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Innovations in Wound Care: The Critical Role of Nurses in Advanced Dressing Management

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Abstract

Background: Chronic wounds profoundly affect individuals' quality of life and pose significant economic burdens, particularly in high-income countries. The increasing prevalence of such wounds is linked to an aging population and rising rates of obesity, diabetes, and cardiovascular diseases. Effective wound management requires comprehensive knowledge of wound etiology and appropriate dressing selection.

Methods: This review synthesizes recent literature on advanced wound dressings, focusing on interactive and bioactive dressing types, including hydrocolloids and hydrogels. We evaluated the physical properties, benefits, limitations, indications, and contraindications of these dressings, alongside existing evidence regarding their efficacy.

Results: Findings indicate that while advanced dressings provide substantial benefits, including moisture retention and enhanced healing, gaps in knowledge persist among healthcare professionals regarding their selection and application. Hydrocolloid dressings were noted for their moisture-retaining properties and pain-free removal but are less effective in high exudate scenarios. Hydrogels demonstrated superior hydration capabilities but lacked adequate bacterial barriers. Evidence on the comparative effectiveness of these dressings remains limited, highlighting the need for more robust clinical studies.

Conclusion: The review underscores the importance of enhancing nurses' knowledge and skills in wound assessment and dressing selection. By improving evidence-based practices, healthcare professionals can better manage chronic wounds, ultimately improving patient outcomes. Ongoing education and research are essential to address existing gaps in wound care knowledge.

Keywords: Chronic wounds, wound management, hydrocolloid dressings, hydrogel dressings, evidence-based practice.

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1. Introduction

Chronic wounds significantly impact health-related quality of life and impose substantial economic costs on society in high-income countries (1-4). The projected increase in prevalence is attributed to an aging population along with a rise in obesity, diabetes, and cardiovascular diseases (3). Wound management represents a critical clinical challenge and is increasingly becoming an economic burden worldwide (5-7). The Wound Care Market was valued at $18.22 billion, as reported in the latest Global Wound Care Market 2016 report by Orbis Research in 2017. The forecast indicates that this value will attain $26.24 billion by the conclusion of 2023. Effective wound care necessitates clinicians' comprehension of wound etiology,

chronicity, the mechanisms and biology of healing, as well as the factors influencing the healing process (8). Accurate diagnosis of wound etiology and appropriate treatment should be the primary focus, followed by the selection of suitable dressings (4, 8).

Understanding dressing products and their characteristics, along with the ability to select appropriate dressings, are two essential elements in clinical decision-making and comprehensive wound care (9). In addition to patient preferences, clinical expertise is essential for providing evidence-based wound care (10). Nonetheless, care based on evidence often falls short of optimal standards (6, 7). To enhance evidence-based decision making, clinicians should evaluate the literature regarding the efficacy and cost-effectiveness of dressing products while minimizing the impact of the dressing production industry (11). Studies indicate that nursing and medical students, interns, as well as nurses and general practitioners, possess inadequate knowledge and skills in wound management assessment and dressing selection (12-15). Enhancing clinicians' knowledge of dressing selection and assessment skills in wound management is crucial on a global scale (16-20).

Keeping a moist wound environment to enhance healing is a recognized evidence-based practice (21). In contrast to conventional passive dressings for wound coverage, first-line interactive/bioactive dressings create a moist and supportive environment that enhances the healing process (8). Interactive dressings modify the wound environment and engage with the wound surface to enhance the healing process (22). These dressings typically consist of three layers. The inner layer inhibits dressing adherence and the resulting trauma to the wound bed. The middle layer effectively absorbs excess exudate, retaining the absorbed volume while ensuring a consistently moist environment. The outer layer serves to block bacterial invasion (23). The characteristics of interactive dressings enhance the processes involved in wound healing. Numerous reviews concerning first-line interactive dressings have been released (11, 24, 25), yet these have primarily provided concise summaries lacking substantial evidence of the dressings' effectiveness. This thorough assessment encompasses a detailed evaluation of the efficacy of first-line interactive wound dressings.

This article explores the primary interactive and bioactive dressing categories frequently utilized in clinical settings, such as semipermeable films, foams, hydroactives, alginates, hydrofibers, hydrocolloids, and hydrogels. We outline the physical properties, various forms and products, as well as the advantages and disadvantages, along with the indications and contraindications for their use. Furthermore, we examine the existing evidence regarding the effectiveness of these groups. This article offers a concise overview for clinicians, medical and nursing students, recent graduates, and researchers engaged in studies related to wound management.

