

# Management of highly exuding diabetic foot ulcers

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## Article points

1. Exudate consists of a number of components that work with the local tissues to achieve wound healing; however, in the person with diabetes their condition and its array of intersecting complications can result in exudate imbalance and over-production that slows down or even prevents healing.
2. Comprehensive assessment is at the heart of effective wound care; the colour, consistency and volume of wound exudate should be the subjects of careful assessment.
3. Patient distress, characterised by social withdrawal or reports of pain, due to exudate-related factors should be elicited during the consultation.
4. Wound care companies provide a broad range of useful product options for managing excess exudate, but there is a paucity of good clinical trial evidence to support evidence-based practice in this area.

## Key words

- Exudate management
- Dressing selection
- Wound exudate

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**In order to effectively manage wound exudate in diabetic foot ulceration it is important for clinicians to understand what it is and why it changes from an essential component in acute wound healing into something which becomes harmful in chronic wounds. There is a need to examine the patient holistically, considering comorbidities responsible for the increasing exudate, medical management, skin quality and integrity and the patient's quality of life.**

Wound healing is the result of a complex interaction between dermal and epidermal cells, plasma cells and the extracellular matrix influenced by growth factors and cytokines. There are three phases of tissue repair: inflammation, proliferation and remodelling. These phases are not distinct from each other, rather they form a dynamic process in order to achieve healing.

Exudate is derived from serum by extravasation in the inflammatory phase. It has a high protein content and also includes fibrin and platelets for clotting in the acute stages, lymphocytes and macrophages for immune defence and growth factors as the wound matures and healing progresses. Thus, exudate is an essential part of the wound healing process that is most noticeable during the inflammatory and proliferative stages of healing and typically reduces in quantity as the wound progresses towards healing (White and Harding, 2006).

Moisture has long been accepted as a necessity for an optimum wound healing environment (Winter, 1962). This knowledge led to the development of the – now standard – principles of moist wound healing. However, it is not uncommon among people with diabetes and foot ulcers for the phases of tissue repair – and the processes that occur as part of those phases (e.g. exudate production) – to become disordered and pathological, resulting in long-standing chronic wounds that are costly for both the patient and the health service.

The focus of this article is the occurrence of excess exudate in chronic diabetic foot ulcers. The reasons for dysregulated wound healing, as well as the holistic management of these patients and their wounds, will be discussed.

## Background

Exudate consists of a number of components that work with the local tissues to achieve wound healing. However, in the person with diabetes their condition and its array of intersecting complications can result in exudate imbalance and over-production that slows down or even prevents cell proliferation, interferes with growth factor availability and contain harmful levels of both inflammatory mediators and activated matrix metalloproteinases (Vowden and Vowden, 2004).

Both exudate content and volume can pose challenges to wound healing. As well as damaging the wound bed itself and delaying healing, excess, harmful exudate can also damage the periwound skin and cause breakdown and enlargement of the wound. Furthermore, failure to effectively manage excess exudate places people with diabetic foot ulcers at risk of infection, amputation and reduced quality of life (leaking, soiling, discomfort/pain and malodour associated with excess exudate all impact negatively on the patient). From healthcare efficiency point of view, good management of exudate should reduce both the frequency of dressing changes and clinician input, thus reducing cost and time burdens (World Union of Wound Healing, 2007).

## Assessing wound exudate

Comprehensive assessment is at the heart of effective wound care; the complexities of wound care in people with diabetes require management by clinicians – ideally in a multidisciplinary setting, or with rapid access to specialist advice and referral (NICE). Exudate assessment should be integrated into general wound assessment at every visit with the

aim of identifying any wound-related, local, systemic or psychosocial factors that may be contributing to exudate-related problems.

The clinician should pay careful attention to exudate at the wound surface, on old dressings and in the patient's socks or shoes. The colour, consistency and volume of exudate should be the subjects of careful assessment. Patient distress, characterised by social withdrawal or reports of pain, due to exudate-related factors should also be elicited during the consultation (White and Cutting, 2006).

### Consistency and colour

Normal wound exudate is usually serous; thin, watery and clear or straw coloured. Colour and consistency changes that may be indicative of pathological processes can be summarised as:

- Seropurulent (thickened, appears yellowish or creamy) or purulent (yellow, greyish or green) are suggestive of infection and inflammation.
- Viscous and sticky red or brown stained discharge indicates trauma to capillaries and established infection.

