A Shear-Dissipating Multilayer Dressing For Pressure Injury Prevention: What It Means In Practice

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Pressure injuries (PIs) of the heel are common in acute care, long-term care and surgical settings. These injuries often begin as deep tissue damage before becoming visible at the skin surface, making early identification difficult and delaying intervention.[1-6] For that reason, prevention is a primary focus of care. The International Clinical Practice Guideline recommends the use of prophylactic dressings, particularly multilayer silicone-foam dressings, for patients at high risk.[1] However, clinicians are often faced with multiple product options and limited clarity on how these dressings differ in performance. This article aims to translate our recently published research[7] into practical clinical language, with a focus on how dressing design influences the management of shear forces which are recognized as a critical contributor to PI development.

Exposure to shear forces is a key factor contributing to the risk of PIs. Shear in tissues typically occurs when the skin remains relatively stationary against a contacting surface while deeper tissues move, such as during repositioning or when the head of the bed is elevated and gravity pulls the body toward the foot of the bed (See Figure 1).

These internal soft tissue distortions can damage cells, impair tissue perfusion and ultimately contribute to deep tissue injury.[2-5] Research on the causes of PIs has established that sustained shearing of skin and subdermal soft tissues is strongly associated with PI development. In other words, pressure alone does not explain the full risk. For many vulnerable patients, especially those who are immobile, critically ill, sedated or recovering after surgery, it is the combination of pressure and shear, which commonly occurs in clinically relevant

scenarios, that is harmful to cells and tissues.[2-5] In practice, this means that patients who appear adequately supported may still be at risk due to internal soft tissue deformations caused by shear forces.[2-5]

Prophylactic dressings are intended to locally reduce the mechanical forces acting on vulnerable body areas. Their protective effects may include reducing friction at the skin surface, helping manage moisture from perspiration and, most importantly, absorbing and dissipating shear forces before those forces are transmitted to the skin and deeper tissues. However, not all dressings achieve these effects to the same extent. In particular, not all dressings are effective in dissipating shear forces, which is the most important role of a preventative dressing. The internal dressing structure, material properties and how the layers interact under load are key determinants of the protective performance of dressings. This is an important practical point, because products that look similar at the bedside, or that are marketed with similar medical claims, may not behave similarly when exposed to patient movements or transfers causing shear (See Figure 1), to repeated loading, or to moisture exposure.[8]

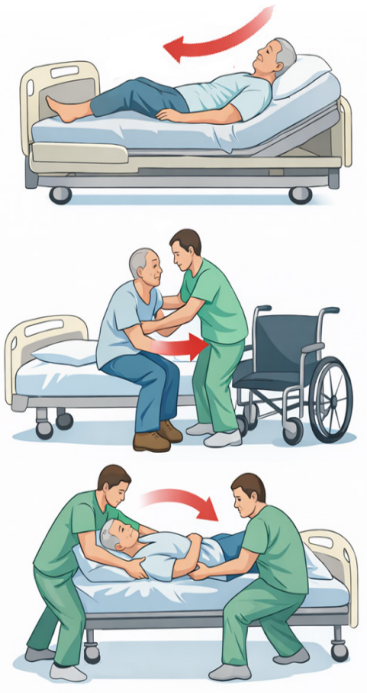

Figure 1: Common clinical scenarios leading to shearing of skin and subdermal soft tissues: Sliding in bed (top), transfer from a bed to a chair (centre) and repositioning in bed (bottom). The support surface alone, as good as it may be, would not be sufficient to protect the skin and subcutaneous tissues from the shearing forces generated in each of these situations. Effective preventative dressings must be placed at the high-risk anatomical sites, particularly at the sacral region and on the posterior heels, to provide focused shear mitigation.

Why Shear Matters In Everyday Clinical Care

From a clinical perspective, shear is typically harder to appreciate than pressure because it is not directly visible (as it occurs internally in the body), and it is also often less intuitive to understand. Yet it is highly relevant to common care situations. A patient may appear comfortably supported on a mattress, but if their body gradually slides downwards in the bed, skin and deeper soft tissues may be exposed to considerable distortions or deformations. The heel is especially vulnerable because it has a relatively small contact area, a prominent bony structure and soft tissues that can be compressed and simultaneously exposed to high shear between the rigid and curved bone and the support surface.[2-5] This helps explain why heel injuries can begin in deeper tissues and only become visible later, when tissue damage is already advanced and presents itself clinically.[4,5] This also explains why prevention must go beyond redistribution of the interface pressure per se. Support surfaces remain essential, but they cannot fully address all the shear occurring within the soft tissues. A dressing placed over a vulnerable heel (or other body regions which are known to be at risk of PI such as the sacrum) can act locally where the risk of damage caused by shear is high. If the dressing is designed appropriately, it may help absorb part of the damaging mechanical energy that would otherwise reach the soft tissues of the patient, where it can lead to cell death and structural tissue damage. That local effect of alleviating shear forces is clinically important because it targets the specific mechanism that often drives PIs in general and deep tissue injury in particular.

