Depth Matters: A Step-by-Step Guide To Packing Hard-to-Heal Wounds

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Wound healing is a dynamic and multi-phase physiological process, determined by various cellular, chemical, and hormonal mechanisms.[1,2] This process occurs through a complex interplay of growth factors, cytokines and chemokines, which restore the structure and function of the skin through regulated phases: hemostasis, inflammation, proliferation and maturation. These phases overlap and are influenced by systemic responses, such as the release of catecholamines and cortisol, which facilitate tissue perfusion and support the cellular activity necessary for healing.[1,2]

Generally, wound healing occurs through three mechanisms: 1) primary intention, where the wound edges are sutured or stapled together; 2) secondary intention, which involves the gradual filling of an open wound with granulation tissue; and 3) tertiary intention, where the wound edges are deliberately left open for delayed closure, allowing for infection control.[3,4]

In a deep wound, it is common to encounter edge detachment, tunnelling or undermining, complications that affect the continuity of the healing process and timely closure of the wound. Edge detachment (Figure 1) occurs when the margins of the wound are slightly separated from the underlying tissue creating a space that can hide fluids, bacteria, or necrotic tissue, which can delay healing and increase the risk of infection. Tunnelling, on the other hand, refers to the formation of holes beneath the skin (Figure 2), resulting from inflammatory or infectious processes, which delays the proper closure of the wound.[5] Undermining (Figure 3), in contrast, occurs when the tissue under the wound edges becomes eroded, causing a pocket of space underneath the skin's surface. [5, 6]

Figure 1
Wound with edges detachment.
Source: Personal archive - 3rd author

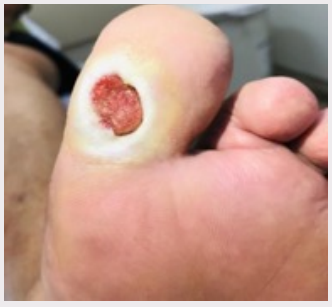


Figure 2
Wound with Tunnel.
Source: Personal archive - 1st author

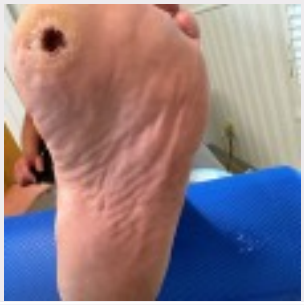
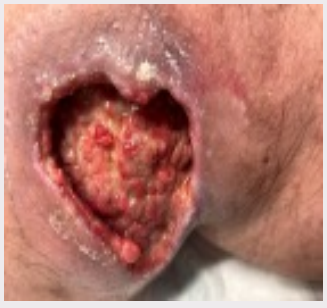


Figure 3
Wound with undermining.
Source: Personal archive - 1st author



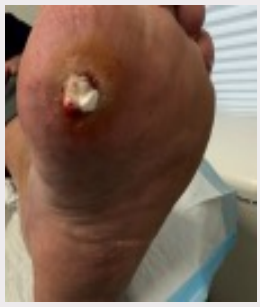
In clinical practice, it is observed that edge detachment, tunnelling or undermining significantly impact healing by delaying tissue repair and compromising treatment progress. A recent expert consensus highlights the importance of assessing not only the size of the wound but also the presence and extent of complications including tunnelling and undermining.[6] Additionally, another consensus on wound healing addresses the TIMERS tool (See box), where one of the key elements of assessment is the wound edge characteristics.[7] The authors report that epithelial advancement is highly unlikely to be accomplished if the wound edge is not properly managed, emphasizing the need to observe for detachment, tunnelling, or epibole.[7]

TIMERS (Tissue, Infection/Inflammation, Moisture, Edge of the wound, Regeneration, and Social factors) can help identify early signs of detachment.[17] TIMERS incorporates a holistic view of wounds healing, ensuring that clinicians address not only the physical aspects of the wound but also the social and emotional factors affecting patient outcomes, ensuring that wound packing and dressings are tailored to the evolving needs of the wound.[17]

