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ABSTRACT

The skin is the largest organ in the body, providing an effective barrier against excessive fluid loss and invasion from bacteria, but the barrier function of the skin can be lost when it is damaged by prolonged contact with moisture. Moisture-associated skin damage can be caused by prolonged exposure to perspiration, urine or faeces, wound exudate or stomal output. Prevention and treatment of moisture-associated skin damage involves application of skin protectants, but there is a wide range of these products available to nursing staff, and clinical decision making is hampered by a lack of robust comparative evidence. Medihoney® Barrier Cream may be used for a number of indications related to moisture-associated skin damage, including incontinence-associated dermatitis. The use of Medihoney Barrier Cream has been shown to lower pruritis complaints associated with intertrigo, and promotes patient comfort.

Key words: Skin care ■ Incontinence ■ Preventive care ■ Wound care ■ Stoma care

The skin provides an effective barrier against the external environment, preventing desiccation of the body through moisture loss (Madison, 2003), permeation of exogenous substances and infection. This barrier function is predominantly achieved by the upper layer of the skin, the epidermis, and in particular the outermost layer, the stratum corneum (Voegeli, 2012) (*Figure 1*).

Within the stratum corneum the skin cells (corneocytes) are arranged in a 'brick wall' structure, held together by lipids. Normal skin has a pH of 4.5-6.2, creating an acid mantle that also contributes to the barrier function against bacteria and other irritants (Holroyd and Graham, 2014). When the skin is damaged, its barrier functions are lost. This article describes the pathophysiology of moisture-associated skin damage and incontinence-associated dermatitis (IAD) in particular. Regimens for prevention and treatment of IAD are discussed and the evidence for, and appropriate use of, barrier creams is presented, with a focus on Medihoney® Barrier Cream.

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Moisture-associated skin damage

Moisture-associated skin damage is a common problem in healthcare settings, where the skin is exposed to moisture for a prolonged period of time. This describes any damage to the skin due to moisture from a variety of sources (*Table 1*), including: perspiration, urinary or faecal incontinence, wound exudate, or stomal output (Voegeli, 2012). When exposed to moisture for a prolonged period of time the skin becomes over-hydrated, which can precipitate inflammation because irritants are able to pass through the skin resulting in dermatitis (Voegeli, 2012). This hyper-hydrated skin is then more prone to mechanical damage from friction and shear, caused by skin rubbing against clothing, bedsheets or incontinence pads. This can result in the skin breaking down, permitting bacteria to enter (Beeckman et al, 2015). Subsequent infections in the stratum corneum can result in irritation and inflammation, further depleting the skin's barrier properties (Corcoran and Woodward, 2013).

Peristomal moisture-associated dermatitis

This is described as the inflammation and erosion to the skin that occurs initially at the junction between stoma and skin, but can extend for up to 10 cm from the stoma (Metcalf, 2018). Skin problems are one of the most common complications associated with a stoma and peristomal moisture-associated dermatitis can be a particular problem for stomas producing more liquid output, such as ileostomies (Metcalf, 2018).

Periwound moisture-associated dermatitis

Normal, moist wound healing does not produce an excessive amount of exudate that will cause maceration of the surrounding healthy skin (Voegeli, 2013). However, in chronic wounds the exudate contains high amounts of proteolytic enzymes that can result in skin breakdown (Colwell et al, 2011).

Intertriginous dermatitis

Intertrigo is an inflammatory condition that occurs within skin folds, caused by moisture from perspiration, heat, skin-to-skin contact and friction (Nijhuis et al, 2012), associated with symptoms of pruritis, pain and burning sensations. This may occur in any skin fold, but in the groin it can be exacerbated by urinary and faecal incontinence. Secondary infections may also occur as bacteria and fungi can colonise areas of broken skin.

Table 1. Moisture-associated skin damage

Type	Cause
Incontinence-associated dermatitis	Urine or faeces (particularly liquid stool)
Peristomal moisture-associated dermatitis	Stomal output
Intertriginous dermatitis	Perspiration
Periwound moisture-associated dermatitis	Wound exudate

Source: Gray et al, 2011

Where fungal infection has occurred, an appropriate anti-fungal cream will need to be incorporated into a skin-care regimen (Beeckman et al, 2015).

