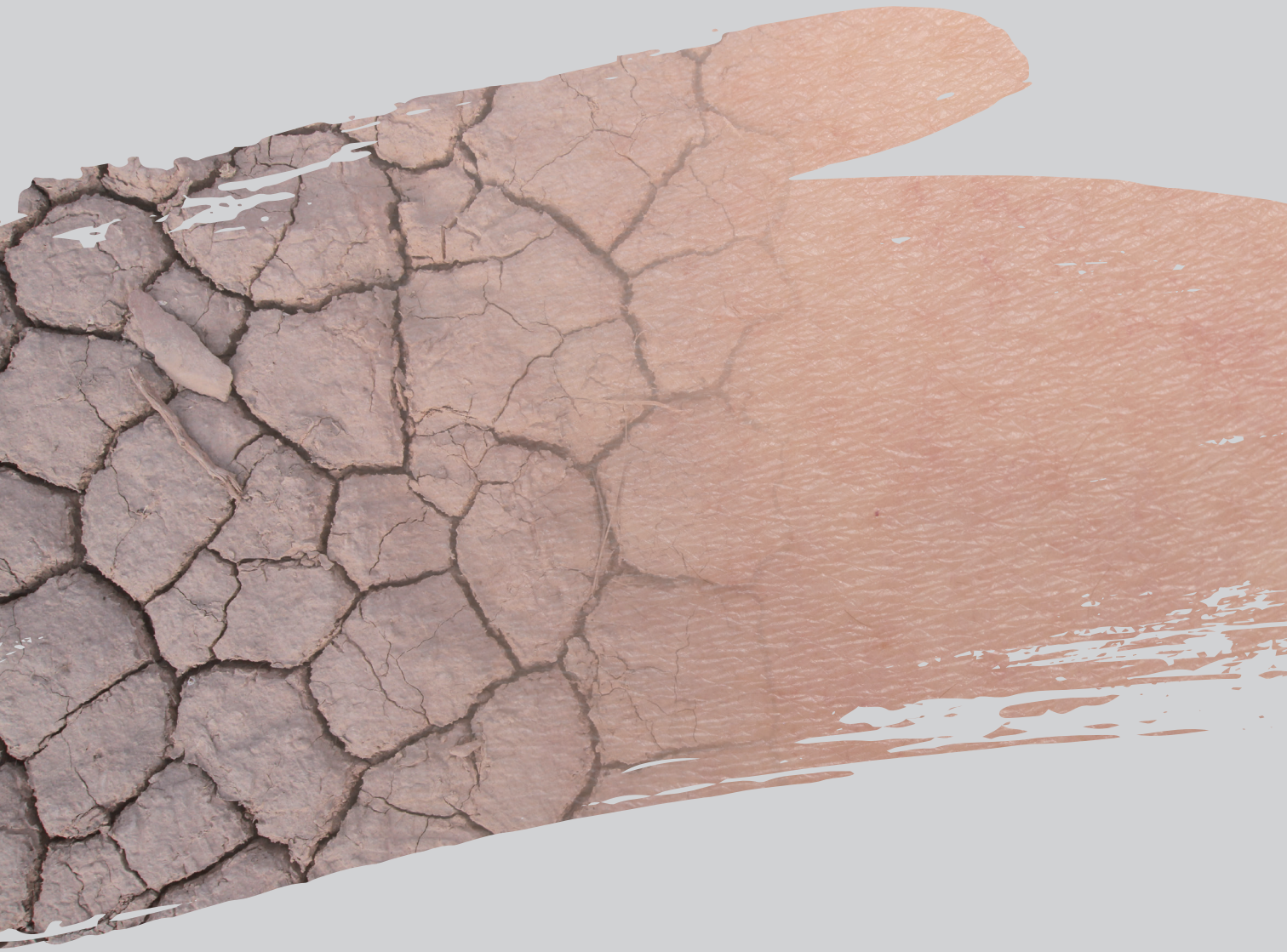
JWC International Consensus Document

Overlooked and underestimated: medical adhesive-related skin injuries



Best practice consensus document on prevention

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Foreword

In July 2019, a panel of wound care experts, educators and researchers met in the UK to review the literature on medical adhesive-related skin injury and discuss best practice for its assessment and prevention. The two-day meeting resulted in this consensus document, which is intended for anyone who uses adhesive medical devices. The document aims to raise awareness of the widespread occurrence of medical adhesive-related skin injury and the burden it imposes on patients, health professionals and the health service. It seeks to encourage a change in culture, whereby risk assessment and prevention of medical adhesive-related skin injury are considered an integral part of patient care. The document, therefore, provides recommendations for the assessment and prevention of this type of injury, with a view to standardising care across all healthcare settings. It also highlights the need for education on this form of skin damage, which needs to become a core topic in skin care and wound management. Until this happens, there is scope for multidisciplinary teams to provide local training on this subject.

In the light of the panel's concern that many health professionals are not only unaware of this avoidable harm but also its abbreviation, MARSI, the term is written in full throughout the document. The panel hopes that implementation of the guidance in this document will reduce avoidable patient suffering and promote better outcomes.

Sian Fumarola, Senior Clinical Nurse Specialist, Tissue Viability and Continence, University Hospitals of North Midlands NHS Trust, UK

Overview of medical adhesive-related skin injury

- 'Medical adhesive-related skin injury' is a term used to define any skin damage related to the use of medical adhesive products or devices such as tapes, wound dressings, stoma products, electrodes, medication patches and wound closure strips. This type of injury is largely avoidable
- Medical adhesive-related skin injury can occur when the attachment between the skin and an adhesive is stronger than that between individual cells, causing either the epidermal layers to separate or the epidermis to detach completely from the dermis (mechanical trauma)
- There are three main categories of medical adhesive-related skin injury: mechanical (skin stripping, blistering, skin tears), dermatitis (irritation in response to the adhesive) and other (maceration and folliculitis)
- Despite the frequent use of medical adhesives in all healthcare settings, there is little awareness of medical adhesive-related skin injuries, which are rarely reported. The true incidence of this type of injury is therefore unknown, but it is expected to rise as the population ages and more premature babies survive
- Although intrinsic (patient-related) and extrinsic (environment-related) risk factors for medical adhesive-related skin injuries can be used to help define 'high-risk' patients, anyone requiring application of an adhesive medical device to the skin is at risk
- As well as compromising the skin barrier function and delaying healing, medical adhesive-related skin injuries can lead to pain, increase the risk of wound infection (potentially leading to sepsis) and cause morbidity. This can result in anxiety, reducing patients' quality of life. It also imposes a burden on the healthcare system
- Education on the prevention of medical adhesive-related skin injury needs to be made more widely available to both health professionals and patients. It needs to include training on how to select an adhesive medical device that reflects individual patient needs and avoids harm. It must also cover good application and removal techniques
- Good skin care, along with the use of skin barriers and adhesive removers, can help to significantly reduce the risk of these injuries
- The use of sterile skin barriers and sterile adhesive removers should be considered in patients requiring adhesive medical devices who are at high risk of infection

Definition and causes

What is a medical adhesive-related skin injury? The panel proposed the following definition, which is a simplified version of one devised by McNichol et al. in 2013.[1]

'*Skin damage related to the use of medical adhesive products or devices such as tapes, wound dressings, stoma products, electrodes, medication patches and wound closure strips.*'

Typically, medical adhesive-related skin injuries occur following removal of an adhesive medical device from patients whose skin is fragile or losing integrity. However, anyone who has a medical adhesive applied to them is at risk, with the risk increasing with the frequency of exposure (application and removal).[1] The injury can cause significant pain and distress, and contribute to:

- Longer hospital stays
- Longer treatment times in the community
- Increased health professional time
- Increased dressing usage
- Increased morbidity
- Delayed wound healing
- Scarring
- Increased risk of complications including infection.

Skin is also the first line of defence against infection. Loss of skin integrity can result in harmful bacteria entering the body, with the potential to cause a local infection. Medical adhesive-related skin injury can therefore consume healthcare resources and cause patients unnecessary suffering. Furthermore, as medical adhesive-related skin injury is an avoidable harm, their occurrence could be considered as negligence.