Despite the relevance of these factors, they are not systematically evaluated by health-care providers (HCPs), particularly those without formal training in wound care. Anecdotally, documentation of edge detachment, tunnelling or undermining is consistently absent from patient charts, complicating effective monitoring of the healing process. Furthermore, inadequate packing techniques are sometimes employed, a gap that warrants further investigation. We hypothesize that this may stem from an insufficient understanding of the procedure's importance. Additionally, it is important to consider that deep wounds typically produce a significant amount of exudate due to damage to underlying tissues, which require robust and sufficient materials for packing appropriately (Figure 4). Therefore, HCPs must select packing materials that effectively manage moisture balance, especially in highly exudative

wounds. Initially, frequent dressing changes may be necessary, with intervals gradually extended as exudate levels decrease. This strategy is essential for optimizing healing and minimizing complications.

Figure 4
Wound filled/packed appropriatly.
Source: Personal archive - 1st author



It is crucial to address wound packing requirements, as inadequate filling of deep wounds increases the risk of complications and negatively impacts patients' quality of life. [8-10] Issues such as foul odour can cause embarrassment, social isolation and emotional distress for patients, directly reducing their overall well-being.[11] To help mitigate these impacts, the goal of wound packing is to gently fill dead spaces from the base of the wound to the surface, promoting tissue growth from the inside out. Literature supports that dressing material should fit snugly, but neither tightly nor loosely, allowing the dressing to optimally absorb exudate while promoting healing from the base upward.[3,4]

The need for a comprehensive packing guide is underscored by the shortage of HCPs trained in wound care, which has led to wound management being performed by generalist HCPs. Consequently, clear, step-by-step guidance is necessary to assist professionals, patients and care partners in addressing these critical aspects of wound care that are often overlooked. Thus, the objective of this work is to provide a step-by-step guide on wound packing technique and dressing selection in the management of deep, undermining and tunnelling wounds, with a focus on preventing complications such as infection, delayed healing and abscess formation.

Methods

We conducted a critical literature review across multiple databases, including PubMed, CINAHL, Medline and Scopus, from July 2024 to September 2024. Google Scholar was also used to capture additional articles that may not have been indexed in the primary databases. Our search focused on peer-reviewed literature published in English.

The following keywords were used: cavity wound packing, depth of wound packing, deep wound management, wound cavity dressing, packing in undermining wounds and dressing selection for deep wounds, to capture a comprehensive range of studies on wound care and packing techniques. To narrow the search, filters related to time (articles published between 2000 and 2024), wound complications, such as undermining and tunnelling, were applied, resulting in overlapping hits and further refinement of the literature pool.

Initially, broader terms such as wound packing, wound depth and cavity wounds were employed, retrieving 3,582, 4,029, and 1,312 results on PubMed, Google Scholar and CINAHL respectively. This indicated substantial research coverage on wound management, particularly on the clinical aspects of wound healing and the need for effective packing. However, using title and then abstract searches, this review was unable to locate peer-reviewed literature specifically addressing the topic of wound packing depth. Instead, it relied on related studies and employed an integrative approach, combining best practice guidelines with evidence from broader wound management research to fill the gap.

A Step-by-Step Guide For Implementation Of Appropriate Wound Packing Techniques

In this section, we present a step-by-step guide for the implementation of appropriate wound packing techniques. This guide includes crucial aspects such as wound assessment, dressing selection, the packing procedure and follow-up

documentation. Table 1 summarizes the entire process, serving as an easy-to-follow resource for professionals who are new to the field.