Incontinence-associated dermatitis

IAD refers to the form of skin irritation that occurs when the skin is exposed to urine or stool, and tends to begin as an inflammation of the skin characterised by redness (Beeckman et al, 2016) and maceration. The prevalence of IAD is unclear and varying rates of between 5.6% and 50% reported (Beeckman et al, 2016), although they may be underestimated. Exposure to faeces is thought to be more significant in the development of IAD, particularly if the stool is liquid or combined with urinary incontinence (Beeckman et al, 2011a; Beeckman et al, 2016). Prolonged exposure to urine or faeces results in the skin becoming over-hydrated, its pH rises and the skin is exposed to enzymes that can break down protein and fat (Gray, 2014); the mechanism of IAD development is summarised in Figure 2.

Certain groups of patients are more at risk of IAD, including babies and young children still wearing nappies, older people (Corcoran and Woodward, 2013) and those who are critically ill (Beele et al, 2018). In older people the skin has reduced epidermal thickness, increasing the risk of skin breakdown, as well as urinary and faecal incontinence being most prevalent in this age group (Van Damme et al, 2017).

IAD may be misdiagnosed as a pressure ulcer and it is not always easy to differentiate the two conditions, but the European Pressure Ulcer Advisory Panel has produced an e-learning package for nurses to develop their skills in pressure ulcer classification and differentiation from IAD that has been shown to be effective (Beeckman et al, 2010). This is now in its fourth edition and can be accessed at https://puclas4.ucvvgent.be. When IAD is present the skin often has a glistening appearance, due to a serous exudate being produced from the damaged skin. Unlike pressure ulcers, IAD does not have to occur over a boney prominence and it will often be widespread over the perineum, buttocks and groins. However, it has also been suggested that the skin maceration that occurs in IAD can be a contributing factor to the development of pressure ulcers (Beeckman et al, 2014).

Best practice would include the use of an assessment tool to identify and differentiate IAD. An international group has recently developed and validated such a tool for use in practice, the Ghent Global IAD Monitoring Tool (GLOBIAD) (Van den Bussche et al, 2018).

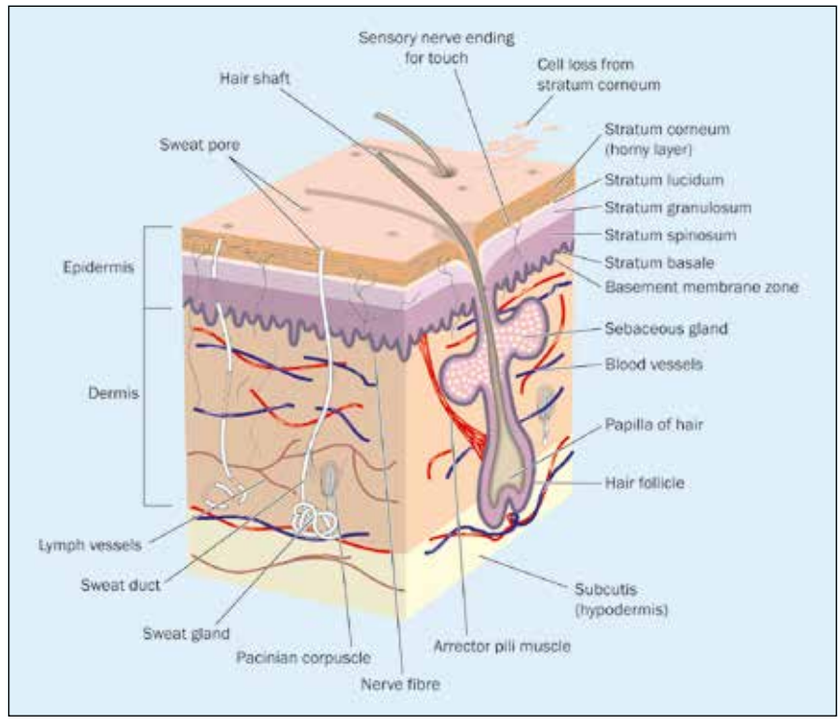

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Figure 1. The structure of the skin

