Managing exudate and preventing biofilms in community wound care

Simon Barrett

There are a number of mechanisms at play that can delay wound healing. Wounds can become stuck in a prolonged inflammatory stage resulting in high volumes of wound exudate, which contains agents that contribute to delayed healing. Exudate plays an essential role in wound healing but at excessive volumes it can also facilitate biofilm formation, which can further delay healing. Maintaining optimum levels of exudate is vital for healthy wound healing, as is the prevention or disruption of biofilm formation in the wound bed. This article also looks at Sorbion Sachet S® (BSN medical), a tried-and-tested superabsorbent dressing, which is now back on the Drug Tariff, but at a lower price. This article discusses the mechanisms used in the reintroduced superabsorbent dressing and how it provides a cost-effective solution to the problem of treating highly exuding chronic wounds where clinical efficacy and budgetary concerns are both top priorities.

KEYWORDS:
- Wound care
- Exudate
- Biofilms
- Superabsorbent dressings

Put simply, exudate is the fluid that leaks from the capillaries during the healing process. It helps to create a moist wound environment and assists with healing by removing devitalised tissue, repairing damaged cells and providing nourishment to assist with epithelialisation. Exudate is produced in the initial wound healing process as part of the inflammation stage.

Exudate is created in response to injury as neutrophils migrate to the wound site and cytokine messengers instruct the surrounding blood vessels to become more porous and leak protein-rich fluid into the wound bed. Exudate is full of nutrients and growth factors and, when produced in the right amount, ensures that there is a moist wound environment, which is essential for timely healing.

In acute wounds, exudate will ‘wash over’ the wound bed and help remove debris and devitalised tissue. If the healing process is allowed to continue unhindered, the amount of exudate produced gradually declines. During the healing process, endogenous proteases help the wound to close and the cells to grow (Benbow and Stevens, 2010).

Problems with exudate production occur if the wound becomes ‘stuck’ in the inflammatory stage and the production of exudate is over-stimulated. Exudate found in chronic wounds (those that fail to heal after six weeks) has a different make-up to that in acute wounds and is often produced in higher quantities. Chronic wound exudate does not have the active growth factors found in acute wound exudate and it can actually block the healing process, destroy the extracellular matrix (ECM) and become a ‘wounding agent’ itself, causing more damage than healing (Chen et al, 1992).

Excessive exudate needs to be controlled and its potential to slow down healing and damage the periwound area needs to be prevented by the use of advanced wound care products.

THE ROLE OF MMPs IN PROLONGING INFLAMMATION

Chronic wound fluid contains raised levels of inflammatory mediators and activated matrix metalloproteinases (MMPs), which are enzymes that play an important part in wound healing. MMPs work in a number of ways — in the inflammation stage they help to remove devitalised tissue, bacteria and biofilms; in the proliferation stage MMPs promote angiogenesis (growth of new blood vessels) and the migration of vascular endothelial cells, as well as aiding scar formation and remodelling, helping to reorganise the ECM (Caley et al, 2015).

Problems arise when the volume of MMPs rise. Here, the very properties that facilitated healing can begin to destroy proteins such as growth factors, parts of the ECM and various receptors that are essential for healing. Excessive MMP volumes also delay healing by deactivating protease inhibitors and allowing the development of high elastase and plasmin volumes, which can result in the breakdown of tissue fibres and the digestion of fibrin, in turn interfering with blood clotting (Gibson et al, 2009; McCarty and Percival, 2013). High levels of inflammatory cytokines and free radicals keep the wound in an inflammatory state and instead of attacking bacteria, they can begin to damage tissue instead.

Growth factors are thought to be degraded by the presence of MMPs as experiments have shown that the breakdown of growth factors was slowed by adding protease inhibitors to chronic wound fluid (Wlaschek...
A mature biofilm will also release planktonic bacteria so that it can form new biofilm colonies. This perpetuates the inflammatory response and also increases the amount of exudate that is produced, providing the rich nutrients needed to feed the continuation and proliferation of the biofilm (Phillips et al., 2010). A wound that has been critically colonised by a biofilm will not be able to continue on a healing trajectory unless the biofilm colony is disrupted. Biofilms are much more difficult to eradicate than up to 60% of all non-healing wounds (James et al., 2008; Zhao et al., 2013). A reduced amount of growth factors in turn inhibits the signals that alert the body to produce the cells needed for tissue growth. In particular, it has been found that high volumes of active MMP-9 are often associated with slower healing rates (McCarthy and Percival, 2013).

**CASE STUDIES**

**Case study one**

This 49-year-old man was morbidly obese and had a post-traumatic venous leg ulcer (Figure 1). He lived with his wife and was in full-time employment as a refuse collector. He was also allergic to silver.

