Medical adhesive-related skin injury

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ABSTRACT

The skin's main function is to act as a physical barrier against harmful substances. Medical adhesive-related skin injury (MARSI) is a prevalent and under-reported condition that compromises the skin's integrity. Repeated applications and removal of appliances can increase the likelihood of MARSI occurring. Prevention and treatment are key to ensure appropriate skin preparation, product appliance and removal. The use of structured approaches is imperative and there is a need to increase the awareness of MARSI among patients and health professionals to ensure that informed decisions are made.

Key words: Medical adhesive-related skin injury ■ Stoma ■ Barrier products ■ Device removal

It is estimated that one in 500 people in the UK are living with a stoma (Colostomy UK, 2019). The most common complaint about surgical stoma formation relates to skin issues. The consistency of the stoma output can affect skin integrity and lead to pain and discomfort, have an impact on quality of life (QoL), delay rehabilitation after surgery and increase product usage and healthcare costs. Peristomal skin problems can impair adhesion of the pouch, which may further exacerbate the skin condition. It is reported that 60% of ostomates experience skin issues, which has an impact on their QoL (Bartle et al, 2013; Chandler, 2015).

De Campos (2017) found that ostomates reported feelings of stigmatisation, embarrassment, fear of the unknown and discomfort due to the sounds and odours from their stoma. According to patients, these are exacerbated when leaks occur, making ostomates more likely to withdraw from social activities, thus affecting their QoL (Lee and Morris, 2003; Cottam et al, 2007).

The aim of this article is to increase awareness of medical adhesive-related skin injury (MARSI) and the impact this can have on stoma patients. It will also look at the methods of prevention and treatments available for MARSI to help health professionals and their patients make informed decisions about their care to improve the patient's QoL.

Normal skin structure and function

The skin is the body's largest organ. Its main function is to act as a physical barrier against the external environment and to prevent harmful substances and pathogens entering the body. It also provides protection from mechanical impact and pressure. In addition, the skin acts as a moisture barrier, preventing excessive fluid gain or loss from the body. This is achieved by the epidermis and its uppermost layer the stratum corneum (Kelly-O'Flynn, 2019) (*Figure 1*).

The skin stays healthy through six primary functions: protection, absorption, excretion, secretion, thermoregulation and sensation (Cowdell and Radley, 2012). When these functions do not perform effectively, skin integrity is compromised and transepidermal water loss (TEWL) can occur. TEWL is the density of water distributed from the dermis and epidermis through the stratum corneum to the skin's surface. An increase in TEWL is associated with skin barrier dysfunction because it creates a moist or wet area on the skin's surface. Therefore, a reduction in TEWL leads to dry skin and is an indicator for intact or renewed skin barrier. This moist area prevents the adhesive from attaching effectively, which in turn increases the risk of leakage that will then excoriate the skin (Cutting, 2006).

The aim of good stoma management is to prevent peristomal skin soreness, healthy peristomal skin is essential for pouch adherence and prevention of effluent leakage. It is imperative that patients are educated and supported with good hygiene regimes that include the following steps (Kelly-O'Flynn, 2019):

- Cleansing: use warm water to wash the area, avoid the use of soaps or wipes because these leave a residue and can impede barrier adhesion
- Use a crusting technique if skin is excoriated: apply stoma powder to the affected area, dusting off any excess. Protect the area by applying a non-sting barrier film and allow to dry, which seals the powder in place
- Ensure the pouch size is adequate to prevent leaks
- Consider two-piece appliances to prevent skin stripping
- Use accessories to enhance the seal, extend wear-time and facilitate skin recovery
- Observe technique: re-education with techniques of measuring or cleansing may be needed
- Query the patient's daily activities: some activities may cause the pouch's adherence to weaken/loosen
- Check clothing: ensure it is not constricting drainage from the stoma into the pouch.