2. Hydrocolloid Dressings

Hydrocolloids are dressings that retain moisture and include gel-forming agents like gelatin, sodium carboxymethylcellulose, and pectin. When wound exudate is present, hydrocolloids absorb the liquid and create a gel, aiding in the maintenance of a moist environment (26).

A variety of hydrocolloid dressings integrate gel-forming characteristics with elastomers and adhesives, typically applied to a carrier like film or foam, resulting in an absorbent, waterproof, self-adhesive wafer (26). The polymer outer layer can be presented in sheet form, functioning as either occlusive or semiocclusive. The interaction of hydrocolloids promotes autolytic debridement. This property allows for a reduction in dressing frequency, providing wear time of up to one week, contingent on the type of hydrocolloid dressing used and the level of exudate present. Hydrocolloids come in both powder and paste forms, enhancing exudate absorption and reducing dead space within the wound cavity (22).

The primary benefits of hydrocolloid dressings include their ability to retain moisture and facilitate pain-free removal. The occlusive properties create an effective barrier against water, oxygen, and bacteria; nonetheless, anaerobic bacteria can thrive in a hypoxic environment. These properties assist in promoting angiogenesis and granulation. Furthermore, hydrocolloid dressings lower the wound surface pH, creating an acidic environment that helps to inhibit bacterial growth (24).

Hydrocolloid dressings are appropriate for both partial- and full-thickness acute and chronic wounds. They advocate for autolytic debridement in cases involving sloughy or necrotic tissue (24). They stick effectively to high friction areas, including heels and the sacrum, and are utilized in the management of pressure injuries. Hydrocolloid dressings serve as protective coverings to avert device-related pressure injuries in intubated patients within the ICU (27). They are utilized in the treatment of minor burns and abrasions.

Health professionals ought to refrain from utilizing hydrocolloid dressings when addressing dry and high exudate wounds. Because of their semiocclusive properties, hydrocolloids featuring a waterproof backing are not advised for use on clinically infected wounds (26). Hypergranulation can develop with extended use of hydrocolloids in wounds that have moderate to high levels of exudate. Regular assessment of wound tissue is essential when using hydrocolloids for extended periods to ensure that hydrocolloid dressings are removed before hypergranulation develops (28). Certain studies advise caution regarding the use of hydrocolloids in diabetic foot ulcers, as they may promote the growth of anaerobic bacteria (26).

Hydrocolloid dressings serve as either primary or secondary dressings in the treatment of pressure ulcers, chronic venous ulcers, diabetic foot ulcers, burns, partial thickness wounds, and split-thickness skin graft donor site wounds, demonstrating varying levels of effectiveness (26, 29). Nonetheless, evidence is scarce regarding their effectiveness compared to other dressings, especially in the treatment of diabetic foot ulcers or pressure ulcers (30). A cost comparison study examining hydrocolloid dressing against transparent polyurethane film for pressure ulcer prevention found that the average cost per dressing change per participant was lower with the transparent polyurethane film compared to the hydrocolloid dressing (31). A randomized controlled study on donor-site wound dressings following split-skin grafting (32) found that the use of hydrocolloid dressings resulted in a seven-day improvement in the time to complete re-epithelialization compared to other types of dressings.

3. Hydrogel Dressings

Hydrogels consist of intricate hydrophilic polymers that contain a substantial amount of water, reaching up to 90%. These are polymers that do not dissolve in water and expand when exposed to it. Hydrogel dressings possess a semiocclusive nature. They serve to hydrate wounds, rehydrate eschar, and facilitate autolytic debridement (22).

Hydrogel dressings come in various forms, including amorphous gel, sheet, or sheet hydrogel-impregnated options. The viscosity of hydrogel varies. Purilon and IntraSite represent two of the most viscous sterile gels available. This property assists in maintaining its position within the wound cavity. Solosite and Solugel are among the thinnest hydrogels, allowing for easy application over a wide surface area; nonetheless, both products include chemical preservatives (22). Antimicrobial agents, antibiotics, and hyaluronic acid have been incorporated into the development of hydrogels (24). Antimicrobial hydrogels, for example. Flaminal Hydro and Forte contain two enzymes, lactoperoxidase and glucose oxidase, which effectively inhibit bacterial growth (33, 34). Oxyzyme and Iodozyme serve as examples of two-layer hydrogel dressings that deliver both oxygen and iodine to the wound surface (24).

