Chronic Wound Care Management and Research

Pressure ulcer prevention and treatment: use of prophylactic dressings

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Abstract: The management of pressure ulcers is challenging for health care providers across disciplines. Pressure ulcers have significant impact on emotional and physical wellbeing, quality of life, and health care costs. The use of wound dressings could be an important and cost-effective strategy in preventing pressure ulcers. The main types of dressings that are examined for this purpose in the literature are foam, hydrocolloid, and films. Some small studies have shown a preventative role for sacral dressings with low-shear backings, though they raise concerns about over-hydration of the skin. Further research demonstrates the application of barrier films over bony prominences to have a prophylactic effect; however, adhesive dressings can also contribute to shearing forces on the skin. There is a vast body of research that examines the use of dressings to prevent pressure ulcers; however, there is limited high-level evidence, such as randomized control trials. A 2013 Cochrane review indicated that there is a paucity of high-level evidence to support the prophylactic use of dressings to prevent pressure ulcers; this paper will examine the emerging literature and consider its relevance to pressure ulcer prevention protocols.

Keywords: quality of life, hydrocolloid dressing, topical agent

Introduction
Pressure ulcers are a major cause of mortality, morbidity, patient suffering, and cost on the health care system worldwide. The management of pressure ulcers is a compounding challenge to health care professionals across disciplines. Individuals who acquire pressure ulcers often require long-term interventions, representing a large economic burden to the health care system. It has been estimated that in Australia, these injuries increase the length of hospital stay and subsequently incur $285 million in cost annually.¹ Since 2008, the Centers for Medicare and Medicaid Services no longer reimburses American hospitals at a higher rate for any pressure ulcer that occurs during a patient’s hospitalization, which provides a strong financial stimulus for pressure ulcer prevention protocols to be implemented.² Indeed, the profound impact of pressure ulcers on the emotional, physical, mental, and social domains of life has been shown in different studies.³ Current management strategies target pressure-relieving surfaces: patient repositioning, nutritional support, and application of protective dressings to prevent pressure injuries. Dressings are accessible and easily implemented devices; however, they can also contribute to high health care costs. Therefore, it is important to evaluate their efficacy.

Although various topical agents and protective dressings have been historically and anecdotally used as preventative strategies to maintain healthy skin, conclusions of the 2013 Cochrane review do not support this practice.⁴ Nonetheless, the application of
dressings and other topical products is prevalent in guidelines regarding pressure ulcer prevention.\textsuperscript{5,6}

**Review of the classification and risk factors**

A pressure ulcer is defined as: “localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear.”\textsuperscript{11} A combination of shear and pressure leads to a large magnitude of tissue injuries near bony prominences. A shearing force acts parallel to the skin surface while the base is stable. Shearing forces occur when a patient cannot support their own weight and maintain postural alignment. Shearing forces significantly decrease the threshold of tissue damage. Shearing force is a factor when a person slides or the angle of the bed or chair changes. The term “shear” describes both shear stress and force.\textsuperscript{7} Friction is the force due to resistance between the motions of two objects when they are touching.\textsuperscript{7} Another influential factor would be skin pH level. Skin integrity is optimized in the pH of 4–6.8.\textsuperscript{3}

Studies have shown that the majority of hospital-acquired pressure injuries had an emergency stay of more than 2 hours.\textsuperscript{9,10} This study emphasizes the role of preventative measures starting from emergency department admissions. The type of fabric next to the skin and lack of moisture affect the amount of shear and pressure and subsequently tissue damage.\textsuperscript{7,10}

A pressure ulcer can be diagnosed at any stage; however, initially (stage I) it may appear as a localized area of non-blanching erythematous skin, often over a bony prominence or adjacent to a medical device (i.e., a nasogastric feeding tube). However, pressure ulcers caused by medical devices on mucous membranes are not staged using the National Pressure Ulcer Advisory Panel (NPUAP)/European Pressure Ulcer Advisory Panel (EPUAP)/Pan Pacific Pressure Injury Alliance (PPPIA) staging system as analogous tissue comparisons of the mucous membrane to the skin cannot be made.\textsuperscript{6} Black et al have described the use of dressings to prevent pressure ulcers from medical devices.\textsuperscript{11} The diagnosis can be confirmed if the lesion resolves when pressure is relieved.

