Care and management of a stoma: maintaining peristomal skin health

Anna Boyles and Sharon Hunt

ABSTRACT
It is estimated that around one in 500 people in the UK are living with a stoma, with approximately 21,000 operations performed each year (Colostomy Association, 2016). These people face a unique set of challenges in maintaining the integrity of their peristomal skin. This article explores the normal structure and function of skin and how the care and management of a stoma presents challenges for maintaining peristomal skin health. Particular focus is paid to the incidence of skin problems for those living with a stoma, whether it is temporary or permanent, and the factors that contribute to skin breakdown in this population. Wider factors such as the central role of the clinical nurse specialist and the impact of product usage on positive outcomes and health economics are also considered.

Key words: Anatomy and physiology ■ Skin ■ Stoma care ■ MARS! ■ Skin breakdown ■ Quality of life ■ Outcomes

The skin is often referred to as the largest organ of the body and performs a number of functions vital to the maintenance of homeostasis (Tortora and Derrickson, 2009). The formation of a stoma and management of its output with appliances and accessories can prove to be a challenge to this equilibrium for a variety of reasons. The Colostomy Association (2016) estimates that there are currently 120,000 people living with a stoma in the UK, with around 21,000 operations performed annually for a wide range of bowel and urinary diseases and disorders, meaning around 1 in 500 people face this challenge on a daily basis.

This article explores the normal structure and function of the skin, the factors that can influence the preservation of good skin health, the perspective that stoma care has on the importance of maintaining good skin integrity and the burden that the care and management of a stoma place on patients and those who care for them.

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Anatomy and physiology of the skin
The skin is the largest organ in the human body, accounting for up to approximately 16% of the total body weight of an average adult, weighing twice as much as the brain (Tortora and Derrickson, 2009). On average, skin is 1-2 mm in depth, although it can vary in its thickness depending on its individual functions and particular area of the body; the eyelids are only 0.5 mm in depth, whereas the plantar region of the foot can be up to 4 mm (Brooker, 1998). According to Turkington and Dover (2007), the skin is composed of thick outer layers, a complex system of sweat glands sensitive to temperature alteration and a strong layer of fatty tissue and sensitive cells, which alert the body to pain, pressure, touch, irritation, heat and cold triggers, all residing just beneath the skin surface.

The skin contains an acid mantle, an invisible covering with a pH range of 4 to 5.5. This provides the closed skin surface with a protective barrier from outside influences, damage and injury, particularly excessive moisture, bacteria and frictional surfaces. The acid mantle aids the skin in the prevention of excessive fluid and electrolyte loss to maintain homeostasis (Tortora and Derrickson, 2009). When the acid mantle is ‘interrupted’ through either an increase of acidity or alkalinity, the skin is vulnerable to epidermal stripping, infection and wound development (Bateman and Roberts, 2013).

Skin types vary from individual to individual and can be segregated generally into four types: dry, oily, normal and sensitive, which can affect how the skin responds to both internal and external stimuli, nutrients and moisture levels (White, 2014).

Stratum corneum
The skin is comprised of three main layers: the epidermis, the dermis and subcutaneous tissue (Kanitakis, 2002) whose overall function is to absorb, excrete, protect, secrete, thermoregulate, pigment produce, perceive senses and provide a safe environment through immunological responses (Hampton and Stephen-Haynes, 2005).

The uppermost layer, the epidermis, consists of 90% stratified squamous epithelium cells known as keratinocytes, whose function is to synthesise keratin, a protein with a strong protective function. It also contains 8% melanocytes, responsible for the production of the pigment melanin, and 2% langerhans and merkel cells, which allow immune responses and touch sensation respectively (Tortora and Derrickson, 2009). Ceramide is the main component of the stratum corneum of the epidermis layer, together with cholesterol and saturated fatty acids. Ceramide

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Figure 1. Skin structure

Table 1. Medications: cutaneous side effects and their causes

<table>
<thead>
<tr>
<th>Medication</th>
<th>Cutaneous side effect</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steroids</td>
<td>Bruising, Skin thinning, Delayed healing, Fragile skin</td>
<td>Act non-selectively so impair healthy anabolic processes that build up organs and tissues</td>
</tr>
<tr>
<td>Anti-coagulants</td>
<td>Bruising, Prolonged bleeding</td>
<td>Inhibition of blood clotting</td>
</tr>
<tr>
<td>Chemotherapy</td>
<td>Rash, Dry skin, Delayed healing, Increased bleeding from the stoma surface</td>
<td>Act non-selectively so target rapidly dividing cells</td>
</tr>
<tr>
<td>Nicorandil</td>
<td>Ulceration</td>
<td>Not understood</td>
</tr>
</tbody>
</table>

creates a water-impermeable, protective organ to prevent excessive water loss owing to evaporation, as well as a barrier against the entry of microorganisms (Hill and Wertz, 2009).

