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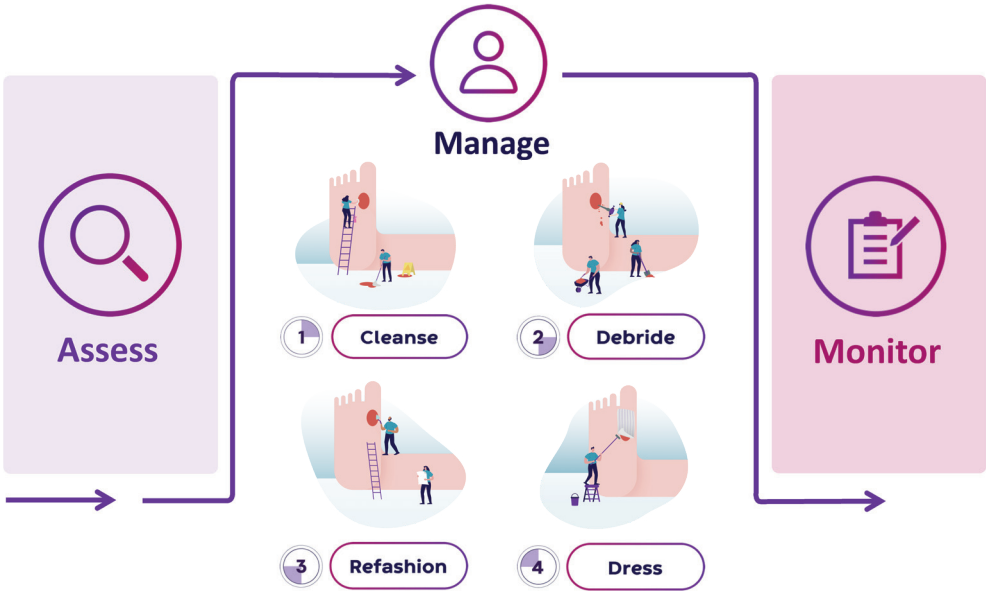
proactive wound healing

A GUIDE TO IMPLEMENTING THE WOUND HYGIENE PROTOCOL OF CARE FOR DIABETIC FOOT ULCERS



Wound Hygiene

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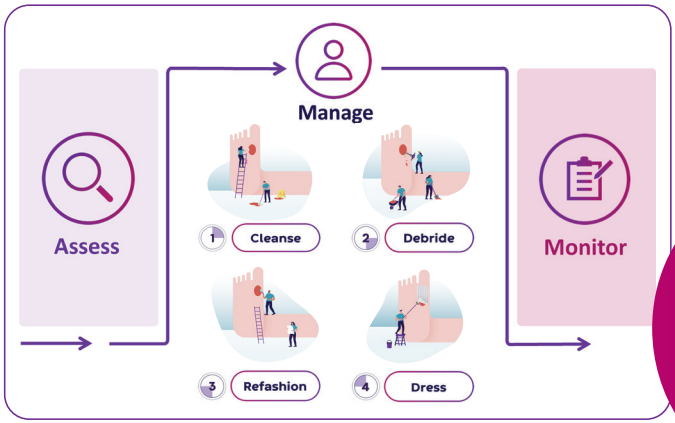
Diabetic foot ulcers (DFUs) are associated with high rates of morbidity and mortality.[1] Over half of these wounds become infected,[1] which can quickly become severe and systemic, and around a fifth of DFUs result in amputation,[1] which can be devastating for the affected individual's quality of life. Neuropathic and ischaemic factors mean that even minor trauma can quickly progress to a hard-to-heal wound.[2]

Consequently, DFUs incur a high health-economic burden, with a 5-year mortality rate and direct care costs comparable to those of cancer.[3] In western Europe, treating DFU complications costs between $2637 and $38621 per wound.[4] The annual cost to healthcare systems has been estimated at $9–13 billion in the US[5] and $4.3 million in Australia.[6]

Averting infection, amputation and mortality associated with DFUs requires prompt and regular assessment, as well as early and effective intervention. This should be embedded into a holistic approach to care[7] and supported by multidisciplinary teamwork, patient education and long-term monitoring of healing outcomes.[2,7] It should also incorporate an antibiofilm strategy to reduce infection and promote healing, based on the Wound Hygiene protocol of care.[8] Together, this approach has the potential to avoid complications, maximise patients' quality of life and minimise the financial burden on health systems. This is a guide to incorporating Wound Hygiene into a proactive wound-healing framework based on holistic assessment, management and monitoring of DFUs.



What is unhealthy granulation tissue?
This is a relatively new term for granulation tissue in a wound that is failing to progress but does not necessarily look unhealthy. It is typically dark red and friable.[7]

Understanding biofilm[7,8]

Hard-to-heal DFUs are likely to contain biofilm, which is resistant to treatment and so delays healing. Biofilm is especially prevalent in necrotic, sloughy and/or unhealthy granulation tissue, compared with the healthy granulation tissue and epithelial tissue found in less severe wounds. However, all wounds are thought to contain some level of biofilm and have the potential for deterioration,[7] and therefore DFUs should always be treated promptly, using Wound Hygiene's proactive antibiofilm strategy.

The information included here is for general guidance only, and health professionals must also refer to their local policy and guidelines

Assess

Assess the wound, foot, lower limb and whole patient.

