

Coloplast
DialogueEducation

Your guide to ostomy adhesives



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Introduction

This guide is designed to:

- Provide an insight into the anatomy and physiology of the skin
- Explain the interaction between ostomy **adhesives** and **peristomal** skin
- Describe the five key parameters of adhesives and explain how they interact
- Offer assistance in choosing the most appropriate adhesive for each individual
- Provide information on the everyday raw materials used to make adhesives

Ostomy adhesives are vital because they protect the peristomal skin from exposure to stomal **effluent**, which helps to maintain healthy skin. This guide explains how adhesives work and how they can be optimised for different appliances, for different wear times and to suit the needs of people living with an ostomy. Adhesive optimisation is illustrated with specific case studies highlighting the adhesive parameters that will maximise comfort and convenience for the individual, while ensuring that the skin remains healthy.

A product guide that is designed to help you make the best choice of appliance for a person with an ostomy, based on skin and **stoma** type, is also included. The product guide will help you become familiar with the different types of ostomy appliances and accessories that are currently available. Finally, a guide to the raw materials that are used in the manufacture of adhesives provides basic information about the raw materials used to manufacture adhesives, and shows how they are used in everyday life. Words contained in the Glossary are indicated in the text in bold type at first mention.

This guide should allow you to relate your own practical experience to the information provided, while increasing your knowledge about ostomy adhesives.

Your guide to ostomy adhesives is part of the DialogueEducation programme.

Chapter 1: What is normal skin?

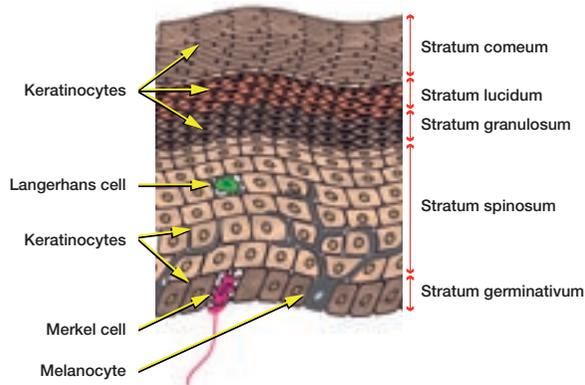
After reading this chapter you will be able to recognise:

- The basic anatomy and physiology of the skin
- How the skin can affect the performance of the adhesive

The skin is the largest organ in the human body.¹ It is considered a sensory organ because it allows us to feel sensations from our environment, such as temperature, texture, pain and pressure. The condition of our skin provides important information about us. When we meet someone, one of the first things we notice is the other person's skin. It reflects an individual's approximate age, nutritional status, and emotional state. How the skin looks gives a strong first impression.

Skin anatomy

Skin is divided into 3 basic layers: the **epidermis**, **dermis** and subcutaneous layers. The most important role of the skin is to provide a barrier against the environment and prevent water loss.



Epidermis

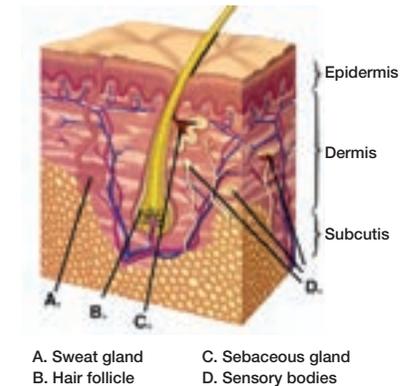
The epidermis, the outermost visible part of the skin, is composed of platelet epithelial cells in four layers or strata:

1. **stratum basale**
2. **stratum spinosum**
3. **stratum granulosum**
4. **stratum corneum**

The innermost layer is called the stratum basale and is the **germinative** layer (where the cells originate).² In this layer the cells (mainly **keratinocytes**) divide and migrate upwards through the next two layers of living cells – the stratum spinosum and the stratum granulosum.³ As the cells (now termed **corneocytes**) migrate through the layers, they gradually degrade and die producing the outer, stratum corneum layer, facilitating the process of cell shedding (**desquamation**). In normal skin this process takes 1–2 months, with approximately one layer of skin being shed every day.²

Dermis

The dermis is primarily composed of **collagen** and **elastin** (connective tissue) and contains very few cells (mainly **fibroblasts**). It contains the nerve endings, blood vessels, muscles, hair follicles, sebaceous and sweat glands. As such, this is both the sensory layer and the layer responsible for keeping the epidermis healthy.^{2,4}



Subcutis

The deepest layer of the skin is the **subcutis**, which is mainly composed of **adipose** (fat) tissue. This layer protects the bones and organs from heat and cold, and against mechanical shock from the environment. The thickness of this layer depends on the sex of the individual, body region, body size and contour.⁵

continued...

Skin physiology

Age

The rate of skin shedding is relatively constant over a short period of time, however, as people age the rate of shedding decreases. For example, the skin of the upper arm is replaced 1.56 times (64%) slower in individuals over 60 years compared with individuals aged 18–29.⁶ This turnover period is likely to be similar in the abdominal skin and will affect the choice of adhesive. A faster turnover of cells will reduce the lifespan of the adhesive and make it easier to remove, a slower turnover of cells will increase the lifespan of the adhesive and make it harder to remove.

Ageing is associated with a 20% loss of dermal thickness and a thinning of the subcutaneous fat which provides cushioning against **mechanical trauma**. This results in an increased risk of tear-like lesions as a result of impact (e.g. a fall). In addition, the **epidermal–dermal papillae** (projections of cells from the dermal layer into the epidermal layer) flatten, increasing the susceptibility of the skin to shearing and friction injuries.⁷

The thinning of elderly skin is compounded by some of the drugs common in this age group. For instance, many elderly people take **steroids** which can compromise skin integrity and strength by inhibiting collagen synthesis.⁷

Perspiration

The main functions of sweat are to maintain a constant core body temperature of 37°C and to remove metabolic waste products. This is achieved by **passive diffusion** through the skin surface and by sweating (perspiring). Passive diffusion occurs continuously and unnoticeably, without resulting in

wetness. Sweat, an effective tool for cooling the body, is produced primarily through the **eccrine glands**, which are found in all areas of the body. The density of sweat glands varies depending on the area of the body, but are most concentrated where the body gets hottest, especially the trunk.^{8,9}

Sweat is a mixture of water, salt, **urea, uric acid, amino acids, lactic acid** and **ascorbic acid**. These **electrolytes** produce a slightly acidic solution that evaporates off the skin surface causing cooling.^{10,11}

Men sweat more than women because they have a lower surface area to body mass ratio. This means that it is easier for women to lose heat than men, therefore, they have to sweat less to maintain the correct body temperature. For this same reason, children also sweat less than adults. Conversely, people who are overweight tend to sweat more due to the decreased surface area to body mass ratio.

When pressure is applied to the skin on one side of the body, a sweating response can result on the opposite side of the body. If a person tends to sweat considerably during the night and has a favourite side to sleep on, the sweating response may be observed on the other side.