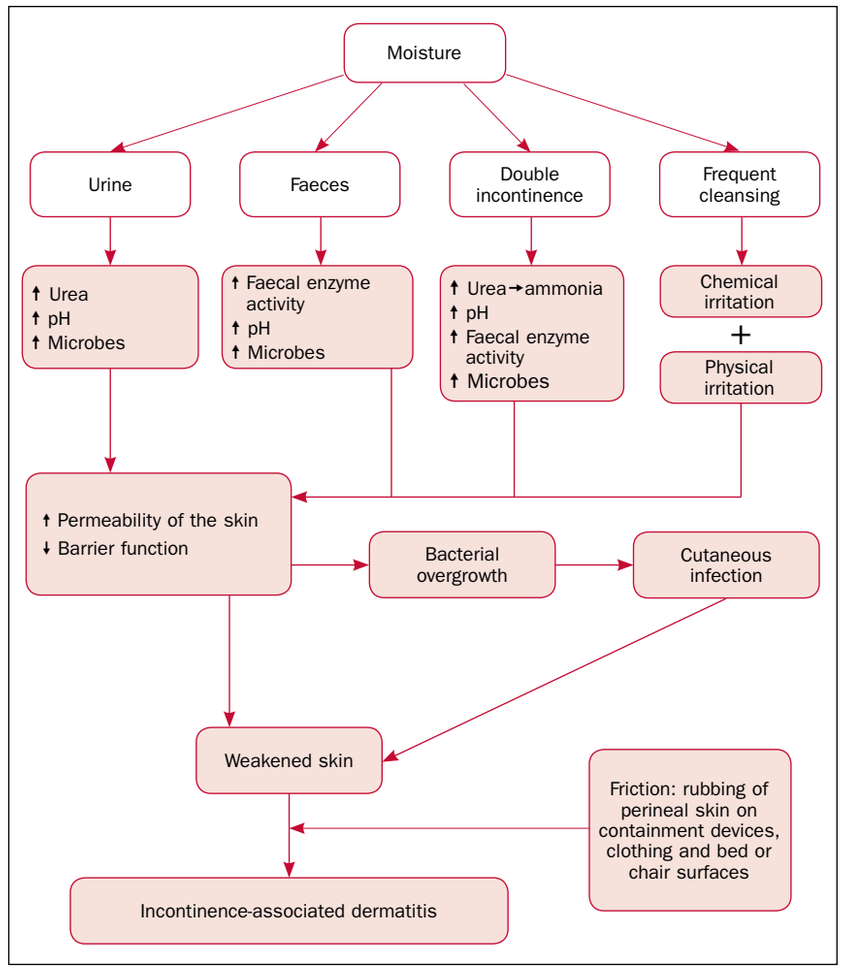

Figure 2. Mechanisms involved in development of IAD

Table 2. Categories of barrier creams	
Lipid-based with metal oxides (e.g. zinc oxide)	e.g. Sudocrem
Petrolatum-based	e.g. Sensi-Care
Silicone-based polymer	e.g. Cavilon, LBF
Silicone-based with honey	e.g. Medihoney®

Box 1. Indications for the use of Medihoney® Barrier Cream

- Prevention and treatment of incontinence-associated dermatitis (for use with/without incontinence pads)
- Protect intact skin around wounds from irritation or breakdown caused by wound exudate
- Prevention of maceration
- Prevention of excoriation
- Promote normal skin pH
- Prevent skin damage caused by frequent handwashing
- Treatment of intertrigo dermatitis

Source: Derma Sciences, 2015

Prevention and management of IAD

If incontinence cannot be prevented, there is general consensus that judicious application of an appropriate skin care regimen following every episode of incontinence is one of the most important methods of prevention and management of IAD (Beeckman et al, 2016). A two-step approach to skin care has been shown to be effective, involving cleansing, followed by application of skin protectants, which has been discussed in detail elsewhere (Beeckman et al, 2015; Beeckman et al, 2016).

Cleansing should be undertaken using a pH-neutral skin cleanser and the use of soap should be avoided; most soaps have an alkaline pH, which can contribute to skin damage (Voegeli, 2012).