### Volume

Exudate volume is significant both as a clue to wound condition and as a factor for consideration in wound care planning. An altered inflammatory response, combined with the effect of bacteria on vasodilation, in chronic wounds leads to an increase in vascular permeability and extravasated fluid.

A moderately exuding wound will show visible fluid on the wound bed and tissues and markings on the dressing, but no strike-through. While a highly exuding wound is characterised by freely running fluid on removal of the dressing and strike-through of a traditional dressing during a short period of time (Figure 1).

A more objective measure of exudate volume can be achieved by using a tool such as the exudate continuum developed by Gray et al (2005) at each visit and recording consistently.

### Patient factors

It is accepted that diabetic foot wounds are difficult to treat and can substantially diminish a person's quality of life. Goodridge et al (2006) showed that those being treated for foot ulceration had a significantly lower score than those with healed

ulceration in the physical component. Patients completing the Cardiff Wound Impact Schedule (Price and Harding, 2004) described feelings of frustration and anxiety regarding their wounds. Patients may lose self confidence and worry that the smell is offensive and can be detected by others, this leads to self-imposed isolation. These factors should be considered and addressed when devising a care plan for these people.

### Managing excess exudate effectively

The characteristics of the wound and the needs of the patient should be the guides to the selection of appropriate management options. It is of primary importance that the patient is managed holistically; return of exudate to healthy levels and, ultimately, wound healing are unlikely to be achieved in a patient with a range of underlying comorbidities that go unaddressed while the clinician focuses solely on the wound.

When assessment indicates that infection is a likely cause of excess exudate, careful and specific management of the underlying cause of infection must be undertaken. Other causes of high exudate volume include conditions that increase capillary leakage (e.g. cardiac failure, renal disease, lymphatic

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**Figure 1. An example of strike-through. (a) Dressing intact with exudate staining the outer surface. (b) Dressing during removal. Note the saturated inner dressing and the wet, soft macerated tissue surrounding the wound.**

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1. There is no evidence to suggest that foam dressings are more effective in healing foot ulcers in people with diabetes than other types of dressing.
2. Decision makers may wish to consider aspects such as dressing cost and the wound management properties offered by each dressing type (e.g. exudate management) when selecting a product for use.
3. When used on the foot, dressings have to withstand shear stress and friction from walking without loosening or wrinkling.

disease), which reduces the body’s ability to move fluid away from the lower extremities (Romanelli et al, 2010). Thus, a full medical review by an appropriately skilled clinician should be undertaken to optimise the patient’s general health and ability to achieve healing.

**Dressings**

Dressing selection should be tailored to the wound and patient. Inspection of the removed dressing will assist in assessing whether the current dressing regimen is appropriate and whether it is coping with the exudate level (taking into account wear time). An example of inadequate dressing selection – for both the exudate level and the needs of the patient – is shown in *Figure 2*.

A large number of dressings are available for use on diabetic foot ulceration. Many are developed as part of a company’s larger wound care portfolio, and randomised control trial evidence for the use of specific dressings on diabetic foot wounds is sparse (Dumville et al, 2013a). Trials are usually geared to show healing as the primary endpoint, rather than exudate management *per se*. Systematic reviews of both foam and alginate dressings for diabetic foot ulceration from the Cochrane Wounds Group and a large Health Technology Assessment (Jeffcoate et al,



**Figure 2.** An example of an inadequately dressed plantar wound associated with a rocker-bottom foot. Note the inadequate size of the primary dressing, the dressing slippage and the strike-through of viscous and sticky red-brown exudate to the secondary dressing

2009) have demonstrated that there is no significant difference between different types of dressings to heal ulcers, which leaves the clinicians dependant on clinical expertise in understanding wound management principles.

Dumville et al (2013b) acknowledge that currently there is no evidence to suggest that foam dressings are more effective in healing foot ulcers in people with diabetes than other types of dressing. Thus, they suggest that decision makers may wish to consider aspects such as dressing cost and the wound management properties offered by each dressing type (e.g. exudate management) when selecting a product for use. Dressings alone cannot heal a wound, however appropriate selection of a dressing may aid in moving the wound from a state of stagnated chronicity to healing by addressing one or a range of the local barriers to healing.

