healing and infection prevention, improving patient outcomes (table 1).

**Wound cleaning and debridement.** Chronic wounds require a comprehensive and tailored approach to treatment. Standard treatment methods commonly used for chronic wound care include cleaning and debridement (surgical or enzymatic). Cleaning the wound of foreign bodies or debris can involve both simple means (e.g., saline solution) and specialized antiseptic agents. Wound debridement can be performed using surgical methods (primary or secondary surgical management) or enzymatic (where necrotic tissues are subjected to exogenous enzymatic effects) or autolytic methods (where necrotic tissues "dissolve" under the influence of the body's own enzymes when maintaining the necessary moisture with dressings). Effective cleaning is very important for promoting healing and preventing infection [38].

Cleaning and debridement allow for:

1. **Removing unpleasant odor and preventing wound infection**. The odor In wound exudate may result from the presence of specific pathogens, necessitating local cleaning methods to reduce the wound's microbial load. Local antibacterial agents (e.g., metronidazole) [9] and absorbent dressings (e.g., activated charcoal-containing dressings like Actisorb) can be used for this purpose. The prevention of infection is also invoulves the removal of exudate, foreign bod-

ies, necrotic, and non-viable tissues.

2. **Stopping bleeding**. To control bleeding, both non-adherent dressings such as simple gauze, and specialized adherent dressings, like alginate dressings with coagulating agents in the second layer, can be utilized. Compression with elastic bandages is another option for controlling bleeding from the wound area. Topical hemostatic agents may also be used. Topical hemostatic agents may also be used, categorized into biological, synthetic, and mechanical types. Synthetic topical hemostatic agents are mostly based on chitosan/chitin or have other polysaccharide bases. Mechanical hemostatic agents include absorbable hemostatic sponges and gauzes or non-absorbable hemostatic meshes [22].
3. **Reducing wound-related symptoms, such as pain or itching**. Itching around the wound may be due to dry skin or the presence of contact dermatitis. Maintaining proper moisture balance and protecting the skin will help reduce itching and skin irritation, while topical corticosteroid ointments may be used if necessary. Pain around the wound should not be overlooked, especially during dressing changes. The World Health Organization's analgesic ladder, developed for treating cancer-related pain, is also applicable to other types of chronic pain syndromes. Topical anesthetics may be used, though their effect may be limited.
4. **Promoting wound healing**. A clean wound microenvironment supports tissue restoration and the formation of granulation tissue [38].
5. **Restoring patient comfort**. Regular cleaning of the wound can help reduce pain and discomfort [38].

The wound-cleaning process for chronic wounds includes six sequential steps, illustrated in table 1.

## Dressings

For the treatment of chronic wounds, both moisture-retaining dressings (hydrogel, foam or alginate) and antimicrobial dressings (containing silver or iodine) are used to reduce the risk of infection [31]. The main types of dressings used for chronic wound treatment include [26]:

1. **Hydrocolloid dressings.** These are adhesive dressings made from a gel-forming substance (usually a combination of materials such as carboxymethylcellulose, gelatin, and pectin), situated between breathable and outer adhesive layers. By maintaining a moist environment, they aid in wound healing. These dressings absorb exudate and form a gel, keeping the wound moist while preventing adherence to the dressing. Hydrocolloid dressings adhere well to the skin, creating a barrier against contaminants and bacteria. Some hydrocolloid dressings are transparent, allowing for easy monitoring of the wound without the need to remove the dressing. Examples include DuoDERM® Extra Thin (ConvaTec) and Comfeel® (Coloplast).
2. **Hydrogels.** Hydrogel dressings are primarily composed of water (up to 90%) and a gelatinous substance. This high water content allows them to moisturize the wound. Hydrogel dressings maintain a moist environment, which can help with autolytic debridement processes, allowing the body to naturally remove non-viable tissues. They often provide a cooling effect, which can help alleviate pain and discomfort. Examples include Intrasite® (Smith & Nephew) and Nu-gel® (Systagenix) [2].
3. **Foam dressings.** These are soft dressings specifically designed for the treatment of wounds with moderate to heavy exudate. They typically consist of an outer hydrophilic layer and an inner hydrophobic layer, facilitating effective moisture management within the wound area. These dressings can absorb moderate to heavy exudate accumulations, helping to maintain moisture levels in the wound area. Foam dressings are available in both self-adhesive and non-adhesive forms, allowing for customization based on wound location and patient requirements. Examples include Allevyn® (Smith & Nephew) and Biatain® (Coloplast).
4. **Alginate dressings.** Alginate dressings are primarily composed of sodium alginate, which forms a gel when in contact with wound exudate. This gel-like substance helps maintain a moist microenvironment for the wound. Alginate dressings can absorb significant amounts of exudate, helping to reduce the risk of maceration. They are available in various forms, including sheets, ropes, and pads, making them versatile for use in treating wounds in different anatomical locations (Kaltostat® (Convatec)).
5. **Antimicrobial dressings.** These dressings often contain antimicrobial agents such as silver, iodine, honey, or other substances with antimicrobial properties. These agents can be incorporated into the layers of the dressing or coat its surface. Antimicrobial dressings are available in various forms, including gauze, foam, hydrocolloid, and alginate combinations, allowing their use on different types of wounds. Many antimicrobial dressings also maintain a moist environ-

