

3M Science.
Applied to Life.™

A comprehensive
guide to understanding
and reducing the risk of

MARSI

Medical Adhesive-Related Skin Injuries



Patient care starts with skin.

Skin is the body's first line of defense against infection. The products you choose to use, as well as how you apply and remove them, may impact the skin more than you might realize.



Medical adhesives are a critical part of healthcare, used by virtually every provider across a variety of settings. If not used properly, adhesive products may cause Medical Adhesive-Related Skin Injury, or MARSIs – a prevalent but under-recognized complication that can be serious enough to require additional treatment.

This guide is designed to help you better understand MARSIs so you're better equipped to help protect your patients.

It will cover:

- What MARSIs are
- Why they occur
- Who's at risk
- Why MARSIs are relevant to your practice
- How you can reduce the risk.



Best practices from recognized experts.

Much of the information in this guide was developed by a panel of 23 recognized key opinion leaders in skin and wound health who convened to establish consensus statements on the assessment, prevention and treatment of MARSIs. The resulting document, **Medical Adhesives and Patient Safety: State of the Science**, can be purchased and downloaded online.



What is MARSI?

MARSI is damage to the skin that may occur when medical adhesives are not selected, applied and/or removed properly. In mild cases, there might not be any visible trauma. But in other cases, the injury can be more serious, requiring additional treatment. MARSI can cause pain, increase the risk of infection and delay healing – all of which can reduce a patient’s quality of life.¹

One way MARSI occurs is during adhesive removal when the bond between the skin and the adhesive is stronger than the bond between the skin’s layers – meaning the skin cells actually separate when the adhesive is removed.

The different kinds of MARSI

MARSI can present in a variety of ways, including the following conditions shown.



Skin tear

Wound caused by shear, friction and/or blunt force resulting in separation of skin layers. Can be partial- or full-thickness.²



Skin stripping

Removal of one or more layers of the stratum corneum following removal of adhesive tape or dressing. Lesions are frequently shallow and irregular in shape and the skin may appear shiny. Open lesions may be accompanied by erythema and blister formation.^{3,4,5}



Tension injury or blister

Injury (separation of the epidermis from the dermis) caused by shear force as a result of distention of skin under an unyielding adhesive tape or dressing, inappropriate strapping of tape or dressing during application, or when a joint or other area of movement is covered with an unyielding tape.^{4,6,7}



Maceration

Changes in the skin resulting from moisture being trapped against the skin for a prolonged period. Skin appears wrinkled and white/gray in color. Softening of the skin results in increased permeability and susceptibility to damage from friction and irritants.



Folliculitis

Inflammatory reaction in hair follicle caused by shaving or entrapment of bacteria. Appears as small inflamed elevations of skin surrounding the hair follicle. May be nonsuppurative (papules) or contain pus (pustules).



Allergic contact dermatitis

Cell-mediated immunologic response to a component of tape adhesive or backing. Typically appears as an area of erythematous vesicular, pruritic dermatitis corresponding to the area of exposure and/or beyond. Persists for up to a week.^{8,9,10}

