

So Many Options, So Little Time:

Dressing Selection Tips from the Experts

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Engineering Principles Underlying the Clinical Efficacy of Wound Dressings

One of the primary roles of wound dressings is managing exudate, a serum-based fluid that is secreted from a wound as part of the inflammation process. Exudate contains proteins, nutrients, inflammatory mediators, digestive enzymes, growth factors, waste products, cells (e.g., neutrophils, macrophages) and platelets, and sometimes bacteria and fungi. The exact make-up of exudate is dependent on the wound etiology, infection status and stage of healing.

Wounds must be moist; not too wet and not too dry. Moisture is critical for:

- Preventing the wound from drying out
- Supporting migration of tissue-repairing cells
- Diffusing nutrients to cells
- Diffusing inflammatory mediators (e.g., histamine)
- Diffusing growth factors (e.g., for angiogenesis)

- Transporting signaling molecules between cells for cell-cell communication
- Allowing immune cell migration to reduce bacterial burden
- Allowing tissue-repairing cell migration, i.e., fibroblasts, which synthesize collagen for wound closure

Excess exudate can be harmful. Having too much exudate can degrade the wound via several different damage pathways. For example, if the wound is infected, exudate is a carrier of pathogens within and outside the wound. If a non-healing wound has excess exudate, there likely is a high concentration of proteolytic enzymes, which compromise granulation tissue formation. Excess exudate can also cause softening and weakening of the periwound stratum corneum and dissolving of dermal collagen crosslinks. Decelerated migration of tissue-repairing cells from the wound edges (e.g., fibroblasts and keratinocytes) can also be caused by excessive exudate and the hos-



tile environment that it induces for these cells. Overall, these issues slow the rates of healing and decrease the extent and rate of wound closure, and may even enlarge the wound.

Requirements of Clinically Effective Wound Dressings

Effective wound dressings ensure appropriate moisture balance in the wound by absorbing and retaining excess exudate, maintain normal physiological skin and subdermal temperatures (including in nearby, undamaged tissue), and are impermeable to external fluids and pathogens while still allowing gas exchange. Dressings should mechanically protect the wound and the periwound, and should not disintegrate and must not leave any microscopic or macroscopic (i.e., visually recognized) debris in the wound bed—particularly during dressing changes when the dressing is subjected to pull-out forces—as

this will likely cause chronic inflammation, thereby critically delaying tissue repair and healing. Dressings must be able to handle exudates of different pH and viscosities.

The Structure-Function Principle

In materials science and engineering, the structure-function principle is the idea that microstructure determines properties. For wound dressings, “function” encompasses mechanical, thermal, fluid transport and retention properties, which altogether form metrics of physical and engineering quantitative performance parameters. It is important to remember that physical and engineering characteristics of wound dressings belonging to the same family of products, such as gelling fibre dressings, may differ across manufacturers, and this micro-structure affects the mass transfer and mechanical properties and, ultimately, the functions and clinical performance of the dressings. For example, commercial gelling fibre wound

dressing products, produced by different manufacturers and tested in robotic wound systems in a bioengineering laboratory, exhibited remarkably different fluid handling and stay-intact performance metrics for simulated use sessions in wound systems of a sacral pressure injury and a diabetic foot ulcer.¹

Physical Characteristics: Material Density and Porosity

In addition to the density of a dressing material, connectivity between pores in the micro-structure is crucial. For example, closed-cell foam structures (having unconnected pore spaces) are not good for dressings, as they cannot hold or transfer fluids. Good capillary action (sorptivity) is required for transferring exudate from a primary to a secondary dressing, or from the wound-facing surface of a dressing to its external surface, from which fluids can evaporate to the environment and thereby clear the dressing reservoir for additional inflowing exudate.²

Physical Characteristics: Permeability

Permeability is another critical aspect for the effective function of wound dressings. Permeability depends on porosity (size and shape) and on connectivity. This property determines the flow rate of exudate with a given viscosity at a certain wound temperature through the dressings, which directly impacts the timing

Biofilm

Up to 70% of non-healing wounds may have biofilm. Debridement is key for removing established biofilm. A topical antibacterial dressing should be used immediately after debridement to prevent the biofilm from re-forming. Use of an antibacterial dressing may prevent biofilm formation from occurring.

and frequency of dressing changes. This, in turn, translates to clinician time and cost-effectiveness.