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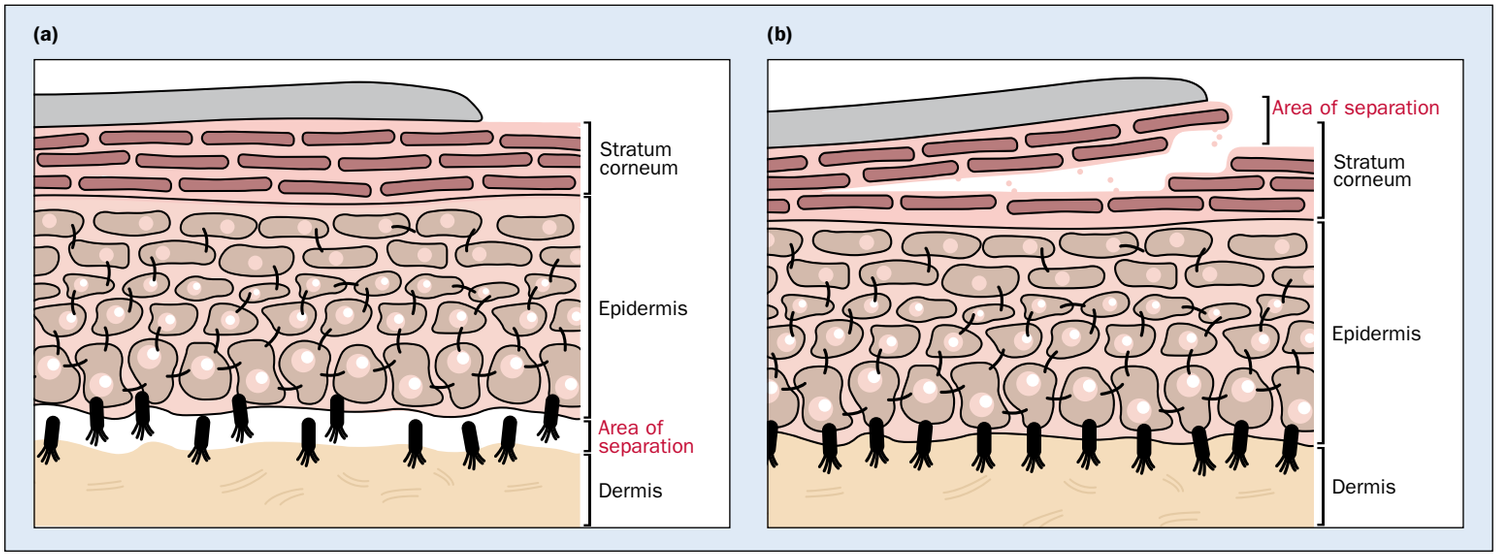

Figure 1. Separation of the epidermis from the dermis, resulting in a medical adhesive-related skin injury (based on Tielemans and Voegeli, 2019)

Table 1. Medical adhesive-related skin injury categories

Mechanical	
Skin stripping	This is the most common cause of MARSI. It occurs following removal of one or more layers of the stratum corneum following the removal of the adhesive
Tension injury/blister	This is caused by the shear force of adhesive, which is strapped to the skin and is distended/stretched for the purpose of adhesion
Skin tear	A skin tear can occur when there is friction from the adhesive or bodily fluid on the skin, which then produces exudate causing skin layers to separate
Dermatitis	
Irritant contact dermatitis	This occurs as a result of a chemical irritant. The skin becomes red, inflamed, irritated with a rash-like appearance and usually resolves in 1–2 days. This is the most common in the older population, reported at 15.5%
Allergic dermatitis	This is a manifestation of an allergic response to contact with a particular substance. The skin becomes red, showing vesicles, which could be itchy and persist for up to a week
Other	
Maceration	Usually observed in patients with a urostomy where the skin is seen as white or grey with wrinkles, due to exposure to moisture for a prolonged period
Folliculitis	This is an inflammatory response from a hair follicle where regrowth of hair irritates the skin and can appear as papules or pustules with red/painful bumps on the skin. To prevent this, it is important that care is taken when shaving the area and ensuring to remove the stoma appliance in the direction of the hair growth

Source: Blume-Peytavi et al, 2016; McNichol and Bianchi, 2016

Medical adhesive-related skin injury

Skin can become compromised by MARSI, a prevalent and under-reported condition that is often preventable (Hadfield et al, 2019). It occurs when:

- The epidermal layer of the skin becomes detached from the dermal layer on the removal of an adhesive dressing or medical device (*Figure 1a*). This is the deeper of two types of skin injury
- The stratum corneum, the top layer of skin, is separated from the epidermis (*Figure 1b*). This is the more superficial of the two injuries.