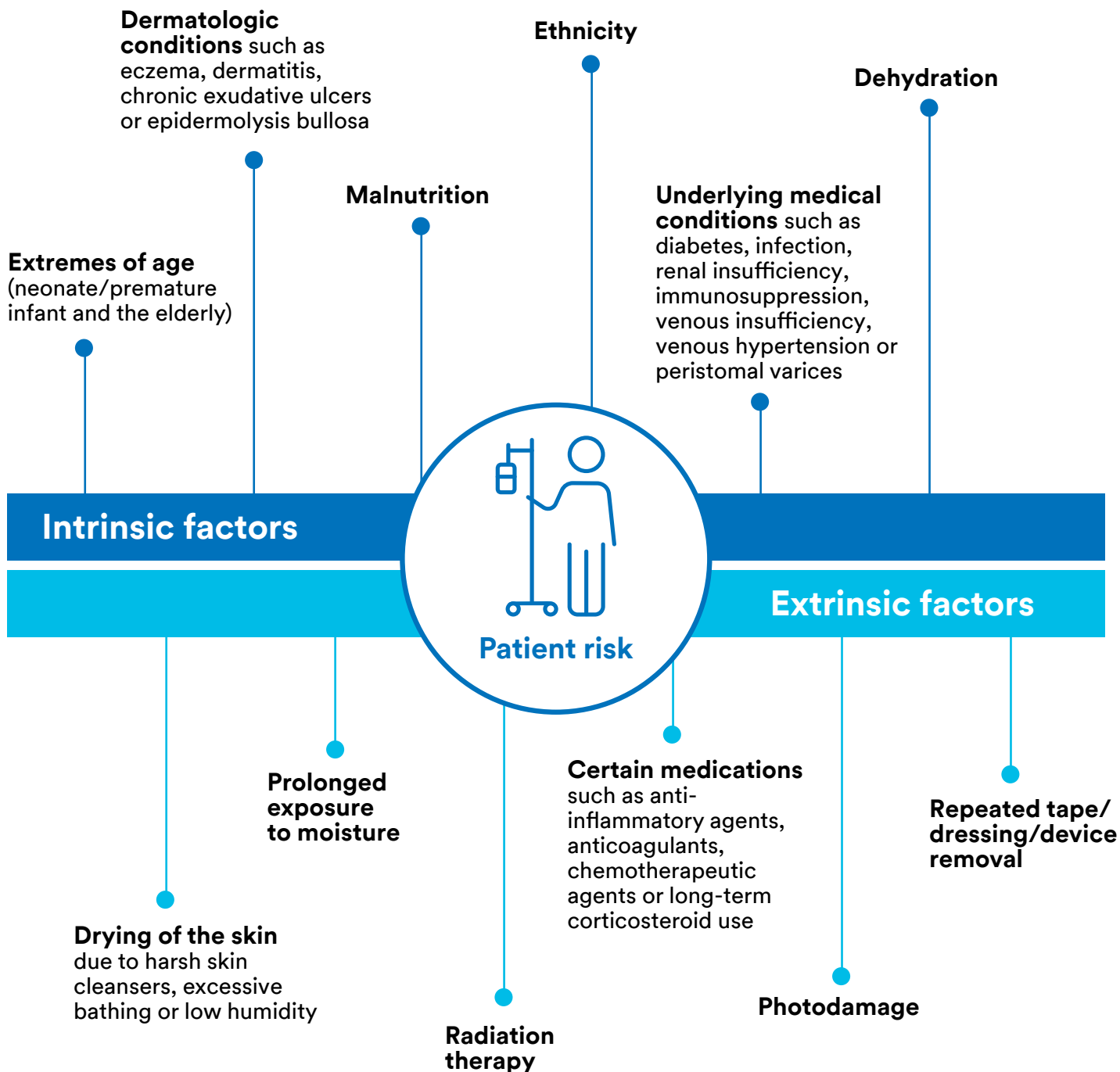


Irritant contact dermatitis

Non-allergic contact dermatitis occurring as a result of a chemical irritant. A well-defined affected area correlates with the area of exposure. May appear reddened and swollen and vesicles may be present. Typically of shorter duration.^{8,9}

Why MARSI occurs

According to the *Medical Adhesives and Patient Safety: State of the Science* consensus document, the pathophysiology of MARSI is only partially understood. But there are a number of intrinsic and extrinsic factors that can influence a patient's risk.⁸



Preventable causes of MARSI

The consensus document also noted that the use of adhesive products also plays a role in enhanced susceptibility to skin injury, and they identified a number of preventable causes.

