The outcomes of barrier protection in periwound skin and stoma care

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Abstract

This article considers the anatomy and physiology of the skin, wound healing, excoriation, maceration, peristomal skin and the importance of periwound protection. The results of a 54-patient study of the use of barrier film forming skin protection in periwound skin are presented and a 10-patient healthy volunteer experimental evaluation. The results confirm the effectiveness of barrier protection in healthy skin in an experimental evaluation and a 54-patient study requiring periwound protection.

Key words: Pressure ulcer ■ Stoma ■ Skin care ■ Skin barrier

The skin

The skin is the largest organ of the body and comprises several layers. The outer layer is the epidermis and the deeper layer the dermis, which contains the blood vessels, hair follicles and sweat glands. This forms a barrier between the internal organs and the environment, offers cushioning to underlying tissues and requires care throughout life. Skin performs the functions of absorption, excretion, protection, secretion, thermoregulation, pigment production, sensory perception and immunity (Hampton and Stephen-Haynes, 2005; Woo et al, 2011). Damage to the skin compromises the barrier, and can have a range of effects, including discomfort and increased risk of infection and further skin breakdown (World Union of Wound Healing Societies (WUWHS), 2007). While a wide range of factors can increase the vulnerability of skin to damage, excessive moisture on the skin surface and dryness of the skin are among the most common factors (Gray et al, 2011; White-Chu et al, 2011). These factors are exacerbated by the structural change that occurs during ageing, including a decrease in sweat glands, decreased vascular function, epidermal thinning, reduced elasticity and slower wound healing (Butcher and White, 2005).

An increase in skin fragility is often associated with the ageing process, which leads to a reduction in blood vessels, nerve endings and collagen, leading to a decrease in sensation, temperature control, rigidity and moisture retention (Baranoski and Ayello, 2004).

Exudate production

Exudate is defined as fluid leaking from a wound. It plays a central role in wound healing and is a normal part of the inflammatory process (Thomas, 1997). It is mainly water, but also contains electrolytes, nutrients, proteins, inflammatory mediators, protein ingesting enzymes, growth factors and waste products, as well as various types of cells (Romanelli et al, 2010). The production of wound exudate occurs as a result of vasodilation during the early inflammatory stage of healing under the influence of inflammatory mediators, such as histamine and bradykinin. Its appearance should be serous, clear to straw-coloured or serosanguinous, clear to pink-coloured fluid in the wound bed, keeping the wound moist and promoting healing (White and Cutting, 2006). Until wound closure, there will be a variable flow of exudate from the wound. The ideal level of exudate necessary for healthy uncomplicated healing is not known (Vuolo, 2004).

In the chronic wound, exudate contains proteolytic enzymes and other components not seen in acute wounds (Cutting, 2003). This type of exudate has justifiably been termed ‘a wounding agent in its own right’, because it has
the capacity to degrade growth factors and periwound skin and is predisposed to inflammation.

The control of moisture is a key function of the skin, contributing to the maintenance of skin integrity, and when intact, offers a protective barrier. In order to develop an effective management approach, the clinician must be able to accurately assess and understand the implications of the composition and quantity of exudate present in the wound (White and Cutting, 2006). Failure to understand and manage the role of exudate can lead to exudate saturation and leakage onto the surrounding skin with the potential to damage and prolong wound healing (Rich and McLachlan, 2003).

**Moist wound healing**

The work of Winter (1962) identified the importance of moist wound healing nearly 50 years ago. The balance between too little and excess moisture is not fully understood (Viuolo, 2004). During wound healing, keratinocytes from the wound edge migrate over the wound, providing epithelialisation. Several factors can affect this, including inflammation in the underlying tissue, which causes degradation of the surface keratin (Zillmer at al, 2006), thus compromising the barrier function of the periwound skin. This impaired barrier function also increases susceptibility to exudate, hinders healing and creates an environment that is conducive to bacterial proliferation and may lead to the development of biofilm (Wolcott et al, 2010).

Several factors lead to an increase in exudates in the periwound area, including periwound inflammation, bacterial infections and uncontrolled oedema. While a moist environment supports the migration of epidermal cells, the management of exuding wounds warrants barrier protection.

**Excoriation**

Excoriation is inflammation of the skin surrounding the wound (periwound skin), caused by an irritant. The irritant may be bacteria or destructive components in the patient's own exudate, or more specifically, proteolytic enzymes in the wound exudate. A group of proteolytic enzymes called matrix metalloproteinases (MMPs), which are released from white blood cells, play a vital role in the autolysis of necrotic tissue, damaged collagen and elastin, therefore debriding and cleansing devitalised tissue. MMP activity is controlled by tissue inhibitor of matrix metalloproteinases (TIMPs) (Hampton and Stephen Haynes, 2005).