**Prophylactic role of dressings**

A wide range of dressings has been studied for the prevention of pressure ulcers. The three main dressings that are primarily reviewed in the literature are:

- **Film dressings**
- **Hydrocolloid dressings**
- **Foam dressings**

In the intact skin of category-stage I pressure ulcers, hydrocolloids and films are indicated in various guidelines. Emollients and film-forming barriers have been used to protect the skin from friction, shear, and moisture-associated damage. More recently, foams and absorptive dressings have been used in clinical trials. Aquacel\textsuperscript{8} foam dressing has been used in a prospective evaluation of 42 patients (mean Braden score: 13.8) with a decrease in incidence of pressure ulcers in populations at risk from 4.3% to 1.8%.\textsuperscript{12} In this study, all patients had altered skin integrity; however, the use of topical agents prevented the injuries from progressing to full thickness. Philbin also reported seven patient case evaluations using the same dressing.\textsuperscript{13} Table 1 summarizes the evidence for the use of dressings for pressure ulcer prevention.

A 2013 Cochrane review concluded that there was insufficient randomized control trial evidence to support or refute the use of dressings, creams, or lotions to prevent pressure ulcers.\textsuperscript{4} Five clinical trials (940 patients) with potential bias, comparing topical agents with a placebo, were included. A risk ratio of 0.78 (95% confidence interval 0.47–1.31; P-value 0.35) is indicative of no beneficial effect of topical agents overall.\textsuperscript{4}

The same study reviewed four trials (561 patients) on the use of dressings over bony prominences and showed a reduced pressure ulcer incidence with a risk ratio of 0.21 (95% confidence interval 0.09–0.51; P-value 0.0006).\textsuperscript{4}

Barrier films were found to have both a protective and treatment role in preventing skin breakdown in a very small study population. By applying an appropriate barrier film or cream, the product mimics the skin’s natural function of protecting and moisturizing the skin underneath. This 95-patient study did not include a Braden score to assess pressure ulcer risk for inclusion in the study, however, most participants had a noted improvement in clinical risk for pressure ulcer development, such as skin maceration. It should be noted, however, that the particular barrier film and cream that were examined were provided by a third-party medical company potentially contributing to funding bias.\textsuperscript{14} In a study by Schaefer et al, the concern regarding over-hydration of the skin by prophylactic dressings was raised, and so dressings with an absorptive structure were recommended.\textsuperscript{15} Doughty reminds us of the clinical importance for the accurate differential assessment of trunk wounds as a critical element for their effective management.\textsuperscript{16}

**Silicone dressings to prevent pressure ulcers**

There is a growing amount of clinical evidence regarding the role of dressings to prevent pressure ulcers. In 2009,
Table 1 Evidence for dressings to prevent pressure ulcers