Improper choice of tape

- Using tape with more adhesion than needed for the patient and application
- Wrong choice of tape (i.e. not using a tape with stretch for an area where swelling or movement is anticipated)



Improper application technique

- Tension on application (i.e. strapping)
- Applying in the wrong direction (i.e. not allowing stretch in the direction of expected swelling/movement)
- Applying to wet/moist skin
- Use of alcohol-based skin preps, which are drying to the skin
- Not allowing skin preps/barriers to dry
- Not clipping/trimming hair prior to application
- Excessive use of substances that increase the stickiness of adhesives (i.e. tackifiers, bonding agents)



Improper removal technique

- Quick removal
- Removal at a high angle
- Insufficient support of the skin at the peel line when removing the adhesive product

Leaving occlusive tapes or dressings on too long

Repeated taping or dressing changes

Dehydration

Who's at risk for MARSI

While any patient who comes in contact with medical adhesives can potentially experience MARSI, certain groups of people are more vulnerable. Identifying these higher-risk patients and taking special care with them by choosing the right adhesive for the right application and using those adhesives properly is a key part of risk reduction.



Infants

Neonatal skin is 40% to 60% thinner than adult skin, largely due to the presence of fewer epidermal cell layers in the stratum corneum.² The most common form of MARSI seen in neonatal patients is skin stripping. Chronically hospitalized infants may also experience irritant contact dermatitis due to the variety of adhesive products they encounter.⁹



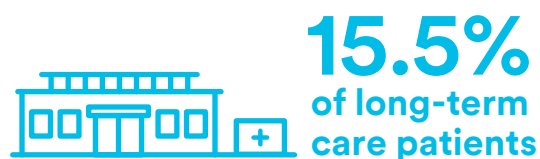
In a one-day prevalence audit, 8% of hospitalized infants and children were found to have tape-related skin stripping.⁸

Elderly patients

Skin changes that are part of the aging process can increase the risk of skin injury in older adults.

These changes include:

- Loss of dermal matrix and subcutaneous tissue
- Epidermal thinning
- Reduced cohesion between the dermal and epidermal layers
- Reduced vascularity, elasticity and tensile strength
- Loss of moisture⁸

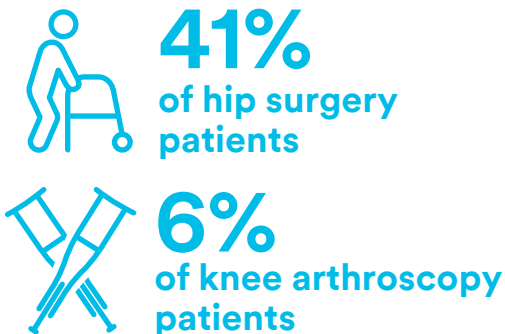


In one study of long-term care (LTC) patients, the cumulative incidence of skin injury caused by adhesive tape was 15.5% (38 incidents per 1,000 person-days).⁸



Orthopedic surgery patients

Skin injuries are more prominent among orthopedic surgery patients due to the large amounts of tape used to secure large compression bandages. The risk of skin damage is then compounded by joint movement, skin friction and the presence of tissue edema, which creates a strapping effect.¹¹



The incidence of tension blisters has been reported to be as high as 41% following hip surgery, and as high as 6% following knee arthroscopy.⁸

Other higher-risk patients include:

- Those with chronic skin conditions such as eczema, dermatitis, chronic ulcers and epidermolysis bullosa
- Those with underlying medical conditions such as diabetes, infection, renal insufficiency, immunosuppression, venous insufficiency or hypertension
- Oncology patients
- Steroid-dependent patients
- Dialysis patients
- ICU patients
- Patients undergoing radiation treatment
- Patients suffering from malnutrition or dehydration

Why MARSI is relevant to your practice

It's critically important to select the right product for the right patient and application. Because not choosing the right product may have a potentially serious impact on clinical outcomes, facility costs and patient care.