**Table 1.**

*Steps for cleaning chronic wounds*

| | |
|---|---|
| **1. Preparation** | **Gather Supplies:** Sterile gloves, saline or wound cleanser, gauze, and any prescribed ointments or dressings.<br>**Hand Hygiene:** Wash hands thoroughly before and after wound care. |
| **2. Assess the wound** | Evaluate the wound size, depth, and any signs of infection (redness, swelling, discharge). |
| **3. Irrigation** | Use saline solution or a wound cleanser to gently irrigate the wound. Avoid using hydrogen peroxide or alcohol, as these can damage healthy tissue.<br>Use a syringe or a gentle stream to flush away debris without causing trauma to the wound. |
| **4. Debridement (if necessary)** | Remove necrotic tissue using a sterile scalpel or scissors. This should be done by a healthcare professional if the wound is complex. |
| **5. Dressing** | Apply an appropriate dressing that maintains moisture while protecting the wound from contaminants. Hydrocolloid, foam, and alginate dressings are popular options depending on the wound type. |
| **6. Documentation** | Record the wound's appearance, the cleaning process, and any changes in the condition for ongoing management. |

ment, which is crucial for optimal healing [19].

6. **Collagen dressings.** These support the body's natural healing processes and are often used for the treatment of deep wounds. They are mainly made from collagen, which can be sourced from various tissues, including bovine, porcine, or marine (fish) sources. They are available in different forms, such as sheets, gels, or powders. Many collagen dressings are designed to maintain a moist environment for the wound, which is important for optimal healing.
7. **Negative pressure wound therapy (NPWT).** This involves applying a vacuum to the wound area, which helps remove excess exudate and improve blood circulation.

The choice of dressing depends on the type of wound, the amount of exudate, and the risk of infection. Patient preferences, comfort, and sensitivity to dressing materials should also be taken into account.

### Infection Management

In the treatment of chronic wound infections, two strategies for infection management are employed: local and systemic antibiotic therapy and biofilm management. Infection control measures for chronic wounds include wound cleaning and debridement of the wound and the application of antimicrobial dressings. Local antimicrobial agents include silver- and iodine-based preparations, honey, certain antibiotics (metronidazole, bacitracin, mupirocin, etc.), and polyhexamethylene biguanide (PHMB).

Silver has broad-spectrum antimicrobial properties and acts through the release of silver ions that kill bacteria. It is available in various forms, including ointments, gels, and impregnated dressings (e.g., silver alginate, silver foam). It is primarily used for the treatment of pressure ulcers [30].

Iodine is an effective, broad-spectrum antimicrobial agent, including bacteria, fungi, and viruses. It is usually released in solutions (iodine tincture, aqueous solutions, etc.), ointments, and dressings (e.g., iodine-based gels,

iodine-impregnated dressings).

Medical-grade honey (e.g., Manuka honey) has natural antibacterial properties and helps maintain a moist environment for wounds. It is available in gels, ointments, and dressings and is effective for chronic wounds, burns, and ulcers, especially for wounds with biofilm.

In cases of suspected specific bacterial infection in chronic wounds, local antibacterial agents can be used, primarily in ointment form (metronidazole, bacitracin, mupirocin, etc.). These can be either broad-spectrum or targeted against specific pathogens; for example, bacitracin and mupirocin are used for local antibacterial therapy of wounds infected with *Staphylococcus aureus*.