It is vital, therefore, to implement measures that will significantly reduce the risk of skin injury. This can, in turn, help decrease the costly incidence of wound infection. This requires greater awareness of the assessment and prevention of this type of skin injury.

Causes

Medical adhesive-related skin injuries are caused when the attachment between the skin and a medical adhesive is stronger than that between individual cells, causing the epidermal layers to separate or the epidermis to detach from the dermis (Figures 1 and 2).[1]

These injuries can range in severity from superficial skin stripping with no visible trauma to skin tears that affect the full depth of the skin.[1] Types of damage include:

- Skin tears (for definition, see Box 1)

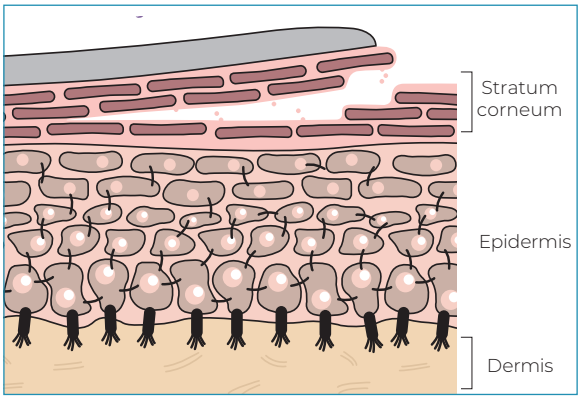


Figure 1. Separation of the dermal layers resulting in a medical adhesive-related skin injury (based on Tielemans and Voegeli)[42]

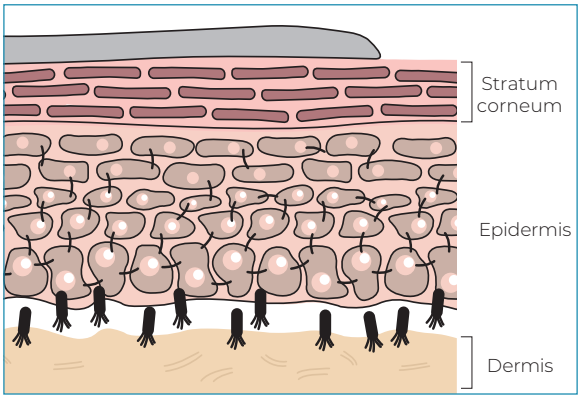


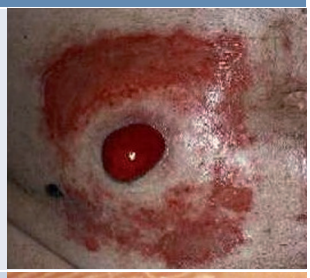
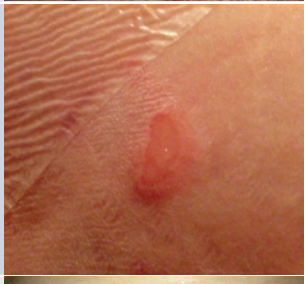
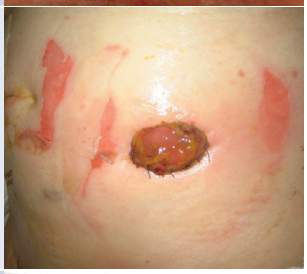
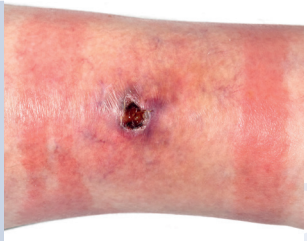
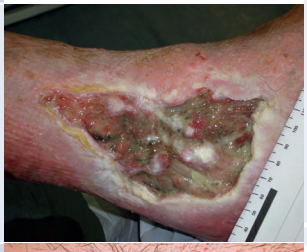
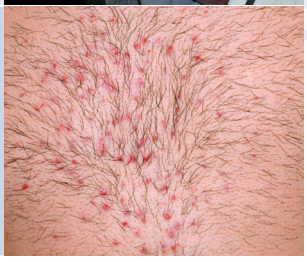
Figure 2. Separation of the epidermis from the dermis resulting in a medical adhesive-related skin injury (based on Tielemans and Voegeli)[42]

- Erosion or stripping of the skin
- Blisters or tension injuries
- Dermatitis
- Skin softening, wrinkling or breakdown due to moisture becoming trapped under an adhesive (maceration)

Box 1. International Skin Tear Advisory Panel (ISTAP) definition of a skin tear[43]

A skin tear is a traumatic wound caused by mechanical forces, including removal of adhesives. Severity may vary by depth (not extending through the subcutaneous layer)

Table 1. Categories of medical adhesive-related skin injury

	Type	Cause	Result	Example
Mechanical	Skin stripping	▪ Removal of adhesive tape or dressing	▪ Removal of one or more layers of the epidermis (top layer of skin). Damage is often shallow and irregular in shape. The skin may appear shiny. Open sores may be accompanied by red skin and blister formation	
	Tension injury or blister	▪ Skin swells or stretches under an unyielding adhesive tape or dressing ▪ Poor application of medical adhesive tape or dressing ▪ A joint or another area of movement is covered with an unyielding tape	▪ Injury caused by shear force (separation of the epidermis from the dermis, which is the second layer of the skin)	
	Skin tear	▪ Skin cut or scrape (shearing) ▪ Rubbing (friction)	▪ Skin is pulled away and the layers of the skin separate. This can cause either a partial-thickness wound (one that extends into the epidermis and dermis) or a full-thickness wound (one that extends into fat and muscle layers)	
Dermatitis	Irritant contact dermatitis	▪ Response to contact with a chemical irritant in the adhesive	▪ The skin is inflamed (red), and can become blistered, dry, thickened and cracked. ▪ Injury caused by shear force (separation of the epidermis from the dermis, which is the second layer of the skin)	
Other	Maceration	▪ Skin damage resulting from prolonged accumulation of moisture under an adhesive tape or dressing	▪ Skin appears wrinkled and white/grey. Softening of skin increases its permeability and susceptibility to infection	
	Folliculitis	▪ Prolonged accumulation of moisture and heat under an adhesive can attract bacteria, which might proliferate in this enclosed environment, resulting in an inflammatory response in the hair follicle	▪ Appears as small inflamed elevations of skin around the hair follicle. These can present as papules (skin that has changed colour or texture) or pustules	

Credits: (from top to bottom) Caroline Rudoni, Director of Clinical Services for the Amcare Group, UK; Jan Hitchcock, New Zealand Registered Comprehensive Nurse, UK; Chantal Tielemans, President of the Flemish Association for Enterostomal Therapists, Belgium; Dr P Marazzi/Science Photo Library; Annemarie Brown, University of Essex, UK; Dr P Marazzi/Science Photo Library. For all images, patient consent was received for dissemination

- Inflammation or infection of hair follicles (folliculitis), which can occur if the moist and warm environment between the skin and adhesive tape or dressing attracts microbes, which then proliferate
- Abnormal reddening of the skin (erythema).

Top tips

If the skin is swollen, damaged or sore, ensure that the cause is identified and treated

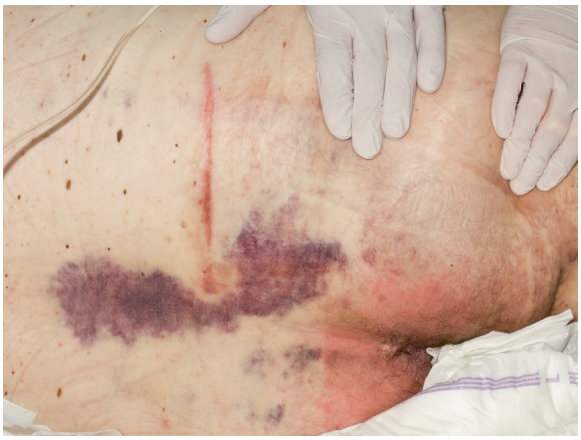
Handle the affected area carefully, moisturise the skin and avoid the use of medical adhesives

Repeated removal of dressings, tape or other adhesive medical devices can increase the risk of medical adhesive-related skin injury

Poor choice of a medical adhesive, such as one that has more adhesion than is needed for securement or poor removal technique, can also increase the risk of injury

Epidermal skin stripping can cause further damage to the wound or periwound skin, leading to prolonged inflammation and an increased risk of local infection.[2,3]

Different types of medical adhesive-related skin injury are listed in Table 1.