This can happen when the adhesive attachment is stronger than skin cell bonds. It is characterised by an erythematous reaction that persists for longer than 30 minutes after the removal of the adhesive and, in some cases, may result in an epidermal tear. Certain types of adhesives used on dressings can damage newly formed skin cells, causing pain and distress to patients during dressing changes (Lawton and Langoen, 2009). Repeated application or removal can result in changes to the skin barrier function and increase the likelihood of MARSI. Furthermore, wound exudate contains water, cellular debris and enzymes, which in combination can be corrosive to intact skin. This fluid can inhibit the growth of fibroblasts, which will have a negative effect on healing and lead to further tissue breakdown (Bianchi et al, 2013).

MARSI is more often observed in inpatient settings and in vulnerable populations, such as the elderly or infants who may have fragile skin (Jones et al, 2018). Therefore, it is important to limit patient harm and maximise clinical outcomes and QoL. Bianchi (2012) highlighted the importance of clinicians having a good understanding of the causes of skin breakdown and the appropriate preventive treatments. In addition, Bianchi et al (2013) found that repeated application or removal of appliances, such as dressings and/or pouches to the skin, can strip the skin and initiate inflammation, oedema and cause pain. A lack of implemented structured regimens had been reported by Hughes (2016), who

Box 1. Factors that can contribute to the development of MARSI

Intrinsic factors	Extrinsic factors
■ Age ■ Race ■ Ethnicity ■ Underlying medical conditions (eg diabetes, infection, venous insufficiency, dehydration, malnutrition) ■ Dermatological conditions (eg eczema)	■ Prolonged moisture exposure or drying of skin due to low humidity or excessive bathing ■ Radiation treatment or medications (eg corticosteroids) ■ Repeated taping or dressing removal

highlighted that a misuse of products, can impact cost, patient care, satisfaction, QoL and clinical outcomes. The wide range of available products can make it difficult for practitioners to select the optimal product (Colwell et al, 2011). Ongoing education and support should be provided to clinicians, patients, families and carers to ensure a consistent and effective approach is taken towards maintaining skin integrity (Kelly-O'Flynn, 2018).

There are three main categories of MARSI, and a variety of subtypes. These are listed in *Table 1*.

Risk

MARSI can occur in any patient group because medical adhesive is used in most care settings. For example, adhesive is used in dressings for wound protection or management, as well as in those to stabilise cannulas for intravenous therapy or to position electrocardiograph dots (Hadfield et al, 2019). Patients at an increased risk of developing MARSI include (Hadfield et al, 2019):

- The older population with dermal fragility
- Infants in neonatal intensive care who may have an underdeveloped epidermis
- Patients with malnutrition and dehydration because normal/adequate hydration levels positively impact normal skin physiology (Palma et al, 2015)
- Patients on medications such as corticosteroids or those requiring radiation treatment, which can induce abnormalities in lipid synthesis and the intercellular structure of the stratum corneum, in turn prolonging epidermal barrier recovery (Del Rosso and Cash, 2013)
- Patients with dermal pathologies such as eczema
- Patients requiring frequent dressing changes.

Financial burden

Clinicians are in the early stages of reporting and understanding MARSI and its causes. While these injuries may often appear to be 'minor', the care and management of these can be expensive; costs can range between £1.10 and £7.90 per patient over the course of treatment, which can take 1–8 weeks depending on the cause of MARSI, requiring a great deal of nursing time (McNichol and Bianchi, 2016). According to Bradbury (2012) and Hughes (2016), the use of barrier protection products on skin that is susceptible or at risk of MARSI, has the potential to reduce the clinical and financial burden associated with this type of injury.

