Choosing the correct dressing is often key to moving a wound along the healing trajectory, with its ability to deal with problems such as pain, excess exudate production and inflammation being crucial to the healing outcome. Infection is also a serious problem in many wounds and this article looks at the basics of wound infection as well as some of the main treatments, such as topical antimicrobials. However, clinicians are faced with a huge range of wound care products, many of which have antimicrobial properties. This article considers the use of one gelling fibrous silver dressing (Durafiber® Ag; Smith and Nephew), which is specifically designed to deal with many of the problems mentioned above, particularly excess exudate production and infection. The authors also present the results of a small, prospective multicentre case series that was carried out to assess the efficacy of Durafiber Ag in a variety of wounds.

KEYWORDS: Infection Exudate Pain Antimicrobial dressings

Wounds have a significant impact on patients’ quality of life with problems including excessive exudate, pain and odour from open wounds (Spilsbury et al, 2007). These issues also prove challenging for clinicians and no one therapy type or dressing regimen is suitable for all patients. Choosing the correct wound dressing — or combination of dressings — can help to reduce the impact of wounds on the patient’s quality of life and prevent delayed healing.

The problem of delayed healing highlights the need for accurate wound assessment, effective diagnosis and initiation of appropriate treatment or therapy regimens. This is particularly true when wound problems are exacerbated due to the tissue types involved (such as necrosis), exudate volumes, infection and problems with the wound edges, such as achieving adequate closure.

The small evaluation featured below aimed to assess the benefits of a new gelling silver fibre dressing (Durafiber® Ag; Smith and Nephew), which is designed to absorb exudate, support debridement and treat wounds showing signs of infection.

EXUDATE

During the early stages of wound healing, the production of exudate in the wound bed is normally controlled by the release of histamines. In the inflammatory phase of healing the body attempts to clear any wound debris such as dead cells and bacteria by releasing key cells — mainly cytokines and proteases — into the wound (Barrett et al, 2012).

In chronic wounds, this response to injury becomes prolonged and in some cases leads to continued inflammation and increased exudate production. The exact causes of this are unknown, however, there are a number of factors which may contribute:

- The presence of foreign material within the wound, such as old dressing fibres
- The presence of bacteria within the tissue
- Sloughy tissue, dead cells and fibrin may also be present in the wound bed, all of which can stimulate the body’s production of proteases and neutrophils.

These factors often lead wounds into a cycle of chronicity and prolonged inflammation, which requires careful management, assessment and intervention.

Wound exudate is a normal part of the healing process. However, in some chronic wounds excessive exudate volumes are often related to abnormally raised protease levels, which can impede healing by degrading the newly formed extracellular matrix (Dowsett and Newton, 2005).

In addition to local wound factors, the patient’s comorbidities — including systemic illnesses such as chronic obstructive pulmonary disease (COPD), cardiac problems and diabetes — must also be considered as a factor in delayed healing.

Patients with poor vascular supply as a result of peripheral vascular disease will have an impeded blood supply to the lower limb, which can result in prolonged healing in ulcers or wounds. Similarly, the presence of venous disease leads to venous stasis in the lower limb, which will also impact on the healing process through accumulation of waste products and oedema.
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\begin{itemize}
  \item Clean one-piece removal\textsuperscript{1-3}
  \item High absorbency\textsuperscript{1-3}
  \item Minimal dressing shrinkage\textsuperscript{1}
  \item Sustained antimicrobial activity (\textit{in-vitro})\textsuperscript{4-6}
\end{itemize}

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3. DS/12/093/DOF.
4. DOF 1004007.
5. DOF 1009011.
6. DOF 1009012.

All references relate to in-vitro testing excluding 2.

For patients. For budgets. For today.
The presence of factors that can impede healing — whether local or systemic — make it essential that patients’ wounds are accurately assessed, including tissue types and exudate volumes. Only then can the clinician choose the correct therapy to appropriately address the needs of the wound and the patient.

**PAIN**

The impact of pain on patients with wounds is often underestimated. Recent studies have highlighted the need to assess and manage patients’ wound pain both in relation to any ‘constant’ or background pain they may experience, as well as the pain associated with dressing changes (White, 2009).