<table>
<thead>
<tr>
<th>Study</th>
<th>Subjects</th>
<th>Type of dressings</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ohura et al&lt;sup&gt;24&lt;/sup&gt; (2008) Japan</td>
<td>Porcine skin model; pressure applied from a sensor and measurements taken</td>
<td>Five dressings in three categories (foams, films, hydrocolloids) evaluated versus a control of no dressing</td>
<td>All dressing materials reduced pressure compared to the control group</td>
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<tr>
<td>Torra I Bou et al&lt;sup&gt;22&lt;/sup&gt; (2009) Spain</td>
<td>111 patients completed a study from three long-term care facilities and three home care programs</td>
<td>Polyurethane foam dressing to heel</td>
<td>Significant reduction in heel pressure ulcers with foam dressings. 3.3% in the foam dressing group developed pressure ulcers compared to 44% in the Soffban/gauze group.</td>
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<tr>
<td>Brindle&lt;sup&gt;21&lt;/sup&gt; (2010) USA</td>
<td>41 high-risk patients from a total of 93 patients in their surgical cardiac ICU over 3 months</td>
<td>Silicone foam dressing to sacrum</td>
<td>0/41 patients developed a pressure ulcer 3 patients developed a pressure ulcer after use of dressing was discontinued</td>
</tr>
<tr>
<td>Brindle and Wegelin&lt;sup&gt;23&lt;/sup&gt; (2012) USA</td>
<td>Nonrandom designation of 100 consecutive patients in a cardiac surgical ICU</td>
<td>Two groups: standard treatment versus intervention group with treatment of a foam dressing to the sacrum</td>
<td>Eight pressure ulcers developed in four of the 35 patients (11.7%) in standard preventive care group. One pressure ulcer developed in the 50 patients in the intervention group (2.0%) with the silicone foam dressing. No statistically significant difference between the two groups; authors suggested that the absence of statistical difference reflects a type 2 error caused by insufficient power Previous prevalence rate: 12.3%.</td>
</tr>
<tr>
<td>Chaiken&lt;sup&gt;17&lt;/sup&gt; (2012) USA</td>
<td>Non-experimental prospective study of ICU patients over 35 months. 273 patients in an ICU received the intervention</td>
<td>Compared prevalence rate in ICU over 35 months before and after care protocol changes to include use of foam dressing to the sacrum</td>
<td>Five patients developed sacral pressure ulcers for a hospital-acquired pressure ulcer incidence rate of 1.8% after routine use of foam dressing applied to sacrum 53 ICU patients had pressure ulcers: 12.5% incidence compared to three out of 62 patients (4.8%) who developed pressure ulcers after routine application of the foam dressing became standard of care Previous prevalence rate: 12.3%.</td>
</tr>
<tr>
<td>Walsh et al&lt;sup&gt;14&lt;/sup&gt; (2012) USA</td>
<td>3-month data collection on ICU patients</td>
<td>Preventive application of foam dressing to the sacrum</td>
<td>0.05; heel pressure ulcers 5 versus 10, P=0.02) and overall 7 versus 27, P=0.0002 Zero pressure ulcers with initiative of this preventive protocol</td>
</tr>
<tr>
<td>Kiely&lt;sup&gt;25&lt;/sup&gt; (2012) USA</td>
<td>Pilot study of use of a silicone foam in acute care</td>
<td>Foam dressing applied to sacrum of patients with Braden score of 18 or below to prevent skin breakdown</td>
<td>One of the 52 patients developed a pressure ulcer (stage II) Fewer sacral (2 versus 8, P=0.05; heel pressure ulcers 5 versus 10, P=0.02) and overall 7 versus 27, P=0.0002</td>
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<tr>
<td>Cubic et al&lt;sup&gt;22&lt;/sup&gt; (2013) Australia</td>
<td>Nonrandomized experimental study of 51 patients over a 2-month period of time based on the Waterlow Pressure Ulcer RCT of patients in ED followed into ICU (n=219) with prophylactic dressing used versus control group of no silicone dressing</td>
<td>Application of silicone dressing to sacrum of high-risk patients from the emergency department transferred to the medical ward</td>
<td>Fewer sacral (2 versus 8, P=0.05; heel pressure ulcers 5 versus 10, P=0.02) and overall 7 versus 27, P=0.0002 Zero pressure ulcers with initiative of this preventive protocol</td>
</tr>
<tr>
<td>Santamaria et al&lt;sup&gt;19&lt;/sup&gt; (2013) Australia</td>
<td>RCT of patients in ED followed into ICU (n=219) with prophylactic dressing used versus control group of no silicone dressing</td>
<td>Silicone foam dressing applied to heel and sacral area</td>
<td>One of the 52 patients developed a pressure ulcer (stage II) Fewer sacral (2 versus 8, P=0.05; heel pressure ulcers 5 versus 10, P=0.02) and overall 7 versus 27, P=0.0002 Zero pressure ulcers with initiative of this preventive protocol</td>
</tr>
<tr>
<td>Philbin et al&lt;sup&gt;11&lt;/sup&gt; (2013) USA</td>
<td>Case study of one hospitalized patient led to a prospective evaluation of 42 patients with Braden Scale scores of 18 or below</td>
<td>Foam dressing applied to sacral area</td>
<td>Preintervention rates ranged from 0% to 17.2% while post-implementation rates of pressure ulcers ranged from 0% to 5.2% with an average of 1.8% Subjects in silicone foam dressing group had significantly lower occurrence of pressure ulcers compared to patients in the control group (6% versus 46%, χ²=21.722, P&lt;0.001)</td>
</tr>
<tr>
<td>Park&lt;sup&gt;20&lt;/sup&gt; (2014) South Korea</td>
<td>Nonrandomized comparison cohort study of 102 patients in two ICUs</td>
<td>52 in group with standard care plus silicone foam dressing and 50 in group with standard care with no foam dressing for prevention</td>
<td>Preintervention rates ranged from 0% to 17.2% while post-implementation rates of pressure ulcers ranged from 0% to 5.2% with an average of 1.8% Subjects in silicone foam dressing group had significantly lower occurrence of pressure ulcers compared to patients in the control group (6% versus 46%, χ²=21.722, P&lt;0.001)</td>
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Abbreviation: ICU, intensive care unit.