Hydrogel dressings create a moist environment that promotes cell migration and absorbs excess exudate. Another advantage of hydrogel dressings is their ability to facilitate autolytic debridement without harming epithelial cells or granulation (35). The primary drawback of hydrogel dressings is their inadequate bacterial barrier.

Hydrogel dressings are appropriate for treating wounds that exhibit minimal to moderate exudate. Amorphous hydrogels can be applied liberally onto a wound and then covered with a secondary dressing, like film or foam. Hydrogels can stay in position for a maximum of three days. Hydrogel products are effective in managing pressure ulcers, skin tears, and surgical wounds. They exhibit calming and refreshing properties on the skin, which is especially beneficial in the treatment of burns, including those from radiation therapy, as well as painful wounds (24). They are secure on neonatal skin. Besides their application in wound care, thin hydrogels are beneficial for managing chicken pox lesions and shingles (35). HydroTac and HydroTac Comfort are utilized in the care of wounds during the granulation and

epithelialization phases of healing. HydroTac ensures adequate absorption of exudate through its top film's water vapor permeability, creating an ideal moist wound environment essential for effective wound healing. This is recommended for the treatment of wounds that exhibit slight to moderate exudation (37). HydroTac Comfort offers the same benefits to the wound bed, but it features an added acrylic adhesive border, creating a comprehensive dressing that ensures waterproof protection for the wound surface (37).

Health professionals need to recognize that certain amorphous gels might include propylene glycol, which could trigger allergic reactions in older individuals. To facilitate the removal of hydrogel dressings, the wound can be irrigated with a saline solution (22). A systematic review on the use of hydrogel dressings for managing pressure ulcers found no definitive evidence indicating that hydrogel dressings are either more or less effective than alternative treatments, nor that various hydrogels produce differing effects (38). The majority of trials featured in this review were quite limited in size and poorly documented, which heightens the potential for bias. A systematic review on the use of hydrogel dressings in managing diabetic foot ulcers indicated that there is low-level evidence suggesting hydrogel dressings are more effective in healing lower-grade diabetic foot ulcers compared to basic wound contact dressings. Nonetheless, the original studies carry a risk of bias, which renders this finding uncertain. Limited evidence suggests that superficial and partial thickness burns treated with hydrogel dressings may heal more rapidly compared to those receiving standard care (39). The studies featured in this systematic review consisted of small trials that exhibited poor quality and a significant risk of bias (39). HydroTac was tested in the treatment of Buruli ulcers, and it was noted that foam dressings lacking a hydrogel component might be more effective (40).

4. Discussion

Despite the increasing development of advanced wound dressings and the introduction of numerous innovative products into the wound market (41), first-line interactive/bioactive dressings remain the most frequently utilized in clinical practice. We have outlined the physical properties of the primary categories of first-line interactive/bioactive dressings, presented various forms and examples of these products, and examined their advantages and disadvantages, along with the indications and contraindications. We have additionally included the most recent evidence of effectiveness. Although there has been progress in promoting evidence-based practice in wound care over the past twenty years, the current evidence regarding the effectiveness of the various groups of first-line interactive/bioactive dressings remains limited. (42-43).

There is a necessity for high-quality randomized controlled trials to assess the effectiveness of dressing products, along with additional evidence synthesis methods such as systematic reviews, overviews of reviews, and network meta-analysis (45, 46). Nonetheless, numerous challenges exist concerning evidence generation in wound care (47), particularly about dressing selection (43). The challenges at hand pertain to legal, technical, methodological, and financial aspects that diminish the necessity for and restrict the chances to carry out high-quality evidence-generating studies (43, 48). Collaboration with the industry has been noted as lacking (49), alongside the competing demands of clinical research and clinical practice (43).

Tackling the challenges of evidence translation holds significant importance as well. The concept of evidence-based practice has evolved to emphasize the importance of methodological quality and epidemiological rigor in studies. This shift may impede the translation of research, rather than promoting a holistic approach that integrates high-quality evidence, clinical judgment, and patient values (43). Improving the quality of studies in wound care continues to be essential (50). Nonetheless, this presents difficulties in real-world clinical practice situations that involve comorbid conditions and the complexity of wounds (49) to guarantee that the selected dressing 'does no harm' (48).