Good knowledge of dressing characteristics helps to ease the decision making process. Ideally the properties of a dressing are that it:

- Provides a moist (but not wet) local environment
- Is a barrier to bacteria
- Does not macerate the surrounding tissue
- Does not require too frequent changes
- Is simple to apply and remove
- Does not damage tissue during application or removal
- Controls malodour
- Is comfortable for the patient

In addition, when used on the foot, dressings have to withstand shear stress and friction from walking without loosening or wrinkling, which can frequently be an issue in plantar wounds (*Figure 3*). The dressings selected also have to fit within the confines of hosiery, footwear or offloading devices (e.g. orthoses, slipper or heel casts, total-contact casts) and be applied in such a way as to not create a new pressure point – potentially culminating in an iatrogenic wound. In such circumstances it should also be considered that, if the dressings used in a highly exuding wound are inadequate, the resulting strike-through will not simply soil a sock or shoe, but an offloading device that may be time- or cost-intensive to replace.

**Selecting an appropriate dressing**

Dressings manage exudate in a variety of ways including absorption, formation of gel, retention by

vertical or horizontal wicking of exudate into upper dressing layers where exudate is held away from the skin. The actions of these dressings are affected by the viscosity of exudate.

Foam dressings, for example, absorb exudate into the fabric of the dressing. However, when under



**Figure 3. An example of a highly exuding wounds in which the selected dressing has been unable to cope with both volume of exudate and the shear stress and friction, resulting in loosening and wrinkling.**

compression by the sole of the foot it is crucial that the chosen foam dressing does not readily release this exudate back on to the wound surface. Biatain® (Coloplast) has a 3D foam structure that holds the exudate within its structure while expanding to conform to the cavity and stay in contact with the surface of the wound bed. Foams often combine a breathable upper polyurethane layer with an absorbent core and a gentle silicone wound contact layer (e.g. Allevyn™ [Smith & Nephew]; Mepilex®, Molnlycke).

Alginates form a gel when in contact with exudate and can cope with moderate to heavily exuding wounds. These can be in the form of calcium alginate (e.g. Sorbsan® [Aspen Medical]) or calcium sodium alginate (e.g. Kaltosat® [ConvaTec]; Biatain® Alginate [Coloplast]) combined with silver to give antimicrobial properties (e.g. Biatain® Ag [Coloplast]). They can be bonded to a secondary viscose pad to increase absorbency, with or without the addition of charcoal for odour control (e.g. Sorbsan® Plus [Aspen

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Medical)] or in the form of ribbons to pack cavities.

Super absorbent dressings are a useful option if the site of the wound allows. The combination of cellulose fibres and gelling agents gives outstanding absorption while binding the bacteria into the inner layers of the dressing and controlling leakage and odour (e.g. sorbion® sachet S [sorbion GmbH & Co.]). Other superabsorbent dressings that can be used as a primary or secondary layer, demonstrate effective wicking of the exudate away from the wound and perform well under pressure (e.g. KerraMax Care™ [Crawford Healthcare]). However, those that are sealed around the edges cannot be cut to fit the awkward spaces often required by foot anatomy. Dressings that combine highly absorbent cores with a breathable backing avoid maceration by allowing moisture vapour transmission (e.g. Eclipse® [Advancis Medical]; Tielle® [Systagenix]).

**Caring for the periwound area**

When a high level of exudate is anticipated, the surrounding skin may be afforded some protection by the use of barrier creams or sprays, such as Cavilon™ Durable Barrier Cream or Film (3M). Such products should be alcohol-free and dry quickly to form a breathable coating on the skin surrounding the wound that will repel the exudate it is exposed to and – if used correctly and consistently – should avoid periwound breakdown.

**Negative wound pressure therapy**

Negative wound pressure therapy (NPWT) is designed to improve tissue perfusion, reduce oedema and promote granulation tissue formation (Topaz, 2012), but its action also removes large volumes of exudate and infective material from the wound bed and collects it safely away from the wound site in a canister. A range of NPWT delivery systems are available (see Smith & Nephew and KCI). It should be noted that, in diabetic foot wounds, the fitting of the NPWT sealants around toes and over flexing tendons requires dexterity and a close knowledge of foot mechanics to achieve an effective fit.

**Conclusion**

Highly exuding diabetic foot ulceration and surgical wounds pose a considerable challenge to healthcare professional and patients. Wound care

companies provide a broad range of useful product options, utilising a range of technologies. However, there is still a paucity of good clinical trial evidence to support evidence-based practice, however the increasing willingness of manufacturers to engage with those working in the field and respond to feedback has seen the development of flexible options for wound care.

Managing exudate and its associated quality-of-life issues for the patient is one of the many important considerations when agreeing a diabetic foot ulcer care plan. It is essential that the progress of the wound is monitored and that clinicians have an in-depth knowledge of both the aetiology, as well as the technologies to facilitate wound healing. ■

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