Skin damage caused by a dressing and adhesive tape

Table 2. Commonly used medical devices associated with medical adhesive related-skin injuries

Vascular access devices
These are often covered and secured with adhesive film dressings. Superficial damage can occur at the access site during removal. In some cases, vascular access devices are inserted for long-term use
Medical adhesive tapes
Used during anaesthesia to: ▪ Close the eyes and prevent corneal abrasions.[44] Skin on the face, particularly the eyelids, is thin and delicate, making it susceptible to medical adhesive-related skin injury. The Association for Perioperative Practice (AfPP) therefore recommends that the use of tape, other than to secure eye pads, should be avoided[45] ▪ Fix devices such as endotracheal tubes, temperature probes, gastric tubes and electrodes Surgical adhesive tapes often contain acrylate, the adhesiveness of which increases over time. In lengthy surgery, there is an increased risk of skin injury during removal
Adhesive tapes are also used on the wards and community settings to secure medical devices
Stoma devices and wound drainage bags
Skin stripping can occur when the stoma flange is removed, resulting in sore, irritated skin
Wound dressings
Many wound dressings have an adhesive border to secure the dressing to the periwound skin
Electrodes
The skin-contact surface of these devices is adhesive
Medication patches
These have an adhesive border
Wound closure strips
The skin-contact surface of these devices is adhesive

Table 3. Evidence on the occurrence of medical adhesive-related skin injury

Reference	Study design	Findings
Ousey and Wasek[46]	Survey of 918 UK-based wound-care health professionals	71% said the occurrence of medical adhesive-related injuries was not reported in their facility Only 31% were aware of the term 'medical adhesive-related skin injury' (sometimes abbreviated as MARSI)
Konya et al.[47]	Survey of 155 people aged ≥65 years in a long-term care facility in Japan	24 people developed medical device related-skin injuries across 34 sites
Wang et al.[48]	Prevalence survey involving 232 patients in a paediatric intensive care unit in China	Over 2 weeks, the prevalence ranged from 25.53% to 54.17% (mean: 37.15%)
Farris et al.[49]	Survey of two inpatient acute care units (total number of beds: 65) in the US	Daily prevalence ranged from 3.4% to 25.0% (mean: 13.0%; median: 12.7%)
Zhao et al.[20]	Two-week prevalence survey involving 419 Chinese patients with vascular access devices (peripherally inserted central catheters)	Prevalence was 29.89%

Categories

There are three main categories of medical adhesive-related skin injury:

- Mechanical
- Dermatitis
- Other, such as maceration and folliculitis.[1,4–11]

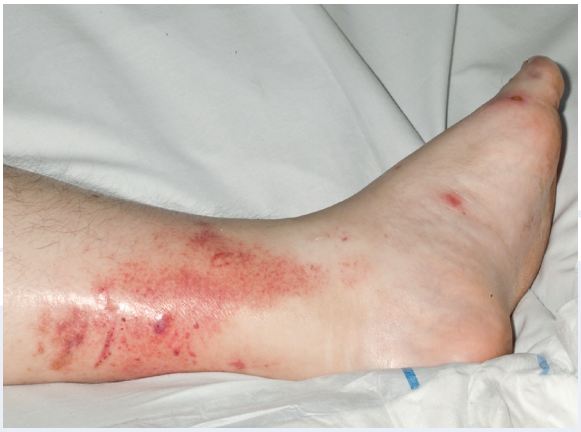
A single medical adhesive-related skin injury can result in the simultaneous occurrence of different types of injury, such as skin tears and blisters.

Key-take home message: the three As of MARSI

- Medical adhesive-related skin injuries are **Adverse skin reactions**/harms that result from the use of a medical adhesive on the skin
- Medical adhesive-related skin injuries can occur in **Anyone requiring a medical adhesive**
- Medical adhesive-related skin injuries are largely **Avoidable when preventive measures are implemented**

The most commonly used medical devices associated with medical adhesive-related skin injuries are listed in Table 2 (see page S7).

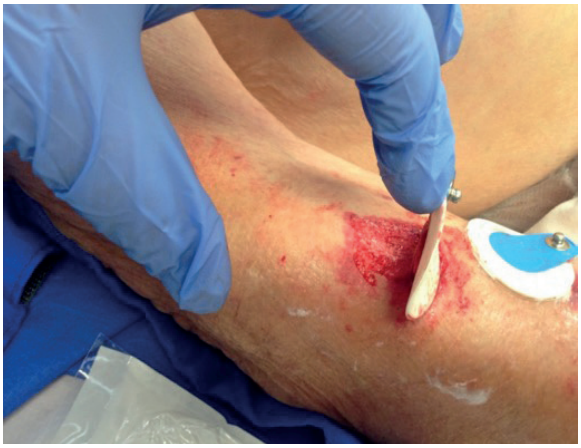
There is no national standard for reporting medical adhesive-related skin injury, so their overall incidence is unknown. Table 3 outlines the findings of studies that have sought to shine a light on this.



Mechanical tension injury caused by an adhesive dressing and tape. Note the blister and tension injury on the foot

Panel recommendation

- Following a skin assessment, high-risk patients could be given cards stating that they are at risk of a medical adhesive-related skin injury
- These cards could help minimise risk and empower patients
- Where this is not possible, electronic alerts on local systems could be implemented



Medical adhesive-related skin injury caused by the removal of an electrode

Risk factors

Intrinsic and extrinsic factors that affect skin integrity can also increase the risk of medical adhesive-related skin injuries. These are summarised in Table 4. More information on intrinsic risk factors is given below.

Intrinsic risk factors

Neonates and paediatrics

At birth, the skin is fragile due to the immature development of the stratum corneum, the skin's protective barrier: neonatal skin is 40–60% thinner than adult skin, with a lower cohesion between the dermis and epidermis.[12] Because it has fewer epidermal cells, it is also more permeable. When a medical adhesive is removed, the additional loss of epidermal cell layers can reduce the neonatal skin's barrier function even further.

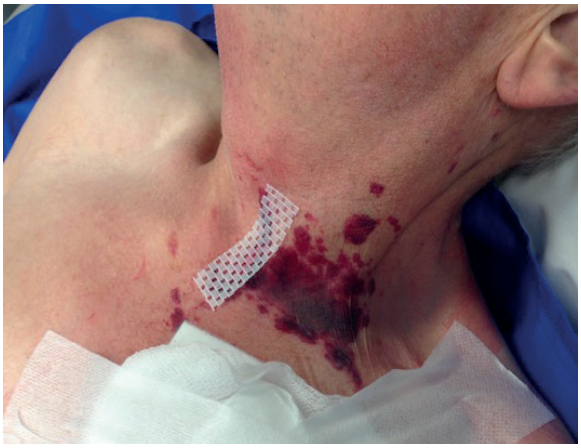
The skin of premature babies is particularly vulnerable to medical adhesive-related skin injuries.[13] Premature babies also often require medical adhesives for the fixation of critical devices such as feeding tubes or ventilation tubes.[14]

The fragility of the skin decreases throughout infancy.