Assessment of patients’ pain has become a central component in wound management, as has the use of dressings that can help to reduce the pain associated with dressing changes. Pain at dressing change is often associated with harsh adhesives or fibrous dressings, which can adhere to tissue and cause damage on removal. In the authors’ clinical experience, using a gelling fibre dressing can help to reduce wound pain as the gel formed on contact with wound fluid means that the dressing remains soft and malleable and is not traumatic to remove.

**WOUND INFECTION**

The overall impact of bacteria within a wound is influenced by the host’s (in this case the patient’s) immunity; the number of bacteria present; the type of bacteria; and its virulence (World Union of Wound Healing Societies [WUWHS], 2008).

The presence of bacteria in a wound is not always detrimental to healing and many chronic wounds will contain a level of bacteria not sufficient in numbers to cause infection — low levels of bacteria can be contained to some extent by the host’s immune response (Butcher, 2013).

However, in wounds where bacteria begin to proliferate because of reduced host immunity — for example, in patients with comorbidities such as diabetes — bacteria may begin to multiply. Once the numbers of bacteria reach a certain level within a wound they can begin to break down the extracellular matrix and, in large enough numbers, will trigger a histamine response from the host. The patient and the wound may then begin to exhibit signs of infection including pyrexia, local erythema, swelling in the wound area, increased exudate volumes and pain.

‘Assessment of patients’ pain has become a central component in wound management, as has the use of dressings that can help to reduce the pain associated with dressing changes’

However, in chronic wounds these signs may not always be apparent as the presence of sloughy tissue and raised exudate volumes may mask the early signs of wound infection. In diabetic patients, the microvascular changes which impact on available neutrophils, as well as the corresponding neuropathy, can also reduce the outward signs of infection such as pain and erythema.

There are three defined states of infection:

1. **Contamination:** the bacterial numbers do not increase significantly and do not cause clinical signs and symptoms — the wound is healing normally
2. **Colonisation:** bacteria are multiplying but there is no damage to host tissue, or a recognisable host response
3. **Infection:** bacteria have multiplied to a level that disrupts healing and wound tissue is damaged. If contained to the wound site, this is known as local infection; however, if the damage progresses beyond the wound edges — and includes the presence of erythema — this is known as spreading infection. If bacteria then enter the blood stream to cause systemic symptoms such as pyrexia and malaise, this is known as systemic infection (WUWHS, 2008).

Another state recognised in the literature is critical colonisation (WUWHS, 2008). This refers to wounds moving from colonisation towards infection and where bacterial levels are not causing tissue destruction but are slowing the wound-healing process. Such wounds may exhibit slow healing, a change in the colour of the granulation tissue and an increase in exudate volumes.

**MANAGEMENT OF WOUND INFECTION**

Appropriate management of wound infection involves careful assessment of the wound and, more importantly, the patient.

The host response is the ability of the patient to react to the presence of bacteria that threatens the wound or may pose a systemic threat. This would be characterised by the signs mentioned above, such as pain, swelling, redness and localised heat.

Within the wound, the host response relates to the efficiency of the host’s immune cells in dealing with bacteria, in particular macrophages and neutrophils, which are responsible for identifying and destroying bacteria.

In the authors’ opinion, improving the host response to the infection is a priority and this may include:

- Achieving good glycaemic control in those with diabetes
- Correcting anaemia — a reduction in the oxygen-carrying capacity of the blood can affect the amount of oxygen reaching the wound and thereby impact on healing
- Using drugs to help control disease symptoms, for example, ferrous sulphate can increase haemoglobin levels in patients with iron-deficiency anaemia; beta-blockers can help to strengthen and steady the heartbeat resulting in more efficient tissue oxygenation
- Improving the patient’s nutritional status.
The next component of treatment involves measures that reduce the bacterial load, including (WUWHS, 2008):
- Debridement of sloughy tissue
- Prevention of cross-contamination
- Managing wound exudate appropriately: this entails dealing with any excessive exudate production while still facilitating an optimal volume of moisture within the wound to support healing
- Increasing the frequency of dressing changes: this helps to remove any bacteria that may be trapped in the dressing and allows wound cleansing so that the clinician can better assess the wound for signs of progress or deterioration
- Wound cleansing
- The use of non-touch aseptic technique when managing the wound
- The judicious use of topical antimicrobials: this means only using antimicrobial products on wounds which are showing signs of infection or slow healing. Overuse of antimicrobials has been linked with bacterial resistance and, therefore, they should only be used when patients will benefit.