In the presence of biofilm in chronic wounds, it is recommended to use topical antimicrobial agents such as polyhexamethylene biguanide (PHMB), which disrupts bacterial cell membranes [30].

Before starting local antimicrobial therapy, several important considerations should be taken into account:

1. Always assess the wound before applying local antimicrobial agents to determine the necessity and appropriateness based on the type of wound and infection status.
2. Follow manufacturer guidelines for application frequency, as some agents need to be applied more frequently than others, depending on the wound condition.
3. Monitor for local reactions immediately after application, such as irritation or allergic reactions, especially with iodine or silver preparations.
4. Long-term use of topical antibiotics can lead to antibiotic resistance, so they should be used judiciously and typically for limited durations.
5. In some cases, local antimicrobial agents may be used in conjunction with other treatments, such as debridement and advanced dressings, to enhance wound healing.

Topical antimicrobial agents can be very effective for treating chronic wounds at risk of infection. A tailored approach, considering the specifics of the wound and the patient's needs, is crucial for optimal outcomes.

The management of biofilm in chronic wounds often requires the use of antibiotics, as biofilms can make bacteria more resistant to standard treatments. Biofilm bacteria are protected by an extracellular matrix, making them less susceptible to antibiotics and immune responses. This means that higher concentrations of antibiotics or specific types may be necessary. Before starting treatment, appropriate antibiotic selection must be made. For this purpose, antibiotic susceptibility testing of the biofilm or wound culture should be performed. Additionally, the type of wound, the presence of comorbidities, etc., must also be considered. For topical antibiotic therapy, agents such as silver- and iodine-based preparations, honey, or topical antibiotics are used. Among the latter, mupirocin is particularly relevant, as its spectrum of activity includes *Staphylococcus aureus*, including some antibiotic-resistant strains, such as methicillin-resistant *Staphylococcus aureus* (MRSA) [1,3].

In cases of chronic wounds with biofilm, systemic antibiotic therapy involves several classes of antibiotics, such as beta-lactam antibiotics (cefazolin, amoxicillin-clavulanate), fluoroquinolones (ciprofloxacin), and glycopeptides (vancomycin). The fluoroquinolone class is used in cases of gram-negative infections, while glycopeptides are used for MRSA infections.

Several strategies help improve the effectiveness of systemic antibiotic therapy [32]. These include:

1. **Combination Therapy:** The combined use of antibiotics can enhance efficacy against biofilms by targeting different bacteria or resistance mechanisms.
2. **Frequent Monitoring:** Regular evaluation of wound and culture results can help adjust the selected antibiotic therapy strategy as needed.
3. **Supportive Therapy:** Combining antibiotics with other treatments, such as debridement or negative pressure wound therapy, can help "break down" biofilms and enhance the overall effectiveness of antibiotic therapy.
4. **Reducing Antibiotic Resistance:** Use antibiotics judiciously to minimize the risk of resistance development, and consider cycling or intermittently using antibiotics as needed [32].

Antibiotics play a vital role in managing biofilms in chronic wounds, but their use must be carefully tailored to the specific characteristics of the wound and the properties of the bacteria involved.

## Expanded approaches to chronic wound treatment

Expanded approaches to chronic wound treatment include negative pressure wound therapy, the application of biological growth factors, or skin substitutes.

**1. Negative pressure wound therapy (NPWT)**. This involves the use of vacuum technology to promote healing by reducing edema and increasing blood flow. By creating negative pressure through vacuum dressings, NPWT effectively removes wound exudate, decreases swelling, and enhances blood flow to the wound area.

This environment fosters tissue granulation and accelerates wound healing. NPWT stimulates angiogenesis and facilitates the active delivery of oxygen and nutrients to the wound site. Mechanical stimulation encourages the proliferation of cells involved in the healing process, such as fibroblasts. Over time, negative pressure may also contribute to wound contraction, reducing the size of the wound [34].

NPWT may be contraindicated in cases where there are open blood vessels or organs present at the base of the wound, as well as in wounds with necrotic and non-viable tissue. It is also contraindicated in the presence of malignant changes in the skin or when there are skin grafts.