Treatment

Prevention is key with MARSI and can be achieved by following four steps:

- Skin preparation: ensure the area is clean and dry, and apply a non-stinging barrier film to protect the skin
- Select the appropriate medical adhesive: look for flexibility with dressings
- Product application: ensure that the skin is in full contact with the dressing and do not stretch the area, applying the dressing with a firm but gentle pressure to obtain adhesion
- Product removal: consider the benefit of silicone adhesive remover for the patient. To remove the product, support the skin with the other hand, keeping the dressing horizontal to the skin and removing it slowly.

Health professionals must be educated about best practice for the management of medical adhesives. Patients need to know about appropriate skin-care routines, and to be proactive in identifying and recognising symptoms where skin integrity is at risk.

To devise the most appropriate plan of care it is imperative for the clinician to use a structured approach to assess the patient and their skin, looking at both intrinsic and extrinsic factors that can contribute to MARSI (*Box 1*).

Adhesive products should be carefully selected, and the correct application and removal techniques must be used. Foam and silicone adhesive removers are gentle on the skin. Cloth tape can tear the skin because these products use strong adhesives. It is therefore imperative to select tapes that have the ability to stretch or tubular netting to secure skin if it is compromised or fragile.

The adhesive product should be removed in the direction of hair growth, keeping the tape parallel to the skin while drawing it slowly away from the skin. Silicone adhesive removers dissolve adhesives and aid their removal, minimising trauma and pain. They also evaporate, so no residue remains on the skin (Bianchi et al, 2013).

To protect the skin prior to dressing replacement, a skin barrier can be used and is an important part of the clinician's toolkit. Barrier films create a protective layer between the skin and adhesive/bodily fluids (Bianchi et al, 2013). They contain silicones, acrylates, organic polymers or inorganic compounds to create transparent, breathable, flexible and protective coatings for the skin. The ingredients allow for the reduction of erythema and MARSI incidents and are recommended for use in patients at increased risk, particularly neonates, those with fragile skin and ostomy patients (LeBlanc et al, 2019). The advice for newborn babies is not to use skin products in the first 2–4 weeks and 6–8 weeks in premature babies until their skin's protective barrier has matured (Trotter, 2002). However, it should be noted that, where a hydrocolloid barrier is used, routine use of a skin barrier in stoma care may not be required.

Barrier products/adhesive remover

Callaghan et al (2018) states that barrier products should be durable, easy to apply, gentle on the skin, non-stinging and not interfere with the absorbency of pouches, dressings or incontinence wear. They should have rapid absorption and drying times. By minimising product use, resources and time, barrier products should be cost-effective.

Case studies

Case 1. Lifteez Medical Adhesive Remover used on an abdominal wound dressing and stoma pouch

Mr A is 56 years old. He was an inpatient in the rehabilitation unit after spending 3 months in intensive care post-laparotomy. He had a large abdominal wound (18 cm x 5.5 cm that was 3.5 cm deep), which was dressed with simple adhesive dressings in close proximity to his stoma (*Figure 2*).

The first dressing change in the rehabilitation unit was performed by ward nurses, and the patient complained of extreme pain when the dressing was removed (he rated it 8 out of 10 on a visual analogue scale). He had no sign of MARSI, his main concern was the pain relating to the removal of the adhesive dressings and stoma appliance.

Mr A was referred to the tissue viability nurse, who used Lifteez Medical Adhesive Remover aerosol to remove the adhesive dressing to help reduce pain on its removal. The patient decided not to take analgesia prior to dressing change. He reported that the aerosol had felt cold. However, the dressing removal was pain free and he described the experience as 'amazing'.