Table 4. Risk factors for medical adhesive-related skin injuries[1]

Intrinsic risk factors	Extrinsic risk factors
Extremes of age (neonates and elderly people are at high risk)	Dry skin (can be caused by low humidity) and harsh (non-pH balanced) cleansers
Dehydration	Prolonged exposure to moisture
Malnutrition	Certain medications such as long-term use of corticosteroids, chemotherapeutic agents, anti-inflammatory agents and anticoagulants
Dermatological conditions	Radiation therapy
Underlying medical conditions that can affect the skin: ▪ Diabetes*[50] ▪ Infection ▪ Renal insufficiency[51] ▪ Immunosuppression[52] ▪ Chronic venous insufficiency[53]	Photodamage or exposure to ultraviolet light
Oedema	Tape, device removal and repeated taping. Itching

*Due to effects of diabetes on the immune system, patients with diabetes are at higher risk of infection if the skin barrier is compromised,[54] making it vital to avoid medical adhesive-related skin injuries in this patient population



Medical adhesive-related skin injury caused by the removal of an adhesive tape

Older adults

Older people experience loss of dermal matrix and subcutaneous tissue, epidermal thinning, lower cohesion between the dermis and epidermis, reduced blood supply to the skin, dehydration, and reduced collagen, elasticity and tensile strength.[1,15–18] Disease-related pathologies, exposure to ultraviolet light and certain medications also contribute to skin ageing. Figure 3 illustrates the differences between aged and young skin.

Increased skin fragility makes the skin more susceptible to mechanical forces such as friction, shear and trauma.[19] In adult oncology patients, independent risk factors that further increase the risk of a medical adhesive-related skin injury include age ≥50 years and haematologic malignancies.[20]

Dermatological conditions

Dermatological conditions that cause dry, flaky, dehydrated skin, such as eczema, psoriasis, dermatitis and epidermolysis bullosa, increase the risk of medical adhesive-related skin injuries.[1]

Panel recommendation

All medical adhesive-related skin injuries should be documented in the patient's notes and the patient and his/her family informed about the injury (statutory duty of candour)

The documentation should include a photo of the injury taken when it occurred or was first observed

Medical adhesive-related skin injuries are patient harms and so should be reported in local reporting system

Oedema

Oedema (swelling) can result in skin changes that increase the risk of a medical adhesive-related skin injury. The skin above a swollen area is generally tight and shiny, and can suffer a loss of elasticity and be prone to flaking or cracking. When assessing the skin before applying an adhesive medical device, observe for swelling that could deteriorate and cause increased tension during removal.

Risk assessment

The skin should be routinely assessed in all patients before an adhesive medical device is applied, even if the skin does not appear fragile or compromised. This involves taking a thorough history and performing a physical examination to assess the overall condition of the skin[21] before applying an adhesive medical device. Additional assessments should be performed at each dressing change and when observing for signs of pressure damage. Table 5 lists some of the key aspects to consider when performing a skin assessment; this will also help identify whether a patient is at risk of medical adhesive-related injury. When assessing the skin before

Table 5. How to undertake a full skin assessment

Visually inspect and, when required, palpate the skin
Assess the skin: ▪ Temperature ▪ Colour ▪ Moisture level ▪ Turgor (fullness and elasticity: lack of turgor is a sign of dehydration) ▪ Fragility ▪ Integrity
Observe for local signs of irritation or damage at the site where the adhesive will be/has been applied
Document the skin assessment

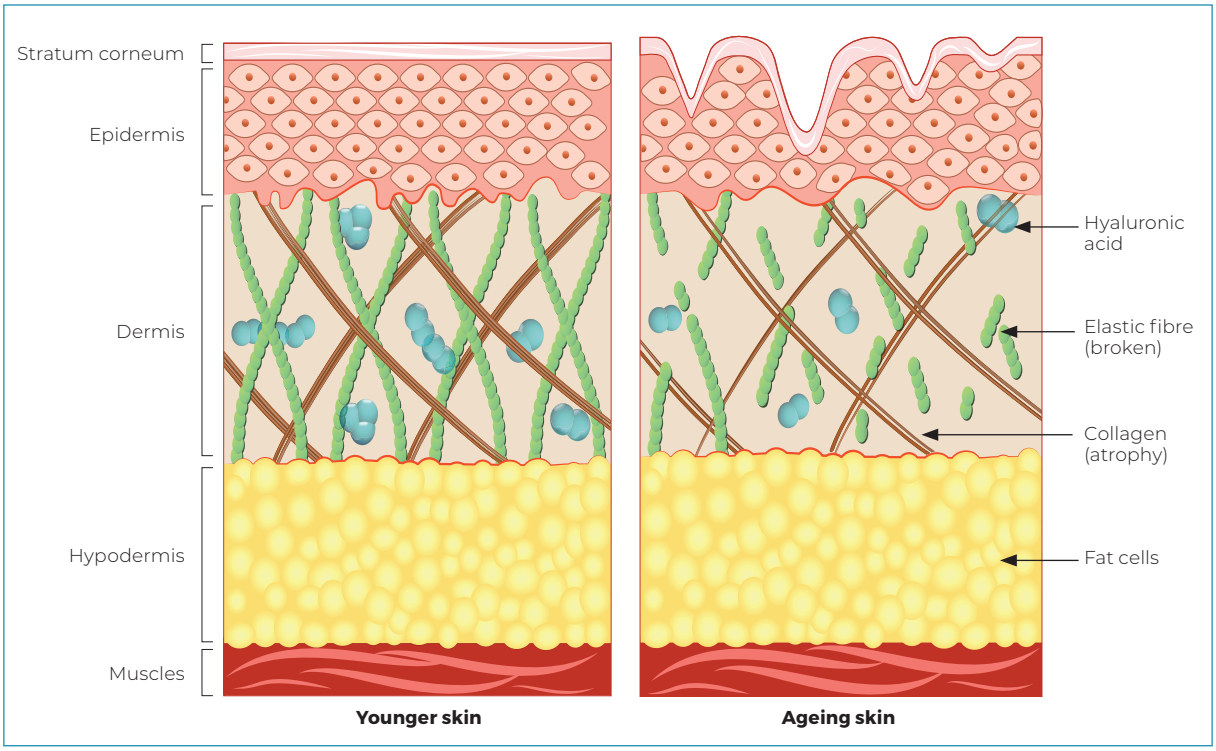


Figure 3. Difference between aged and young skin

the application of an adhesive medical device, observe for swelling that could deteriorate and cause increased tension during removal.

For NHS organisations, introducing a standardised process for skin assessment would help to ensure consistency of care and reduce the risk of medical adhesive-related skin injuries. Furthermore, if these injuries do subsequently occur, it will enable accurate identification and reporting.

What if a pre-existing injury is present?

If the skin assessment reveals a pre-existing skin injury, its cause (such as excess moisture or adhesion) should be identified, the diagnosis documented and, if necessary, referral to a specialist such as a tissue viability nurse (TVN) should be arranged in accordance with local guidelines.

As previously stated, there may be more than one type of medical adhesive-related skin injury at a single site; for example, a skin tear, blistering and redness can coexist. Any scar tissue or pain should be noted, and application of an adhesive medical device to the affected area avoided, if possible. It is also important to be aware of any factors that may increase the patient's risk of infection. The skin assessment should help identify a suitable preventive intervention for the patient, particularly if they are at high risk.

There is no national standard for national or local reporting of medical adhesive-related skin injuries and no adequate clinical coding for them.[22] If a medical adhesive-related skin injury is identified at any point, a patient incident report should be completed to document this patient harm.

Key take-home message

- The skin should be assessed in all patients before applying a medical adhesive. Remember, **everyone is at risk**
- **Assess the skin each time** a medical adhesive is applied or removed
- During the assessment, **observe for any skin changes** that might increase the patient's risk of developing a medical adhesive-related skin injury
- Where available, **follow evidence-based clinical guidance** on skin assessment for particular patient groups, such as those with a stoma

Prevention

Education

At present, prevention of medical adhesive-related skin injury is not included in many health professional training curricula. This needs to be addressed, so that it becomes an important part of pre-registration and post-registration education on wound management and skin care. In the meantime, information on how to prevent medical adhesive-related skin injury should be made widely available to all levels of health professionals and patients. This should cover:

- Skin preparation
- Application and removal technique
- Use of skin barrier products and/or adhesive removers.

Where education is not available, consider liaising with the multidisciplinary team to determine how it can be delivered.

Education should be provided to patients as well as health professionals. Educating patients on medical adhesive-related skin injury might empower them to insist that prevention strategies are implemented and will help them identify this type of skin damage if it does occur.