The Research

The new Allevyn Complete Care™ (Smith+Nephew Limited, UK) dressing evaluated in the recent published research[7] uses a multilayer design in which the internal dressing layers can slide relative to one another, that is, they are not fixed or glued together (See Figure 2). This feature enables the dressing, also known as ACC, to effectively absorb the

applied shear forces within the dressing itself, which in turn limits the transfer of these forces to the skin and subcutaneous soft tissues. In simple terms, the dressing acts as a "buffer zone" between the patient and the support surface, similarly to how shock absorbers protect passengers in a car from being exposed to high forces when the car crosses a bump on the road. Similarly, instead of allowing most of the shear forces to pass through to the body tissues, the dressing manages much of these forces internally through controlled layer-on-layer movements that occur within the dressing (See Figure 2).

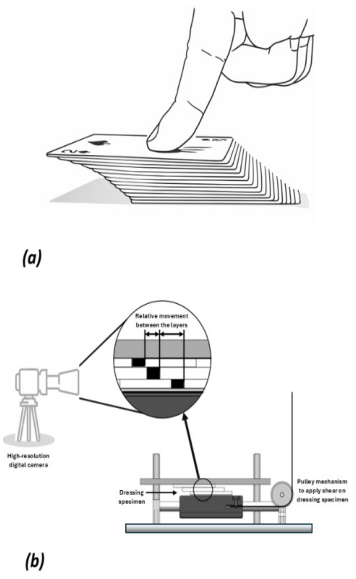

Figure 2: Relative movements of layers within the multilayer dressing dissipates shear forces before they can reach the skin and underlying tissues. (a) A deck of cards provides a good analogy of the layer-on-layer motion occurring inside the dressing. Combined pressure (from the bodyweight, represented by the pressing finger) and shear forces (from patient movements as shown in Figure 1, represented by the cards sliding upon each other) move the top cards, but their ability to slide upon each other prevents the shear forces from distorting the bottom of the stack (representing the dressing interface with the skin). (b) The movement of the layers inside the dressing was evaluated experimentally in a bioengineering laboratory using a custom-made system. The system was used to apply clinically relevant shear levels to the dressing to simulate the layer-on-layer sliding induced by patient movements, and a high-resolution digital camera was used to monitor that relative movement between the dressing layers.[7]

This point is especially important because many products are described as "multilayer," but a multilayer structure alone is not enough. To effectively mitigate shear within a preventative dressing, the dressing must do more than simply contain multiple internal layers. It must use those layers effectively, in a functional way, so that the layers can distort and move relative to each other and dissipate shear motion. At the same time, the dressing must remain structurally stable (intact and structurally functional) under the loading so that this protective effect is maintained over time. Our published work highlights this principle clearly: the protective benefit is not just about thickness or softness, but about how the dressing handles frictional and shear-related energy internally.[6-8]

Another relevant finding is that the protective effect of the dressing was maintained under moist conditions and repeated movement.[7] This matters in real clinical practice because dressings used for prevention are not applied in ideal laboratory dryness. Patients sweat, move, are repositioned and remain on dressings for prolonged periods. A dressing design that performs well only when new and dry may not provide reliable protection in day-to-day care and cannot be applied for several continuous days of PI prevention. The dressing evaluated continued to show strong protective performance under conditions intended to simulate these clinical realities, which strengthens the clinical relevance of the findings.[7]

How The Research Was Conducted

The research combined advanced laboratory testing with computer modeling of the heel.[7] The laboratory work used advanced digital-optical methods to measure how much shear-related mechanical energy the dressing could absorb internally (See Figure 2). Under simulated clinical conditions, the ACC dressing absorbed approximately 93% of that energy.[7] Put simply, most of the damaging shear was managed and dissipated inside the dressing rather than being passed on to the soft tissues of the patient. The computer modeling then examined what this meant for the soft tissues of the heel from a clinical perspective. These computer simulations showed that the dressing substantially reduced soft tissue deformations and stress levels in both the skin and deeper soft tissues, which is important because excessive deformations are strongly associated with massive cell death and soft tissue damage in

the cascade of PI development, i.e., the PI vicious cycle.[2,3] The modeling also showed that the dressing eliminated the highest levels of tissue deformations and stresses, that is, the mechanical loading levels at which tissue breakdown is most likely to begin. This is clinically meaningful because PIs and, specifically, deep pressure injuries often originate at localized sites of high internal soft tissue loading, not simply at the skin surface. A preventative dressing design that reduces these tissue stress peaks may therefore provide protection where it is needed most.