When making decisions about dressing product selection, clinicians need to take into account the patient's comorbid conditions, wound assessment, dressing properties, and cost (51). This process should be guided by evidence-based wound management guidelines (16), which provide optimal and cost-effective care to assist clinicians in enhancing healing outcomes in clinical practice (3). This review's primary contribution lies in its compilation of the most recent evidence regarding the effectiveness of the primary categories of

first-line dressings. It offers an in-depth discussion of the key disadvantages, contraindications, and precautions that can assist health professionals in making informed decisions about dressing selection, complementing the recommendations found in clinical practice guidelines. Concise and straightforward summaries of first-line dressings, presented in an organized manner, can serve as a valuable resource in clinical practice.

5. Constraints and Safety Measures

This review has three primary limitations. While this is a thorough scoping review, it should not be regarded as systematic. To begin with, our literature search was semisystematic, and we did not create the PRISMA charts for the included categories of first-line dressings. Second, we aimed to concentrate on the data sources that offer the highest quality evidence, including RCTs and systematic reviews. Consequently, if these data sources were accessible, information on the effectiveness of first-line dressings based on findings from studies with a lower level of evidence was excluded. In the absence of higher quality evidence, lower levels of evidence were taken into account, including descriptive studies and pilot projects. For instance, a pilot project focused on the use of hydrogel dressings for managing Buruli ulcers (40). This approach to study inclusion is deemed suitable, as the objective of this review was to gather the most recent evidence available.

In selecting dressings, when high-quality evidence is lacking, a mixed-method approach may be utilized to gather clinically valuable data and enhance understanding of a specific dressing (43). Thirdly, we focused on the most recent evidence regarding the effectiveness of first-line dressings in wound management; therefore, any evidence produced before 2014 was excluded unless no new evidence had been published. This manuscript presents specific products from different manufacturers as examples, and the list of dressing products should not be viewed as comprehensive, as numerous other products are available in the market. The results of this review should not be considered as an independent guide for selecting attire. Health professionals are advised to consult the wound-specific national clinical practice guideline recommendations to assist in the assessment, diagnosis, differential diagnosis, and management of wounds.

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الابتكارات في رعاية الجروح: الدور الحيوي للممرضين في إدارة الضمادات المتقدمة

الملخص

الخلفية :تؤثر الجروح المزمنة بشكل كبير على جودة حياة الأفراد وتفرض أعباء اقتصادية كبيرة، خاصة في الدول ذات الدخل المرتفع. يرتبط تزايد انتشار هذه الجروح بالتقدم في العمر وزيادة معدلات السمنة، والسكري، وأمراض القلب والأوعية الدموية. تتطلب الإدارة الفعّالة للجروح معرفة شاملة بمسبباتها واختيار الضمادات المناسبة.

المنهجية :تستعرض هذه المراجعة الأدبيات الحديثة حول الضمادات المتقدمة للجروح، مع التركيز على الأنواع التفاعلية والنشطة بيولوجيًا، مثل الضمادات الهيدروكولويدية والهلاميات المائية. تم تقييم الخصائص الفيزيائية، الفوائد، القيود، المؤشرات، وموانع الاستخدام لهذه الضمادات، إلى جانب الأدلة الحالية حول فعاليتها.

النتائج :أظهرت النتائج أن الضمادات المتقدمة توفر فوائد كبيرة، بما في ذلك احتباس الرطوبة وتعزيز الشفاء. ومع ذلك، هناك فجوات معرفية بين العاملين في مجال الرعاية الصحية فيما يتعلق باختيارها وتطبيقها. لوحظت فعالية الضمادات الهيدروكولويدية في احتباس الرطوبة وسهولة الإزالة

بدون ألم، لكنها أقل فعالية في حالات الإفرازات الشديدة. أما الهلاميات المائية فقد أظهرت قدرات ترطيب فائقة ولكنها تفتقر إلى الحواجز الكافية ضد البكتيريا. لا تزال الأدلة على الفعالية المقارنة لهذه الضمادات محدودة، مما يبرز الحاجة إلى المزيد من الدراسات السريرية المتينة.
الاستنتاج :تؤكد المراجعة على أهمية تعزيز معرفة ومهارات الممرضين في تقييم الجروح واختيار الضمادات المناسبة. من خلال تحسين الممارسات القائمة على الأدلة، يمكن للعاملين في مجال الرعاية الصحية إدارة الجروح المزمنة بشكل أفضل، مما يؤدي في النهاية إلى تحسين نتائج المرضى. التعليم المستمر والبحث ضروريان لسد الفجوات القائمة في معرفة رعاية الجروح.

الكلمات المفتاحية :الجروح المزمنة، إدارة الجروح، الضمادات الهيدروكولويدية، الهلاميات المائية، الممارسة القائمة على الأدلة.