Complications following therapy may include local skin irritation, maceration, and the formation of inconsistencies at the wound site; however, these complications can be prevented by regulating pressure changes. Proper training of healthcare professionals is necessary for the effective and safe application of therapy [35].

The duration of NPWT depends on the type of wound and treatment progress, typically ranging from several days to a few weeks. Therapy should be discontinued when there is significant granulation tissue growth and the wound closure is near, as well as if signs of uncontrolled infection are observed. Patient discomfort or pain in the wound area during and after therapy should also be considered an indication for discontinuation of therapy [34, 35].

**2. Hyperbaric oxygen therapy/topical oxygen therapy.** Used as an adjunct to wound care in chronic wound treatment. HBOT has been shown to have *in vitro* effects on wound healing. It may also help improve blood supply to the wound area by increasing tissue oxygen perfusion. However, there is currently insufficient evidence regarding the effectiveness of hyperbaric oxygenation, although it remains a component of treatment for patients with diabetic foot ulcers [7]. While several studies of varying sizes and quality have suggested its benefits, later studies indicate that HBOT offers no advantage in treating diabetic foot ulcers and limb salvage [24].

**3. Biological growth factors.** The application of platelet-derived growth factors is employed to restore disrupted cellular activities in chronic wounds. Therapy utilizing biological growth factors represents an innovative approach to chronic wound management. These therapies utilize natural proteins that promote wound healing by enhancing cell proliferation, migration, and tissue regeneration [36]. The following exogenous growth factor substitutes can be applied:

- **Platelet-derived growth factor (PDGF):** Stimulates cell proliferation, migration, and angiogenesis (the formation of new blood vessels). Commonly used in conjunction with dressings or applied directly to the wound.
- **Transforming growth factor (TGF):** Involved in the regulation of inflammation and fibrosis, aiding wound healing and tissue remodeling. TGF-β1 is particularly important for stimulating fibroblast activity.
- **Vascular endothelial growth factor (VEGF):** Stimulates angiogenesis and increases vascular permeability, enhancing blood supply to the wound. Particularly important in cases where increased blood flow is needed.
- **Epidermal growth factor (EGF):** Promotes keratinocyte proliferation and migration, essential for wound epithelialization. Often used for skin injuries and ulcers.
- **Fibroblast growth factor (FGF):** Stimulates fibroblast activity, angiogenesis, and extracellular matrix production, aiding in tissue regeneration. FGF-2 is commonly used in wound healing [36, 42].

Therapy with biological growth factors represents a promising advancement in the treatment of chronic wounds, addressing underlying deficiencies in healing. By reinforcing the body's natural healing processes, these therapies can improve outcomes and promote faster recovery. Growth factor therapy is often combined with other treatments, such as debridement, NPWT, or advanced dressings, to achieve optimal results.

**4. Skin substitutes.** Bioengineered skin substitutes or grafts are often employed for wound coverage. For relatively small wounds, primary closure with sutures or staples may be achieved if there is minimal or no tension on the surrounding skin. Understanding the appropriate tension and blood supply is crucial for treatment. In the case of infected wounds, suturing should be avoided. Larger or more complex wounds may require grafts or skin flap procedures. The latter can be performed using one of the following methods:

- **Split-thickness skin graft (STSG):** This technique involves transferring a free skin graft from a donor site on the patient's body and transplanting it to the wound area. The flap typically includes the epidermis and superficial dermal layers, providing a thin graft. Common donor sites can include the anterior thigh, anterior abdominal wall, or groin area. STSGs usually heal more quickly than full-thickness grafts and have a shorter recovery time. While they can provide ad-