Table 1 A step-by-step guide for implementing appropriate wound packing

	Procedure	References
Supplies	Syringe (10-60 mL), needleless adaptor, sterile normal saline or prescribed fluid, sterile dressing tray, sterile forceps, sterile scissors, cotton-tipped applicators, sterile gloves, waterproof pad, outer sterile dressing, packing gauze or recommended packing material (see Table 2) and refuse bag, as per orders.	19-22
Preparation	Gather supplies. Greet the patient and explain the procedure. Position the patient comfortably, ensuring the wound is vertical for drainage. Use waterproof padding under the wound site to protect clothing and bedding.	20-22
Assessment & Cleansing	Remove old dressing with sterile forceps if surgical wound. Note that in contaminated wounds such as diabetic foot ulcer there is no need to use sterile materials as it can be safely done with a clean procedure. If packing sticks, moisten with saline to avoid trauma to the wound bed. Assess the wound using the clock method (12 o'clock at the patient's head, 6 o'clock at their feet). Measure the length, width, depth and check for undermining, tunnelling, or sinus tracts and the condition of the wound bed. Use the **TIMERS** framework (Tissue, Infection/Inflammation, Moisture balance, Edge of the wound, Regeneration and Social factors) to assess the wound healing environment and plan the next steps. Pay special attention to wound edge detachment or tunnelling. Cleanse the wound with saline irrigation or compresses (as prescribed).	5,17,20-22
Irrigation	If irrigation is prescribed, use a 35 mL syringe with prescribed fluid for irrigation, aiming for pressures between 4-14 psi. Irrigate until the return fluid is clear, ensuring no increase in patient discomfort. Proper irrigation helps to manage wound detachment and reduce bacterial load.	7,17,20-22

Packing the Wound	Moisten the packing gauze with the prescribed solution, ensuring it is **damp** but **not soaked**. If using **Foam Dressings**, **Specialized Foam Dressings, Impregnated Dressings** (silver, honey, or iodine), **Calcium Alginate, Gelling Fiber, or Hypertonic Gauze Ribbon**, gently place the dressing into the wound cavity, ensuring that it fills the dead space without being over-compressed. These dressings do not require moistening, as they are designed to absorb exudate and conform to the wound shape. Gently pack a wound using forceps or applicator, ensuring the dressing touches all surfaces of the wound. Avoid overpacking (which can restrict blood flow) and underpacking (which leaves dead spaces that can increase bacterial load and increase the risk of abscess). Ensure the packing supports the wound edge to prevent detachment and promote epithelialization.	7,17,20-22
Dressing Application	Apply a skin protectant to the peri-wound area to prevent maceration from exudate. Place a dry, sterile outer dressing over the packed wound (if surgical wound), ensuring it stays dry to prevent contamination. Ensure the dressing supports wound edges and helps prevent detachment.	6,7,20-22
Post-Procedure	Reposition the patient for comfort, ensuring the wound is secure and the dressing is dry. Discard used materials and perform hand hygiene.	6,20-22
General	If ethically applicable, and consent has been obtained, photograph the wound before and after packing. Document the wound assessment using the clock method to record the location and depth of tunnelling, undermining, or sinus tracts. Record the type of packing used, the dressing applied and the patient's response. Include the length of packing used for wounds with tunnelling or sinuses. Monitor and record the condition of wound edges, especially if there is any detachment, using TIMERS to assess healing progress.	7,17,20-22

Step 1: Wound Assessment

To assess depth, a traditional cotton-tipped applicator can be used for measurement. The cotton tip should be inserted into the wound until it reaches the deepest point.[2] The HCP then pinches the cotton-tipped applicator at the skin surface level and measures the inserted portion's length.[2] When assessing undermining, where tissue separates due to friction or shear, the clock system is again used to identify its location and a cotton-tipped applicator helps determine how far the undermining extends.[2]

To accurately assess deep wounds, HCPs should visualize the wound area as a clock, with 12 o'clock positioned at the patient's head and 6 o'clock at their feet.[2,4] The length of the wound should always be measured from 12 to 6 o'clock, while the width is recorded between 9 and 3 o'clock at the longest and widest points.[4] Use a cotton-tipped applicator to explore edges detachment and undermining, and measure the location where the detachment or undermining is present, documenting it according to the clock position. For example, if edges detachment or undermining is found at the 3 o'clock position, note both the clock location and the depth or size of the undermining. This clock method is beneficial for consistent documentation of wound structures, tissue characteristics and locations, allowing other HCPs to interpret the wound assessment clearly.[2,4] Similarly, tunnelling is assessed by gently probing the wound edges with a cotton-tipped applicator to detect hidden pathways.[2] Although this technique is not frequently reported in the literature, anecdotally, another method for assessing tunnelling involves filling the wound with 0.9% saline solution and then aspirating with a syringe to quantify the volume in millilitres. This approach allows for a sequential volume measurement at each assessment, providing additional insight into the extent of tunnelling.