General measures should also be carried out to treat the signs and symptoms of wound infection. These include management of pyrexia, appropriate pain management and the provision of patient education to ensure patients are fully informed about their condition.

**THE USE OF TOPICAL ANTIMICROBIALS**

The value of topical antimicrobials in the treatment of wound infection has increased in recent years due to the emergence of antibiotic-resistant organisms and the need to manage more complex wounds (WUWHS, 2008).

The use of topical antimicrobials relies on assessment — without accurate assessment products may be used inappropriately or unnecessarily.

‘Antimicrobials — whether in solution form or contained in dressings — have the ability to reduce the overall bioburden of the wound’ (WUWHS, 2008).

The level of infection, tissue types present, and exudate volumes will also have a bearing on the choice of dressing used. Systemic antibiotics may be necessary in cases of spreading wound infection and where there is a risk of systemic infection occurring.

However, unregulated use of antibiotics has been linked to bacterial resistance so clinicians must be wary of overprescribing.

Bacterial resistance to antibiotics was documented as early as 1948, soon after the development of penicillin (Demerec, 1948). There is also an additional risk of *Clostridium difficile* when combinations of antibiotics are used to treat infection. In the authors’ opinion, in some cases it may be more beneficial to use topical agents as these can be targeted to areas known to contain bacteria. Many antimicrobials also have multiple actions on bacteria, which can help to reduce the ability of organisms to develop resistance (WUWHS, 2008).

Antimicrobials — whether in solution form or contained in dressings — have the ability to reduce the overall bioburden of the wound (International Consensus, 2012). They are available in many forms, including liquids, pastes, gels, foams, fibre dressings and other impregnated dressings. Types of antimicrobials include silver, iodine, honey and polyhexamethylene biguanide (PHMB).

Antimicrobials are most commonly used to treat open wounds such as venous leg ulcers, pressure ulcers and diabetic foot ulcers, and antimicrobial dressings are able to work in close proximity to the wound bed in order to destroy bacteria (Thomas, 2004). Absorbent products also have the ability to kill bacteria that have been absorbed into the dressing itself.

**Table 1: Summary of patients’ wounds included in the evaluation**

<table>
<thead>
<tr>
<th>Case</th>
<th>Wound type</th>
<th>Signs of infection (before treatment): redness; pain; increased exudate levels; slow healing</th>
<th>Did wound show signs of improvement such as progression towards healing, debridement, reduced exudate volumes, reduction in wound area?</th>
<th>Reduction in signs of wound infection?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Venous leg ulcer</td>
<td>Yes</td>
<td>Wound size and pain reduced; went on to heal</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>Bite wound to leg</td>
<td>Critically colonised</td>
<td>Not recorded</td>
<td>Not recorded</td>
</tr>
<tr>
<td>3</td>
<td>Carotid blow-out; bilateral connecting wounds</td>
<td>Critically colonised</td>
<td>Patient discharged</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>Hip wound</td>
<td>Locally infected</td>
<td>Wound re-sutured</td>
<td>Yes</td>
</tr>
<tr>
<td>5</td>
<td>Dehisced abdominal wound</td>
<td>Locally infected</td>
<td>Not recorded</td>
<td>Not recorded</td>
</tr>
<tr>
<td>6</td>
<td>Venous leg ulcer</td>
<td>Locally infected</td>
<td>Wound healing; reduced size and pain enabled full compression</td>
<td>Yes</td>
</tr>
<tr>
<td>7</td>
<td>Venous leg ulcer</td>
<td>Locally infected</td>
<td>Wound size and pain reduced; went on to heal</td>
<td>Yes</td>
</tr>
<tr>
<td>8</td>
<td>Pressure ulcer (buttock)</td>
<td>Locally infected</td>
<td>Wound debrided and progressing towards healing</td>
<td>Yes</td>
</tr>
<tr>
<td>9</td>
<td>Pressure ulcer (heel); diabetic foot ulcer</td>
<td>Critically colonised</td>
<td>Not recorded</td>
<td>Yes</td>
</tr>
<tr>
<td>10</td>
<td>Pressure ulcer (buttock)</td>
<td>Locally infected</td>
<td>Patient discharged</td>
<td>Yes</td>
</tr>
</tbody>
</table>
EXAMPLE CASES: SUMMARY