Moisturisation helps to repair the barrier function of the skin, reducing transepidermal water loss and thereby increasing water content within the skin, and restoring the lipid barrier's ability to attract, hold and redistribute water (Beeckman et al, 2011b). If maceration is present, an emollient-based moisturiser with low water content is recommended, rather than a humectant-based moisturiser (Beeckman et al, 2015). A barrier product should then be applied, if this has not been combined with the cleanser/moisturiser selected.

Barrier creams and skin protectants

A skin protectant has been recommended for patients who are at risk of IAD for a number of years now (Beeckman et al, 2009; Holroyd and Graham, 2014). Barrier products protect the skin against further contact with urine or faeces (or other moisture) and are designed to repel moisture (Voegeli, 2012). Barrier products fall into a number of categories (*Table 2*), although those presented are not an exclusive list of products available. The summary of product characteristics produced by the manufacturer should be checked because not all products are suitable for use on broken skin (no CE Class I medical device can claim this).

Both lipid-based and silicone-based products will leave a thin layer on the skin to repel water, but the newer silicone-based polymers form a semi-permeable protective coating (Voegeli, 2012) to prevent maceration, excoriation and irritation resulting from effects of incontinence and diarrhoea. Zinc oxide pastes have been shown to provide the best protection from contact irritants, but they are less effective at maintaining optimal hydration (Gray, 2014). In contrast, silicone-based polymers are variable in the protection they provide against irritants, but are more effective at promoting hydration of the underlying skin (Gray, 2014).

There are few comparative studies of barrier products, with many of the studies that have been undertaken having poor methodological quality (Corcoran and Woodward, 2013; Beeckman et al, 2016), so there is insufficient evidence on which to recommend one product over any other. Anecdotal evidence suggests that barrier products may be misused in clinical practice, with nurses applying them in too great a quantity. Not only can this interfere with the absorptive properties of any incontinence pad, but it can also lead to an exacerbation of IAD because the pad is no longer able to wick the liquid away from the skin.

One of the newer barrier products on the market for IAD is Medihoney® Barrier Cream and the use of manuka honey may have additional benefits.

Honey as an antimicrobial

Honey is non-toxic and there is low risk of bacteria developing resistance (Cooper et al, 2010; Gottrup et al, 2013). Bacteria readily colonise an open wound and a biofilm (living layer of bacteria) develops in any chronic wound, which can lead to delayed wound healing. The antimicrobial properties of manuka honey have been investigated and it has been found to be bactericidal against a wide range of bacteria that typically colonise chronic wounds, including antibiotic-resistant organisms (Merckoll et al, 2009). A study to investigate the properties of manuka honey in inhibiting the development of biofilms demonstrated that concentrations of 17% Medihoney were sufficient to inhibit formation of a biofilm, whereas a 35% concentration was required to inhibit an established biofilm in vitro (Cooper et al, 2014).

In addition to its wide-ranging antimicrobial properties, the high osmolarity of honey prevents the growth of bacteria and encourages healing (Bradshaw, 2011). Other substances, such as iodine, polyhexanide and silver nitrate, have also been shown to have antimicrobial properties and have been used in the preparation of wound dressings. Manuka honey, however, has advantages over other preparations.

Du Toit and Page (2009) demonstrated that silver had cytotoxic effects, interfering with epidermal cell proliferation and migration, which were not seen with the honey-based dressings tested. Bacterial resistance to silver has also been demonstrated (Gottrup et al, 2013), although this has not become apparent with honey. Unprocessed manuka honey has been used in the preparation of wound dressings for some time due to its potential for promoting wound healing by reducing bioburden via its acidic pH, its high osmotic activity, and its production of hydrogen peroxide while maintaining a moist wound bed (Gray and Weir, 2007).

It has been suggested that honey-based wound dressings do not cause periwound maceration and consequently there has been interest in using honey for the prevention and treatment of periwound moisture-associated skin damage. However, Gray and Weir (2007) did not find any studies that investigated the efficacy of honey on periwound moisture-associated skin damage in their systematic review, so further research is indicated. Given the properties of manuka honey discussed above, it is possible that honey will have beneficial effects in the treatment of moisture-associated skin damage, including IAD, intertrigo dermatitis and peristomal moisture-associated skin damage. Indeed, manuka honey has been impregnated into hydrocolloid stoma flanges on the premise that it 'may help to promote healthy skin around the stoma' (Clinimed, 2019), although to date robust clinical trials demonstrating effectiveness are lacking and further research is required.