Clinical impact

Choosing a high-adhesion tape for use on fragile skin may result in MARSI, which may cause pain, increase the risk of infection and delay healing.¹



Cost impact

MARSI doesn't just affect clinical outcomes and patient well-being. It may also contribute to higher care costs, which can burden the healthcare system as a whole.



Patient impact

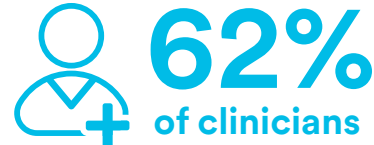
Not choosing the right medical adhesive may negatively impact the patient, affecting everything from their care experience to your facility's satisfaction scores.



For every 100 patients who receive a medical tape application, 55 treatments for MARSI will be needed.¹²



The average tape-induced skin injury costs \$88.50 to treat, which is 125x greater than the average cost of one roll of plastic tape.¹²



In one survey, 62% of clinicians indicated their current medical tapes do not meet the needs of fragile skin patients.¹³



Ratings and reimbursement

Hospitals and care facilities are increasingly being rated and reimbursed based on patient satisfaction. Reducing the risk of MARSI is just one more way to help achieve positive outcomes that can lead to positive ratings.

3 steps to reduce the risk of MARSI

While there are a variety of ways to help reduce the risk of MARSI, the most important things can be summarized in just three steps.



Assess

the patient's age, medical history and skin conditions.



Select

the right adhesive product for the right patient and application.



Use

appropriate adhesive application and removal techniques.



Assess

General assessment:

Before conducting an in-depth assessment of the patient's skin, it's important to examine the broader context within which the patient and their condition exist.

Be sure to note:

- Age
- Co-morbidities
- Medication
- Allergy sensitivities
- Nutritional status

Allergy/sensitivity assessment:

The consensus document also notes that it's important to obtain a history of patients' known or suspected allergies and sensitivities to minimize the risk of MARSI.

Medical adhesives are a common cause of non-allergic irritant contact dermatitis and such reactions are more likely to occur with extended exposure.⁸ Allergic contact dermatitis related to adhesive products is less common, though numerous reports of allergic reactions to components of adhesive products can be found in the literature.⁸

Avoidance of the causative substance is key to the prevention and management of dermatitis⁸, so it's prudent to obtain a history of known or suspected allergies, as well as any previous episodes of irritant contact dermatitis, before using an adhesive.

Skin assessment:

According to the consensus document, it's a widely accepted standard of care that skin be assessed on all patients on admission to a healthcare facility and then at regular intervals, with more frequent assessment of patients at higher risk for skin breakdown or damage.⁸

Skin assessment requires thorough observation and data collection, followed by interpretation. Good lighting is essential for this process.

The skin should be assessed for:

- Color
- Texture
- Uniformity of appearance
- Integrity

Any lesions should be described accurately with regard to:

- Type
- Color
- Arrangement
- Size
- Distribution

Accurate description of the skin and any lesions can help distinguish adhesive-related skin damage from other non-traumatic dermatologic disorders or conditions, and may help identify an infectious process if present.



What happens if MARSI is noted during assessment?

According to the consensus document, if MARSI is noted during a skin assessment or device change, the injury should be assessed and the severity determined in order to guide management.

Mechanical injuries such as skin stripping, tension injuries and skin tears may be assessed as general wounds and classified according to depth (i.e. superficial, partial thickness or full thickness).⁸

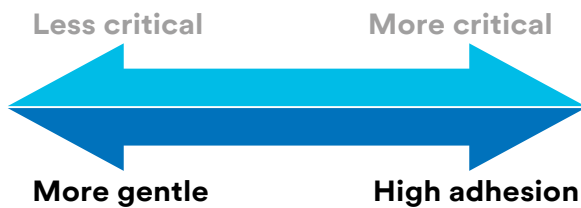
Irritant and allergic dermatitis are difficult to distinguish from one another, but a thorough assessment may help identify key features and enable determination of severity, thus guiding appropriate management.⁸ Identifying allergic dermatitis is important as the patient should be advised to avoid the same or similar materials in the future.