In an acute wound, such as a surgical wound or a new trauma wound, these two components are balanced in such a way that only devitalised tissue is degraded. However, in a chronic wound, MMPs become more prolific and TIMPs less available. This imbalance results in a destructive exudate that causes damage to any skin tissue it comes into contact with (Hampton and Stephen Haynes, 2005).

**Periwound healing protection**

Periwound skin damage can occur around chronic wounds as a result of excessive moisture, due to wound exudate and damage from inflammatory enzymes in the exudate (Williams, 2010; WUWHS, 2007). The resulting degradation of keratin compromises the barrier function of the periwound skin and can result in further skin breakdown that may enlarge the wound (Cameron et al, 2005; Guest et al, 2011).

When dressings are repeatedly applied and removed, care must be taken to protect the skin. The effect of the repeated action is exacerbated by the structural change that occurs during ageing, including a decrease in sweat glands, decreased vascular function, epidermal thinning, reduced elasticity and slower wound healing (Butcher and White, 2005).

**Skin stripping and integrity**

Adhesives spread over the skin surface into crevices and surface detail. The effectiveness of the adhesive is dependent on the adhesive chemistry, the risk of irritation from the adhesive, allergic reaction to the materials, minor inclusions in the adhesive system, which can cause contact dermatitis, and the restriction of transpiration of moisture by the adhesive product (Berry et al, 2007). The removal of adhesive products will remove loosely bound epidermal cells and, with repeated use of adhesive products, can strip away varying amounts of the stratum corneum (superficial epidermis) layer (Dykes et al, 2001; Zillmer et al, 2006). This increases the trans-epidermal water loss, leading to a burst of mitosis in the basal epidermal cells. The ensuing inflammatory skin reaction leads to skin breakdown, which changes the skin's barrier function.

Dressing and tape damage can present as skin discolouration on intact skin, contact dermatitis or broken, stripped skin. It tends to represent the shape of the dressing or tape, but this is not always the case, due to the uneven distribution of adhesive (Zillmer et al, 2006).

Further complications can result from the effects of ageing on the skin, where there is a loss of dermal thickness and a reduction in skin elasticity. Indeed, most damage is created when dressing or tape is removed from fragile, incontinence/exudate damaged or circulatory-compromised skin. Skin stripping is seen in a number of particular groups—elderly, fragile, paediatrics, epidermolysis bullosa (EB) and those with a stoma. Therefore, care must be taken to protect the skin when medical adhesive devices are repeatedly applied and removed.

**Maceration**

Maceration is an indication of excessive exudate, which has the potential to lead to further wound breakdown. It is caused by over-hydration of the wound and the periwound skin, which becomes saturated, white and friable. If not corrected by effective management, the macerated skin will break down, leading to wound extension (Fletcher, 2002; Stephen-Haynes, 2008). A protective agent can be applied to reduce risk of maceration and excoriation (Cameron, 2004). Macerated skin is weaker than non-macerated skin, as it is damaged by physical trauma and eroded by proteolytic enzymes in the exudates (Young, 2000; Fletcher, 2002).

**Quality of life and skin care**

A literature review by Moore and Cowman (2009) identified several issues which occur frequently in patients with pressure ulcers, affecting their quality of life. These include pain and several wound-related issues, including maceration, excoriation, skin stripping and management of exudates.
Peristomal skin

102,000 people have a stoma in the UK and a large proportion of those will have experienced some sort of stoma complication or peristomal skin problem (Black, 2009). Stomal complications, such as leakage, maceration and skin-stripping on removal, are common and occur frequently after the stoma has been fitted (Lynch et al, 2008). The integral adhesive wafer of stoma appliance is made of hydrocolloid, which aims to protect the skin from faeces and urine. The tissue surrounding a newly created stoma may become inflamed or oedematous shortly after surgery, and the fit of the flange may need adjustment as the surrounding tissue returns to normal. Problems with skin creasing around the stoma may also cause leakage (Burch, 2013).

Poor technique, repeated applications and pre-existing skin conditions can lead to peristomal skin problems. As Lyon and Smith (2010) note, patients who physically pull their stoma appliance off to remove it, rather than easing it from the skin, are more likely to suffer from peristomal skin breakdown. Berry et al (2007) observe that appliance removal will inevitably lead to the removal of loosely bound epidermal cell layers and that more cells will be removed as the process continues. Williams et al (2010), in an 80-ostomate study, reported that 68% of patients had peristomal skin problems with repeated application and removal of stoma appliances, which affected peristomal skin.

Therefore, an important objective of stoma care is to maintain good peristomal skin. Skin around the stoma should be clean, dry and intact, with the objective of there being no difference between peristomal skin and the remainder of the healthy abdominal skin. Appropriate assessment can help the clinician to consider the potential effect of exudates on the periwound and peristomal area.

Dowsett (2011) suggests this should include:
- A full and detailed assessment of the patient
- The impact of wound exudate on the patient’s quality of life
- Assessment of the wound
- Assessment of the periwound skin
- Assessment of the type and amount of exudate
- Assessment of the current dressing regimen and its effectiveness at managing exudate.