Medihoney Barrier Cream

Medihoney Barrier Cream is a silicone-based product containing 100% Medihoney Antibacterial Honey (30% by weight or volume). It contains no added colour or fragrance, lanolin, parabens, steroids or mineral oils, which are often found in other similar topical preparations. It has a number of clinical applications (*Box 1*) and has been developed to be applied to both intact and at-risk skin to provide protection from body fluids and moisture as part of a skin-care regimen for prevention and treatment of IAD. It can also be applied around wounds and under skin folds, wound dressings and incontinence pads where it will form a protective barrier to help prevent skin breakdown due to moisture-associated skin damage in these areas.

Medihoney Barrier Cream should be applied as required, because it will remain intact if not cleaned or removed for up to 12 hours, and can be reapplied after washing or at each dressing change. It is suitable for use with children and anecdotally has been found to be effective in preventing and treating nappy rash in babies and young children. Medihoney Barrier Cream is available in a sachet, as well as in a larger tube; because barrier products should be single-patient use, a smaller sachet of product may prove to be more cost effective. Each tube of Medihoney Barrier Cream continues to be effective for up to 4 months once opened.

There is some evidence of the effectiveness of Medihoney in the treatment of intertrigo. One small-scale, single-blind randomised study compared the effectiveness of Medihoney Barrier Cream with a zinc oxide ointment to treat intertrigo (Nijhuis et al, 2012). This study included 31 patients with bilateral intertrigo who acted as their own controls and found no significant difference in wound healing over the 21-day intervention period. The authors did find, however, that patients subjectively reported a statistically significant reduction in the symptoms of pruritis and pain associated with the intertrigo when Medihoney Barrier Cream was applied compared with application of zinc oxide ointment, and no adverse effects were noted. The study was not without limitations, most notably it was small scale and lacked blinding to the treatment allocation, but the findings suggest that Medihoney Barrier Cream was at least as effective as zinc oxide ointment and may be preferred by patients and nurses.

Figure 3. Case study 1: a 70-year-old woman admitted for treatment of pneumonia had extensive incontinence-associated dermatitis. The images show the patient's skin after application of a topical antifungal cream and Medihoney Barrier Cream on Day 1 (a), Day 4 (b), Day 8 (c), Day 14 (d)

There is a lack of evidence supporting Medihoney Barrier Cream for other moisture-associated skin damage indications —studies have yet to be conducted and further research is warranted. Clinical comparative studies of the effectiveness of Medihoney Barrier Cream versus other barrier products for the prevention of IAD in particular would be helpful in supporting nurses with evidence-based clinical decision making. However, there is some anecdotal evidence of effectiveness from case studies, which will now be presented.

Case studies

The following case studies have been provided by colleagues from the continence advisory service at King's College Hospital NHS Foundation Trust. Consent was obtained from the patients prior to recording them for publication.

Case study 1

The first case is that of a 70-year-old woman who had extensive IAD on admission to the hospital for treatment of pneumonia, weight loss and loose stools. The continence team was called to review the IAD and described this as 'the worst IAD I have ever seen'. Cleansing her caused excruciating pain. The cause of the loose stools was investigated and a bowel management system was inserted to divert faeces away from skin to help with the healing process. The application of Medihoney Barrier Cream was started (*Figure 1a*).

The cream reduced the inflammation and the skin was less painful to touch, but this may not be reflected in the photographs (*Figure 3 a-d*).

Figure 4. Case study 2: incontinence-associated dermatitis in 76-year-old woman, who developed loose stools after admission. The IAD did not improve after using a Proshield and Clinell wash cloth combination for several days (a). The application of Medihoney Barrier Cream showed significant improvement as the images show: Day 0 (a), Day 6 (b), Day 13 (c)

Case study 2

A 76-year-old woman was admitted with a chest infection and swallowing difficulties. During admission she was commenced on enteral feeding and developed loose stools, thought to be secondary to the use of antibiotics (several stool samples sent for cultures were found to be negative) and IAD. She had an indwelling urethral catheter in situ on admission and was commenced on Clinell Continence Care wipes, which progressed to Proshield Foam and Spray, as staff reported that the IAD did not improve with the use of Clinell Continence Care wipes over several days (*Figure 4, a-c*).