Increased sweating is also a problem in **diabetic** patients where **hypoglycaemia** and nerve damage can cause excessive sweating both during the night and while eating a meal (NIH diabetes information). Some patients, particularly older people, require additional medications. Some of these medications, particularly certain classes of antidepressants (**selective serotonin reuptake inhibitors** [SSRIs]), can significantly increase sweating due to their actions on the **autonomic**

nervous system and may become an issue with adhesive selection.¹²

It is important to remember that sweating is highly dependent on the individual. When selecting an appropriate appliance many factors should be taken into consideration including body mass, exercise, cultural and racial background and medication.¹³

The natural acidity of the skin

The skin produces oil and sweat that helps to keep it **elastic** and healthy and at a **pH** of 5.5. This slightly acidic environment is the first line of defence against invading micro organisms such as **fungi**.^{14,15} Factors that can influence the pH of the skin include the **normal flora (bacteria)** normally present on the skin surface) which can decrease the pH (make more acidic) via the breakdown of **fatty acids**, and soap which makes the skin less acidic.¹⁶

Summary

- Skin is a complex organ composed of three basic layers
- Skin is the first line of defence against temperature extremes, trauma and invading micro organisms
- The rate of skin loss is dependant on age
- Water is constantly lost through the surface of the skin; water loss can increase depending on the external or internal temperature
- Men generally lose more water through their skin than women
- The skin is slightly acidic to reduce the risk of infection

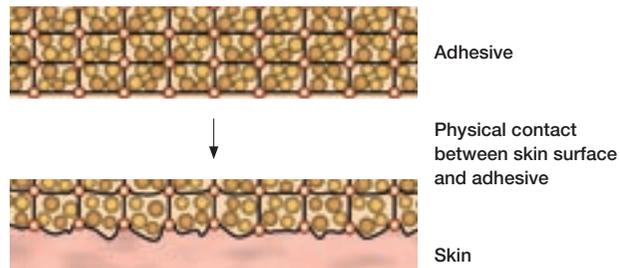
Chapter 2: What is adhesion and what are ostomy adhesives?

After reading this chapter you will be able to:

- Understand the mechanisms by which ostomy adhesives work
- Understand how the type of stoma and length of wear time affect adhesives

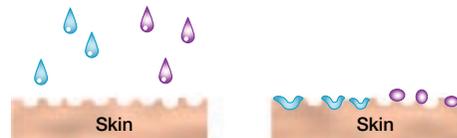
An adhesive is defined as a product that can join two surfaces together so that they are kept in close contact. There are two factors that work together to create adhesion:

1. The size of the area in physical contact between the two surfaces



2. The degree of chemical attractiveness between the two surfaces

Wetting (blue) and non-wetting (purple) droplets on the skin surface



Ostomy adhesives

Ostomy appliances contain a special kind of adhesive called **pressure sensitive adhesives (PSAs)**. PSAs develop immediate adhesion when light pressure is applied. There are many PSAs in everyday use where there is a need to temporarily join materials e.g. masking tape, pricing labels and nicotine patches all contain PSAs.

Importance of the ostomy adhesive

The ostomy adhesive plays an important role in product performance by supporting the ostomy bag and protecting the peristomal skin from being exposed to stomal effluent. The composition of the adhesive is very important in the overall performance of the appliance, allowing it to adhere safely to the skin and absorb moisture during wear.

One-piece and two-piece appliances

During the development of ostomy adhesives, it is very important to consider factors that will affect adhesion, including stoma effluent, skin conditions and stresses caused by physical activity. Currently, there are two broad types of ostomy appliance.

When the ostomy adhesive is permanently attached to the bag, the ostomy appliance is known as a one-piece product. These appliances are generally designed to be worn for short periods of time (3 hours to 3 days) and the adhesive is optimised for ease of removal.



A *one-piece appliance*

continued...

When the adhesive is attached to the bag via a **coupling system** that can be separated, the **ostomy appliance** is known as a two-piece product. These appliances are generally designed for longer wear time (1–6 days), and the adhesive is optimised for high adhesion and erosion resistance.



A *two-piece appliance*

What people with an ostomy need from an adhesive

The first generation of adhesives were made of **zinc oxide** and met only the basic requirement of supporting the ostomy bag during use. Second generation adhesives used **karaya gum** and **glycerol**, and aimed to improve the condition of the underlying skin by absorbing moisture. However, the adhesive tended to dissolve around the stoma during use compromising the protection of the skin. Karaya Gum adhesives have a much lower adhesion to the skin than the first generation adhesives based on zinc oxide, compromising the main requirement of support.

New adhesives use modern technology and synthetic or naturally occurring raw materials. The properties of modern adhesives can be tailored by combining different raw materials to achieve better adhesion, erosion resistance, moisture handling, flexibility and ease of removal. To meet the person's needs on a very high level it is necessary to focus not only on the properties of the adhesive itself but also on the construction of the product. e.g. combining more than one adhesive in one product.

Summary

- Adhesion plays an important role in product performance
- Adhesives serve a double purpose: they should support the bag and protect the peristomal skin thus providing security
- The new generation of adhesives focus on tailoring properties and optimising product design

Chapter 3: How do ostomy adhesives affect the skin?

After reading this chapter you will be able to recognise:

- Which adhesive properties are important in maintaining healthy peristomal skin
- How these factors can be influenced by the SCN and the person with an ostomy

Maintaining healthy skin around the stoma is essential because it ensures that the ostomy appliance will adhere securely and maximises comfort for the person with an ostomy. Since ostomy adhesives can affect the skin in several different ways, it is important for the SCN and the person with an ostomy to work together to limit these effects.

Key attributes of ostomy adhesives

1. Adhesives must provide a protective seal

- An adhesive must prevent stomal effluent from coming into contact with the peristomal skin.

If not:

- Skin irritation will occur due to **enzymes** and other contents in the effluent

2. Adhesives must not affect skin pH

- An adhesive must maintain the pH range of normal skin

If not:

- Changes in pH increase the risk of infection

3. Adhesives must absorb moisture

- An adhesive must maintain the moisture balance of the skin

If not:

- The skin may become **macerated** if moisture is not completely absorbed by the adhesive

4. Adhesives must not stress the skin

- An adhesive must be removable without **stripping** the skin and without leaving **residues**

If not:

- Removing the adhesive or adhesive residue by scrubbing may compromise the epidermis
- Adhesion that is too strong may stress the skin on removal (**peel force**)
- Adhesion that is too weak may compromise the skin by leaving residue

5. Adhesives must not cause allergic reactions

- An adhesive must be **hypoallergenic**

If not:

- Allergic reactions can cause significant discomfort for the person with an ostomy and can prevent them using the product correctly

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Factors that the SCN and person with an ostomy can influence

1. Choice of product

- The SCN and the person with an ostomy must work together to choose the product that best fulfils the user need
 - For example, if the person with an ostomy participates in sports then a device with increased flexibility and moisture handling may be more important

2. Choice of accessory

- Accessories may be needed if the adhesive does not fully meet the needs of the person with an ostomy
- It is important to choose the right accessory because the performance of the adhesive may be affected

3. Skin preparation

- The skin surface should be clean and dry to allow optimal performance of the adhesive
 - The person with an ostomy needs to make sure that the skin is always well prepared before attaching a new device

4. Cutting and fitting the adhesive

- Cutting and fitting is essential to guarantee a good seal around the stoma
 - If the hole is cut too big the skin will come into contact with stomal effluent
 - If the hole is cut too small the adhesive may cause mechanical stress to the stoma and **oedema** may develop
 - In extreme cases this can prevent effluent from leaving the stoma

5. Changing the appliance

- Must be in accordance with the intended wear time of the appliance
 - Changing too often may lead to mechanical trauma
 - Changing after the recommended time has elapsed may lead to loss of adhesion, **erosion of the adhesive** and leakage

Summary

- SCNs and people with ostomies have a great influence on the condition of the skin through
 - Product choice (including the adhesive)
 - Product handling
- It is essential to keep the skin healthy in order to maximise the performance of the adhesive

Chapter 4: Optimising adhesive properties

After reading this chapter you will be able to:

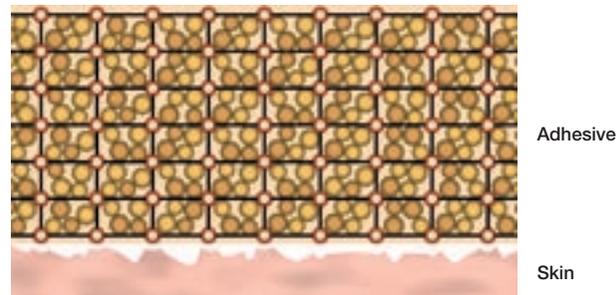
- Identify the five different parameters of ostomy adhesives
- Understand how the different parameters interact with each other
- Relate your own experience to the characteristics of the different parameters

In order to secure the ostomy appliance and maintain healthy skin, an adhesive must fulfil five key properties (listed below). Although each property must be addressed to produce a universal adhesive, it has been difficult to optimise all five. If one property is optimised, another must be sacrificed. For example, strong adhesion may result in difficulty in removing the appliance, and high **absorption** may increase erosion and the likelihood that residue will be left on the skin. As a result, different appliances are optimised for different people's needs. Consequently SCNs and people with ostomies have had to decide which properties are most important and choose an appliance most appropriate to the person's lifestyle.