Case 3
This male patient suffered a carotid artery blow-out. Following repair of the artery, the wound had broken down at both sides, but was connected in the centre (Figure 1).

This wound was considered suitable for Durafiber Ag due to the exudate volumes, presence of sloughy tissue, signs of infection and the need for a dressing that would conform to the wound bed but still be able to be removed in one piece. Figure 2 shows the Durafiber Ag in place.

The dressing managed the exudate without causing maceration to the surrounding skin. It was also removed in one piece and allowed pain-free removal.

Case 8
This 73-year-old female, who had a history of stroke, lived in a nursing home. She presented with a category three pressure ulcer on the sacral area, which had developed over the past three months. The wound measured approximately 10x10cm with a depth of 4cm and was full of necrotic tissue (Figure 3). A honey dressing had been applied in the community but the ulcer was slow to debride, although there was some exudate being produced.

It was decided to apply Durafiber Ag to help debride the necrotic tissue and absorb the exudate. The dressing was changed every three days — Figures 4–5 show the changes in the wound following two dressing changes over a seven-day period, with the wound bed visible in Figure 5. The dressing performed well, with excellent debridement and absorption properties.
Silver has been shown to impact on bacteria by disrupting the cell membrane, resulting in leakage of the cell contents and eventual cell death (International Consensus, 2012). Silver is also known to be active against a number of bacterial species including meticillin-resistant *Staphylococcus aureus* (MRSA).

**DURA FIBER AG**

Durafiber Ag is an absorbent (Smith and Nephew, 2010), non-woven, silver-containing antimicrobial dressing composed of cellulose ethylsulphonate fibres. The ionic silver in the dressing provides antimicrobial activity against a broad spectrum of common wound pathogens, which may help to reduce bacterial bioburden and the risk of infection (Vaughan et al, 2010; Woodmansey, 2010).

The dressing is designed to be used on wounds where exudate is moderate to heavy, and which are showing signs of infection.

Durafiber Ag forms a cohesive gel when it comes into contact with wound exudate. This gel keeps the wound moist, assisting with autolytic debridement and supporting the natural wound-healing process (Myers, 2012).

Autolytic debridement is the process by which the body attempts to remove sloughy tissue from a wound by increasing exudate volumes and proteases in order to help debride the tissue. This is a natural process that can be supported by using dressings which maintain moisture levels within the wound (Myers, 2012).

The dressing is designed to stay in place for up to seven days if necessary (Dowler, 2012a; Forlee et al, 2014). This dressing was also recommended that the dressing be left in place for up to seven days and exudate volumes.

In a recent study carried out in South Africa, Durafiber Ag was trialled in a group of patients (n=14) with venous leg ulceration (Forlee et al, 2014). The dressing was assessed in relation to potential reduction in bioburden, wound progress, pain on application and removal, wear time, and dressing integrity.

In-vitro testing of Durafiber Ag showed sustained antimicrobial activity against Gram positive and Gram negative bacteria, antibiotic-resistant strains of bacteria, anaerobic bacteria, a yeast and filamentous fungus over a seven-day period (Vaughan et al, 2010).

In a recent study carried out in South Africa, Durafiber Ag was trialled in a group of patients (n=14) with venous leg ulceration (Forlee et al, 2014). The dressing was assessed in relation to potential reduction in bioburden, wound progress, pain on application and removal, wear time, and dressing integrity.