Trans epidermal water loss (TEWL) relates to the amount of water that transfers from within the body to the external environment through the epidermis layer; for example, in perspiration (Elias, 2005). Gray et al (2011) suggested that TEWL increases when skin dysfunction—such as stripping trauma, infection, eczema and psoriasis—occurs.

The TEWL process is significantly reliant on ceramides, which play an essential role in minimising water loss, ensuring the moisture level of the stratum corneum is optimised and maintaining skin health and protection (Coderch et al, 2003). Other important aspects related to fluids and management within the biological system of the body that ceramides are involved in include: forming a ‘bricks and mortar’ model comprising the corneocytes, as the ‘bricks’ embedded in lipids with ceramides, or the ‘mortar’ (Gray et al, 2011; Voegeli, 2012); structuring and maintaining water permeability barriers within the skin (Feingold, 2007), and forming waterproofing of the skin.

This outer layer is dependent on the next layer, the dermis, for its supply of oxygenation, metabolic delivery and waste removal, because of its avascular structure. The middle layer, called the dermis, is fundamentally built up of an integrated system of fibrous, filamentous and amorphous connective tissue inclusive of a fibrillary protein, known as collagen. The dermis provides the bulk of the skin ensuring its elasticity, pliability and tensile strength (Kanitakis, 2002). It is in this layer where lymph vessels, nerve endings, hair follicles and glands which are responsible for exchanging nutrients between the dermis and epidermis are found. There are up to 4 million sweat glands containing hair follicles separated into two types, eccrine and apocrine, which are distinguished by their differing structures, locations and actual secretion. Eccrine glands allow thermoregulation through evaporation to the skin surface ensuring temperature control and skin moisture, whereas apocrine glands, which are activated by hormones, produce what is commonly known as body odour, when the secreted sweat metabolises with skin flora (Casey, 2002).

In the final layer, the subcutaneous, fat cells or lipocytes are separated by fibrous septa made up from large blood vessels and collagen. Considered an endocrine organ, subcutaneous fatty tissue provides the body with buoyancy, insulation and acts as a store for energy. It also provides protection and attachment to underlying bone and muscle tissue (James et al, 2006).

The skin requires regular maintenance to keep it at its optimum functioning capacity (cleaning appropriately, protection from the harmful sun rays, oxygenation through physical exercise and a mixed varied healthy diet in rich nutrients, alongside adequate fluid intake). These key aspects of skin care become more important as the body ages (National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIH), 2016).

When skin is damaged owing to injury, infection, friction, excessive moisture, trauma, or dehydration, a system of biological changes come into action. These are correlated into set phases: haemostasis, inflammation, proliferation and maturation (Collier, 2002).

Haemostasis is the response which starts immediately after skin injury; it is achieved by a combination of vasoconstriction to conserve blood loss and the release of clotting factors, with the clot acting as a bacterial barrier and a framework for migrating cells (Benbow, 2005). The clotting cascade is initiated and a mesh is formed trapping blood cells to start the next phase of inflammation.

Inflammation occurs because of the extensive vasodilation presenting heat, swelling, erythema and often discomfort to the site of injury, where increased neutrophils appear to cleanse the area of bacteria and devitalised tissue, a phase that occurs over a 24–48 hour period (Collier, 2002). Wound exudate, which is produced at this phase, contains substances that are vital for the tissue to progress to full healing, such as neutrophils, macrophages, lymphocytes, proteases and essential growth factors. When contained, wound exudate is vital for wound healing; however,
when in excess and not managed appropriately, tissues may become macerated, damaged and healing can stall (Timmons, 2006).

Proliferation or granulation, which occurs around day 3 to 14 (Casey, 2002), is where healthy vascular rich tissue is laid down within the wound bed, allowing wound contraction and epithelial cells to migrate, to eventually form closure of the wound. Epithelial cells form within hair follicles, sebaceous and sweat glands, which are essential to keeping the new tissue protected, moist and at optimal functioning states (Timmons, 2006).