Assessment for evidence of infection should be performed in all cases of MARSI.



Select

Choosing the right medical adhesive for the right situation is critical to patient care. According to the *Medical Adhesives and Patient Safety: State of the Science* consensus document, clinicians should consider the following factors when selecting an adhesive product.⁸



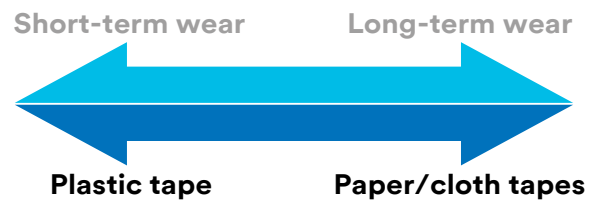
1. Intended use of the product

The foremost patient consideration is the intended use or purpose of the product (i.e. securement of a critical device, non-critical device or dressing, wound closure, etc). Depending on the application, clinicians must balance the need for adhesion and the need for gentleness.



3. Anatomical location

If the location has potential for skin distention or movement (i.e. areas with joint articulation or in cases of edema), the risk of adhesive-related skin damage may be reduced by using tapes that stretch and flex with the body.



2. Anticipated wear time

The intended use of the product directly influences anticipated wear time. Some tape materials are better suited for either short- or long-term wear, meaning clinicians should consider the trade-offs between tapes with plastic backing versus paper or cloth backing.



4. Ambient conditions present at the site

Consider whether the area is smooth or contoured, subject to movement or friction, or exposed to moisture, perspiration, humidity, exudate and/or body fluids. Some products are designed with these challenging conditions in mind.

Making it easy to make the right medical tape decision

Generally speaking, most facilities have three types of securement needs: general securement, flexible securement and critical device/tube securement. 3M has made it easy to meet these securement needs while choosing the right tape for the right patient and application, while also streamlining the number of medical tapes your facility carries. To learn more about 3M medical tapes and how they can help you reduce the risk of MARSIs, visit 3M.com/MedicalTapes.

General Securement



- Blood draws
- Dressings
- I.V. lines and tubing
- Non-critical tubes

Flexible Securement



- Long-wear compression
- Securement when swelling or movement is anticipated

Critical Device/Tube Securement



- Central venous catheter
- Foley catheter
- Nasogastric tube
- Endotracheal tube
- Chest tube
- Orogastric tube
- Surgical drain tube

Ideal for fragile/at-risk skin

Ideal for intact skin (for at-risk skin, use a barrier like 3M™ Cavilon™ No Sting Barrier Film)

Extra gentle



3M™ Kind Removal Silicone Tape ✓

✓ Available in single-patient-use rolls

Multi-purpose



3M™ Transpore™ White Surgical Tape ✓

3M™ Transpore™ Surgical Tape ✓

3M™ Micropore™ Surgical Tape ✓

Flexible



3M™ Medipore™ H
Soft Cloth Surgical Tape ✓

3M™ Microfoam™ Surgical Tape

High-adhesion



3M™ Durapore™ Surgical Tape ✓

3M™ Multipore™ Dry Surgical Tape

Why single-patient-use products are preferred

Federal and Centers for Disease Control guidelines suggest that to help prevent cross-contamination, products like medical tapes should be dedicated for use only on a single patient.¹⁴

 **74%**
of tape rolls

In one study, 74% of partially used tape rolls from various sites within the hospital had some bacterial growth.¹⁵



Use

The consensus document notes that proper application and removal of adhesive products is critical to minimizing skin damage and reducing the risk of MARSI. Here are some recommended steps to use as you apply and remove medical tapes.