The wound had been present for four months and as well as odour, it was causing what the patient felt was significant pain, scoring ‘5’ out of ‘10’ on a scale where ‘10’ was the worst pain. This ulcer had resulted in him being off sick from work and losing pay due to the pain, exudate and odour being generally difficult to manage. Before being treated by the author, the wound had been swabbed and treated with a hydrogel dressing.

The patient was also given antibiotics for spreading wound infection.

When the author assessed the patient, the wound measured 6cm x 2cm and was 0.5cm deep. It was producing moderate-to-high volumes of medium viscosity exudate. The periwound area was also red and inflamed. Based on the volume of exudate and the presence of infection, the author decided to use an antimicrobial non-silver dressing for two weeks then review. After the two-week review, the author changed the dressing to Sorbion Sachet S complemented by graduated multilayer compression bandaging.

**Outcome**

The use of Sorbion Sachet S managed the exudate, in turn reducing maceration and skin breakdown of the periwound area.

As a result of the exudate being managed, the bacterial burden in the wound was also reduced. The patient also experienced a reduction in pain. After nine weeks of treatment, the wound was on a healing trajectory.

**Case study two**

This 79-year-old man had type 2 diabetes and had previously undergone a bilateral hip replacement as well as surgery to remove varicose veins. He also had a history of cardiac problems and had undergone a coronary artery bypass two years previously. At the time of the wound assessment he was living with his wife in a bungalow, but was physically independent and self-caring.

The patient had a venous leg ulcer on his right leg that had been present for two years and was not healing. The patient was bothered by odour from the wound and experienced variable pain — ranging from a score of ‘7’ out of ‘10’, to ‘4’ — depending on the dressing being used. There was a high volume of low viscosity exudate and the wound also exhibited significant yellow slough.

At assessment the wound measured 7.5cm x 7cm and was 0.2cm deep. Treatment of the wound had been varied in the past, but the author decided that the main aim was to manage the exudate and control odour.

Following assessment, the author decided to apply Sorbion Sachet S and compression, primarily to deal with the exudate and relieve the odour.

**Outcome**

Following the application of Sorbion Sachet S and compression the exudate reduced to a more manageable level, the patient’s pain was reduced and the wound began to move along the healing trajectory (Figure 1). The wound was finally fully healed after 13 weeks of Sorbion Sachet S and compression.

A mature biofilm will also release planktonic bacteria so that it can form new biofilm colonies. This perpetuates the inflammatory response and also increases the amount of exudate that is produced, providing the rich nutrients needed to feed the continuation and proliferation of the biofilm (Phillips et al., 2010). A wound that has been critically colonised by a biofilm will not be able to continue on a healing trajectory unless the biofilm colony is disrupted. Biofilms are much more difficult to eradicate than...
planktonic bacteria as they have a very high anti-bacterial resistance.

**REMOVING DEVITALISED TISSUE AND EXCESSIVE EXUDATE TO FACILITATE HEALING**

As explained above, too much or too little exudate can delay healing. Exudate volumes need to be managed to provide optimum moisture levels at the wound bed. If the wound is too dry, moisture-donating dressings can be used; conversely, if exudate volumes are excessive, superabsorbent dressings can be used to absorb the exudate and lock it away from the wound so that it cannot cause any damage. The preparation of the wound bed is also very important and the debridement of slough and devitalised tissue and the disruption of biofilms is necessary so that bacteria cannot colonise the wound, causing infection and delaying wound healing.

**Debridement and the role of absorbent dressings**

There are many different types of absorbent dressings and these manage exudate by absorbing and retaining excessive wound fluid, preventing it from damaging the wound bed and surrounding skin, while also allowing an appropriate amount of moisture at the wound bed.

Absorbent dressings vary in their fluid-handling capacity, with superabsorbents being able to handle excessive quantities of exudate. Before the advent of superabsorbents, foam dressings were often used to handle exudate, but they would need to be changed frequently and were unable to handle very high volumes. The subsequent leakages often resulted in damage to the periwound skin (Romanelli et al, 2010).

Superabsorbents have a much higher fluid-handling ability which allows them to reduce the bacterial count of the wound by absorbing MMPs and cytokines, drawing them into the dressing and away from the healing wound.

**Sorbion Sachet S**

Sorbion Sachet S® (BSN medical) was one of the original superabsorbent dressings, which was briefly unavailable when it was replaced on the Drug Tariff with Sorbion Sachet EXTRA® (BSN medical), which has a larger absorbent core. However, Sorbion Sachet S is now back on the superabsorbent dressing market since its return to the Drug Tariff at the beginning of 2016. The dressing is now produced by BSN medical and is available at a significantly lower price.