Torra I Bou et al reported a significant reduction in heel pressure ulcers in persons in long-term care facilities and home-care agencies when foam dressing rather than a protective heel bandage (Soffban and gauze) was used. In this study, participants who received the gauze bandage had a 44% risk of developing a pressure ulcer compared with the 3.3% represented by the foam dressing. Bindle et al conducted some of the earliest studies using critically
ill patients. In one of these observational studies, none of the 41 high-risk patients who had a silicone dressing prophylactically applied to their sacrum developed a pressure ulcer. In a follow-up nonrandomized study of 100 consecutive patients in the cardiac surgical intensive care unit, Brindle and Wegelin reported that four of the patients in the standardized care group developed pressure ulcers compared to one out of 50 patients in the intervention group that had a foam dressing prophylactically applied to the sacrum. A 2013 study by Cubit et al demonstrated that application of a protective sacral dressing with low-shear backing is a simple preventative strategy to reduce the risk of pressure ulcers. The results comparing the 51 patients in the interventional group to patients with similar demographics demonstrated that the control group was 5.4-times more likely to develop pressure ulcers. With this growing amount of evidence, the NPUAP/EPUDP/PPPIA included a recommendation in their 2014 Pressure Ulcer Guideline. It states “Consider applying a polyurethane foam dressing to bony prominences (eg, heels, sacrum) for the prevention of pressure ulcers in anatomical areas frequently subjected to friction and shear (strength of evidence B).”

Conclusion
Chronic pressure ulcers pose some complex challenges for patients that include excess drainage, odor, pain, decreased participation in activities of daily living, and increased need for caregiver and health care support. It is indisputable that appropriate use of dressings to treat pressure ulcers is an important dimension to enhancing a patient’s quality of life.

The best management of pressure ulcers is prevention, through a variety of means, including nutritional support, proper supportive surfaces, frequent movement or turning, as well as the appropriate use of dressings.

There remains a gap in the literature surrounding the use of dressings and topical agents to prevent the development of pressure ulcers. While a fair amount of literature has been generated since the Cochrane review on this topic, study sizes are small mostly non-randomized in design. Stronger randomized control trials and case series are needed in order to support the guidelines in this area. Dressings certainly play a role in the treatment of pressure ulcers as part of a multifactorial treatment plan. Stronger evidence to support a particular type of dressing is needed.

Disclosure
The authors report no conflicts of interest in this work.

References