The onset of maturation varies extensively depending on the wound size, closing by primary or secondary intention, comorbidities and overall skin health. During this phase, the wound is strengthened and the scar will change in colour significantly. Fully healed and formed scar tissue is relatively avascular, containing no hair or sweat glands, and can take from 1 to 2 years to achieve (James et al, 2006).

**How the stoma and device can contribute to peristomal skin breakdown**

The incidence of peristomal skin problems is widely described in the literature. Richbourg et al (2007) reported skin breakdown as the most common complication in their post discharge study group and put incidence at 74–83%, while other studies point towards 21–70% of ostomists (those living with a stoma), dealing with complications or a problematic stoma (Leenen and Kuypers, 1989; Bass et al, 1997; Shellito, 1998; Cottam and Richards, 2006). Other groups have reported that 6–70% of patients experience peristomal skin irritation or breakdown (Nugent et al, 1999; Ratliff et al, 2005) and Lyon (2013) postulated that upwards of 10% of peristomal rashes are unable to be attributed to primary disease, allergy or infection, and are more likely to be secondary to a low-grade irritant process related to the occlusion of the stoma appliance. Examples of mild, moderate and severe peristomal excoriation are illustrated in Figures 1–3.

A study by Herlufsen et al (2006) found that the majority of problems are experienced by patients with an ileostomy, of whom 57% have peristomal skin problems. Of those with an ileal conduit 48% experience issues, while 35% of colostomists have problems. These findings could well be attributed to the amount and type of output being contained, but even taking this into account, it is clear that for every 10 colostomists who are still using the vast majority of their gut complement and will therefore have a more conventional stool, at least 3 will still experience issues with their peristomal skin. Woo et al (2009) offered that of those ostomists diagnosed with a peristomal skin disorder, 77% could be related to contact with their stoma output.

All stomas are created by exteriorising part of the bowel through the abdominal wall to the surface, where it is everted and sutured into place. Colostomies sit relatively flush to the skin and ideally should spout 10–15 mm (Cottam and Richards, 2005). Ileostomies should protrude slightly more, with a spout of 2–2.5 cm (Hall et al, 1995), and ileal conduits should be similar to an ileostomy spouting 1.5–2.5 cm (Fillingham, 2005).

The need for this type of length in a stoma spout is directly related to the consistency, amount and content of its output. As a colostomy is formed from part of the colon, most of the normal length of gut is still in use. The ileocaecal valve is still in situ acting as a brake between small and large bowel, and the vast majority of absorption has happened during transit. As such, the enzymes and salts that aid digestion have been neutralised making the stool passed likely to be soft to semi-formed and less irritant. A colostomy is also likely to have periods of relative inactivity over the course of the day and tends to function more in keeping with what patients have been used to as their usual bowel habit.
The output from an ileostomy is looser, as stool will not have passed through the colon where the majority of water is reabsorbed, giving the stool its form and consistency. The volume of output passed from an ileostomy increases inversely to the length of remaining small bowel in continuity, but a normal output for a terminal ileostomy is considered to be 600–800 ml in 24 hours (Black, 1997). Anecdotally, many patients manage without problems with an output of around 1000 ml in 24 hours; anything above this can be considered a high output, putting patients at risk of dehydration and electrolyte imbalance (Nightingale and Woodward, 2005). Small bowel content from an ileostomy still contains the acids and salts secreted higher in the gut to be used for chemical digestion, which gives it a more corrosive nature when it comes into contact with peristomal skin.

An ileal conduit will pass urine at a steady rate as the storage provided by the bladder has been lost. An average volume may be around 1500 ml per day (Burch, 2006), although this is variable on the level of hydration and renal function of the individual. Exposure of the peristomal skin to urine will in itself increase risk of irritation, but there is an added consideration of maceration where the appliance holds the moisture next to the skin for prolonged periods, thus increasing permeability and the risk of breakdown.

In practice, higher stomal outputs provide a greater challenge to containment and skin protection. Looser output in larger volume will find the smallest weakness or gap in the hydrocolloid barrier, meaning the skin will be exposed to the stool and make the appliance more likely to leak. A more corrosive output will also contribute to the corrosion of the hydrocolloid adhesive, known colloquially as ‘melt’, which also leads to a loss of the skin barrier next to the stoma and an increased risk of subsequent skin problems. In the author’s (A.B.) practice, patients who have a higher output will often need to change their appliance more regularly or use accessories, such as seals or skin barrier films, to protect the peristomal skin and reduce the incidence of irritation and breakdown.