Note that to ensure optimal contact between the skin and the adhesive, it is vital that the skin is as clean, dry and hair free as possible.

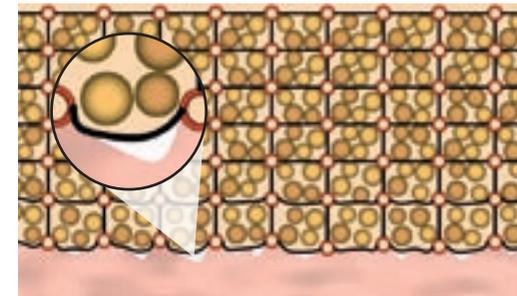
Stickiness and adhesion

Stickiness (tack) is the adhesive property relating to instantaneous pressure- and temperature-sensitive bonding to the skin. Subsequently, a slower adherence process begins. The adhesive flows into the skin increasing the contact area and significantly increasing the adhesive force.

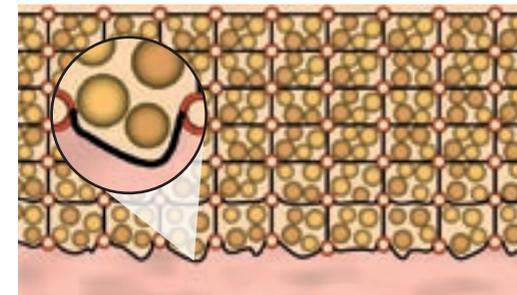


Importance for the person with an ostomy

- A high degree of stickiness ensures that the appliance feels safe and secure on application, allowing the person to move freely immediately after attaching the appliance
- Adhesion keeps the appliance safely in place during wear time, ensuring a high degree of security for the person with an ostomy



Poor adhesion due to poor contact between adhesive and skin

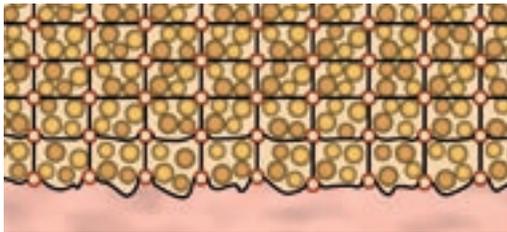


Good adhesion due to complete contact between adhesive and skin

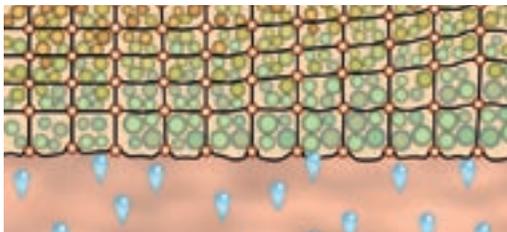
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Absorption

Absorption is the ability to absorb moisture from the skin, keeping it dry and healthy. This is achieved using a combination of several different compounds (known as **hydrocolloids**) with different moisture absorbing capabilities, which create a balance between initial and intermediate absorption.



Before absorption



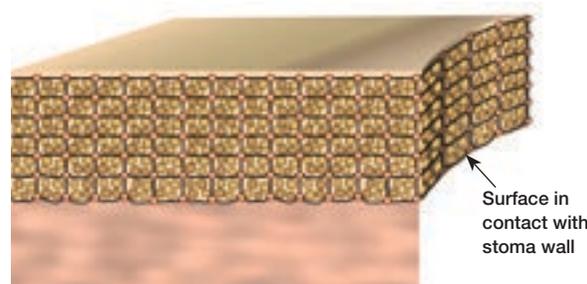
During absorption

Importance for the person with an ostomy

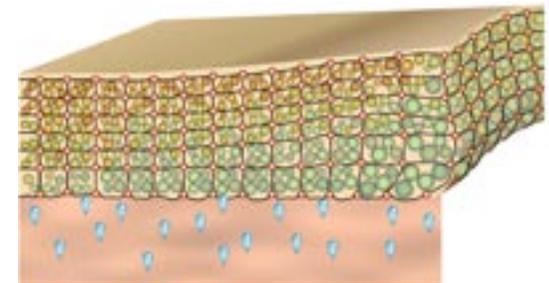
- Hydrocolloids ensure that the skin remains healthy and free from maceration by absorbing moisture from the skin
- They aid the adhesion process if the skin is moist, and help to maintain adhesion throughout wear time by absorbing moisture from the skin surface
- Provide good adhesion and ease of removal

Erosion resistance

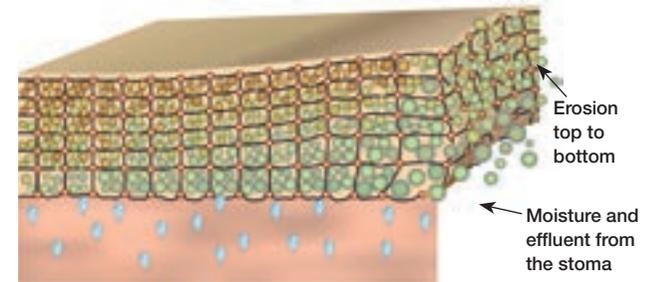
Erosion resistance is defined as the ability of the adhesive to withstand wearing (disintegration) during contact with effluent. Erosion resistance is dependent on the strength of the adhesive framework (**polymeric matrix**) and the absorptive power of the hydrocolloids present.



Just after application (adhesive is not swollen)



Erosion resistant adhesive (swelling, but not eroding)



Eroding adhesive (swelling and eroding)

Importance for the person with an ostomy

- Erosion resistance is a key parameter of a good adhesive as the majority of skin problems are due to contact with stoma effluent
- A low level of disintegration ensures that effluent-skin contact is kept to a minimum

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Flexibility

Flexibility is measured by how easily the adhesive can bend and adapt to an individual's body shape and movement. This



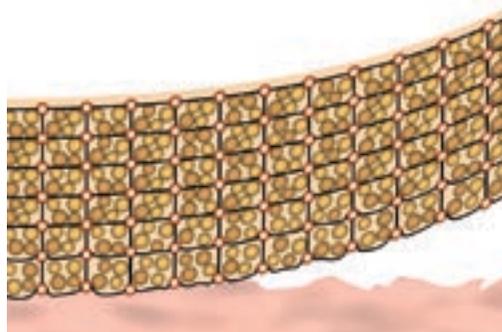
flexibility is determined by the composition and design (shape, thickness and patterns) of the product.

Importance for the person with an ostomy

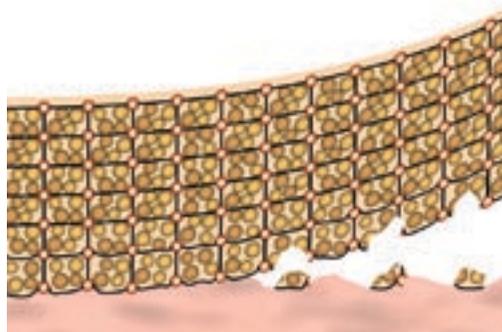
- Flexibility helps to maintain adhesion to the skin by preventing channel formation
- It aids comfort for the person with an ostomy by following skin movement and causes less pain on removal of the adhesive

Ease of removal

Ease of removal is judged by the force required to remove the adhesive from the skin. It should be possible to remove the adhesive without causing stress or irritation to the skin and without leaving residue.



