Defining a holistic pain-relieving approach to wound care via a drug free polymeric membrane dressing

Wound care practice continuously demonstrates that healing cannot be adequately controlled if a patient’s experience of pain is not managed effectively. Current pain management guidelines do not account for the holistic treatment of pain emanating from a wound — an environment of uncontrolled or rogue inflammation, neuropathy and neuroischaemia. This article investigates how polymeric membrane dressings can interact with the pathology of wounds to correct abnormalities in pain pathways of the nervous system and dampen problematic ongoing pain to enhance the clinical picture of wound healing.

Several studies have demonstrated strong links between patient pain experiences and healing outcomes.1,2,3 This topic has been the focus of intensive research over the past decade, resulting in three ‘Best Practice’ statements4,5,6 and two books dedicated to the ongoing research and teaching.7

It is clear that practitioners must consider wound-related pain as important an issue as their patients do, for it impacts on treatment, and on clinical outcomes. However, practice will only change if all professionals actively engage in care strategies that are proven to minimise trauma and pain in wound care.8

A variety of measures may be taken to reduce or even avoid pain during the period of wound management — for example, the administration of pharmacologically active agents (including opioid analgesics, topical anaesthetics, non-steroidal anti-inflammatory drugs [NSAIDS], anticonvulsants or antidepressants)9. However, recommended pharmacological strategies can be inadequate and often have associated dose-limiting side-effects. Where the origin of wound pain is multifaceted — at times involving a vicious combination of neuropathy, uncontrolled inflammation, oedema and neuroischaemia — it is reasonable to suggest that such pharmacological agents do not offer holistic treatment.

Pain at dressing change must also be considered. Such pain may arise through the removal of adherent dressings,10 which can cause damage to the surrounding skin and the wound bed. Such trauma will increase the time to healing11 and so involve extra time and materials. Pain responses are affected not only by physical injury, but also by the psychological, social, and environmental conditions at any given time12 — thus, apprehension at wound cleansing can also give rise to unnecessary pain in wound patients.3

Fig 1 depicts a rudimentary summary of how pain levels may fluctuate during wound care. In healthy patients, an acute wound (such as an abrasion) can progress to healing within days; however, the more complex pathology seen in a ‘chronic’ ulcer or in a burn wound can be more difficult to control and/or treat and will typically take months to heal. In the long term, this can lead to adverse modifications to the delivery of pain messages to the brain (nociception), which can result in pain symptoms that linger, chronically, in the background (dysaesthesia) or that appear on mechanical or thermal stimulation of the affected area (hyperalgesia and allodynia).13

In a context of background pain, the process of dressing change can impair wound care and pain management, and have a highly detrimental effect on healing.1 It is important, therefore, that when considering the treatment of wound-related pain, a holistic perspective be adopted, which demands

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**References:**

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Figure 1. If we could depict the progression of pain levels in wound care patients over time would they look like this?

When applying this theory to chronic wounds, there are two foci in the nervous system that should be considered:

- Nociceptors (pain sensors) in the tissue bed — at the peripheral level
- The spinal cord — at the central level.

Pain messages themselves are transmitted through the nervous system via action potentials (electrical activity across nerve membranes), which move from peripheral nociceptors to the spinal cord, from which they move to higher centres of the brain where pain is registered. Action potentials are generated by the influx of sodium ions in to nerve cells, which causes electrical activity to move along nerve fibres.

The augmented pain sensations observed in patients with injured or inflamed tissue or nerves are associated with ectopic augmented levels of action potentials being sent from the site of damage. Hence, researchers have investigated the role of sodium ion exchange in this response. Preclinical studies in animal models of tissue inflammation, neuropathy and neuroischemia, together with investigations using clinical biopsies of damaged tissue, have demonstrated that sodium channels — which facilitate the movement of sodium ions during the generation of an action potential — cluster to abnormally high levels in injured tissue. This is associated with a lowering of the threshold of sensory input (mechanical or thermal) needed to evoke an action potential — nociceptors within tissue become ‘sensitised’. This might also explain why abnormal pain symptoms continue to be reported post-healing.

If the contribution that sodium ions make to this pain signal could be dampened, chronic pain symptoms may be reduced (potentially the background pain that exists in chronic wounds). Preliminary data suggest that polymeric membrane dressings elicit their effects by absorbing sodium ions from the outer layers of the epidermis — if not removed, these sodium ions may exacerbate the generation of...
Fig 2. A pooled analysis of pain relief achieved post polymeric membrane wound dressing*  

<table>
<thead>
<tr>
<th>Proportion of patients (%)</th>
<th>Diminished wound pain post-polymeric membrane dressing</th>
<th>Significant or complete pain relief post-polymeric membrane treatment</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>20</td>
<td>40</td>
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<tr>
<td>20</td>
<td>60</td>
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<td>40</td>
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*Data taken from Sessions, 2008

Certainly, the removal of dressings that have adhered to the wound bed causes trauma and significant pain to the patient. Further, this extends time to healing as the wound reverts back to the inflammatory stage at each dressing change. Traditional gauze and paraffin tulle products (such as Jelonet) have repeatedly been shown to adhere to the wound bed in this way, and if left in situ, granulation tissue grows into the product mesh, exacerbating adherence, with wound pain and trauma on removal.14,45,46

It is a professional concern that, patients are still subjected to wound cleansing and dressing strategies that exacerbate their existing pain, and which often cause further trauma to delicate healing tissues. Wounds do not routinely require cleansing. Wiping the wound bed with gauze traumatizes fragile granulation tissue, and on virtually every occasion it is a painful, unpleasant experience for the patient. To use a genuinely non-adherent dressing and limit unnecessary traumatic wound cleansing at dressing change could also lower patient apprehension and their experience of pain. These attributes are recognised characteristics of polymeric membrane dressings.14,15,47

To refer back to the issue of exacerbated pain responses at dressing change — compounded by the continuous background pain associated with chronic wounds (see Fig 1) — this review article has presented data indicating that polymeric membrane dressings could impact on inflammation, its dissemination beyond a site of injury, nociceptor activation and the neuromodulation that is linked to tissue damage — there is certainly evidence that they are linked to pain relief. If we relate this to a ‘dampening’ of background wound pain, and also consider the non-adherence and self-cleansing characteristics of polymeric membrane dressings, we might propose an amendment to the clinical picture (Fig 3).