On re-examination there was evidence of IAD with a concomitant fungal skin present and the patient was commenced on a topical antifungal cream and Medihoney Barrier Cream. She also had the enteral feed type changed to one with added fibre with the aim of solidifying stools. A marked improvement was noted in the skin 6 days after commencing the application of Medihoney Barrier Cream in combination with a topical antifungal cream, and the patient reported experiencing less pain and discomfort in the affected areas (*Figure 4*).

Complete healing was noted in the skin of the inner thigh and groin 13 days after commencing the application of Medihoney Barrier Cream in combination with a topical antifungal cream, with only small satellite skin breaks remaining over the buttock areas *(Figure 4c)*. The patient also reported that she no longer had pain and discomfort in the affected areas.

Case study 3

The third case is that of an 80-year-old woman admitted for a toe amputation who developed diarrhoea with consequential damage to the skin in the perineal, groin, natal and intergluteal areas; she also developed pressure ulcers over her buttocks, reporting pain and discomfort in the affected areas. She was also catheterised urethrally and therefore urine was diverted away from the skin. She was commenced on the standardised Trust skin care protocol, however, this did not appear to have the effect of completely healing the skin and she still had skin breakdown in the area between her buttocks and natal cleft (*Figure 5a*).

She was commenced on Medihoney Barrier Cream and the condition of her skin improved by day 6 (*Figure 5b*); although there was still redness and irritation extending to posterior buttocks and inner thighs, there was no redness and inflammation surrounding the skin on the buttock and natal cleft areas. Nursing staff reported that the cream was not applied to the posterior buttocks and inner thighs because there had been no redness or inflammation in these areas at the time.

By day 14 (*Figure 5c*) there was visible evidence of healing, however it should be noted that by this date the patient had moved to the intensive therapy unit (ITU); the ITU staff had not been applying the Medihoney barrier cream, but reported using only the Proshield Barrier Gel.

Figure 5. Case study 3: incontinence-associated dermatitis in a woman aged 80, who developed diarrhoea and consequential damage to the perineal, groin, natal and the area between gluteal skin, as well as pressure ulcers over parts of her buttocks. The standard skin care protocol did not improve her condition, nor did the use of a Proshield and Clinell wash cloth combination (a). The IAD improved after application of Medihoney Barrier Cream: before application Day 0 (a), application on Day 1 (b), Day 13 (c)

Case study 4

A 2-month-old infant admitted with diarrhoea had developed nappy rash prior to admission and had redness, and inflammation with superficial skin breakdown in the areas between the buttocks. Her mother reported that she had been applying Sudocrem to the area for several days, but this did not reduce the redness. During the infant's hospital stay and for a few days after discharge she was commenced on the Proshield Skin Protectant Gel and Foam spray and these products were used on her skin for about 4 days (*Figure 6a*).

This infant was then commenced on Medihoney Barrier Cream and there appeared to be significant improvement, with evidence of epithelialisation over the previously inflamed and broken skin areas on day 7 of using the product (*Figure 6b*). Her mother noted that there was development of tiny white spots. A skin swab was taken at her GP practice, which found some bacteria present, however, the infant's mother reported that the spots appeared to have cleared up on their own without further intervention. She reported that her infant no longer appeared to be in any pain or discomfort after using the Medihoney Barrier Cream and that she was very satisfied with the outcome.

Case study 5

This patient was being cared for by a community nursing team for support with the management of her suprapubic catheter. An area of over-granulation had developed and the skin around the catheter insertion site had become excoriated. It was suspected that a wound infection had developed and swabs were taken and sent for microscopy, culture and sensitivities testing. The site was oozing, appeared red and inflamed, and was causing some discomfort, although the patient described the pain as mild (*Figure 7a*).