Adhesive does not leave residues during removal



Adhesive leaves residues during removal

Importance for the person with an ostomy

- With less pain and minimal residue, the user will be able to change their appliance more quickly and comfortably, without irritating the skin

Summary

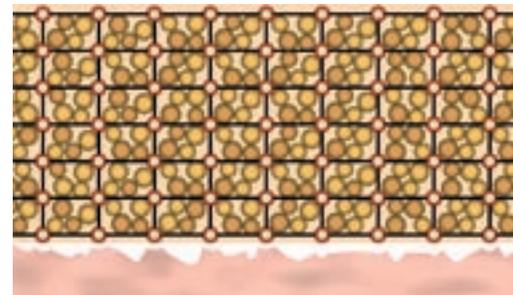
- It is a challenge to optimise the five parameters in an adhesive without compromising the others. For example, high adhesive power reduces the ease of removal
- Creating a balance between the five different properties of adhesives is critical in ensuring that the needs and wants of the person with an ostomy are met

Case stories

Case story 1 – stickiness and adhesion

A 65 year old man with a **colostomy** due to a colon cancer operation in 1999 presented with even peristomal skin without any disorders. He was using a one-piece appliance that he changed three times a day.

When the man changed his appliance, he often noticed what appeared to be air bubbles forming underneath the adhesive. On closer inspection, the air bubbles turned out to be adhesive residue. This residue prevented the adhesive from sticking properly when first applied. The man felt that the appliance did not immediately stick and he had to manipulate the appliance for long periods in order to get it to stick properly. During wear, the upper edge of the adhesive tended to loosen. He became worried that the appliance might detach and the length of time he had to spend changing his appliance was a particular problem during bouts of diarrhoea.



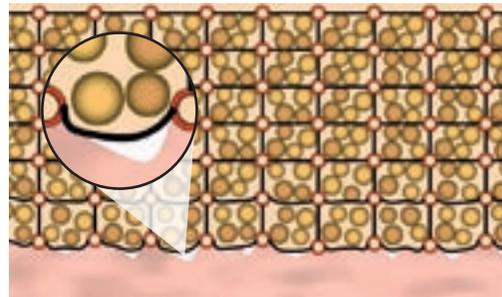
Before application

Adhesive

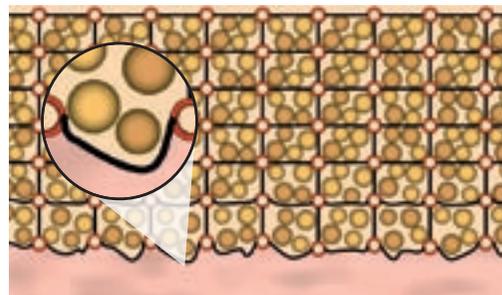
Skin

Key issue

Of the five parameters, **immediate adhesion** appears to be the most important as this person tends to change the appliance often. This means that there is little need for strong adhesion that might leave residues and irritate the skin.



Poor adhesion due to poor contact between adhesive and skin



Good adhesion due to complete contact between adhesive and skin

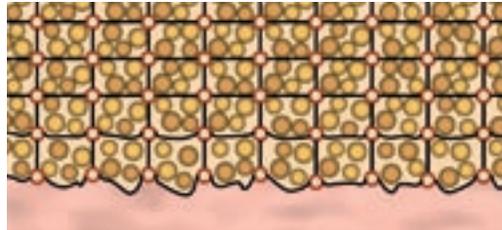
Case story 2 – absorption

An 80 year old woman with a colostomy due to a colon cancer operation 12 years previously presented with a regular shaped stoma and normal, healthy peristomal skin with creases. She has had multiple hernia and abscess operations and, as a result, uses a hernia **belt**.

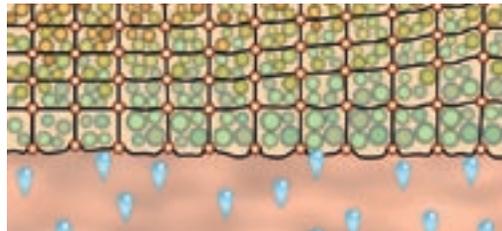
The woman had tried several different products, all of which had a tendency to leak. This happened in warm weather and at dinner parties, when the rooms tended to be warm. The problem was caused by warm and moist skin. If the ostomy adhesive was unable to absorb the moisture, it soon began to leak and smell, forcing her to change the appliance. If she did not have an extra appliance with her, she became anxious and insecure.

Key issue

Of the five parameters, it would appear that **moisture absorption** is the most important in this case. An appliance with a high degree of absorption power should be considered for this person.



Before absorption



During absorption

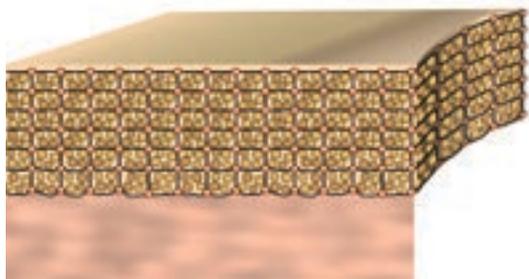
Case story 3 – erosion resistance

A 77 year old woman with an **ileostomy** following colon cancer surgery 12 years previously, presented with an oval shaped stoma and sensitive but normal skin with occasional reddening. She was using a one-piece appliance that she changed once a day.

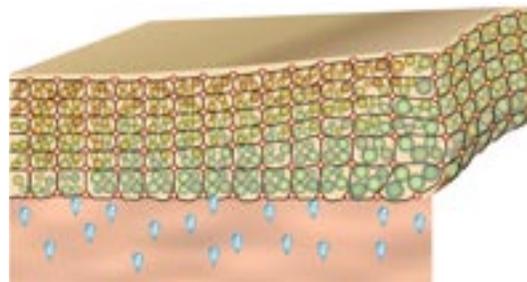
On examination, the adhesive appeared to have dissolved at the site of the skin reddening. When protective skin film was used, the complaint cleared up in two days. However, she would prefer not to have to use protective film.

Key issue

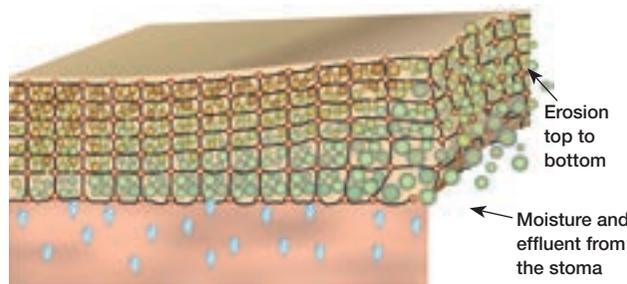
Of the five parameters, **erosion resistance** is the highest priority due to enzymes present within the effluent degrading the adhesive. An appliance that is more resistant to proteolytic breakdown should be considered for this person.



Just after application (adhesive is not swollen)



Erosion resistant adhesive (swelling, but not eroding)



Eroding adhesive (swelling and eroding)

Case story 4 – flexibility

A 60 year old man with a colostomy presented with a peristomal skin disorder.

The man was a keen walker, regularly visiting the wilderness. As a result, he had to change his appliance in areas without cleaning facilities and decided to use a two-piece appliance. However, the adhesive often loosened from his skin causing leakage, resulting in the appliance having to be changed too often without adequate cleaning. He felt that the coupling device caused some of the problems as it was too rigid to follow his movements while walking. He also reported that he felt a worrying pressure when releasing the coupling device.

Key issue

Of the five parameters, **flexibility** represents the highest priority in this situation as the appliance needs to move with the body during extreme motion. However, the appliance still needs to be well constructed in order to cope with the increased moisture management required due to exercise.