Prepare the skin



1. Clip/trim hair.
2. Clean and dry the skin to remove soil and/or residue from medical grade adhesive remover, moisturizer or lotion.
3. Apply 3M™ Cavilon™ No Sting Barrier Film to protect at-risk skin.
4. Allow barrier film to dry completely before applying tape.
5. Avoid routine use of tackifiers.

Using a barrier to protect your patients

The consensus document recommends considering use of a skin barrier prior to applying an adhesive product, especially for patients at high risk for skin injury.

3M™ Cavilon™ No Sting Barrier Film is designed to provide superior protection and comfort for patients who are vulnerable to MARSI. It's alcohol-free, sting-free and can be used on intact and damaged skin, making it a versatile solution for a variety of skin problems.



Benefits of a barrier film

In one study of skin complications around peripherally inserted central catheter (PICC) lines, local skin complications were noted in 62% of patients in the standard care group compared to just 6% in the barrier film group.¹⁶

6%

of patients experienced skin complications when a barrier film was applied.

62%

of patients experienced skin complications with standard care.

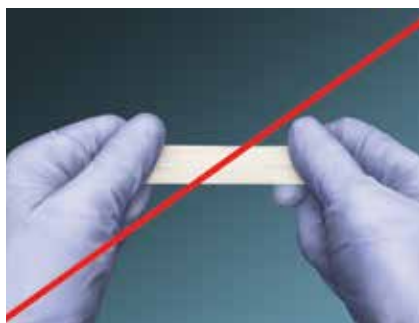
Tape application techniques



1. Apply tape to skin without stretching or tension.



2. Apply firm pressure to activate the adhesive and gain full contact with the skin.



Application tips

- Tape should not be pulled or stretched when applied.
- Minimize touching adhesive surface to retain adhesive levels.
- Avoid gaps and wrinkles that can allow moisture to get between the tape and the skin, tubing or dressing.
- Do not encircle a limb completely with tape.
- If swelling occurs, loosen and replace tape. 3M™ Kind Removal Silicone Tape can be repositioned without compromising adhesion.
- When securing dressings, tape should extend a minimum of one-half inch (one inch is preferred) beyond the edge of the dressing to hold the dressing in place.

Tape removal techniques

Proper tape removal is critical in reducing the incidence of MARSIs.



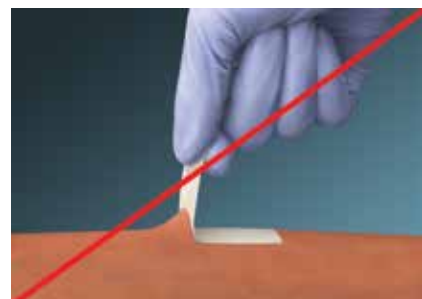
1. Loosen edge of tape.

Tip: To start the edge, press a small separate piece of tape onto a corner of the piece to be removed. This serves as a handle for lifting the edge of the tape.



2. Stabilize the skin with one finger at the peel line.

3. Remove tape “low and slow” in the direction of hair growth, keeping it close to (parallel with) the skin surface while pulling it back over itself.