Adhesive devices associated with skin injury

Medical adhesives are used for the fixation of devices, such as dressings, feeding tubes, catheters and electrodes, to the skin. Examples of medical devices containing adhesive are listed in Table 6.

Medical adhesives should be biocompatible, non-sensitising, non-irritating and non-cytotoxic.

Panel recommendation

- Given the current lack of awareness of, and education on, medical adhesive-related skin injury, a first step is to provide local training and advice on this topic to all levels of health professionals
- The ultimate objective is to ensure that content on medical adhesive-related skin injury is included in all pre-registration and post-registration education on wound management and skin care
- Education should also be provided to patients, procurement staff and pharmacists

Categorisation

Adhesive and securement needs can be broadly categorised by purpose:

- General: to dress wounds and secure intravenous lines, non-critical tubing and cannula
- Flexible: securement when swelling or movement is anticipated
- Critical: to secure central venous catheters, nasogastric, tracheostomy and percutaneous endoscopic gastrostomy (PEG) fixation, and stoma pouches. Here, the need for high adhesion may supersede all other considerations.

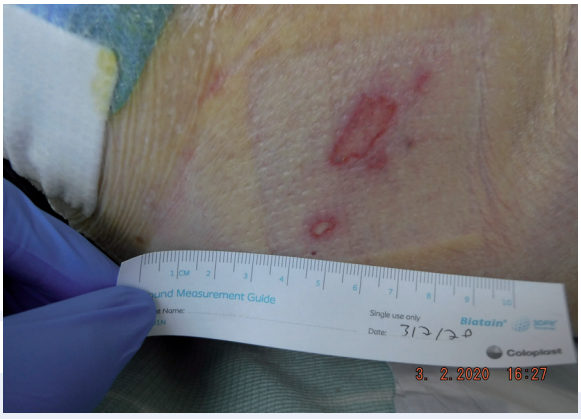
Table 6. Examples of medical devices with adhesives

Type of device	Examples
Fixation Diagnostics	▪ Electrodes ▪ Cannula dressings ▪ Nasogastric and percutaneous endoscopic gastrostomy (PEG) tube fixation ▪ Wound closure strips ▪ Zinc oxide strapping tapes ▪ Surgical drapes ▪ Film dressings ▪ Adhesive dressings
Stoma products*	▪ Adhesive stoma products
Wound drainage bags*	
Adhesive wound dressings	▪ Hydrocolloids ▪ Hydrogel adhesive sheets ▪ Foams ▪ Film dressings
Tapes	▪ Types of adhesives used include: ▪ Silicone ▪ Acrylate (paper and plastic) ▪ Zinc oxide ▪ Silk
Wound tapes	▪ Plasters ▪ First aid dressings
Urethral catheter fixation	▪ Multipurpose paper tape with a lower level of adhesive strength
Urinary sheath securement	

*Stoma bags and wound drainage bags use the same technology

Table 7. Type of adhesives used in medical devices[1]

Type	Advantages	Disadvantages
Silicone	▪ Biocompatible with skin ▪ Repositionable (extends dressing wear time) ▪ Useful for repeat application to the same area ▪ Moisture/water-resistant ▪ Permeable ▪ Atraumatic removal from skin ▪ Latex-free ▪ Hypoallergenic	▪ More expensive than acrylate adhesives ▪ Not strong enough to secure critical tubing ▪ Less moisture-resistant than acrylate tape
Acrylate	▪ Less expensive than silicone adhesives ▪ Low sensitisation ▪ No dressing breakdown ▪ Not harmful to living tissue ▪ Breathable ▪ Resistant to heat and humidity ▪ Latex-free ▪ Can be laminated to surfaces	▪ Not repositionable ▪ Can cause more skin trauma during removal ▪ Poor adhesion stability over time
Hydrocolloids	▪ Adhesion can weaken over time depending on its water content	▪ Can cause skin trauma during removal



Medical adhesive-related skin injury caused by a permeable adhesive tape used to secure a dressing

Adhesives used in tapes and dressings are mainly acrylate, silicone, hydrocolloids and, more occasionally, polyurethane.[1,23] Adhesives are also applied to film and foam dressings.

Most wound dressings have either an acrylate, silicone or hydrocolloid adhesive to keep them in place. Although hydrocolloids have some degree of adhesion, the addition of plasticizers and tacking agents to the formulation is often required to improve adhesiveness.

Characteristics such as the degree of adhesion, repositionability and permeability can vary between different medical adhesives. In simple broad terms, their modes of action also differ: as pressure is applied and the skin warms, acrylate adhesives fill the gaps between the adhesive backing/device and the skin's irregular surface, increasing the strength of the bond over time. In contrast, silicone-based adhesives are softer and gentler, and maintain a constant level of adherence over time. The relative advantages and disadvantages of medical adhesives are described in Table 7.[1]

Because the properties of medical adhesives can change in high and low temperatures or humid conditions, always follow the manufacturer's instructions when storing them.

Selection

The choice of medical adhesive should be based on the patient's skin type, as determined by the assessment. This involves considering:

- Why the adhesive medical device is needed
- The patient's risk of skin damage
- Whether the adhesive needs to be repeatedly removed and reapplied.

Table 8 (overleaf) describes how this can be approached. With reference to Table 8 if, for example, moisture is present in the anatomical area where the adhesive medical device is to be applied or the room is hot, consider selecting an acrylate adhesive. If the patient's skin is fragile and dry, a silicone product would be most suitable. The manufacturer's instructions for use will

Table 8. Factors to consider when selecting an adhesive medical device

The part of the body where the medical adhesive will be applied (face, eyes, sensitive area)
▪ How much movement occurs in that area? (For areas with oedema (swelling), consider using tape that can stretch) ▪ How much moisture is present in that area? ▪ How exposed is the area to the external environment?
The amount of time (days or weeks) for which the adhesive will need to be applied
▪ Consider plastic tape for short-term wear ▪ Consider paper/cloth tape for long-time wear
Whether the adhesive is being used to secure a critical device
▪ Consider plastic tape for short-term wear ▪ Consider paper/cloth tape for long-time wear
Whether the adhesive will need to be repeatedly removed and re-applied
The patient's age
The patient's lifestyle (sedentary, active)
The patient's environment (hot, cold, humid, dry)
The patient's skin type (fragile, dry, flaky, hairy, sun-damaged, wrinkled)
The patient's health status, including medications prescribed that might alter skin integrity
Whether the skin needs to be prepared
▪ Should it be cleansed, dried, hair clipped/trimmed?
Whether a barrier film should be applied
▪ Is there enough time (approximately 30 seconds) for the product to dry before the adhesive is applied?
Whether the skin needs to be rehydrated or, if possible, another location considered if the area is extremely dry*
How the adhesive will be removed and by whom

▪ Is there access to an adhesive remover? If so, does it need to be:
  ▪ Sterile or
  ▪ Non-sterile?

Whether the patient has an allergy to adhesives

* Note this is not possible for stoma sites

contain useful information that can aid selection. Seek expert clinical advice from a TVN or tissue viability link nurse when necessary. Importantly, a one-size-fits-all approach will not work for all patients in a clinical setting or for all of the adhesive medical device needs of a single patient. For example, it will sometimes be necessary to use different types of adhesives in different areas in a single patient. Selection will be influenced by local formularies.

Always document the condition of the patient's skin and how the adhesive medical device is likely to affect it.

Skin sensitisers

Skin sensitisers are substances that trigger an allergic response following contact with skin. Medical adhesives are common skin sensitisers and a reaction can occur at any time. In 2016, Alavi et al. recommended that all ingredients of adhesive medical devices should be listed on the packaging and that common allergens should not be used in the construction of wound care products.[24] The panel would like to see this implemented. At present, this information is available from the manufacturer but there is no requirement to include it on packaging.

Generic application and removal techniques should always be followed to avoid skin stripping, and the manufacturer's instructions consulted.

Application

Always follow the manufacturer's instruction when applying an adhesive medical device. Guidance on the safe and effective application of adhesive medical devices is outlined in Table 9.