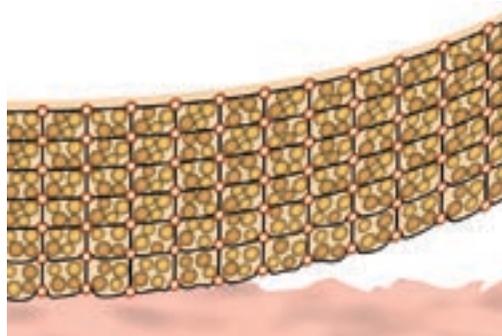
Case story 5 – ease of removal

A 47 year old woman with a colostomy due to **Crohn's disease** presented with a well-sited, oval stoma with even, although slightly loose, peristomal skin.

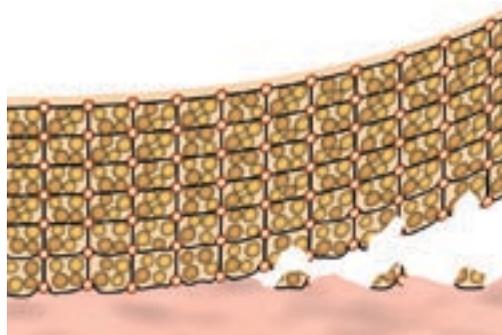
The woman reported changing her appliance 3 to 5 times a day. Although the stool was loose, she preferred a one-piece, closed appliance because she was very hygiene conscious and preferred not to clean bags or baseplates. Due to the frequent changing of appliances, the skin was stressed causing redness and pain. Occasionally, a small piece of skin was torn off during removal causing significant discomfort.

Key issue

Of the five parameters, **ease of removal** has the highest priority in this case. A device with low long-term adherence should be considered.



Adhesive does not leave residues during removal



Adhesive leaves residues during removal

Product guide

After reading this chapter you will be able to:

- Recognise the different types of ostomy products
- Recommend an adhesive based on an individual's specific circumstances

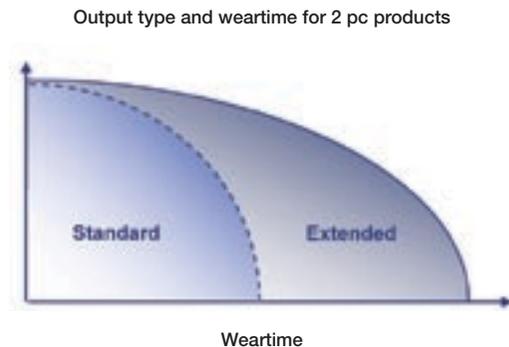
When choosing an ostomy appliance, it is important to know which appliances are on the market and how they differ. For example: one-piece vs. two piece, and open vs. closed bags. Product choice should always be a joint decision between the SCN and the person with an ostomy.

Standard wear

These appliances are usually worn for up to two days and are generally one-piece products. The products are designed to be changed frequently according to the person's use pattern; therefore, it is important that the adhesive is not too strong to avoid stressing the skin. However, as these products are not designed for long-term use, they tend to erode more easily.

Extended wear

These products are usually worn for more than two days and are generally two-piece products chosen when the stomal effluent is particularly corrosive. They are designed so that the bag can be changed without removing the adhesive, therefore, the adhesive has to be strong and the product needs to be resistant to erosion so that the peristomal skin is protected during the entire wear time. If the adhesive is changed too frequently it can cause irritation and damage to the skin.



Choosing between adhesives depends on the aggressiveness of the effluent and the intended wear time.

Assessment of stoma morphology and the peristomal skin

Full assessment of the stoma and the peristomal skin will allow a choice between flat or convex, pre-cut or cut-to-fit adhesive solutions. When assessing the stoma it is important to take particular note of its height, level of protrusion, size and shape. When assessing the peristomal skin it is particularly important to take note of folds, creases and scars.

One-piece or two-piece solutions?

Choosing between one- or two-piece appliances primarily depends on personal preference. However, factors such as dexterity, mobility and degree of product flexibility should be considered during the decision process.

Accessories

In some cases accessories may be required to increase the performance of the appliance or to make it more comfortable for the person. Accessories that may be considered include:

- Belts – these increase the sense of security by supporting the product on the abdomen by exerting light pressure
- **Skin prep** – this protects the peristomal skin from stomal effluent and can also change adhesive properties of the product
- **Tube** or **strip paste** – used to level out creases and scars in the skin improving adhesion
- **Rings** – builds up the thickness to the stoma for better erosion resistance, or to level out folds and irregularities in the stoma shape

Stoma Types

How to use the product guide

The product guide is designed to give you an idea of which appliances are most appropriate for particular individuals. The guide is split into five sections: stoma type, system (or appliance type), type of adhesive, shape of adhesive and accessories.

To use the product guide effectively you should follow these simple instructions:

1. On the right hand of this page there are illustrations of different stoma types. Start at the top left photograph of protruding stomas, looking for a stoma that most closely matches that of your patient. If the stoma is not protruding, follow the arrow through the flush/retracted stomas again looking for the one that most closely matches that of your patient. If none of these resemble the stoma, follow the arrow to the other stoma types
2. When you have picked the most appropriate stoma type, click on the name of the stoma. This will take you to the next page displaying the list of stoma types and the different appliances, adhesives and shapes of adhesive across the top of the screen. The different products are accompanied by pictures and descriptions which appear when you move your mouse over the icon.
3. Moving horizontally across the row for your stoma type, if there is a green tick in the product column, then the patient can use that product. However, if there is a red cross in the column the product is not appropriate.
4. Finally, the last column indicates whether there are any appropriate accessories that the person may want to use to increase the comfort and the efficiency of the ostomy solution. If there are accessories available for the patient you can click on the link indicated. This will take you to a final page where all the appropriate accessories are described.

PROTRUDING – Does the stoma protrude as either of the illustrations below? IF NOT go to the next section

FLUSH / RETRACTED – Is the stoma flush or retracted as any of the illustrations below? IF NOT go to the next section

OTHER STOMA TYPES – Please study the illustrations of the remaining stoma types below

Appliances, Adhesives & Shapes

Stoma Types	System			Adhesive		Shape			Accessories
	1-piece	2-piece mechanical coupling	2-piece adhesive coupling	Standard wear	Extended wear	Flat	Slightly convex	convex	
Protruding									
Firm abdomen	✓	✓	✓	✓	✓	✓	✗	✗	No
Flabby abdomen	✓	✓	✓	✓	✓	✗	✓	✗	Yes
Flush / retracted									
Flush	✓	✓	✓	✓	✓	✗	✓	✓	Yes
Slightly retracted	✓	✓	✓	✓	✓	✗	✓	✓	Yes
Retracted	✓	✓	✗	✓	✓	✗	✗	✓	Yes
Scars	✓	✓	✓	✓	✓	✓	✓	✓	Yes
Skin folds	✓	✓	✓	✗	✓	✓	✓	✓	Yes
Other stoma types									
High output stoma	✗	✓	✓	✗	✓	✓	✓	✓	Yes
Parastomal hernia	✓	✗	✓	✓	✓	✓	✗	✗	No
Loop stoma with rod	✓	✗	✓	✓	✓	✓	✗	✗	No
Prolapse	✓	✗	✓	✓	✓	✓	✗	✗	No

Appliances, Adhesives & Shapes

Stoma Types	System			Adhesive		Shape			Accessories
	1-piece	2-piece mechanical coupling	2-piece adhesive coupling	Standard wear	Extended wear	Flat	Slightly convex	convex	
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Flabby abdomen	✓	✓	✓	✓	✓	✗	✓	✗	Yes
Flush / retracted									
Flush	✓	✓	✓	✓	✓	✗	✓	✓	Yes
Slightly retracted	✓	✓	✓	✓	✓	✗	✓	✓	Yes
Retracted	✓	✓	✗	✓	✓	✗	✗	✓	Yes
Scars	✓	✓	✓	✓	✓	✓	✓	✓	Yes
Skin folds	✓	✓	✓	✗	✓	✓	✓	✓	Yes
Other stoma types									
High output stoma	✗	✓	✓	✗	✓	✓	✓	✓	Yes
Parastomal hernia	✓	✗	✓	✓	✓	✓	✗	✗	No
Loop stoma with rod	✓	✗	✓	✓	✓	✓	✗	✗	No
Prolapse	✓	✗	✓	✓	✓	✓	✗	✗	No