It is important to recognize that wound assessment is a continuous process, repeated at every follow-up. After each assessment, it is crucial to thoroughly describe and document all observations and measurements in the patient's record (Step 4). Accurate and detailed documentation ensures a clear record of the wound's progress.

Step 2: Packing Procedure And Techniques

The depth of packing depends on the depth of the wound, as well as any presence of undermining or tunnelling. Packing that is too tight can restrict blood flow to the wound bed, impairing the delivery of oxygen and nutrients that are critical for tissue repair.[4,8] Overpacking may also damage newly formed granulation tissue, increasing the risk of necrosis and delaying healing.[8]

Conversely, underpacking can lead to the accumulation of exudate, bacteria and dead space within the wound, fostering an environment conducive to infection and abscess formation.[8-10] To avoid these complications, HCPs must ensure that the packing material is snug but not too tight (Figure 4), filling dead space without exerting excessive pressure on the wound bed.[8-10,12] By doing so, packing supports the growth of granulation tissue, thereby promoting efficient wound closure from the base upwards to the surface (Figure 5 and 6).[8-10,12,13]

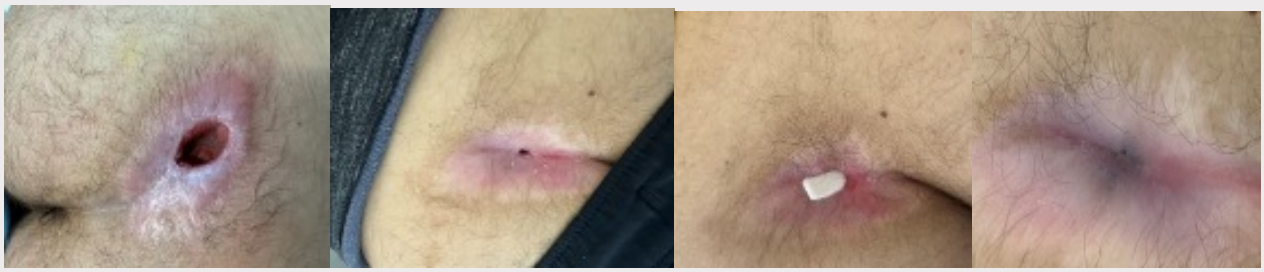


Figure 5
Evolution of a tunnelling pressure injury after applying appropriate packing.
Source: Personal archive - 1st author

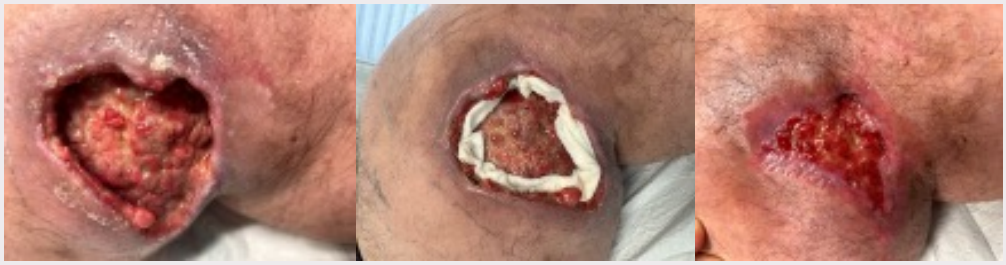


Figure 6
Evolution of a traumatic wound with undermining tissue after applying appropriate packing.
Source: Personal archive - 1st author