Removal

Table 10 (see page S16) outlines removal techniques that will minimise the risk of skin damage.

Do not attempt to remove an adhesive medical device with one swift action. Fast, vertical pulling is not only more painful, but it also generates a higher peel force than slow removal. In addition, the adhesive product is likely to fold onto itself.

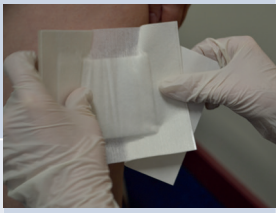
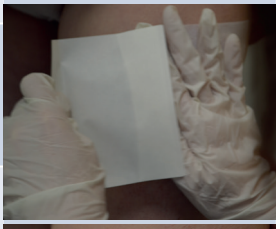
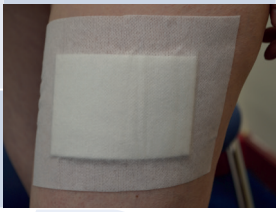
To minimise skin damage during removal, generic removal techniques should be followed.

Avoiding pain

An informal pain assessment should be undertaken at every dressing change. Always follow local guidelines on pain assessment and management. In most cases, pain can be minimised by:

- Checking that the patient is comfortable during the procedure, which will help reduce anxiety. This can

Table 9. Key consecutive steps for the application of adhesive medical devices

▪ Prepare the skin (e.g. cleanse the area and clip or trim hair, if necessary) ▪ Where possible, avoid the use of products, such as alcohol-based skin preps, that dry the skin. Exceptions include surgical skin preparation and skin decontamination before application of a film dressing to a vascular access site[55,56]	
▪ Apply to dry skin (moisture can reduce the effectiveness of the adhesion)	
▪ Do not apply with tension or stretching	
▪ Apply in the correct orientation to allow for stretching if movement or swelling is anticipated	
▪ Use firm, gentle pressure to smooth the adhesive product into place without gaps or wrinkles	
▪ Only remove and reposition if the manufacturer's instructions state that it is safe to do so	
▪ Assess appropriate borders and only apply adhesive over the area required	

Panel recommendation

- Always apply adhesive medical devices in accordance with the manufacturer's instructions

involve controlling the room temperature and ensuring the patient is not in an awkward position during the procedure
- Using the application and removal techniques described in Tables 9 and 10
- Providing patient information about the procedure
- Considering the use of adhesive removers and skin barriers

Key take-home message

- **Assessment and management of pain** should form part of routine assessment and care[57]
- Health professionals should be encouraged to think about how they can incorporate **pain-minimisation strategies** into their routine practice when using adhesive medical devices. For example, if a patient is receiving an analgesic, it could be administered before the device is removed

- For wounds, ensuring that the size, shape and absorbency of the dressing selected are right for the lesion and that it will maintain its integrity for the wear time specified in its instructions for use.

Psychosocial effects can play a role in the patient's perception of pain—for example, negative thoughts about pain, emotional distress, anticipatory pain[25] and anxiety can all heighten the pain experience. Pain can also reduce appetite and cause sleep deprivation, which can further aggravate the stress response; this, in turn, can delay the inflammatory response, which is a key phase of wound healing.[26] Children, in particular, can experience anticipatory fear during removal, especially if they have experienced traumatic removal previously.[14]

Unfortunately, some patients who experience medical adhesive-related injury during dressing removal are reluctant to express their pain for fear of being marginalised[19] or because they do not know that these injuries are avoidable.

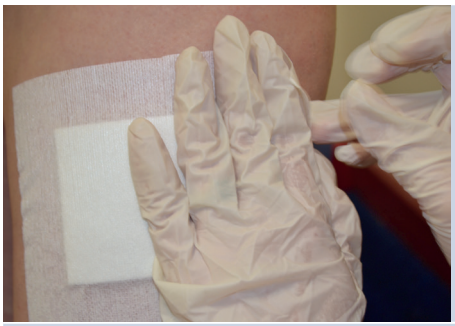
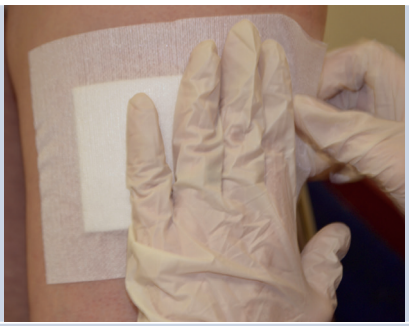
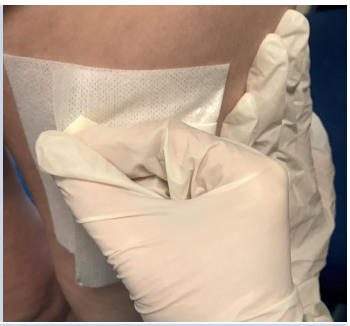
The panel calls for greater awareness among health professionals that removal of adhesive medical devices can be painful and may cause patients anxiety. In addition, health professionals need to improve communication with patients and their informal carers about this risk. Every effort must be made to avoid pain during removal and the occurrence of medical adhesive-related skin injury.

Guidelines and recommendations for assessing and managing wound pain advise that pain should be assessed before each dressing change, and appropriate action taken to address an identified cause.[27–29] Health professionals should also know when to refer for specialist pain assessment.

Skin care

Maintaining optimal skin health will help maintain skin integrity and thus reduce the risk of medical adhesive-related skin injuries.[30] Table 11 (overleaf) outlines components of good skin care.

Table 10. Key consecutive steps for the removal of adhesive medical devices

Loosen the edges of the adhesive product
With the fingers of the opposite hand, push the skin down and away from the adhesive
Gently remove the adhesive product, keeping it as close to the skin as possible. Slowly move the product back over itself in the direction of hair growth, keeping it horizontal and close to the skin surface
As the product is removed, continue moving the fingers of the opposite hand as necessary to support newly exposed skin at the peel line
Non-bordered transparent film dressings can be removed by loosening a corner of the dressing and stretching it horizontally in the opposite direction of the wound (stretch and relax technique). Walk fingers under the dressing to continue stretching it. One hand should continuously support the skin adhered to the film dressing. The process can be repeated around the dressing
Tape strips may be removed by slowly removing each side toward the wound. When both sides are completely loosened, lift the strip up from the centre of the wound
Use medical adhesive remover if needed to loosen the adhesive bond. Follow the manufacturer's instructions for use
The same steps illustrated in the images above apply to the removal of tape strips and film dressings

Table 11 demonstrates that certain lifestyle factors can age and/or dehydrate the skin. These should be noted during assessment. In addition, patients should be given simple guidance on skin care, including advice on changing their lifestyle.

Local guidelines, where appropriate and applicable, are available on the skin care of neonates, elderly people and patients undergoing radiotherapy, who are at high risk of loss of skin integrity. These should be implemented alongside the guidance, suggested by the panel, outlined in Table 11, as appropriate. Patients with dermatological conditions such as eczema and psoriasis should receive standard good skin care, but be referred to a specialist for treatment, as required.

Alternatives to medical adhesives

Alternatives to medical adhesives that can be used to hold dressings in place include adhesive bandages, strapping and supports, although care must be taken to ensure they do not restrict movement and provide adequate securement. Training may be required on their application.

Skin barriers

Skin barriers form a protective interface between the skin and adhesive, thereby alleviating the risk of adhesive trauma.[31] The panel recommends that skin should be protected with a barrier product before an adhesive medical device is applied and that this should be considered as a standard part of the skin-care protocol. The

Panel recommendation

- Adhesive removers can play a bigger role in the prevention of medical adhesive-related skin injury
- In clinical areas where high-risk patients are treated, every time an adhesive medical device or barrier film is ordered, the system should issue an alert suggesting that an adhesive remover should also be ordered
- The decision of whether to use adhesive removers should be a clinical one based on the existing evidence and not a procurement decision

Key take-home message

- The **option to use an adhesive remover** should be **available to all health professionals**
- Lack of availability should not be a reason for not using an adhesive remover when it is **clinically justified to avoid patient harm**

panel advised that barrier products should therefore be made widely available to health professionals in all clinical areas, including emergency care, theatre, general practice surgeries, wards and clinics.