Appliances, Adhesives & Shapes

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Flabby abdomen	✓	✓	✓	✓	✓	✗	✓	✗	Yes
Flush / retracted									
Flush	✓	✓	✓	✓	✓	✗	✓	✓	Yes
Slightly retracted	✓	✓	✓	✓	✓	✗	✓	✓	Yes
Retracted	✓	✓	✗	✓	✓	✗	✗	✓	Yes
Scars	✓	✓	✓	✓	✓	✓	✓	✓	Yes
Skin folds	✓	✓	✓	✗	✓	✓	✓	✓	Yes
Other stoma types									
High output stoma	✗	✓	✓	✗	✓	✓	✓	✓	Yes
Parastomal hernia	✓	✗	✓	✓	✓	✓	✗	✗	No
Loop stoma with rod	✓	✗	✓	✓	✓	✓	✗	✗	No
Prolapse	✓	✗	✓	✓	✓	✓	✗	✗	No

Appliances, Adhesives & Shapes

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Flush / retracted									
Flush	✓	✓	✓	✓	✓	✗	✓	✓	Yes
Slightly retracted	✓	✓	✓	✓	✓	✗	✓	✓	Yes
Retracted	✓	✓	✗	✓	✓	✗	✗	✓	Yes
Scars	✓	✓	✓	✓	✓	✓	✓	✓	Yes
Skin folds	✓	✓	✓	✗	✓	✓	✓	✓	Yes
Other stoma types									
High output stoma	✗	✓	✓	✗	✓	✓	✓	✓	Yes
Parastomal hernia	✓	✗	✓	✓	✓	✓	✗	✗	No
Loop stoma with rod	✓	✗	✓	✓	✓	✓	✗	✗	No
Prolapse	✓	✗	✓	✓	✓	✓	✗	✗	No

Appliances, Adhesives & Shapes

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Flabby abdomen	✓	✓	✓	✓	✓	✗	✓	✗	Yes
Flush / retracted									
Flush	✓	✓	✓	✓	✓	✗	✓	✓	Yes
Slightly retracted	✓	✓	✓	✓	✓	✗	✓	✓	Yes
Retracted	✓	✓	✗	✓	✓	✗	✗	✓	Yes
Scars	✓	✓	✓	✓	✓	✓	✓	✓	Yes
Skin folds	✓	✓	✓	✗	✓	✓	✓	✓	Yes
Other stoma types									
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Parastomal hernia	✓	✗	✓	✓	✓	✓	✗	✗	No
Loop stoma with rod	✓	✗	✓	✓	✓	✓	✗	✗	No
Prolapse	✓	✗	✓	✓	✓	✓	✗	✗	No

Appliances, Adhesives & Shapes

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Flush / retracted									
Flush	✓	✓	✓	✓	✓	✗	✓	✓	Yes
Slightly retracted	✓	✓	✓	✓	✓	✗	✓	✓	Yes
Retracted	✓	✓	✗	✓	✓	✗	✗	✓	Yes
Scars	✓	✓	✓	✓	✓	✓	✓	✓	Yes
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Loop stoma with rod	✓	✗	✓	✓	✓	✓	✗	✗	No
Prolapse	✓	✗	✓	✓	✓	✓	✗	✗	No

Appliances, Adhesives & Shapes

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Flush / retracted									
Flush	✓	✓	✓	✓	✓	✗	✓	✓	Yes
Slightly retracted	✓	✓	✓	✓	✓	✗	✓	✓	Yes
Retracted	✓	✓	✗	✓	✓	✗	✗	✓	Yes
Scars	✓	✓	✓	✓	✓	✓	✓	✓	Yes
Skin folds	✓	✓	✓	✗	✓	✓	✓	✓	Yes
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Loop stoma with rod	✓	✗	✓	✓	✓	✓	✗	✗	No
Prolapse	✓	✗	✓	✓	✓	✓	✗	✗	No

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Flush / retracted									
Flush	✓	✓	✓	✓	✓	✗	✓	✓	Yes
Slightly retracted	✓	✓	✓	✓	✓	✗	✓	✓	Yes
Retracted	✓	✓	✗	✓	✓	✗	✗	✓	Yes
Scars	✓	✓	✓	✓	✓	✓	✓	✓	Yes
Skin folds	✓	✓	✓	✗	✓	✓	✓	✓	Yes
Other stoma types									
High output stoma	✗	✓	✓	✗	✓	✓	✓	✓	Yes
Parastomal hernia	✓	✗	✓	✓	✓	✓	✗	✗	No
Loop stoma with rod	✓	✗	✓	✓	✓	✓	✗	✗	No
Prolapse	✓	✗	✓	✓	✓	✓	✗	✗	No

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Flush / retracted									
Flush	✓	✓	✓	✓	✓	✗	✓	✓	Yes
Slightly retracted	✓	✓	✓	✓	✓	✗	✓	✓	Yes
Retracted	✓	✓	✗	✓	✓	✗	✗	✓	Yes
Scars	✓	✓	✓	✓	✓	✓	✓	✓	Yes
Skin folds	✓	✓	✓	✗	✓	✓	✓	✓	Yes
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Parastomal hernia	✓	✗	✓	✓	✓	✓	✗	✗	No
Loop stoma with rod	✓	✗	✓	✓	✓	✓	✗	✗	No
Prolapse	✓	✗	✓	✓	✓	✓	✗	✗	No

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Flabby abdomen	✓	✓	✓	✓	✓	✗	✓	✗	Yes
Flush / retracted									
Flush	✓	✓	✓	✓	✓	✗	✓	✓	Yes
Slightly retracted	✓	✓	✓	✓	✓	✗	✓	✓	Yes
Retracted	✓	✓	✗	✓	✓	✗	✗	✓	Yes
Scars	✓	✓	✓	✓	✓	✓	✓	✓	Yes
Skin folds	✓	✓	✓	✗	✓	✓	✓	✓	Yes
Other stoma types									
High output stoma	✗	✓	✓	✗	✓	✓	✓	✓	Yes
Parastomal hernia	✓	✗	✓	✓	✓	✓	✗	✗	No
Loop stoma with rod	✓	✗	✓	✓	✓	✓	✗	✗	No
Prolapse	✓	✗	✓	✓	✓	✓	✗	✗	No

Appliances, Adhesives & Shapes

Stoma Types	System			Adhesive		Shape			Accessories
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Flabby abdomen	✓	✓	✓	✓	✓	✗	✓	✗	Yes
Flush / retracted									
Flush	✓	✓	✓	✓	✓	✗	✓	✓	Yes
Slightly retracted	✓	✓	✓	✓	✓	✗	✓	✓	Yes
Retracted	✓	✓	✗	✓	✓	✗	✗	✓	Yes
Scars	✓	✓	✓	✓	✓	✓	✓	✓	Yes
Skin folds	✓	✓	✓	✗	✓	✓	✓	✓	Yes
Other stoma types									
High output stoma	✗	✓	✓	✗	✓	✓	✓	✓	Yes
Parastomal hernia	✓	✗	✓	✓	✓	✓	✗	✗	No
Loop stoma with rod	✓	✗	✓	✓	✓	✓	✗	✗	No
Prolapse	✓	✗	✓	✓	✓	✓	✗	✗	No

Accessories

Roll over accessory image to view description

Raw materials used in adhesives

After reading this chapter you will be able to:

- Identify the different raw materials used to make adhesives
- Recognise the different everyday uses for these materials

Modern adhesives are produced using many different raw materials that can be found in everyday use. These materials are classed as either **hydrophilic** (water loving) or **hydrophobic** (water repelling) compounds. The hydrophilic **polymers** (hydrocolloids) are responsible for moisture handling, while the hydrophobic polymers are responsible for adhesion and ease of removal, and have an impact on erosion resistance. Varying the hydrophilic and hydrophobic content, changes the properties of the adhesive, allowing control over adhesive power and moisture handling.