However, it is important to consider the need to assess exudate levels, as high exudate levels can reduce the packing material's effectiveness. Furthermore, excessively exuding wounds can cause discomfort and pain, particularly through skin damage in the periwound area and highly absorbent dressings can produce a 'drawing' sensation.[14,15] As wound size, depth and location influence exudate production, deeper and larger wounds or those in lower extremities (such as the legs) tend to produce more exudate.[14,15] When exudate levels decrease, absorbent dressings can exacerbate discomfort. Managing both the wound's drainage and the condition of the surrounding skin is crucial to alleviating patient discomfort and promoting healing.[14] As detailed in Table 2, dressings specifically designed for increased fluid output include foam, gel-forming, and superabsorbent dressings.[15] However, some dressings interact with exudate, and certain types may gel upon contact with moisture, decreasing their size and potentially filling capability.[14,15]

Dressings such as alginates and fibre, upon interacting with exudate, undergo gel formation, which can result in a reduction in volume. This process is effective in absorbing fluid and promoting a moist wound environment. However, as exudate levels diminish, the capacity of these dressings to maintain close contact with the wound bed may be compromised.[15] Importantly, hydrocolloid dressings should not be used in wounds with tunnels, undermining or sinus tracts because they cannot effectively absorb fluid or fill the deep spaces, potentially leaving dead space that may lead to complications.[16] In instances where exudate decreases substantially, alginate and hydrocolloid dressings may fail to sufficiently expand to fill the wound cavity, creating voids where the dressing no longer adheres adequately to the wound bed.[15] This reduction in wound bed contact can compromise the effectiveness of the packing, leaving portions of the wound unsupported, which may impede healing and elevate the risk of infection.[15] To mitigate these risks,

Table 2: Summary of popular packing supplies for wound types that are usually deep

Wound Type	Recommended Packing Supplies	Explanation
Surgical Wounds (Open or Dehisced)	Calcium Alginate Specialized Foam Dressings Gauze	Calcium alginate absorbs exudate and helps maintain moisture. Foam dressings can help fill dead space, and gauze may be used for drainage and short-term management.[4,15,18,19]
Diabetic Foot Ulcers	Gelling Fibre Calcium Alginate	Gelling fibre and calcium alginate maintain a moist environment and absorb excess exudate. This helps manage moisture levels in diabetic foot ulcers, preventing infection and promoting granulation tissue formation.[4,15,18,19]
Stage 3 and 4 Pressure Injuries	Specialized Foam Dressings Calcium Alginate Gelling Fibre	Foam dressings help cushion and absorb moisture, while calcium alginate and gelling fibre dressings support healing by absorbing exudate, preventing dead space, and promoting the formation of granulation tissue.[4,18,19]
Abscesses	Hypertonic Gauze Ribbon Iodine-Based Dressings	Hypertonic gauze helps manage exudate and prevents premature closure. Iodine-based dressings help control infection by reducing bacterial load.[4,18,19]
Traumatic Wounds	Saline-Soaked Gauze Specialized Foam Dressings	Saline-soaked gauze helps cleanse and maintain a moist environment. Foam dressings help fill dead space and cushion the wound, preventing further trauma while simultaneously promoting healing.[4,18,19]
Chronic Wounds (Venous Leg Ulcers)	Hypertonic Gauze Ribbon Gelling Fibre	Hypertonic gauze ribbon manages exudate by pulling moisture out, while gelling fibre helps with autolytic debridement and managing exudate in chronic wounds.[4,15,18,19]

clinicians may need to adjust or replace the dressing more frequently to maintain optimal coverage and wound contact as healing progresses.[15] While gel-forming dressings are advantageous in managing high exudate, their shrinking properties as moisture levels decrease require careful monitoring, particularly in deep, tunnelling, undermining, or cavity wounds.[14,15]

