Section: General Surgery

Systematic Review

THE EVIDENCE FOR THE USE OF SPECIFIC DRESSINGS FOR DIFFERENT TYPES OF CHRONIC ULCERS: A SYSTEMATIC REVIEW

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Abstract

This systematic review explored evidence supporting specific dressings for various chronic ulcers, emphasising the need for tailored wound management. Chronic wounds, influenced by multiple factors, including biofilm presence, necessitate specialised dressings for optimal healing. Moisture-retentive dressings are pivotal for creating a conducive environment for epithelial cell movement, angiogenesis, and reduced fibrous tissue development. This article categorises dressing options for diabetic, venous, pressure, and arterial ulcers and highlights the efficacy of hydrocolloids, foams, and hydrogels. Pinch grafting is considered a bedside treatment for venous leg ulcers. Venous ulcers benefit from compression therapy, and antimicrobial dressings, including silver-based options, are recommended. Silicone and polyurethane dressings effectively treat pressure ulcers, emphasising their roles in minimising discomfort and facilitating tissue repair. The review concludes with a comprehensive comparative analysis of the dressing types for each ulcer category, stressing the importance of a systematic approach for successful wound management.

INTRODUCTION

Investigations into the development of non-healing wounds have revealed growing complexity and persistent difficulties in achieving wound closure. The influence of both inherent and external factors, including the causes and chronic nature of the wound, insufficient blood supply, underlying health conditions, medication usage, infection, and the detrimental consequences of prolonged inflammation, has been extensively documented.[1] While microbial bioburden has been acknowledged as a potential hindrance to wound healing for quite some time, there is now an emerging recognition of biofilms as a significant microbial obstacle. Biofilms encompass microbial communities that attach to surfaces and are surrounded and shielded by a self-generated extracellular polymeric substance (EPS).[2] Dressings that are either fully occlusive or partially occlusive have been created to encourage the regrowth of epithelial tissue and closure of chronic and acute wounds. When applied and removed, these dressings aim to minimise discomfort, expedite healing, absorb blood and body fluids, and ensure a painless experience. It's important to note that current clinical practice guidelines for pressure ulcers, leg ulcers, and diabetic foot lesions, as well as systematic reviews on the treatment of arterial leg ulcers or surgical wounds, do not establish a specific care approach for each type of wound.[3]

The dressing is a wound covering, and wound dressings have various shapes, sizes, colours, and origins. Before technological advancements introduced a range of moisture-retentive dressings, natural fenestrated dressings like gauze and Vaseline gauze were commonly used.[4] Gauze bandages, typically made from cotton, are convenient, readily available in most medical facilities, and cost-effective. However, their effectiveness diminishes once they become saturated with wound exudate. It can be impregnated with thick, hydrophobic substances like petroleum jelly, wax, or other ointments to enhance gauze's moisture-retaining properties.[5] The primary types of dressings that can be fully occlusive or partially occlusive include hydrocolloid dressings (HCDs), alginates, hydrogels, foam dressings (FDs), hydro fibre dressings (HFDs), as well as paraffin gauze and non-adherent dressings.[6]

Moisture-retentive Dressings

Moisture-retentive dressings fulfil various essential roles in modern wound care. This creates a moist environment that supports the movement of epidermal cells and preserves the electrical gradient necessary for directed cell migration. Furthermore, this moist wound environment effectively retains growth factors, stimulates angiogenesis (formation of

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new blood vessels), and reduces the development of fibrous tissue. These dressings also act as a protective barrier against injuries and infections, enhance a patient's ability to perform everyday activities, and are associated with reduced scarring.[7]

Pinch Grafting

Another bedside treatment option available for chronic wounds such as venous leg ulcers is pinch grafting. The procedure involves the following steps: administration of local anaesthesia (1% lidocaine) to the donor site, typically at the front of the thigh. A curved #25-gauge needle was used to elevate small portions of the skin from the donor area, which could then be removed using a #15 blade. The grafts were positioned on the dermal wound bed, maintaining a 2 to 3 mm distance between them. The grafted and donor sites were covered with a transparent dressing or petroleum gauze. Secure a gauze pad on the grafted region using an elastic bandage. If exudates accumulate beneath the graft, aspirate it using a #18-gauge needle.[8]