Hydrocolloids – the water loving compounds

Hydrocolloids are used to absorb moisture from the skin, control erosion resistance and have an impact on ease of removal.

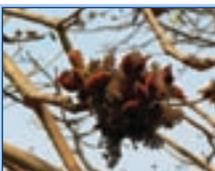
Hydrocolloids come in different shapes and sizes. By varying the types and amounts of hydrocolloids, it is possible to control the absorption capacity, absorption rate and erosion resistance of the adhesive.

Hydrocolloids are spread throughout the adhesive as separate particles. When these particles absorb water, they swell and come into contact with each other. This contact allows the transport of water into the adhesive, drawing it away from the skin, maintaining a healthy environment.

As the adhesive absorbs moisture, it swells and eventually begins to dissolve and break down (erosion). The rate at which this happens depends on which hydrocolloids are present, the type of hydrophobic polymers present and the type and amount of effluent from the stoma. Because the influence of the stomal effluent is greatest, the adhesive is most likely to dissolve in this area.

The ability of hydrocolloids to bind water is widely used by other industries including the food and drugs industry where they are used to control the consistency of products such as jam, yoghurt, ice cream and toothpaste. They are also used in pills and tablets to control the release of the active ingredients.

Hydrocolloids

Name	Primary source	Other applications outside ostomy
Pectin, aE 440	<ul style="list-style-type: none"> • Peel from apples • Peel from citrus fruits 	<ul style="list-style-type: none"> • Thickener for fruity products (jam, marmalade, compot) 
Gelatin, E441	<ul style="list-style-type: none"> • Extracted from collagen from connective tissue (skin and bones) from animals. • Primary sources are pigs (type A, porcine gelatin), cows/cattle (type B, bovine gelatin) and fish 	<ul style="list-style-type: none"> • Thickener in gelatin desserts (puddings, jelly) and sweets (gummi bears) 
Carboxymethylcellulose (CMC), E 466	<ul style="list-style-type: none"> • Cotton lint 	<ul style="list-style-type: none"> • Disintegrant in pills • Thickener in yogurt, ice cream and toothpaste 
Karaya Gum, E 416	<ul style="list-style-type: none"> • Karaya tree 	<ul style="list-style-type: none"> • Disintegrant in pills • Thickener in ice creams and cheeses 
Guar Gum, Guaran, E 412	<ul style="list-style-type: none"> • Guar beans 	<ul style="list-style-type: none"> • Thickener in ice cream and cheeses 

Polymers – the water repelling compounds

Hydrophobic polymers have an important influence on stickiness, adhesion and ease of removal and also affect erosion resistance and flexibility.

The hydrophobic polymers are responsible for the adhesion and removal of the product. Different polymers have different abilities to adhere to the skin. By varying their content, it is possible to control the level of adherence of the product.

The hydrophobic polymers may also be considered as a cell wall surrounding a hydrocolloid nucleus. On one side the polymers provide the structure of the adhesive (elastic properties), and on the other allow the adhesive to flow into the skin (plastic properties). This arrangement of elastic and plastic polymers is known as a 'polymeric matrix'.

Examples of elastic polymers are **styrene-isoprene-styrene (SIS)** polymers and the high molecular weight isobutylene-isoprene (**butyl rubber**) polymers. These polymers are strong and elastic, like rubber bands, and provide the adhesive with strength and durability. This means that the adhesive is more resistant to effluent from the stoma and later can be removed without leaving residue.



An example of a plastic polymer is the low molecular weight **polyisobutylene (PIB)** which is a synthetic polymer originating from the oil industry. This polymer shows a high degree of fluidity (or flow), meaning that, if left in a container, it will eventually flow over the bottom taking its exact shape. This property is exactly what is required for the adhesive to align itself with the skin surface, allowing it to make full contact with the skin.

The adhesive must have an optimum balance between plastic and elastic polymers in order to be able to flow and adhere to the skin, while also resistant to erosion and removable in one piece.

continued...

Polymers

Name	Primary source	Other applications outside ostomy
Styrene-isoprene-styrene (SIS) block co-polymer	<ul style="list-style-type: none"> Chemical formula of SIS $\left[\text{CH}_2 - \underset{\text{C}_6\text{H}_5}{\overset{\text{CH}_3}{\text{C}}} \right]_n \left[\text{H}_2\text{C} = \underset{\text{CH}_3}{\text{C}} - \underset{\text{H}}{\text{C}} = \text{CH}_2 \right]_m \left[\text{CH}_2 - \right]$	<ul style="list-style-type: none"> High endurance shoe soles 
Butyl rubber	<ul style="list-style-type: none"> Chemical formula of butyl rubber $\left[\text{CH}_2 - \underset{\text{CH}_3}{\text{C}} = \underset{\text{H}}{\text{C}} - \text{CH}_2 \right]_m \left[\text{CH}_2 - \underset{\text{CH}_3}{\overset{\text{CH}_3}{\text{C}}} \right]_n$	<ul style="list-style-type: none"> Chewing gum 
Poly-iso-butylene (PIB)	<ul style="list-style-type: none"> Chemical formula of PIB $\left[\text{CH}_2 - \underset{\text{CH}_3}{\overset{\text{CH}_3}{\text{C}}} \right]_n$	<ul style="list-style-type: none"> Chewing gum 

Tackifiers (synthetic resin) – provide stickiness

Synthetic resin is used to increase the immediate tack and adhesion of the product. They are very low molecular weight compounds that flow readily at room temperature and under slight pressure, aligning instantaneously with the skin surface.

Resins can be either synthetic or naturally occurring; however, naturally occurring resins (such as those from pine trees) tend to cause allergic reactions and are, therefore, rarely used in ostomy adhesives. Synthetic resins are used in adhesives that contain high percentages of elastic polymers. This is because polymers take time to flow into the skin to produce their adhesive force, so synthetic resins are required to hold the adhesive in place while the plastic polymers gradually build up their skin contact.

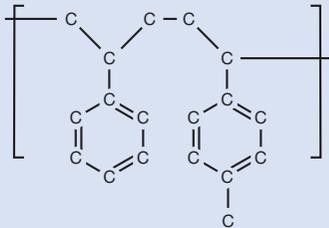
Synthetic resins are used in the cosmetic industry in products where fixation is needed such as lip gloss, eye liners, hairspray and gel.

Plasticisers – softeners

Softeners are oils used to control both tack and adhesion while increasing the flexibility of the adhesive.

Softeners are used in adhesives that contain very elastic polymers. The softeners reduce the elasticity of the polymers making them softer. This enables the adhesive to adapt faster to the skin surface, increasing the rate of adhesion while making them more comfortable with the increase in flexibility.

An example of a synthetic softener is **paraffinic oil**, which is used in the cosmetic industry in the production of skin oils.