**Table 2.**

*Key nutrients for wound healing [23]*

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|---|---|
| **1. Protein** | **Importance:** Essential for tissue repair and the formation of new cells.<br>**Sources:** Lean meats, fish, poultry, dairy products, legumes, nuts, and seeds.<br>**Recommendation:** Aim for higher protein intake, particularly in malnourished individuals or those with increased needs due to wound healing. |
| **2. Calories** | **Importance**: Energy is crucial for the healing process; inadequate caloric intake can impair recovery.<br>**Sources**: A balanced diet including carbohydrates (whole grains, fruits, vegetables) and healthy fats (avocados, olive oil, nuts).<br>**Recommendation**: Increase caloric intake based on individual needs, especially in cases of high metabolic demands. |
| **3. Vitamins** | ***Vitamin C:***<br>**Importance:** Essential for collagen synthesis and immune function.<br>**Sources:** Citrus fruits, strawberries, kiwi, bell peppers, and broccoli.<br>***Vitamin A:***<br>**Importance:** Supports epithelial cell production and immune response.<br>**Sources:** Carrots, sweet potatoes, spinach, and liver.<br>***Vitamin E:***<br>**Importance:** Acts as an antioxidant, protecting cells from damage.<br>**Sources:** Nuts, seeds, spinach, and vegetable oils. |
| **4. Minerals** | ***Zinc:***<br>**Importance**: Crucial for cell proliferation and immune function.<br>**Sources**: Meat, shellfish, legumes, seeds, and whole grains.<br>***Iron:***<br>**Importance**: Necessary for oxygen transport and energy production.<br>**Sources**: Red meat, poultry, lentils, and spinach. |
| **5. Hydration** | **Importance**: Adequate fluid intake is essential for overall health and wound healing.<br>**Recommendation**: Encourage regular fluid intake, focusing on water and hydrating foods. |

equate functional coverage, the cosmetic outcome may vary since the graft may differ in color characteristics from the surrounding skin [28].

- **Full-thickness skin grafts (FTSG):** This involves transferring a skin flap containing both the epidermis and the entire dermal layer from the donor site to the wound area. This type of graft is typically used for reconstructive purposes and is crucial in restoring skin integrity in various clinical situations, particularly in areas with greater tissue thickness, such as lower extremity venous ulcers [12].
- When autologous grafting is not feasible, xenografts or allografts may serve as viable alternatives. A common approach includes the use of these grafts for the dermal tissue reconstruction at the wound base followed by the application of an STSG. Over time, these xenografts/allografts are replaced by the body's own tissues. For more superficial wounds, porcine epidermis is often effective, while for deeper wounds, may require bovine collagen or allografts to provide adequate structural support [6].
- **Local tissue plasticity:** This is employed in many clinical situations where primary closure of wounds is not possible. Local tissue plasticity is performed using flaps made from adjacent tissues or special techniques used in plastic surgery. Techniques such as V-Y plasty, Z-plasty, etc., are often employed [40].
- **Flap plasticity on the Limb:** Flap techniques are employed for the closure of deep chronic wounds, particularly when exposed tendons, bones, and the need to mobilize muscles or flaps for closure are present. For instance, a flap from the abductor hallucis muscle may be used to cover defects on the medial surface of the lower leg, while a flap from the gastrocnemius muscle may be used for knee defects, etc.
- **Free skin flap plasticity:** Involves multi-layered flaps that are transferred from the donor site to the wound area as needed.

**Table 3.**

*Key topics and strategies for educating patients about chronic wound care [25].*

| | |
|---|---|
| **1. Understanding chronic wounds** | **Definition:** Explain what chronic wounds are and list the common types (e.g., diabetic ulcers, venous ulcers, pressure ulcers).<br>**Causes:** Discuss factors contributing to chronic wounds, such as diabetes, poor circulation, and pressure. |
| **2. Wound care basics** | **Daily Inspection**: Teach patients to inspect their wounds daily for signs of infection (redness, swelling, increased pain, discharge).<br>**Cleaning**: Instruct on how to clean the wound properly using saline or prescribed solutions.<br>**Dressing Changes**: Provide guidance on how and when to change dressings, including techniques to avoid causing additional trauma. |
| **3. Signs of infection** | **What to Look For**: Educate patients on symptoms of infection, such as increased redness, warmth, swelling, odor, or pus.<br>**When to Seek Help**: Emphasize the importance of contacting healthcare providers if they notice any signs of infection. |
| **4. Nutrition for healing** | **Importance of Nutrition**: Explain how a balanced diet supports wound healing.<br>**Key Nutrients**: Discuss the role of protein, vitamins (especially A and C), and minerals (like zinc) in recovery.<br>**Hydration**: Stress the importance of staying hydrated to support overall health and healing. |
| **5. Managing underlying conditions** | **Blood Sugar Control**: For diabetic patients, emphasize the importance of maintaining stable blood glucose levels.<br>**Circulation Improvement**: Discuss strategies for improving circulation, such as regular movement and elevating legs for venous issues. |
| **6. Pressure relief and offloading** | **Importance of Offloading**: Educate on techniques to relieve pressure from the wound, especially for foot ulcers (e.g., wearing special footwear).<br>**Positioning**: Teach about proper positioning to prevent pressure ulcers in bed-bound individuals. |
| **7. Lifestyle modifications** | **Smoking Cessation**: Discuss the negative effects of smoking on healing and encourage quitting.<br>**Activity Levels**: Promote safe levels of physical activity that can enhance circulation and overall health. |
| **8. Follow-up care** | **Regular Appointments**: Stress the importance of attending follow-up appointments for monitoring and adjustment of treatment.<br>**Adherence to Treatment Plans**: Encourage patients to follow prescribed treatments and report any concerns to their healthcare team. |
| **9. Psychosocial support** | **Emotional Impact**: Acknowledge the emotional challenges of living with chronic wounds and encourage seeking support when needed.<br>**Support Groups**: Suggest connecting with support groups for sharing experiences and coping strategies. |