Following the use of Lifteez Medical Adhesive Remover, the dressing and stoma flange both adhered well to the skin because there was no hydrocolloid residue left on the skin. Lifteez Medical Adhesive Remover continued to be used at every dressing and stoma flange change three times a week (the stoma flange had to be changed three times a week due to the proximity of the wound). The main concern for the patient was the pain relating to the removal of the adhesive dressings and stoma appliance.

Figure 2. Stoma positioning and adhesive dressings, both were very painful for the patient on removal

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Case 2. Lifteez Medical Adhesive Remover and Medi Derma-S used on a stoma pouch and mucous fistula

This patient is a 67-year-old woman, who had been diagnosed with Crohn's disease almost 20 years ago following a partial bowel resection after it perforated. She suffered an anastomotic leak resulting in a total large bowel resection, formation of an ileostomy and subsequent mucous fistula. Following surgery, she developed a wound infection, full thickness wound dehiscence and was treated in hospital for a further 8 weeks.

Once the abdominal wound had healed, she became confident enough to independently manage both stomas. However, she continued to experience intermittent bouts of local skin irritation, particularly when the ileostomy was more active than usual. This was causing her discomfort when changing her stoma appliance. In addition, she also experienced further discomfort and excoriation around the mucous fistula and local irritation to the surrounding skin when changing the adhesive dry dressing (*Figure 3* and *Figure 4*).

The skin around the ileostomy was previously managed with Orahesive protective powder, prior to fitting her stoma bag and using StoCare adhesive remover wipes to release the adhesive hydrocolloid flange from her skin. However, she found the wipes dried up quickly, forcing her to use multiple wipes to remove her stoma bag and the dry dressing covering her mucous fistula. She also found that the protective powder sometimes failed to fulfil her requirements. She agreed to trial the Medi Derma-S barrier film applicators and Lifteez Medical Adhesive Remover spray for a week. There were no signs of MARSI.

Feedback from the trial was positive, the patient commented that the Lifteez Medical Adhesive Remover spray was much easier to use than the wipes and lifted off both the stoma bag and dry dressing much more effectively and with less pain. She also indicated that the barrier film applicators were much easier to use than the Orahesive protective powder she had previously used and the sensitive skin around her ileostomy and mucous fistula was less sensitive. She also noted better adherence of her stoma bag, and reported that her general skin condition improved.

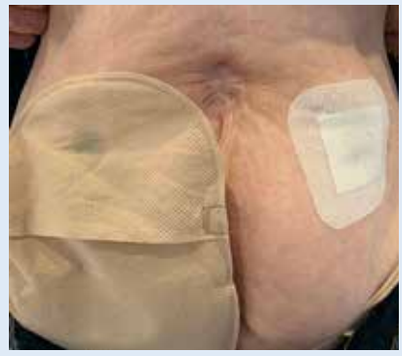

Figure 3. Ileostomy bag and dry dressing over mucous fistula

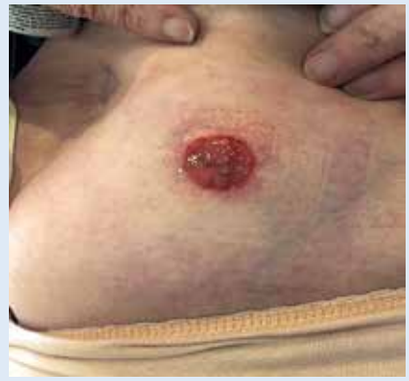

Figure 4. Mucous fistula with surrounding irritation

Dale Copson

Box 2. How to apply Medi Derma-S products

Barrier film spray

- Ensure that skin preparation is adequate
- Clean the area and dry from grease
- Hold the spray 5–15 cm away from the skin surface (depending on can or spray), using a sweeping motion
- Once the area is dry, after about 30 seconds, ensure skin folds are kept open to ensure complete drying of the area.