The risk of medical adhesive related skin injury

Adhesives used in stoma appliances and accessories play a part in maintaining skin integrity. However, there is a potential for the adhesives themselves to cause skin problems. Medical adhesive related skin injury (MARSI) is a mechanism of skin injury that occurs when the skin to adhesive attachment is stronger than the skin cell to skin cell attachment. This causes a cohesive failure within the structure of the skin that leads the epidermal layers to part or separates the epidermis from the dermis (McNichol, 2013). This type of injury may manifest itself in a number of ways; from the removal of layers of the stratum corneum (so-called skin stripping) and maceration from trapping moisture next to the skin for prolonged periods, to tension injuries such as blisters or tears. While there may not be any visible trauma, there is a cumulative removal of epidermal cells that over time will result in a compromise to the skin barrier function, that will in turn result in the mounting of an inflammatory and wound healing response.

There are a number of factors that lead to the mechanism of injury. These include the energy required to remove the adhesive, the composition of the adhesive and the occlusiveness of the adhesive. The moisture that gets trapped underneath an occlusive dressing leads to maceration and irritation of the skin, which increases the risk of mechanical trauma. Hydrocolloid adhesives trap moisture over time, meaning the skin becomes macerated and more permeable, thereby increasing its susceptibility to friction and irritants. However, it has been argued that the ability of hydrocolloid barriers to absorb excess moisture can reduce these unfavourable side effects when compared to other occlusive barriers (Zaih and Maibach, 2002).

McNichol et al (2013) postulated that MARSI constitutes ‘a significant negative impact on patient safety’. Aside from the obvious physiological effect of skin damage leaving wounds that require healing, associated pain, an increased risk of infection and further skin breakdown, there are also psychological ramifications. Patients with skin damage can suffer compromise to their quality of life through interference with their normal physical activities. This can lead to social isolation, increased anxiety and even depression (Herlufsen et al, 2006; Woo et al, 2009; Boyles, 2010a; McMullen et al, 2011; Salvadalen, 2016). Add to this the financial implications of treating this type of injury—not only in terms of supplies but also service provision and time—then the multifaceted negative effects of this type of injury will soon mount.

Intrinsic factors contributing to peristomal skin breakdown

There are a number of intrinsic factors that can have an influence on how skin behaves when exposed to the various stressors brought about by both the stoma and appliance.

As skin ages, it becomes more susceptible to damage and breakdown as a result of the following factors:

- Loss of the dermal matrix
- Loss of subcutaneous tissue
- Epidermal thinning
- Reduction of the cohesion between dermal and epidermal layers

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Reduced vascularity
- Reduced elasticity
- Reduced tensile strength
- Less moisture (Lober and Fenske, 1991; Cutting, 2008; Wysocki, 2012).
- Ethnicity is also being shown to have an effect on how skin is affected by exposure to adhesives. Differences in percutaneous absorption rates and the level of stratum corneum lipid (ceramide) content and tensile mechanical properties of the dermis (skin rigidity) across skin tones all play a part. This concept is still emerging, but there is some evidence to show that darker skin tones tend to have a higher degree of rigidity than lighter skin tones that may make it more prone to injury (Evans et al, 2012), while ceramide levels have been found to be higher in Asian skin types and lowest in darker skin types (Richards et al, 2003).

Additional intrinsic factors can also increase the risk of skin damage. These range from comorbidities, such as diabetes, renal failure, immunosuppression, hypertension and peristomal varices, to other conditions such as psoriasis, eczema, malnutrition and dehydration. Extrinsic factors including dry skin, maceration, radiotherapy, friction from the appliance or clothing, as well as certain medications, also have an effect on the skin that increases the risk of MARSI.

**Quality of life and wellbeing**

There are a variety of reasons why a stoma may be formed. The raising of a stoma will always be part of a wider disease or disorder process, which means that people will arrive at that point from a range of physical and psychological places. Regardless of the reason for stoma formation, it will always have a multifaceted impact on how people live their lives.