Types of Chronic Ulcers

1. Diabetic Ulcers

Uncontrolled diabetes can result in severe complications, and diabetic ulcers are a prevalent issue. These complications can be minimised through the effective management of blood glucose levels, regular self-examination of the feet, and routine medical check-ups.[9] Several risk factors, such as Charcot arthropathy, are associated with diabetic foot ulcers. Weak pulses, cold skin, and bluish tint are characterised by impaired blood circulation. Irregularities in peripheral sensations include the inability to perceive pain due to diabetic neuropathy. Additionally, smoking can detrimentally affect foot circulation, further increasing the risk of diabetic foot complications.

2. Venous ulcers

Ulcers manifest as uncovered lesions on the skin that affect various regions of the body's outer layer. Leg ulcers, also known as venous ulcers, arise because of issues related to blood circulation in the veins of the legs. Typically, when an injury occurs, such as a cut or scrape, the body initiates healing to seal the wound, leading to eventual natural recovery. However, ulcers may persist without appropriate treatment, hindering natural healing.[10]

Venous ulcerations typically appear around the ankles. They are typically the consequence of damage to the leg vein valves, which control arterial blood pressure. Walking helps lower the blood pressure because of these valves. Chronic venous hypertension occurs when the blood pressure inside the veins in the legs increases while walking. This elevated blood pressure, in particular, has a role in developing ulcers around the ankles.[11]

3. Pressure ulcers

Pressure ulcers, also known as bedsores or decubitus ulcers, occur because of prolonged pressure on the skin, leading to injuries to the skin and underlying tissues. These sores typically form on areas of the body with bony prominence, such as the heels, ankles, hips, and tailbones. Individuals at an increased risk of developing bedsores are those with medical conditions that restrict their ability to change positions or compel them to spend extended periods in a bed or chair.[12] The onset of bedsores can occur within hours or days. Although many sores respond well to treatment and healing, some ulcers never fully recover.

Signs indicating the existence of pressure ulcers or bedsores include abnormal alterations in skin colour or texture, swelling, discharge resembling pus, skin areas exhibiting a temperature difference either cooler or warmer than the surrounding regions, and sensitivity or tenderness in specific areas. Bedsores are categorised into various stages, each determined by depth, severity, and distinctive characteristics. Skin and tissue damage can range widely, from pigmentation changes to severe injuries involving the muscles and bones.[13]

4. Arterial ulcers

Ischaemic ulcers, alternatively termed arterial ulcers or ischaemic wounds, emerge from arterial damage due to insufficient blood flow to the tissues. Peripheral artery disease (PAD) is frequently the primary cause. In contrast to other ulcer types, these wounds on the legs may require an extended period, often months, to heal and sometimes may not heal at all.[14]

Diminished blood circulation is the primary factor contributing to arterial ulcer development. With reduced blood flow, the affected regions suffer from oxygen and nutrient deprivation, leading to inflammation and open wound formation. Without proper intervention, these ulcers can potentially instigate necrosis and cause skin and tissue death. Although ulcers can emerge anywhere on the body, arterial ulcers are more prevalent on the legs and feet.[15] Other possible causes of arterial ulcers include advancing age, diabetes, smoking, elevated blood pressure, high cholesterol levels, kidney failure, trauma, atherosclerosis, arterial thickening, and vasculitis.