**Hydration response technology**

Sorbion Sachet S employs hydration response technology and addresses both exudate management and wound bed preparation in one dressing. The dressing has a core of cellulose fibres and gel-forming polymers, which form a matrix that absorbs and retains large quantities of exudate and any agents that can potentially delay healing such as proteases, cytokines and free radicals, keeping them away from the wound bed and reducing the bacterial load of the wound (Evans, 2010).

Any excess exudate is locked away — even under compression bandaging — and the dressing has a high capacity for fluid retention (Cutting and Westgate, 2012). The gel that is formed inside the dressing helps to maintain a moist wound environment and encourages autolytic debridement, removing non-viable tissue from the wound’s surface and ensuring that the wound bed is inhospitable to biofilm formation. It can also reduce the amount of fibrinous necrotic tissue through soft debridement.

The dressing has a polypropylene outer layer that is hypoallergenic to reduce skin irritation as well as an expandable border that allows maximum contact with the wound bed, even when the dressing is saturated with exudate. Sorbion Sachet S is designed for use in both acute and chronic wounds, including mixed aetiology leg ulcers, pressure ulcers, diabetic foot ulcers, dehisced wounds, drainage wounds and discharging laparotomy wounds healing by secondary intention. It can also be used with compression therapy. It comes in seven sizes that can be chosen according to the extent of the wound.

**Cost-effectiveness**

Sorbion Sachet S also represents value for money. One study compared Sorbion Sachet S with a similar dressing that is also on the Drug Tariff, KerraMax Care® (Crawford Healthcare). The dressing size compared was 10 x 10cm and the prices were taken from the November 2015 Drug Tariff. In a ‘free swell’ *in vitro* test (without compression), the KerraMax dressing was found to absorb 84ml of fluid and the Sorbion Sachet S 153ml. When comparing the price per 100ml absorbed, the Sorbion Sachet S was more than 50p cheaper, costing 97p per 100ml, while the KerraMax dressing cost £1.27 per 100ml. Therefore, although the KerraMax may initially appear to be a cheaper option at £1.49 per dressing, in a patient with heavily exuding wound Sorbion Sachet S would in fact result in fewer dressing changes, particularly as the wear time for one Sorbion Sachet S dressing is four days, without the need to use more than one layer (data on file).

In other *in vitro* tests carried out at an independent laboratory for BSN medical, Sorbion Sachet S absorbed up to 91% more than other superabsorbent dressings (data on file).

**Patient comfort**

As well as providing a cost-effective high-performance option for exudate management, Sorbion Sachet S has been found to be comfortable (Cooper et al, 2010), as it reduces the risk of leakage and the presence of odour (Chadwick, 2008). There is also a tendency with other lower cost superabsorbent dressings to apply them in more than one layer to make up for their lack of absorbency. This is not necessary with Sorbion Sachet S as it is highly absorbent while lacking in bulk, which also means improved comfort for the patient (Chadwick, 2008).

The case reports above illustrate the effectiveness of Sorbion S Sachet and the benefits to patients with highly exuding wounds.

**CONCLUSION**

Sorbion Sachet S has returned to the Drug Tariff and its new lower cost means that not only is it a high-performing superabsorbent,
CASE STUDIES

Case study three
This 74-year-old woman lived alone and had a mixed aetiology leg ulcer, which had been present for four years. In the past she had undergone a femoral popliteal bypass and had an existing abdominal aortic aneurysm.

At the time of the author’s assessment, the wound measured 22cm x 16cm and was of superficial depth (Figure 1). The wound bed exhibited extensive slough and was producing a high volume of medium viscosity exudate.

The patient was bothered by the leaking exudate and odour but demonstrated poor compliance with wound treatment, which in the past had included a hydrofibre dressing underneath an absorbent pad. At the time of the assessment, the patient was being visited daily by nursing staff to have her dressings changed due to excess exudate. Following the author’s assessment, the care plan was to use a silver dressing alongside Sorbion Sachet S underneath very light compression (10mmhg).

Outcome
Following the new dressing regimen, the exudate was much more controlled, which reduced visits from nursing staff to every other day. The odour was also reduced and the wound began to progress toward healing.

Due to the lack of odour from the wound and the reduced exudate, the patient could see the benefits of the new regimen and, as a result, was more involved in her treatment.

KEY POINTS

- There are a number of mechanisms at play that can delay wound healing.
- Wounds can become stuck in a prolonged inflammatory stage resulting in excess wound exudate that will contribute to delayed healing.
- Exudate plays an essential role in wound healing but at excessive volumes it can also facilitate biofilm formation, which can further delay healing.
- Maintaining optimum levels of exudate is vital for wound healing, as is the prevention or disruption of biofilms in the wound bed.