Patient Preferences: Are we meeting their expectations?

Wounds have a major impact on patient quality of life and, therefore, dressing selection must take into account the patient's lifestyle, priorities and goals. Key stressors encountered by people living with non-healing wounds might include wound-related symptoms (e.g., pain, odour, bleeding, exudate), changes to functional status and mobility, changes to emotional and psychological state, negative self-image, financial burden and burden on social relationships. Patients with wounds report high levels of anxiety, frustration, fear and loneliness, as well as depression and difficulty sleeping.

Unfortunately, very little research has been done into what patients prefer when considering different wound dressings. Pain has been identified as a significant predictor of non-concordance with compression bandaging; other concerns include excessive warmth, pruritus and difficulty putting

PRODUCT PICKER Wound Dressing Selection

Clinical Situation	Wound Care Goals	Care Considerations
TISSUE TYPE - Epithelium or granulation	In a HEALING wound: - Protect healing wound - Promote moisture balance	- Select a dressing or dressing combination that can remain in place as long as possible to maintain an appropriate moisture balance
	In a NON-HEALING wound, the above goals PLUS: - Stimulate healing in a non-healing or stalled wound	- Select a dressing that can remain in place as long as possible and maintain moisture balance - If granular tissue is friable (bleeds easily) - Treat the cause of the infection - Consider selecting a primary anti-inflammatory active
		- If the wound is not infected - Consider a pro-inflammatory dressing to "kick start" healing

on footwear and other clothing. Exudate control has also been identified as a key factor in patient satisfaction with a given dressing. High-volume and viscous exudate is often associated with unpleasant odour, painful periwound maceration, increased infection risk and exorbitant care costs due to frequent dressing changes. Leakage from dressings on highly exudative wounds onto clothing, furniture or bed linens can cause embarrassment and social isolation.

Psychological stress also has a major effect on wound healing. Stress activates the 'fight-or-flight' response, which directs critical biological resources away from the wound healing process, thus delaying healing.

How do you determine which dressing to use?

It is important to contextualize the wound in relation to the patient's goals and overall

health-care plan. The acronym **"DRESSINGS?"** can help clinicians remember some of the considerations to keep in mind: **D**imensions: diameter and depth

Resources and costs

Exudate: amount and viscosity

Site: location, contour, movement, contamination

Surrounding area: skin and beyond

Infection (upper or lower) or biofilm

Necrotic or non-viable tissue

Goals: healable, non-healing, non-healable

Suffering: pain and related symptoms

? Questions from the patient and/or care partner(s)

Wounds Canada's Product Picker: Wound Dressing Formulary is an excellent resource for

determining the type(s) of dressing(s) that might be considered for a given patient. You may view it at: <https://www.woundscanada.ca/docman/public/health-care-professional/1114-product-picker-2017-selection-guide-1/file>.

Local Infection and Antibacterial Dressings

Dressing selection should take into consideration the healing potential of the wound:

- Healable: adequate blood supply to heal
- Healable but non-healing: adequate blood supply to heal, but either the patient cannot or will not adhere to the plan of care or the health-care system does not have the appropriate resources
- Non-healable: inadequate blood supply and/or the cause cannot be corrected

Superficial infection should be treated topically, while deep infection should be treated systematically.

References

1. Lustig A, Gefen A. The performance of gelling fibre wound dressings under clinically relevant robotic laboratory tests. *Int Wound J*. 2022, doi: 10.1111/iwj.13761.
2. Lustig A, Alves P, Call E, Santamaria N, Gefen A. The sorptivity and durability of gelling fibre dressings tested in a simulated sacral pressure ulcer system. *Int Wound J*. 2021;18(2):194–208.