### Nutrition for patients with chronic wounds

Nutrition plays a vital role in the treatment of chronic wounds. Adequate nutritional support can significantly enhance tissue regeneration, combat infection, and improve the body's ability to recover after injury [17,37]. The requirements for proper nutrition in patients with chronic wounds are illustrated in table 2. Optimizing nutrition is a crucial component of chronic wound management. Tailored dietary plans, rich in proteins, vitamins, and minerals, can significantly enhance healing outcomes. Collaboration with a registered dietitian can provide personalized guidance and support for individuals with chronic wounds [23].

Before initiating proper nutritional support, it is essential to consider the patient's dietary preferences and habits to prevent deficiencies, malnutrition, weight loss, or unwanted weight gain. For diabetic patients, the focus should be on balanced foods that regulate blood glucose levels while providing appropriate nutrition for treatment. In individuals at risk of malnutrition, the use of nutritional supplements or enteral feeding should be considered if necessary. It is important to note that in the context of chronic inflammation, nutrient absorption and uptake by the wound tissue may be reduced [17, 23].

Nutritional support is a critical element in the management of chronic wounds. A tailored diet high in proteins, vitamins, and minerals can significantly improve healing outcomes. Collaborating with a dietitian is recommended to provide personalized guidance and support for individuals with chronic wounds.

### Education for patients with chronic wounds

Patient education is crucial for individuals with chronic wounds, as it enhances healing, prevents complications, and promotes self-management [14]. The key topics and strategies for educating patients about chronic wound care are presented in table 3. Effective patient education is essential in empowering individuals with chronic wounds to engage actively in their care. Providing clear, concise information and fostering open communication with healthcare providers can lead to improved outcomes and enhanced quality of life.

### Conclusion

The effective management of chronic wounds necessitates a comprehensive and multifaceted approach aimed at promoting optimal healing and enhancing patient outcomes. Key strategies, such as thorough wound assessment, appropriate debridement, and advanced therapeutic modalities, such as Negative Pressure Wound Therapy (NPWT) and biological growth factors, are instrumental in supporting tissue regeneration. Additionally, adequate nutritional support and patient education are essential in empowering individuals to actively participate in their care, which can significantly enhance healing outcomes and overall quality of life. By adopting a multidisciplinary approach that integrates these standard practices, healthcare providers can optimize the management of chronic wounds, reduce complications, and foster a more effective healing process.

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## ԱՄՓՈՓՈՒՄ

### ՔՐՈՆԻԿԱԿԱՆ ՎԵՐՔԵՐԻ ԲՈՒԺՈՒՄԸ. ՍՏԱՆԴԱՐՏ ՄՈՏԵՑՈՒՄՆԵՐ ԵՎ ՌԱԶՄԱՎԱՐՈՒԹՅՈՒՆՆԵՐ (ԳՐԱԿԱՆՈՒԹՅԱՆ ԱԿՆԱՐԿ)

*Օրդույան Ս.Լ., Հակոբյան Է.Կ., Սիմոնյանց Լ.Գ.*
*ԵՊԲՀ, օպերատիվ վիրաբուժության և տեղագրական անատոմիայի ամբիոն*