Dressing options for diabetic ulcers

1. Hydrocolloid dressings

Hydrocolloid dressings typically consist of an absorbent hydrocolloid matrix integrated into a vapour-permeable film or a foam backing. Notable examples include Granuflex (ConvaTec) and the NU DERM (Systagenix). Fibrous alternatives are also designed to resemble alginates, providing a non-occlusive option, with Aquacel (ConvaTec) being a representative example.[16]

2. Foam dressings

Foam dressings are crafted using hydrophilic polyurethane foam to absorb wound exudates and maintain a moist wound surface. Various iterations exist, with some incorporating additional absorbent materials, such as viscose, acrylate fibres, or superabsorbent polyacrylate particles. Some foam dressings were silicone-coated to facilitate non-traumatic removal. Notable examples include

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Allevyn (Smith & Nephew), Biatain (Coloplast), and Tegaderm.[16,17]

3. Alginate dressings

Alginate dressings, which are highly absorbent, are available in calcium alginate or calcium sodium alginate forms and can be combined with collagen. When in contact with the wound surface, alginate forms a gel that can be lifted off during dressing removal or rinsed away with sterile saline. These dressings can be bonded to a secondary viscose pad by augmenting their absorbency. Examples of products in this category include Curasorb (Covidien), SeaSorb (Coloplast), and Sorbsan (Unomedical).

4. Transparent films

Aptly named for their translucent appearance, transparent film dressings consist of polyurethane (PU) membrane sheets. These dressings allow water and small molecules to pass through while blocking larger molecules, such as bacteria and proteins. This characteristic makes them highly effective at preserving wound moisture and reducing the risk of infection. These self-adhesive dressings were securely attached to the wound site without adhering to the wound margins. Acting as an outer cover, they create a conducive environment for moisture, facilitating epithelial cell migration across the wound surface. Consequently, this promotes enhanced wound healing.[18]

Dressing selection for venous ulcers

1. Compression bandages

Compression therapy is the cornerstone of treating venous leg ulcers (VLU). Compression therapy and effective wound care repair most minor venous ulcers recover quickly. Compression therapy aims to relieve pain and oedema, encourage ulcer healing, and stop ulcers from recurring.[19] Compression therapy for VLU involves narrowing veins, restoring valve competence, reducing ambulatory venous pressure, and ultimately diminishing venous reflux (VR). This approach also contributes to reducing inflammatory cytokines, accelerating capillary flow, and mitigating capillary fluid leakage, leading to the relief of limb oedema. Additionally, it plays a role in softening lipodermatosclerosis, enhancing lymphatic flow and function, and improving fibrinolysis.[20]

2. Antimicrobial dressings

Antimicrobial dressings for venous ulcers are specialised wound coverings designed to inhibit the growth of microorganisms and prevent infections in the context of venous leg ulcers. These dressings typically contain agents such as silver or other antimicrobial substances that exert bactericidal or bacteriostatic effects, helping to create a sterile environment conducive to wound healing. By addressing the microbial component, these dressings contribute to the overall management of venous ulcers, promoting a healthier healing process and reducing the risk of complications associated with bacterial infection.[21]

Silver dressings and antimicrobials

Silver has a well-established history as an antimicrobial substance and is utilised in various applications, ranging from water containers to silver sulfadiazine cream for burn treatment. The mechanism of silver's antimicrobial action is believed to involve its binding to bacterial cell membranes, disruption of bacterial electron transport, attachment to bacterial DNA, and binding to crucial cellular components.[22]

Managing pressure ulcers with specific dressings

1. Silicone dressings

Employing a soft silicone wound dressing for pressure ulcers of this nature can mitigate potential harm to the surrounding skin and decrease the frequency of dressing changes. These benefits, in turn, lead to reduced patient discomfort. Moreover, individuals prone to pressure ulcers can benefit from applying a soft silicone-bordered foam dressing. This dressing serves as a protective measure for sensitive skin areas, preventing the development of pressure ulcers by minimising friction and sheer force, particularly when repositioning patients or preventing footwear-related rubbing.[23]