Step 3: Selection Of Dressing Types

Wound packing, along with other wound care techniques, plays a crucial role in preventing and mitigating edge detachment, which occurs when the edges of a wound separate from the underlying tissue, creating spaces where fluid, bacteria, and necrotic tissue can accumulate.[17] Proper dressings and packing techniques fill dead spaces (Figure 4), providing support to the wound bed and reducing the likelihood of edge detachment.[17] In this sense, selecting the appropriate dressing is essential to preserving wound edge integrity. Flexible and moisture-retentive dressings, such as alginates or foam dressings, should be applied to conform to the wound and support the edges, allowing for proper epithelialization. Rigid or poorly fitted dressings may worsen edge detachment by pulling on the wound margins or failing to accommodate changes in exudate levels. Regular assessment of wound edges using frameworks like TIMERS can help identify early signs of detachment.[17] Additionally, applying protective barrier films or ointments around the wound edges can prevent mechanical stress and moisture buildup, further preserving the integrity of the wound margins. By addressing these aspects, wound care professionals can significantly improve wound healing outcomes and minimize the risk of complications related to edge detachment.

Types Of Packing Dressings

Packing deep wounds requires careful selection of dressings that not only fill the wound cavity but also promote optimal healing by managing exudate, maintaining moisture balance and preventing infection. Various types of packing dressings are available, each designed to address specific wound conditions and needs. These dressings, when used correctly, support wound healing by absorbing excess fluid, maintaining the right environment and preventing further tissue damage. The following are some of the most commonly recommended packing dressings for managing deep wounds. Table 2 provides a summary of recommended packing dressings for wound types that are usually deep.

Calcium Alginate: Alginates transform into a gel upon contact with wound exudate, making them ideal for wounds with moderate to heavy drainage.[19] For optimal packing depth, the dressing should be applied in sufficient quantity to fill the wound cavity without overpacking.[10] For deep wounds with significant exudate, calcium alginate helps maintain moisture control, and if impregnated with silver it can also control local infection, but careful application is required to avoid necrosis.[18,19]

Foam Dressings: Foam dressings are designed to manage moderate exudate and are effective in filling wound cavities.[19] The depth of packing ensures that foam absorbs excess fluid without compressing underlying tissue. Foam's ability to conform to the shape of the wound makes it suitable for deep wounds, such as stage three and four pressure ulcers, where both cushioning and moisture balance are necessary.[18,19]

Gauze: Commonly used for mechanical debridement or short-term packing, gauze must be packed at an appropriate depth to avoid over-compression, which could impede blood flow and delay healing.[19] Underpacking leaves dead space, which encourages bacterial growth. Because gauze can dry out and adhere to the wound bed, it is best used for wounds requiring frequent dressing changes, with light packing to avoid excessive pressure.[18,19]

Gelling Fibre: Gelling fibre dressings expand and form a gel when absorbing exudate, making the packing depth essential to allow this transformation.[19] These dressings support moisture retention and autolytic debridement, crucial for managing deep wounds with heavy exudate. Gelling fibres effectively fill dead space and are ideal for wounds requiring moisture management and

debridement.[18,19]

Hypertonic Gauze Ribbon: Hypertonic gauze ribbon creates an osmotic effect that pulls fluid out of the wound, which is especially beneficial for heavily exudating wounds or abscesses.[19] The packing depth must be carefully controlled to avoid over-compression.[18] When used appropriately, hypertonic gauze effectively manages moisture and maintains an environment conducive to healing in wounds with heavy drainage or chronic conditions like venous leg ulcers.[18,19]

Step 4: Follow-up And Documentation

To ensure clarity and continuity of care for incoming HCPs, it is essential to be as accurate as possible with documentation using the clock method, as described previously, to record the location and depth of tunnelling, undermining, or sinus tracts.[20-22] Additionally, it is important to document the type and length of packing, the dressing applied, and the patient's response. When ethically appropriate and with consent, photographing the wound before and after packing can provide a clear visual record of the wound condition and progression (Figures 5 and 6). For wounds with tunnelling or sinuses, specify the length of packing used.[20-22] Regular monitoring and thorough recording of wound edges, particularly any detachment, using the TIMERS framework, are crucial for tracking healing progress and ensuring smooth transitions between shifts.[7]