Quality of life is generally concerned with two aspects of information: functional status and how patients judge their health to affect their quality of life (Muldoon et al, 1998). Relating health to these physical and mental parameters allows the assessment of two factors: objective functioning (the ability to perform tasks) and subjective wellbeing (how an individual evaluates their state of health).

The concept of objective functioning can relate to a range of physical tasks, from the ability to walk a certain distance to the ability to resume a normal sex life, while it may also encompass an individual’s ability to perform cognitive and social tasks. In terms of stoma care, it can be more related to achieving a level of confidence to resume normal routines, such as work and social activities, as well as being physically capable of going back to a job that requires a certain level of physical activity. In a study by Nugent et al (1999) 8% of colostomists and 11% of ileostomists changed their job as a result of surgery; at 6 months, the differences between the groups was of permanent colostomy with those undergoing low anterior resection. The APER group had a lower start point at time of surgery; at 6 months, the differences between the groups was not significant and had disappeared by 36 months.

For those living with a permanent stoma, Feddern et al (2015) found there was little or no impact on how patients perceived their quality of life. Nair et al (2014) saw a dip at 2 weeks postoperatively that returned to preoperative levels by 3 months, and Chambers et al (2012) found a response shift towards good quality of life. Campos-Lobarto et al (2011) compared those undergoing abdominoperineal excision (APER) and formation of permanent colostomy with those undergoing low anterior resection. The APER group had a lower start point at time of surgery; at 6 months, the differences between the groups was not significant and had disappeared by 36 months.

It is easy to see that living with a stoma has some inevitable effects on how people view themselves and live their lives. Complications such as sore skin appear to have a direct negative impact on patient outcomes in this area, but there are wider issues that are worthy of note. In terms of money, the cost of prescribed stoma care products in England for 2015 was £280 million, of which £74 million was on accessories. To give this figure some context, the total cost of dispensed prescriptions in that year was £9.27 billion (Health and Social Care Information Centre, 2016). As this cost is purely related to the materials needed for stoma care, these figures do not take into account any extra costs that treating complications may incur. These may include additional medications or treatments, referral on to other specialties, such as dermatology and, importantly, nursing time and resources needed to assess and
The trans epidermal water loss (TEWL) process is significantly reliant on ceramides, which play an essential role in minimising water loss. Intact peristomal skin is the cornerstone to promoting positive outcomes for patients with a stoma. Ceramides ensure the moisture level of the stratum corneum is optimised and maintain skin health and protection. A stoma will always have a multifaceted impact on how people live their lives.

**KEY POINTS**

- The trans epidermal water loss (TEWL) process is significantly reliant on ceramides, which play an essential role in minimising water loss.
- Intact peristomal skin is the cornerstone to promoting positive outcomes for patients with a stoma.
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failure, the embarrassment of leaks and the self-assurance in their products and technique they need to take their normal place in the world. **BJN**

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Persson and Helstrom (2002) *Economic implications of patients being able to manage their accessories to manage problems. Both groups prioritised sore skin and skin damage in the top three reasons to use accessories. Furthermore, 91% of stoma nurses and 72% of patients felt these accessories were essential and beneficial to patients’ social and emotional wellbeing.**

The consistent thread running through this particular strand of the patient pathway, however, is the presence of clinical nurse specialists (CNS). As expert practitioners, the CNS is an accessible way for patients to be assessed, evaluated and using a sound evidence base, recommend and implement a path of management for an ever-widening range of issues. The CNS role means they are best positioned to provide care across organisational boundaries, implement regular review and follow-up, have a sound knowledge of product choices and have a strategic knowledge of the issues facing both patients and the wider NHS. This means they are able to advocate for change and improvements to patient care in a challenging organisational and financial landscape. This, in turn, ensures care remains centred around those who need it and remains relevant to their needs in terms of positive outcomes, products and timing (Bass et al, 1997; Bekkers et al, 1996; Pittman et al, 2009).

**Conclusion**

Intact peristomal skin is the cornerstone to promoting positive outcomes for patients with a stoma. While many patients will have to deal with problematic skin at some point, it should not be considered the acceptable norm as it can have profound impact on an individual’s optimal physical, psychological and social functioning. Good skin health means that pouch barriers can function reliably, which in turn leads to consistent stoma care. By placing the patient at the centre of that care, delivered in a timely way and with a basis in robust evidence, the CNS remains key in championing these positive outcomes. This enables patients to concentrate their efforts on building their confidence and wellbeing freer from the concern of pouch

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