This offers a comprehensive framework for a holistic approach to care and its implementation would contribute to protecting the periwound and peristomal area.

Results from the Sorbaderm evaluation on the periwound

A study (n=95) investigating the efficacy of Sorbaderm barrier film and barrier cream (Stephen-Haynes and Stephens, 2012) included 54 subjects recruited for periwound protection or management in the barrier film segment of data stream (the remaining 41 subjects were recruited as part of a wider evaluation of Sorbaderm, including pressure ulcers and stoma). Patient consent was obtained following fulfilment of the inclusion criteria. Patients who were under 18 years of age, not willing to participate, affected by incapacity to consent or unable to follow product instructions were excluded from this evaluation. The evaluators could also exclude any patients (in their opinion) deemed to be unsuitable to undertake this evaluation for any other reasons. Participants were invited to take part in the study, consent was obtained and participants were able to leave the study at any time.

Evaluators were instructed to seek indications where barrier films or creams are routinely used. Indications included periwound protection, incontinence and pressure ulcers.

The clinical indications explored were:
- Prevention of skin breakdown
- Maintenance of skin condition
- Periwound maceration
- Excoriation and incontinence-related skin protection
- Adhesive skin stripping.

Inclusion criteria

- Patient is >18 years of age
- Patient is willing to participate and has capacity to consent
- Patient has an indication suitable for treatment with a barrier product
- Patient will be seen regularly by the evaluator.

Exclusion criteria

- Patient is <18 years of age
- Patient does not wish to participate or have capacity to consent
- Patient not suitable for barrier product treatment
- Instructions for the product use cannot be followed
- Any other reason the evaluator feels the patient should be excluded.

To ensure competency, consistency and reduce data variability, evaluators were selected who had completed their tissue viability/continence care qualifications and competency, with all staff having completed an accredited course (a degree-level accreditation in tissue viability). Additionally, a study initiation visit was undertaken at each centre, during which the protocol was explained to each evaluator by the same evaluation monitor and evaluators training on the appropriate application technique for each Sorbaderm product.

Indications treated included surgical sites (n=4), extravation injury (n=1), peripressure ulcer (n=6), stoma (n=1), percutaneous endoscopic gastrostomy (PEG) (n=1), adhesive skin stripping (n=11), active maceration (n=19) and prevention of maceration or adhesive skin stripping (n=11).

Of the 19 subjects recruited into the study with active periwound maceration, 9 subjects were completely reversed during a 72-hour period with a daily treatment application of barrier film. The remainder (n=10) were reported to have a dramatically improved periwound skin condition. Subjects with a peripressure ulcer (n=6), with exudate levels reported to be moderate or high, were all prevented from developing signs of maceration throughout the study.

Periwound adhesive skin stripping from dressings and devices was prevented in surgical sites (n=4), peripressure ulcer (n=6), stoma (n=1), PEG (n=1). Where active adhesive skin stripping (n=11) was present on recruitment into the study, a dramatic improvement was reported within a 72-hour period. Barrier film application was predominantly every
There is increased emphasis on effective care that does the patient no-harm, and barrier skin protection contributes to this strategy for periwound skin damage. The studies presented confirm the effectiveness of barrier protection in healthy skin in an experimental evaluation and a 54-patient study requiring periwound protection.

Healthy volunteer experimental evaluation

To gain an objective view, the authors conducted a healthy volunteer experimental evaluation comparing the two barrier films (n=10) and creams (n=10). The study barrier and the previous treatment gold standard barrier were used.

Healthy volunteers were recruited as per inclusion criteria within study protocol. Recruitment baseline visual skin assessment and photographs were obtained. Application of barrier film or cream to a 10 x 10cm area marked with surgical ink was made, 5 cm product ‘S’ and 5 cm product ‘C’. The experimental area was covered with water-saturated foam dressing and double layered with an outer film dressing to maintain moisture and humidity at the experiment site. At 72 hours, maceration skin assessment was conducted and photographic evidence of the experimental area obtained.

After 72 hours, the waterlogged dressings were removed to reveal zero maceration at either half of the barrier site. These findings reinforce the previous subjective feedback that the evaluated barrier performed the same as or better than the gold standard.

Discussion

A number of patients have the potential for epidermal stripping, including the young, elderly, those with frail skin, ostomates and those with specific skin conditions, such as haemangiomas and EB. Both low and high levels of exudate can lead to significant clinical challenges, with a low level of exudate resulting in drying of the wound, which can inhibit the healing process. A poorly-managed high level of exudate can cause periwound damage. Failure to protect the perianal skin or stoma from wound exudate may delay healing and result in patient discomfort. The ease of use of skin barrier protectors and the visibility of the skin can assist the clinician in maintaining intact skin. The use of a barrier film or barrier cream is an effective treatment, management or preventative approach to minimizing infected wounds.