Name	Primary source	Other applications outside ostomy
Tackifier	<ul style="list-style-type: none"> Chemical formula of a typical tackifier 	<ul style="list-style-type: none"> Cosmetic products 

Name	Primary source	Other applications outside ostomy
Paraffinic oils	<ul style="list-style-type: none"> Chemical formula of paraffinic oils C_nH_{2n+2} <p>(Where n is between 8 and 20)</p>	<ul style="list-style-type: none"> Skin care products 

Glossary

Absorption: The ability to absorb moisture from the skin keeping it dry and healthy

Adhesive: The part of an ostomy appliance that attaches the appliance to the skin during wear. The adhesive must ensure a close contact with skin surface

Adipose tissue: Loose connective tissue composed of fat-containing cells (adipocytes)

Amino acids: The biochemical building blocks of proteins

Ascorbic acid: An organic acid with antioxidant properties

Autonomic nervous system: Part of the peripheral nervous system that acts as a control system, maintaining constant, stable internal environment (homeostasis) in the body

Bacteria: Unicellular microorganisms with a wide-range of shapes, ranging from sphere to rods or spirals

Belts: Used to support an ostomy product on the abdomen by exerting light pressure

Butyl rubber: A polymer with medium molecular weight with both elastic and plastic properties. Provides both strength and adaptability to the ostomy adhesive

Collagen: The fibrous protein constituent of skin, cartilage, tendon and other connective tissue

Colostomy: A surgical procedure that connects the large intestine to an opening (stoma) on the wall of the abdomen

Corneocyte: A type of skin cell found in the stratum corneum

Coupling system: Attaches the adhesive to the bag in a two-piece appliance, allowing the bag to be changed without changing the adhesive

Crohn's disease: A chronic, episodic, inflammatory condition of the gastrointestinal tract

Diabetic: A person suffering from diabetes – a syndrome characterised by disordered metabolism and high blood glucose levels (**hyperglycaemia**)

Dermis: The skin layer beneath the epidermis that consists of connective tissue, cushioning the body from stress and strain

Desquamation: The shedding of the cells in the outer layer of the skin

Eccrine glands: Sweat glands found over the entire body surface, particularly on the palms of hands, soles of feet, and on the forehead

Effluent: The waste product that is released from the stoma

Elastic: An adhesive needs to be elastic, meaning that it is able to follow the movements of the body and at the same time retain its form. An adhesive with high elasticity is also easy to remove without the adhesive leaving residues

Elastin: A protein found in the skin and connective tissue that allows them to resume their shape after stretching and also helps maintain the integrity of the skin under loading

Electrolyte: Salts in the body that conduct electricity. They are found in the fluid, tissues, and blood. Examples are electrolytes

are chloride, calcium and magnesium ions

Enzymes: Proteins that catalyse biochemical reactions in the body, such as the breakdown of foods in the intestine

Epidermis: The outermost visible part of the skin

Epidermal–dermal papillae: Projections of cells from the dermal layer of the skin into the epidermal layer

Erosion of adhesives: A gradual process of wearing down, reduction and weakening, such as the erosion of adhesive due to stomal effluent

Extended wear: An adhesive that is worn for a longer time period and / or in connection with aggressive stomal effluent (i.e. ileostomy, urostomy). Generally used with two-piece appliances

Fatty acid: A carboxylic acid that is the basic building block of fat

Fibroblast: A cell that maintains the structural integrity of connective tissue, provides a structural framework for many tissues, and plays a critical role in wound healing

Flexibility: The ability for an adhesive to bend and stretch in accordance with the body movements

Fungi: Microorganisms that can cause disease

Germinative: Capable of developing, or creating

Glycerol: A colourless, sweet and non-toxic chemical compound that forms the backbone of fat

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Hydrocolloids: Powders that absorb moisture forming a gel-like structure. In adhesives, hydrocolloids play an important role in absorption of moisture from the skin

Hydrophilic: Water-loving (or attracting) compound, e.g. hydrocolloids

Hydrophobic: Water-repelling compound, e.g. SIS or PIB polymers

Hyperglycaemia: A pathologic state caused by a higher than normal level of glucose in the blood

Hypoallergenic: Something that does not cause an allergic reaction

Hypoglycaemia: A pathologic state caused by a lower than normal level of glucose in the blood

Ileostomy: A surgical procedure that connects the small intestine to an opening (stoma) on the wall of the abdomen

Karaya gum: A hydrocolloid with anti-fungal properties used in older ostomy adhesives

Keratinocytes: The cell type that makes up about 90% of the epidermis

Lactic acid: A chemical that is formed when sugars are broken down for energy in the absence of adequate oxygen

Macerated: Softening and weakening of the skin due to excessive soaking with fluid

Mechanical trauma: Injury caused by an appliance rubbing against or pulling on the skin surface causing damage

Normal flora: The population of microbes found on the outer or inner surfaces of people

Oedema: Swelling of soft tissues due to accumulation of excess water

One-piece appliance: An ostomy appliance with the ostomy bag attached directly to the adhesive

Ostomy appliance: Consists of a bag (that collects diverted waste from a stoma) and a baseplate (adhesive) which attaches to the abdomen

Paraffinic oil: A synthetic fluid (plasticizer) which provides plasticity to an ostomy adhesive for better adaptability

Passive diffusion: The movement of molecules from an area of high concentration to an area of low concentration through a membrane without the expenditure of energy

Peel force: The force required to remove (peel off) the adhesive

Peristomal: The surrounding area of a stoma

pH: A measure of the degree of acidity or alkalinity

PIB, polyisobutylene: A polymer with low to medium molecular weight and high plasticity providing high adaptability to an ostomy adhesive. This enables the adhesive to flow into the irregular skin surface and creating a good contact to the skin

Polymers: Compounds that are made of many small building blocks (SIS and PIB are polymers)

Polymeric matrix: The arrangement of elastic and plastic polymers, such as an adhesive framework. The framework can be perceived as three dimensional skeleton that supports the hydrocolloids and keeps them in place

Pressure sensitive adhesives (PSAs): Adhesives that develop immediate adhesion when light pressure is applied

Residue: Residue of adhesive material left on the skin once the adhesive has been removed

Ring: An accessory used to prevent erosion or to level out folds and irregularities in the stoma shape

Selective serotonin reuptake inhibitors (SSRIs): Class of antidepressant medications used in the treatment of depression, anxiety disorders, and some personality disorders

Skin prep: A liquid film-forming dressing that when applied to intact skin forms a protective film that protects the skin from stoma output. Most skin preps will influence the peel force of the adhesive, so one needs to be careful when using

Steroid (corticosteroids): Class of drug used to relieve swelling or inflammation

Stickiness (tack): The adhesive property relating to instantaneous pressure

Stoma: A surgically created opening that connects a portion of the body cavity to the outside environment. Stoma comes from Greek meaning mouth or orifice

Stratum basale: The innermost layer of the epidermis where skin cells originate

Stratum corneum: The outer layer of the epidermis of the skin, which comprises degraded and dead cells

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Stratum granulosum: A layer of the epidermis of the skin, which cells (mainly keratinocytes) migrate through before they gradually degrade and die to produce the outer, stratum corneum layer

Stratum spinosum: A layer of the epidermis of the skin, which cells (mainly keratinocytes) migrate through to become corneocytes

Stripping: Removal of the top layer of skin when the adhesive is removed

Strip paste: A mouldable accessory used to level out creases and scars in the skin near the stoma to improve contact between an irregular skin surface and the adhesive

Styrene-isoprene-styrene (SIS): A polymer with high molecular weight and high elasticity providing strength and durability (erosion resistance) to an ostomy adhesive

Synthetic resins (tackifiers): Substances that produce immediate adhesion (tack), commonly used in the cosmetic industry in products like lipstick

Subcutis: The deepest layer of the skin

Tack (stickiness): the adhesive property relating to instantaneous pressure sensitive adhesion

Tackifiers: See synthetic resins

Tube paste: A mouldable fluid accessory used to level out creases and scars in the skin, improving contact between an irregular surface and the adhesive

Two piece appliance: An ostomy appliance where the bag is attached to the adhesive with a coupling system, allowing changes of the bag without changing the adhesive

Urea: A nitrogen-containing substance normally cleared from the blood by the kidney into the urine

Uric acid: An organic compound found in human urine

Zinc oxide: A skin friendly compound used in first-generation adhesives

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