Barrier film foam applicator

- Apply a uniform coating over the whole area to be protected, or where the ostomy pouch, adhesive device or dressing will be applied
- Wait for 5-10 seconds for the barrier film to fully dry
- Once fully dry, apply the ostomy pouch, adhesive device or dressing as normal

Barrier cream

- Use a 'pea to palm' size on the area, a pea size for an area as large as your palm
- Apply in a circular motion with fingertip, ensure skin is visible, do not overapply
- Once skin is dry, apply the pouch
- Always ensure regular review of the area for any signs of breakdown

Source: Medicareplus International, 2020

The Medi Derma-S barrier range (*Box 2*) provides rapid and sustained improvement in peristomal skin; these products reduce/prevent the development of erythema because they provide a protective barrier to prevent effluent excoriating the skin. They have a fast-drying action and require the application of only a small amount of cream/film, preventing any potential problems occurring with overall adhesion of the dressing/device (Bianchi et al, 2013).

The Medi Derma-S barrier range has been reported to possess durability and effectiveness due to a protective effect that prevents the removal of the stratum corneum (Dykes et al, 2012) and avoids periwound breakdown (Bianchi et al, 2013). The barrier film is silicone based and uses ingredients that have stability, low toxicity and low flammability. The benefits of using the Medi Derma-S barrier range is that the products (Rudoni, 2008; Kelly-O'Flynn, 2019):

- Provide maximum barrier protection against bodily fluids such as wound exudate and not interact chemically with wound exudate
- Are less likely to cause sensitivity because they contain organic ingredients
- Are alcohol-free and odourless with a non-stinging formulation, and dry in seconds
- Are available as aerosols, wipes and applicators
- Are suitable for use in adults and children, and can be applied to damaged skin.

The Medi Derma-S product range is ideal to use in skin folds and as periwound and peristomal protection, and the products do not need to be removed between applications because they wear off naturally, making them an easier and cost-effective preventive intervention.

The cream forms a protective, transparent coating to the skin, and can be applied to damaged skin. It should be used in small amounts and once gently massaged, it is quickly absorbed (Dykes et al, 2012). See *Box 2* for manufacturer's instructions.

Lifteez Medical Adhesive Remover is a skin-friendly, alcohol-free adhesive remover containing siloxanes that aid the removal of adhesive dressings or medical devices. It is quick drying and therefore does not affect adhesion of the replacement pouch. It quickly targets and breaks strong adhesive bonds, minimising pain and any potential for skin stripping or tearing on removal. It is available as an aerosol or as wipes and should be sprayed, or wiped, evenly around the area while gently removing the device. The dressing should be kept as close to the skin as possible and pulled back gently over itself in the direction of hair growth (Jones et al, 2018).

Lifteez Medical Adhesive Remover allows the use of a stronger adhesive dressing in cases where patients require undisturbed healing and less frequent dressing changes (Jones et al, 2018).

Conclusion

Maintaining a good stoma skin care regimen and providing ongoing education and support will improve patient outcomes and enhance the patient's QoL. It is known that MARSI decreases skin barrier protection and increases healing times, and consequently has a negative impact on patients' QoL. It can also increase costs to the health service. Prevention is key: it is essential that both patients and health professionals understand the importance of effective peristomal skin care, selection of the most appropriate adhesive dressing/device and are familiar with the manufacturers' instructions for use. Educating and supporting the patient and health professionals to be proactive in identifying and recognising symptoms of risk to skin integrity will help minimise skin trauma, improve patient's QoL, reduce healthcare cost and ultimately prevent a MARSI. **BJN**

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KEY POINTS

- Medical adhesive-related skin injury (MARSI) is a prevalent and under-reported skin condition which affects quality of life (QoL) particularly for ostomates
- Prevention is key in skin preparation and in the selection of products to minimise skin trauma
- Education and ongoing support for patients and health professionals improves QoL and patient care efficacy
- Barrier products provide rapid improvement to peristomal skin thereby reducing healthcare costs

CPD reflective questions

- Why is it important to have good stoma care management and how would you go about caring for a patient's stoma?
- Can you describe the intrinsic and extrinsic factors that can contribute to the development of MARSI?
- Consider a patient in your care, describe the steps you could take to help prevent MARSI