Liquid barrier films are available in formats such as foam applicators, wipes and sprays. Alcohol-free products are recommended because alcohol can cause pain when applied to sore, broken, irritated skin, such as peristomal or periwound skin.

Barrier products may be contraindicated if a skin infection is present; information on this will be included in the instructions for use. Sterile barrier film products can be used on broken skin.

Always follow the manufacturer's instructions for use before using a skin barrier. Check before using two products in combination and double-check the frequency of application. Barrier products must be left to dry before being covered to prevent the adhesive medical device sticking to it.

Advantages and disadvantages of the various skin barrier products are summarised in Table 12 (page S18).[32,33]

Adhesive removers

Medical adhesive removers are routinely used in clinical practice to remove adhesive and barrier film residues and to minimise discomfort and skin damage. Medical adhesive removers are:

- Alcohol or organic solvent based
- Silicone based.

They are available as wipes, pads, liquid sachets or sprays. Some characteristics of alcohol- and silicone-based adhesive removers are summarised in Table 13 (page S19).[34,35]

The anatomical location where the adhesive remover will be applied should influence selection—for example, avoid sprays above the neck and use liquid sachets with caution where there is a risk that the contents might enter the body.

Unfortunately, access to adhesive removers is not the same across all healthcare settings. Health professionals who regularly use adhesive medical devices, such as stoma products, or care for patients with fragile skin, such as neonates, are more likely to have access to them.

Table 11. Examples of good skin care that will help avoid loss of skin integrity

- Incorporate good skin care into daily routine:
  - Avoid washing the skin too much
  - Use a pH-balanced soap substitute to avoid drying the skin
- Hydrate the skin and body (moisturise the skin daily and ensure the patient drinks enough water to prevent dehydration):
  - Assess the skin for visual signs of flaky, cracking or dryness
  - Consider intrinsic signs such as dark-coloured urine
  - Note that smoking can age/dehydrate the skin
- Avoid using alcohol-based products, perfumes, dyes or harsh soaps:
  - Advocate pH balanced, fragrance-free and paraben-free soap substitutes
- Use emollients as a moisture barrier:
  - Advocate washing with emollient wash products and apply an emollient afterwards
- Handle skin with care:
  - When drying the skin, lightly pat without rubbing
  - Be aware of environmental hazards such as sharp objects, furniture, equipment and extreme temperatures
- Avoid clothing that scratches the skin, causes itching, or puts pressure on the skin
- Encourage patients to adhere to the following sun-care recommendations:
  - Use sunscreen with a sun protection factor of at least 30
  - Cover up with clothes, a hat and sunglasses
  - Avoid spending time in the sun between 11.00 and 15.00

Panel recommendation

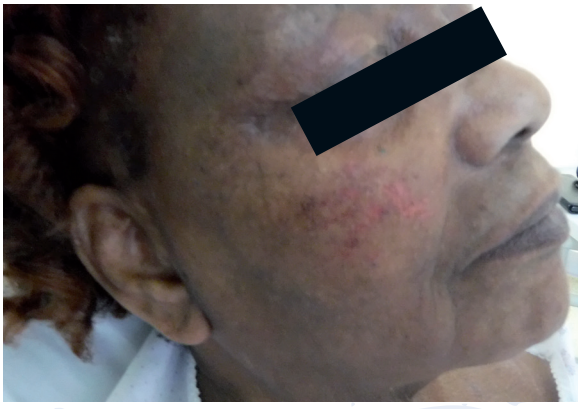
- The decision of whether or not to use a sterile adhesive remover or a sterile skin barrier should be based on clinical judgement as part of a risk management strategy
- There is a strong case to consider the use of sterile skin barriers in patients who are at high risk of infection
- These patients include neonates, those with open wounds, surgical wounds, intravenous access sites or central lines, and those who are immunocompromised
- For other patients, use of these sterile products could be considered as part of a risk management process

Table 12. Guide to the selection of skin barrier products[32,33]

Product category	Presentation	Advantages	Disadvantages
Film-forming polymers in water or organic solvents	Liquid film	▪ Forms a mechanical barrier over the skin ▪ Thin and non-messy ▪ Dressings can still adhere to the skin ▪ Protects against skin-stripping during dressing change ▪ Some can be used on both intact and damaged skin ▪ Organic, solvent-free formulations have been shown to provide greater protection against trauma than solvent-containing solutions	▪ Some films contain alcohol or ethyl acetate, which can cause stinging and irritation ▪ Flammable ▪ Not suitable for deep, full-thickness wounds
Silicone barriers	Available as creams, films and wipes. Films have a foam applicator	▪ Conform to the skin/tissue ▪ Create a dry, water-repellent, transparent barrier ▪ Can be applied to broken or irritated skin without stinging (includes sterile barriers) ▪ Dry quickly	▪ If applied incorrectly, barrier creams and ointments can interfere with the adherence and absorption of primary dressings ▪ Some silicone creams are not indicated for use on broken skin

Panel recommendation

- The decision to use a sterile adhesive remover should be based on clinical judgement. These products should be strongly considered for high-risk patients with open wounds, intravenous access sites, central lines, percutaneous endoscopic gastrostomy (PEGs), neonates, and those who are immunocompromised.
- For other patients, the use of sterile adhesive removers could be considered as part of a risk management process.



Medical adhesive-related skin injury caused by a paper tape used to secure a device intra-operatively

Benefits of sterile skin barriers and sterile adhesive removers

All wounds are contaminated with microorganisms, but it is only when the bacteria multiply to the extent that this triggers a host response that they can be considered to be infected. The risk of a medical adhesive-related skin injury leading to local infection will therefore depend on the host defences.[36]

Patients with compromised natural defence mechanisms include:

- Immuncompromised patients
- Patients with comorbidities such as diabetes, renal impairment, malignancy, cardiac/respiratory disease, obesity, rheumatoid arthritis (who might be considered at high risk).[36]
- Patients with surgical wounds.[37]

Other risk factors include taking certain medications such as corticosteroids,[38] cytotoxic agents and immunosuppressants, poor personal hygiene and lifestyle choices.

Local wound infection can delay healing, cause complications and reduce a patient's quality of life. If it becomes systemic, antibiotics will be required.

To protect patients from the risk of microbial contamination, as a minimum a clean technique should be practised, which involves good hand hygiene and thorough cleansing, including of all surfaces, to limit exposure to harmful microorganisms. For high-risk patients, the principles of asepsis, which aim to ensure that an area is free of harmful microorganisms, is practised. This involves the use of sterile gloves, sterile

Table 13. Characteristics of adhesive removers[34,35]

Alcohol-based adhesive removers	Silicone-based adhesive removers
Can cause stinging on application, particularly when applied to broken skin	Do not cause stinging on application
Vasoconstriction can occur when the alcohol evaporates, causing the skin to become dry and to crack	Can be applied at the edge of tape or dressing, which can then be gently peeled back
	Does not leave a sticky residue, so the adhesive medical device can be reapplied with no effect on its adhesiveness

wound cleansing agents, sterile dressings and sterile equipment.[36,39]

Given that clean/aseptic technique is a cornerstone of care, the use of sterile adhesive removers and sterile skin barriers could be considered to be a natural component of that, although selection is based on individual clinical judgement and organisational policy. Adhesive removers can be used on both intact and broken skin. Sterile adhesive removers have been shown to be easy to use and effective on both intact and broken skin.[40,41] They have also been observed to reduce infection rates, the need for analgesia and thus nursing time and costs.[41] The use of sterile adhesive removers and skin barriers is therefore recommended on patients at risk of wound infection.

If a medical adhesive-related skin injury does become locally infected, health professionals should implement clinical guidance on best practice for its management, which involves a full holistic assessment, wound cleansing, debridement and the use of antimicrobial dressings, if required.[36]

Panel recommendation

- All formularies should include adhesive removers. Patients should also be aware that they can purchase adhesive removers.