2. Polyurethane dressings

Polyurethane foam is a foam dressing that does not adhere to a surface. This type of dressing is comprised of two distinct layers. The first layer consisted of hydrophilic polyurethane foam, which had a notable capacity for absorption. The second layer comprised a transparent polyurethane film as a protective barrier against bacterial and viral agents. Simultaneously, this film allows for optimal transmission of moisture vapour. Furthermore, the polyurethane film is resistant to water and is affixed to the dressing with an adhesive of medical-grade quality.[24]

3. Honey-impregnated dressings

Although honey has been used to treat wounds for thousands of years, its efficacy has only recently been validated. Honey possesses an acidic nature, characterised by a pH ranging from approximately 3.2 to 4.5, and scientific evidence suggests that its low pH can impede the action of proteases, consequently diminishing the degradation of the essential matrix required for tissue restoration. Furthermore, an acidic environment has been shown to augment the liberation of oxygen from haemoglobin, thereby exerting a favourable influence on wound repair.[25]

Honey can be classified as a hypertonic solution characterised by an osmotic pressure of approximately 105 atm. Consequently, elevated osmolarity of honey can effectively hinder bacterial proliferation. Moreover, its increased viscosity aids in establishing a protective barrier, thereby preventing the onset of infection. It is worth noting that honey contains hydrogen peroxide, an indispensable element for safeguarding against infectious agents and cleaning wounds. Even in minimal concentrations, this component promotes the progression of wound healing.[26-30]

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Table 1: Comparative analysis

Type of Ulcer Dressing	Mechanism of Action	Clinical Effectiveness	Considerations
Diabetic Ulcer Dressings	Diabetic ulcer dressings aim to provide a moist wound environment, manage exudate, and prevent infection. Some may contain agents promoting angiogenesis and tissue regeneration.	Studies indicate that advanced dressings, such as hydrogels and foams, promote diabetic ulcer healing by accelerating wound closure and reducing infection rates.	Consider patient adherence, as some advanced dressings may require more frequent changes.27
Venous Ulcer Dressings	Venous ulcer dressings focus on managing exudate, reducing oedema, and enhancing the venous return. Compression therapy is often integrated into the treatment plan.	Compression therapy combined with appropriate dressings has effectively promoted venous ulcer healing by improving blood circulation and reducing swelling.	Ensure proper venous insufficiency diagnosis, as compression therapy may be contraindicated in arterial disease.28
Pressure Ulcer Dressings	Pressure ulcer dressings are designed to relieve pressure, manage moisture, and prevent infection. They should redistribute pressure away from the wound site.	Silicone and foam dressings have effectively promoted pressure ulcer healing by providing a protective barrier and supporting tissue repair.	Regular repositioning and offloading strategies should complement dressings to address the root cause of pressure ulcers.29
Arterial Ulcer Dressings	Arterial ulcer dressings focus on promoting perfusion, managing infection, and preventing ischemia. Maintaining a moist wound environment is crucial.	Studies suggest that dressings with silver or antimicrobial properties may be beneficial in managing infection in arterial ulcers, but revascularisation remains a primary intervention.	Collaborate closely with vascular specialists to address underlying arterial insufficiency and optimise blood flow to the affected area.30

CONCLUSION

In conclusion, the effective management of chronic ulcers requires a tailored approach that considers specific characteristics and underlying causes. Advanced dressings, such as hydrocolloids, foams, and hydrogels, are effective for diabetic ulcers, emphasising the need for patient adherence. Venous ulcers benefit from a combination of compression therapy and suitable dressings, contingent on accurate diagnosis. Pressure ulcers require dressings to relieve pressure, with silicone and foam dressings showing efficacy. Arterial ulcer care promotes perfusion, manages infection, and collaborates with vascular specialists for interventions.[31]

A systematic approach to dressing selection, considering the unique needs of each type of chronic ulcer, is crucial for successful wound management. Integrating advanced dressings, compression therapy, and targeted interventions aligns with the current best practices. As wound care evolves, ongoing research and clinical evaluation will further refine our understanding of optimal dressing choices, contributing to improved outcomes for individuals with chronic ulcers.[32]

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