Medihoney Barrier Cream was applied to the surrounding reddened skin three times a week and a foam adhesive dressing containing silver was used to dress the area. The patient was also commenced on a course of antibiotics once the infection was confirmed and sensitivities were known. The redness was greatly reduced over the period of 1 week (*Figure 7b*), the discomfort was eliminated and a reduction in the inflammation associated with the over-granulation at the suprapubic catheter site was noted.

Conclusion

Moisture-associated skin damage, in particular IAD, is prevalent in a variety of healthcare settings, with older people particularly at risk. It is generally accepted that skin care for people with IAD requires a three-step, structured approach incorporating the application of a cleanser, moisturiser and barrier. There are many barrier products on the market, but Medihoney Barrier cream has become more widely used for the prevention of IAD. It has been used successfully to treat other forms of moisture-associated skin damage and the manuka honey in the cream has antimicrobial properties that may be advantageous in the treatment of IAD.

There remains insufficient evidence on which to recommend one barrier product over any other and further research is warranted. **BJN**

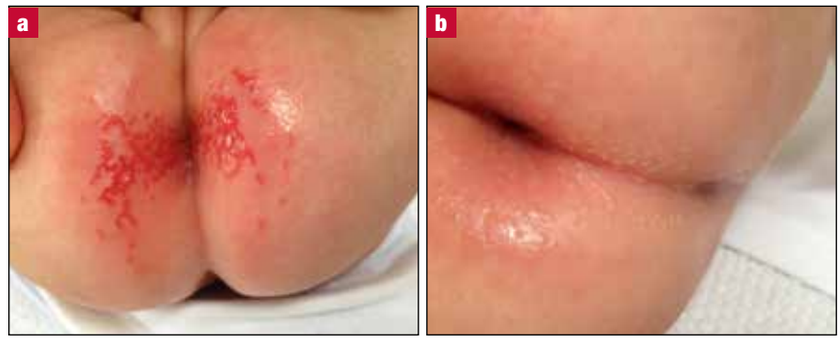

Figure 6. Case study 4: an infant aged 2 months with diarrhoea and IAD did not improve after several days of Sudocrem and Proshield Skin Protectant Gel application. After 4 days, she was commenced on Medihoney Barrier Cream (a) and by Day 7 there was significant improvement (b)

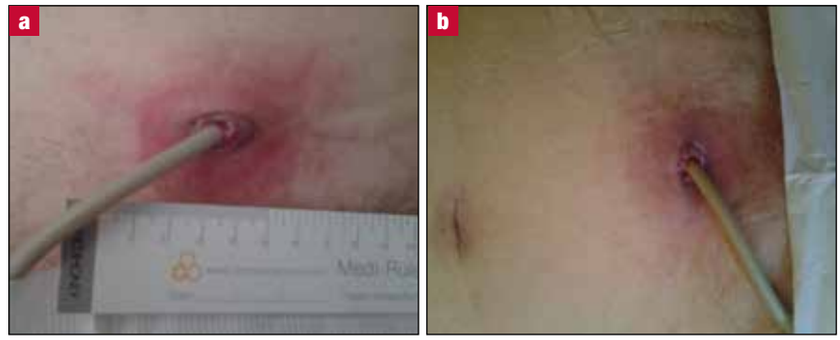

Figure 7. Case 5: patient with excoriation around the suprapubic catheter (a). Improvement in the skin around the site was noted after 1 week of treatment (b)

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KEY POINTS

- The skin is the largest organ in the body, providing an effective barrier against excessive fluid loss and invasion from bacteria
- The barrier function of the skin can be lost when it is damaged due to prolonged contact with moisture
- Prevention and treatment of moisture-associated skin damage involves application of a barrier cream
- There is a wide range of barrier products available to nursing staff, and clinical decision making is hampered by lack of robust comparative evidence
- Medihoney Barrier Cream may be used for a number of indications related to moisture-associated skin damage

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CPD reflective questions

- Are your policies and guidelines in practice for the prevention and treatment of incontinence-associated dermatitis (IAD) based on the best available current evidence?
- What can you do to ensure that patients at risk of IAD are identified and to prevent the development of this skin damage?
- How can you promote patient engagement in decision making in relation to the prevention and management of IAD?