Conclusion

Assessment, skin care and prevention strategies are fundamental aspects of patient care. In all patients, the skin should be assessed before a medical adhesive is applied. The skin should then be reassessed for as long as the medical adhesive is in place. Use of adhesive

Medical adhesive-related skin injury: prevention checklist

The checklist below should be completed before applying an adhesive medical device.

1. **Have you performed a local skin inspection where the adhesive needs to be applied?** ☐
2. **Have you considered the patient's risk factors?**
   - Intrinsic ☐
   - Extrinsic ☐
3. **Have you considered using an alternative to a medical adhesive?** ☐
4. **If there is no alternative to the use of a medical adhesive, have you considered:**
   - Using a skin barrier, if clinically indicated? ☐
   - How to select an appropriate adhesive? ☐
   - Using an adhesive remover, if clinically indicated? ☐
   - Reviewing your adhesive removal technique (is it low and slow)? ☐
5. **If there is any skin damage, have you considered advice on how to repair the skin between repeated applications of adhesive medical devices (including rest time if severe damage has been caused)?** ☐
6. **If there is no skin damage, have you considered providing good skin care?** ☐
7. **Have you communicated the outcome of the skin assessment to your colleagues, the patient, the patient's caregiver and the patient's family?** ☐
8. **Have you documented the assessment and any actions/interventions?** ☐
9. **If a medical adhesive-related skin injury is identified, have you completed a patient incident report?** ☐

Medical adhesive-related skin injury: patient information

Meaning: what is a medical adhesive-related skin injury (MARSI)?

It is skin damage that can occur during the removal of adhesive medical devices including but not limited to tapes, wound dressings, stoma products, electrodes, medication patches and wound closure strips. Damage can include skin stripping, skin tears, blisters, inflammation and reddening. The skin can also soften if moisture is not able to escape from the adhesive medical device.

Aetiology (cause): what causes a medical adhesive-related skin injury?

Most often, it is caused when the layers of the skin are stripped, torn, put under tension or exposed to friction during the removal of an adhesive medical device. Other causes can include skin reactions, such as dermatitis, to chemicals or materials used in the adhesive products, with moisture becoming trapped under the adhesive device, or bacteria becoming trapped and colonising hair follicles.

Risk: who is susceptible?

Anyone who needs to have a medical adhesive applied to their skin is at risk. However, those most at risk include those with fragile skin such as babies and children, elderly people, patients with skin conditions such as dermatitis and eczema, patients with swollen limbs, patients taking certain medications or treatments including corticosteroids, anticoagulants or chemotherapy, patients undergoing radiation therapy and patients who require repeated tape/dressing removal. Some health conditions, such as diabetes and kidney disease, are also associated with risk.

Side effects: what are the consequences of a medical adhesive-related skin injury?

These injuries can be painful and take time to heal. Therefore, when you undergo a procedure requiring a medical adhesive, always be aware of the risk and discuss with the health professional how it can be avoided.

Intervention: can we prevent these skin injuries?

In most cases, there are simple and effective preventive measures that you, healthcare staff and healthcare organisations can take to reduce the risk of medical adhesive-related skin injuries occuring:

- Keep your skin hydrated and healthy by moisturising daily, using products that can protect your skin from harm (sunscreen, skin barriers, adhesive removers) and drinking enough water
- Make sure a health professional performs a skin assessment before applying a medical adhesive to you. This will help them choose a medical adhesive that will not damage your skin. Health professionals can also use particular application and removal techniques that will minimise any risk of any skin damage.

Panel recommendation

- Best practice guidelines are required to ensure that medical adhesives are applied appropriately.

removers and skin barriers, alone or in combination, are recommended when clinically indicated. Provision of local training on the awareness, identification and prevention of medical adhesive-related skin injuries is required. The panel recommends that research should be conducted, particularly in high-risk patient groups, to inform selection, application and removal of medical adhesive devices, with the ultimate aim being to standardise the prevention of medical adhesive-related skin injuries. Meanwhile, manufacturers of medical adhesive devices must continue to develop innovative products in consultation with health professionals and disseminate the results of their research. More evidence on medical adhesive products, including their combined use, would be welcomed.

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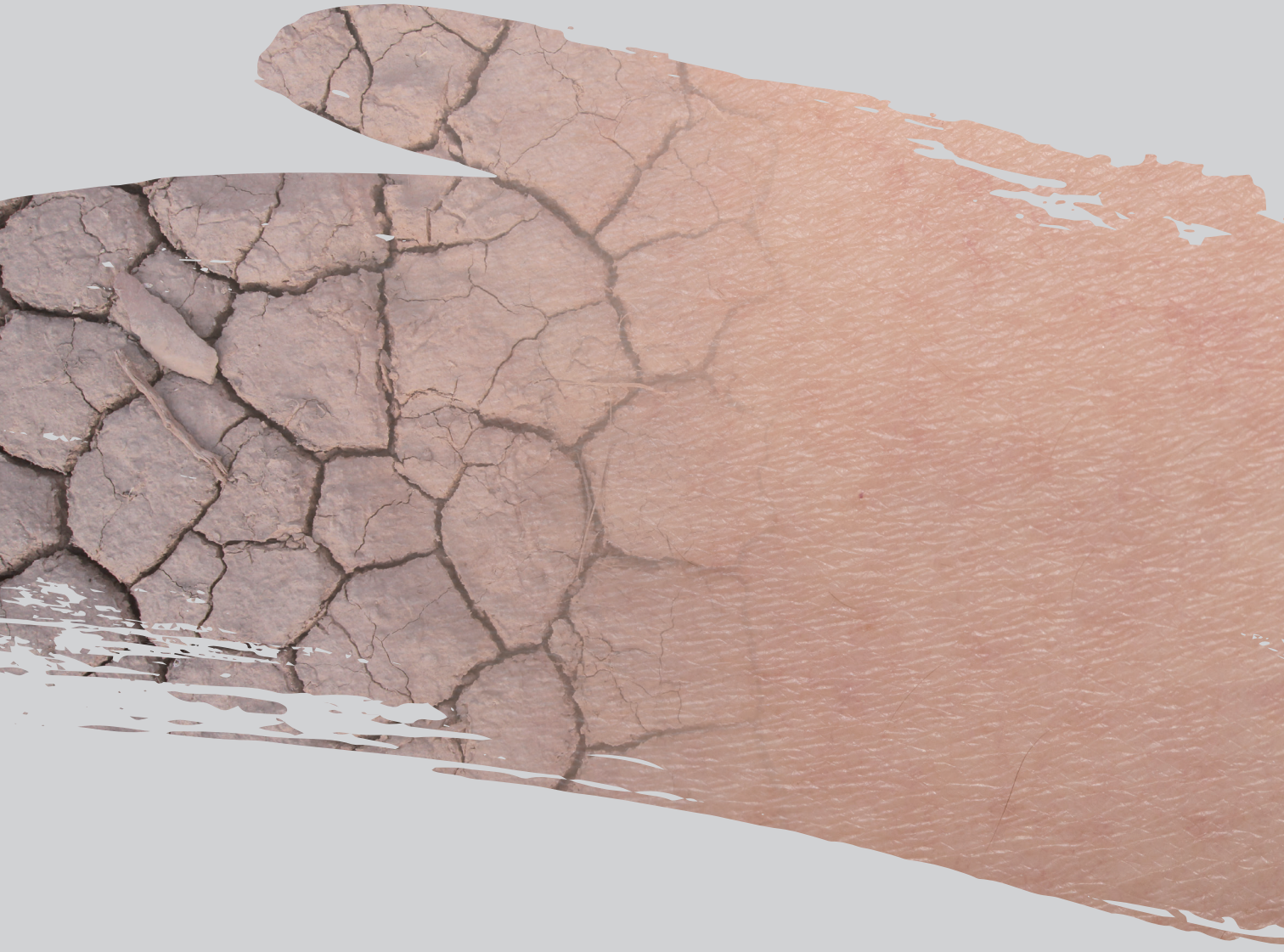

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