Comprehensive documentation should also include ongoing assessments of wound progression to detect complications early. Accurate records of the type and length of packing or dressing used are vital for ensuring continuity of care, especially during rotation of professionals or absences. Detailed documentation allows subsequent caregivers to maintain optimal care, track healing and intervene early if necessary. Additionally, as the wound heals, the need for more or less packing should be evaluated and adjusted based on regular assessments during dressing changes. If possible, and ethically justified, photographs can provide valuable visual evidence of the wound's progress.

Discussion

This critical review of the literature revealed and/or reinforced some key points.

During the proliferation stage of wound healing, keratinocytes play a critical role by migrating from the wound edges to the centre, quickly covering the wound surface and forming a new epithelial layer.[1-3] This process is vital because it restores the skin's protective barrier, preventing further damage and contamination. For superficial wounds, the migration of keratinocytes is both efficient and beneficial, as the epidermal layer is restored rapidly with minimal tissue remodelling.[1-3] The newly formed epithelial layer helps maintain the skin's integrity and serves as an essential defence mechanism by sealing the wound and reducing the risk of infection from external pathogens.[2,4,13]

In contrast, large wounds with significant tissue deficits present more challenges during this stage.[4,12,13] In these cases, the wound surface may close before the wound depth has sufficiently reduced, or before tunneling and undermining have resolved. This premature closure leaves dead space beneath the new skin, creating an environment where bacteria can proliferate and increasing the risk of abscess formation.[4,12-14] This is particularly concerning as the hidden infection can progress, complicating the healing process and requiring more intensive interventions such as antibiotic therapy.[2,4]

Wound packing is designed to prevent such premature closure by filling dead spaces, thus promoting proper healing from the base of the wound upwards and reducing the risk of abscess development.[4,12,13] However, improper packing can introduce its own set of complications. Overpacking the wound can block natural drainage, leading to fluid buildup and a higher risk of infection.[8,11-13] Moreover, if the packing material is too tightly packed, it can bunch up, exerting excessive pressure on the wound bed, which may impede blood flow and cut off the oxygen and nutrients required for healthy granulation tissue formation, leading to delayed healing and—in some cases—tissue necrosis.[8]

In this context, it is essential for HCPs to pay

close attention to detailed wound care for wounds with edge detachment and/or tunnelling. This attention is crucial for promoting timely and effective healing. Regular updates in knowledge and the incorporation of scientific evidence into clinical practice, are also fundamental. Additionally, thorough documentation of assessments and interventions in patients with wounds is necessary to ensure continuity of care, especially considering potential shifts in HCPs and the need for consistent follow-up.

Conclusion

The findings of this critical review served as the foundation for developing a step-by-step guide on wound packing techniques and dressing selection for managing deep wounds, with a focus on preventing complications and enhancing quality of life. This guide emphasizes the importance of regularly assessing and reassessing wound healing progress, selecting appropriate dressings, and ensuring proper packing, followed by thorough documentation. It highlights the risks associated with improper packing, stressing the need for ongoing education and training for specialized and non-specialized HCPs to deliver optimal wound care. These insights are invaluable for advancing wound care delivery, contributing to enhanced patient outcomes, improved quality of care and better quality of life in clinical practice.

Premature closure of the wound surface without addressing deeper cavities can lead to abscess formation and infection. To optimize healing, clinicians must carefully assess the wound's depth, tunneling and undermining, and choose appropriate dressing materials for each case. This approach prevents premature closure, supports granulation tissue formation and reduces the risk of infection, ultimately improving patient outcomes. Inadequate packing can leave dead space between the wound base and surface, hindering the healing process. Therefore, health-care providers must select packing materials that maintain moisture balance, particularly for highly exudative wounds. Initially, frequent dressing changes may be necessary, with intervals extending as exudate levels decrease. This strategy is essential for optimizing healing and minimizing complications.

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