‘Autolytic debridement is the process by which the body attempts to remove sloughy tissue from a wound by increasing exudate volumes and proteases in order to help debride the tissue’

Fifty percent of the patients’ wounds healed within the eight-week study duration, with a median reduction in wound area of 98.2%. There was also a 78% reduction in devitalised tissue over the course of the study. Exudate volumes and pain scores improved during the study and the average wear time of the dressing was 6.4 days (Forlee et al, 2014).

**CURRENT EVALUATION**

A small, prospective multicentre case series/evaluation was carried out in three UK sites to assess the efficacy of Durafiber Ag in a variety of wounds. The three sites chosen for this evaluation were two hospitals and one community trust and the nurses were all clinical nurse specialists in tissue viability.

The product was used on patients with cavity wounds or venous leg ulcers that had signs of infection, sloughy tissue and moderate-to-heavy exudate volumes.

Feedback was collated via an evaluation form that was filled in by the nurses and contained the same information for all patients. The patients detailed in the case studies shown in this article were chosen to be representative of the study as a whole, and were picked to show instances where the product was effective.

During this evaluation, the dressing was assessed against the following criteria:

- Ease of application
- Conformability
- Exudate handling
- Patient comfort
- Ease of removal
- Wear time
- Overall performance.

In addition to the dressing’s performance, wounds were assessed for clinical signs of infection once the dressing was removed, including erythema, oedema, pain and exudate volumes.

Ten patients were recruited in the first instance and more are still being added — this is, therefore, an interim report on the cases so far. Eight patients had the dressing applied in hospital and were discharged into the community. Two patients with venous leg ulcers commenced and completed therapy within the community setting, and a further two patients were involved in community-based evaluations.

**Application**

Durafiber Ag was applied to all the wounds and wear time was left to the discretion of the nurses in charge of the patient, however, it was recommended that the dressing be left in place for up to seven days (Dowler, 2012a; Forlee et al, 2014).

In five of the 10 cases, Alleyyn® Life (Smith and Nephew) was chosen as the secondary dressing (Dowler, 2010), as it contains a hyperabsorbent layer that can help to manage increased volumes of wound exudate and reduce dressing changes (Simon and Bielby, 2014). It also has a masking layer which helps to improve the unsightly appearance of exudate ‘strike-through’ (Smith and Nephew, 2012).

**RESULTS**

Table 1 shows a summary of the
wounds included in the evaluation. Of the patients included, all 10 (100%) rated application and removal as excellent. In all cases the clinicians reported intact removal of the product (product removed in one piece).

The product was also rated as excellent in terms of conformability by all clinicians — this meant that the dressing was able to contour to the shape of the wound bed allowing maximum contact with the wound.

CONCLUSION

Following the results of this small evaluation it can be concluded that Durafiber Ag may be a suitable product for a range of wound types and clinical indications.

Despite some of the patients being lost to follow-up, the clinicians were able to evaluate the main properties of the dressing.

These included minimising or reducing pain during application and removal; management of wound exudate; reduction in signs of wound infection; and debridement. The dressing also showed no signs of shrinkage and was able to be removed from the wound in one piece.

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KEY POINTS

Choosing the correct dressing is often key to moving a wound along the healing trajectory, with its ability to deal with problems such as pain, excess exudate production and inflammation crucial to the healing outcome.

Infection is also a serious problem in many wounds and this article looks at the basics of wound care products, many of which have antimicrobial properties.

However, clinicians are faced with a huge range of wound care products, many of which have antimicrobial properties.

This article considers the use of one gelling fibrous silver dressing (Durafiber® Ag; Smith and Nephew), which is specifically designed to deal with many of the problems mentioned above, particularly excess exudate production and infection.

The authors present the results of a small, prospective multicentre case series that was carried out to assess the efficacy of Durafiber Ag in a variety of wounds.

The clinicians were able to evaluate the main properties of the dressing, which included minimising or reducing pain during application and removal; management of wound exudate; reduction in signs of wound infection; and debridement.

This article considers the use of a gelling fibrous silver dressing, which is specifically designed to deal with excess exudate production and infection.'