**Բանալի բառեր՝** *քրոնիկական վերք, վարակի կառավարում, վերքի մշակում, վիրակապում, սննդային աջակցություն, բուժառուի կրթում, հյուսվածքների վերականգնում, վերքի լավացում:*

Քրոնիկական վերքերը կարևոր կլինիկական մարտահրավերներ են առողջապահական ոլորտում՝ հաճախ երկարաժամկետ կառավարմամբ՝ բուժման խթանման և բարդությունների կանխարգելման առումով: Սույն վերլուծությամբ ուսումնասիրվում են քրոնիկական վերքերի բուժման մեջ կիրառվող ստանդարտ մոտեցումները և ռազմավարությունները: Վերքի խնամքի հիմնական բաղադրիչներն են վերքի համապատասխան գնահատումը, մաքրումը և մշակումը, վարակների վերահսկումը և առաջադեմ վիրակապերի օգտագործումը: Ցածր ճնշմամբ վերքային թերապիան (NPWT) դարձել է խոստումնալից միջամտություն՝ բարելավելով բուժումը, նվազեցնելով այտուցը և լավացնելով արյան շրջանառությունը: Բացի դրանից, ընդգծվում է կենսաբանական աճի գործոնների դերը՝ բջիջների վերականգնմանը աջակցելու գործում: Սննդային աջակցությունը, որն ուղղված է սպիտակուցների, վիտամինների և հանքանյութերի բավարար ընդունմանը, կարևոր է օպտիմալ բուժում ապահովելու համար: Հիվանդի կրթությունն ու իր կողմից բուժման որոշ փուլերի ինքնուրույն կառավարումն ընդգծվում են որպես կարևոր գործոններ բուժման արդյունքների և կյանքի որակի բարելավման համար: Հոդվածում կարևորվում է նաև բազմամասնագիտական մոտեցման հարցը, որով նախատեսվում է ըստ անհրաժեշտության բուժման մեջ ներառել առողջապահական տարբեր մասնագետների, այդ թվում՝ բուժքույրերի, վիրաբույժների և վերքերի խնամքի մասնագետների, քրոնիկական վերքերի արդյունավետ կառավարումն ապահովելու համար: Ամբողջական և ապացույցների վրա հիմնված մոտեցմամբ՝ քրոնիկական վերքերի բուժումը կարող է էականորեն բարելավվել, որը կհանգեցնի ավելի լավ արդյունքների և առողջապահական ծախսերի նվազեցման:

## РЕЗЮМЕ

### ЛЕЧЕНИЕ ХРОНИЧЕСКИХ РАН: СТАНДАРТНЫЕ ПОДХОДЫ И СТРАТЕГИИ (ЛИТЕРАТУРНЫЙ ОБЗОР)

*Ордуян С.Л., Акопян Э.К., Симонянц Л.Г.*
*ЕГМУ, Кафедра оперативной хирургии и топографической анатомии*

**Ключевые слова:** *хронические раны, борьба с инфекциями, лечение ран, перевязка, нутритивная поддержка, обучение пациентов, восстановление тканей, заживление ран.*

Хронические раны представляют собой важную клиническую проблему в здравоохранении, часто требующую длительного лечения для ускорения заживления и предотвращения осложнений. В этом обзоре литературы рассматриваются стандартные подходы и стратегии, используемые при лечении хронических ран. Ключевые компоненты ухода за ранами включают соответствующую оценку ран, их очистку и лечение, инфекционный контроль и использование современных повязок. Терапия ран низким давлением (NPWT) стала многообещающим вмешательством для улучшения заживления за счет уменьшения отека и улучшения кровообращения. Кроме того, подчеркивается роль биологических факторов роста в поддержке регенерации клеток. Нутритивная поддержка, направленная на адекватное потребление белков, витаминов и минералов, необходима для обеспечения оптимального выздоровления. Обучение пациентов и самоконтроль на определенных этапах лечения выделяются как важные факторы улучшения результатов лечения и качества жизни. В статье также освещается вопрос междисциплинарного подхода, который предполагает привлечение различных специалистов здравоохранения, в том числе медсестер, хирургов и специалистов по уходу за ранами, по мере необходимости для обеспечения эффективного лечения хронических ран. Благодаря целостному и научно обоснованному подходу уход за хроническими ранами можно значительно улучшить, что приведет к улучшению результатов и снижению затрат на здравоохранение.