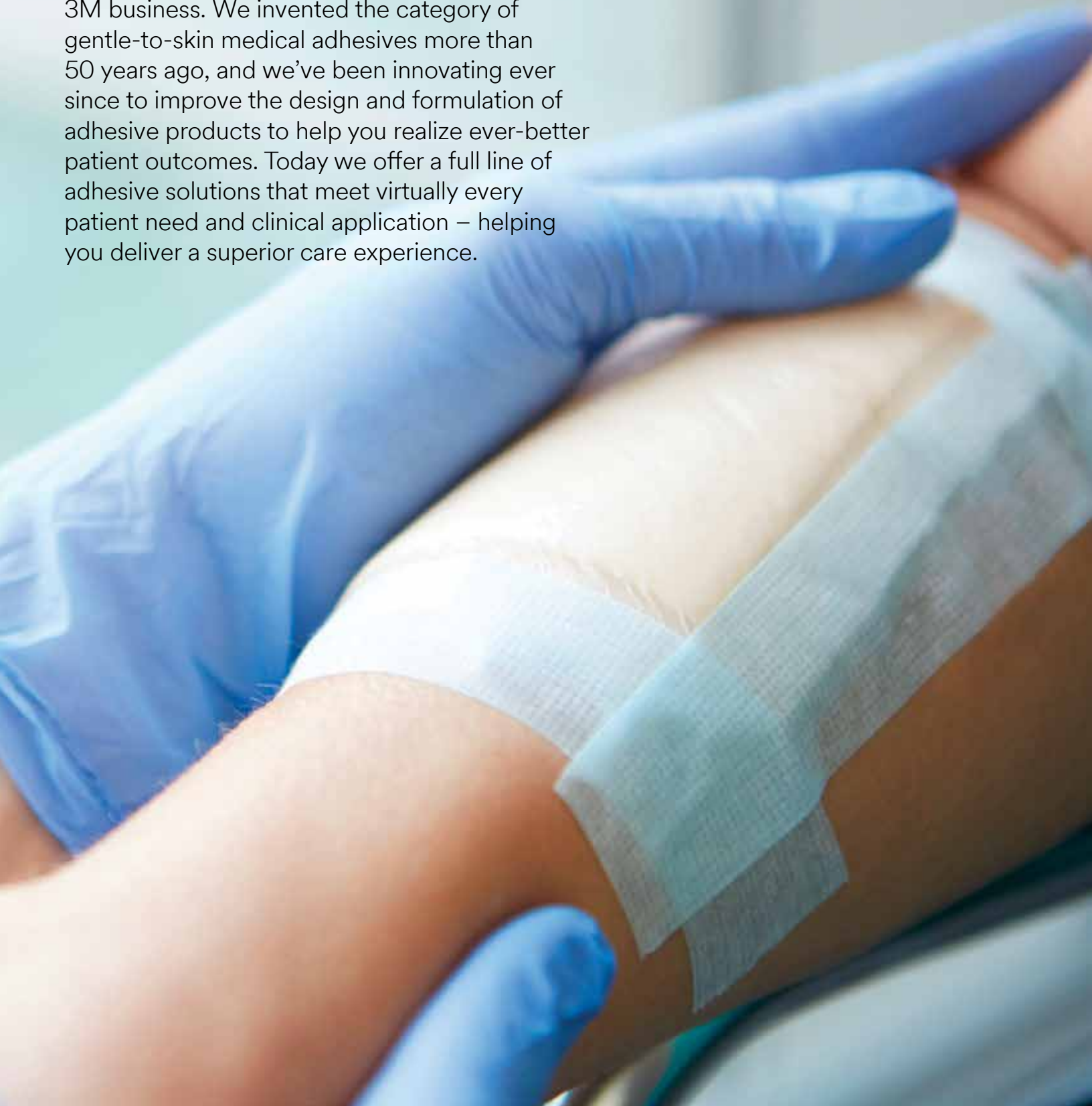
4. Pulling tape at a vertical angle (perpendicular) to the skin will pull at the epidermis, increasing the risk of MARSIs.

5. As tape is removed, continue to support the skin at the peel line.

Tip: For tape that is strongly adhered to skin or hair, consider using a medical grade adhesive remover or moisturizer to soften the adhesive along the peel line (peel edge).

Advancing the science of securement

Adhesive technology is a cornerstone of the 3M business. We invented the category of gentle-to-skin medical adhesives more than 50 years ago, and we've been innovating ever since to improve the design and formulation of adhesive products to help you realize ever-better patient outcomes. Today we offer a full line of adhesive solutions that meet virtually every patient need and clinical application – helping you deliver a superior care experience.





To learn more about tips, techniques and 3M products that can help you reduce the risk of MARSI, visit **[3M.com/MARSI](https://www.3m.com/MARSI)**.

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