The published study[7] further reported that the dressing substantially lowered the above-median deformations and stresses in both skin and adipose tissues and importantly, the dressing was able to fully eliminate the highest stress exposures in the top quartile of the modeled tissue loading distributions. In practical terms, this means that the dressing did not merely produce a small average benefit, but rather, that it specifically reduced the most dangerous loading concentrations in the soft tissues of the supported posterior heel. That is exactly the effect clinicians would hope for in a prophylactic dressing intended for patients at high risk for heel PIs. Taken together, these findings indicate that this dressing not only reduces overall tissue loading but specifically targets the most harmful stress concentrations associated with PI onset.

What Does This Mean For Clinicians?

For clinicians, the key takeaway is that effective PI prevention depends not only on reducing the interface pressures between the body and a support surface, but also, critically, on managing the shear forces acting on the body region which requires protection. This is highly relevant in patients who are immobile, have impaired sensation, are hospitalized in intensive care and are partially conscious or unconscious, are undergoing long surgical procedures or are otherwise at elevated risk of heel PIs. For these patients, a dressing design which dissipates shear may provide meaningful additional protection complementary to that of the support surface.

The practical implication is not that prophylactic dressings replace established prevention measures such as use of an adequate support surface and routine skin assessments. They do not. Application of a preventative dressing must always be an adjunct, not a replacement, for comprehensive PI prevention strategies. Repositioning, support surfaces, skin inspection, moisture management and individualized risk assessments remain essential. However, when a dressing is used, its primary mode of action should be meaningful local shear mitigation at body regions under risk. On that basis, this dressing is promising because it directly targets a key risk factor, namely shear, that can be effectively mitigated, at least in large part, by a good preventative dressing.

This also matters for education and bedside conversations. Clinicians often hear general statements that prophylactic dressings are beneficial, but they are not always given a clear explanation of why. The published research[7] offers a clinically understandable answer: the dressing works by taking up shear internally, thereby protecting tissues from distortion in shear and focal excess or sustained loading at damaging levels. Framing the mechanism this way may help clinicians make more informed product choices and may also support better adherence to prevention protocols.

Product Selection And Institutional Policy Development

For those involved in product selection for clinical use, formulary decisions, procurement and institutional policy development, product choice should be informed by mechanism of action supported by published peer-reviewed research evidence, not just cost, thickness or the general label "multilayer." This latter distinction is particularly relevant for procurement decisions, where product categories alone (e.g., "multilayer silicone-foam") may not reflect meaningful differences in bioengineering laboratory and ultimately in clinical performance.

For example, thicker dressings are not necessarily better dressings, and multilayer dressings are not necessarily effective shear-dissipating dressings.

What matters for prophylaxis is whether the dressing design can actively absorb and dissipate shear internally (so that soft tissues remain predominantly shielded from the harmful effect of shear forces) while the dressing structure remains stable during the intended period of use. Dressings that actively dissipate shear may provide additional critical protection alongside a support surface, since the dressing focuses on local shear mitigation, which is not easily achieved by a support surface alone, even when using high-end support surfaces. From a systems perspective, investment in effective prevention technologies, and in particular a dressing design that has proved to effectively mitigate shear forces, may help reduce the downstream clinical and financial consequences associated with PIs. Benefits would include, for example, lower treatment burden, shorter stays and less litigation related to preventable harm.

Conclusion

A shear-dissipating multilayer dressing demonstrated the ability to substantially reduce the shear forces associated with heel PI development.[7] By absorbing shear internally and reducing tissue deformations, this type of dressing may offer meaningful clinical benefits. Specifically, the evidence reported for the ACC dressing indicates that it can substantially reduce the transfer of damaging loads to heel tissues and eliminate the highest soft tissue stress concentrations under simulated clinical conditions.[7] For clinicians, the take-home message is that PI prevention should not focus on redistributing pressures alone. Shear is a critical risk factor, and it should be addressed directly by a preventative intervention which focuses on dissipating that shear before it is transferred to the skin and from there to deeper soft tissues. Advanced designs of dressings, which specifically mitigate shear, should therefore be considered as part of all comprehensive PI prevention approaches and clinical programs.

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