- Assess the patient and their needs, including history, comorbitities, glucose control, mobility and pain (which may be absent in neuropathy).
- Set objectives to monitor the healing trajectory.[7]
- Ensure all DFUs are referred to the multidisciplinary diabetic foot team.[2,9]

Aetiology

DFUs are caused by peripheral neuropathy (lack of protective sensation in the foot due to nerve damage), ischaemia (impaired blood flow due to peripheral arterial disease, limiting supply of oxygen and nutrients to the lower limb) or a combination of these.[2,9]

Determine whether the DFU's aetiology is predominantly neuropathic, predominantly ischaemic or a combination (neuroischaemic)[2]

- Screen for neuropathy with a 10 g monofilament—a simple and effective test of sensation when pushed to bending on three sites on the foot's plantar aspect (avoid areas of callus).[2]
- Alternatively test sensation to vibrations using a standard 128 Hz tuning fork.[2]
- Assess vascular status with pulse palpation, where absence of pedal pulses indicates ischaemia—supported by ankle brachial pressure index (ABPI) and Doppler waveform, ankle/toe systolic pressure, cutaneous oxygen pressure ($TCPO_2$) and tissue perfusion.[2]
- Ischaemia is also indicated by claudication—pain in the leg muscles, usually induced by exercise, but sometimes at rest (intermittent claudication).
- In sudden (acute) or severe (critical) ischaemia, or if vascular status is in doubt, refer urgently to a vascular specialist for a full assessment and potential revascularisation.[2]

DFU type	Neuropathic	Ischaemic	Neuroischaemic
Senation	Sensory loss	Painful	Some sensory loss
Location	Plantar forefoot or toe	Toe, heel or foot margin	Toe, foot margin/dorsum
Wound	Rounded	Shallow; defined edges	Raised edges
Periwound	Warm, thick callus	Cool, pink, uncallused	Cool, thin callus
Example			

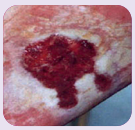
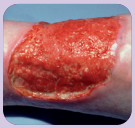
Physically examine the foot and ulcer for the following:

- Wound characteristics, including colour, edge and tissue types—some of which are indicative of biofilm and thus delayed healing—as well as exposed bone or periwound callus
- Signs of pressure damage, skin breakdown, fissures or callus
- Osteomyelitis, with probe-to-bone test supported by X-ray and MRI
- Local signs of infection, which can quickly become systemic.

Pressure and foot deformity[2,10]

Assess and minimise risk of abnormal pressure on bony prominences, which can result from motor neuropathy. Pressure can cause callus, ulceration, muscle atrophy and deformities, such as Charcot foot and hammer or claw toes, which impair gait and increase pressure risk, exacerbating ulceration on the top and end of the toes or ball of the foot.

Charcot foot

Tissue types		
Necrotic tissue		Black or brown; can be adherent (hard, dry or leathery) or soft and wet
Slough		Yellow or white; usually wet, sometimes dry and adherent; thick patches or thin coat
Unhealthy granulation		Typically dark red; often bleeds when touched; can be friable
Healthy granulation		Newly formed tissue; bright red, moist and shiny; cobblestone-like
Epithelial		Pale pick or white; migrates across wound surface from the edges; initially, can be fragile

Clinical signs of infection and patient risk status[2]

DFUs are particularly prone to infection, so it is essential to establish clinical signs of infection (note that neuropathic patients may not feel pain and ischaemic patients may not show erythema). These signs will determine risk status and thus requirement for prompt referral to the multidisciplinary diabetic foot team for early intervention.

Covert signs of local infection[11]

- Hypergranulation (excessive vascular tissue)
- Bleeding, friable granulation
- Epithelial bridging/pocketing in granulation tissue
- Wound breakdown and enlargement
- Delayed wound healing
- New or increasing pain
- Increasing malodour

Overt signs of local infection[11]

- Erythema (redness)
- Local warmth
- Swelling
- Purulent discharge
- Delayed wound healing
- New or increasing pain
- Increasing malodour

Manage

Treat the underlying aetiology and the whole person (eg, skin care and nutrition), following Wound Hygiene through the healing trajectory.[7]

- Optimise glycaemic control,[2] as hyperglycaemia is associated with amputation.[12]
- Educate people with diabetes on how to regularly check their feet and perform preventive self-care of their feet and nails, based on their level of risk.[2]
- Treat infection according to severity, using antibiotics as required.[2]

Offloading[2,9]

The gold-standard treatment for neuropathic DFUs is offloading. Non-ischaemic neuropathic individuals should be referred for a total contact cast or knee-high removable walkers made irremovable. Offloading with removable forefoot or rearfoot devices or therapeutic footwear may be necessary. Prophylactic pressure redistribution via therapeutic footwear and insoles can be an effective preventive strategy. Patients should be informed of the benefits and involved in decision-making.

Cleanse both the wound bed and the entire foot.[8]

- Use sterile gauze or a pad.
- Use a surfactant if possible and antimicrobials if necessary.

Tissue type	Cleansing methods
Necrotic, sloughy and/or unhealthy granulation tissue	Vigorous* cleansing (gauze, soft pad, pH-balanced or surfactant solution)
Healthy granulation tissue	Moderate or gentle cleansing[7]
Epithelial tissue/intact skin	Gentle cleansing

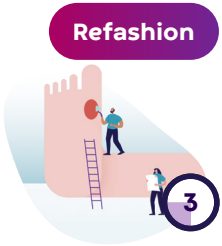
Debride non-epithelialising tissue with appropriate vigour to remove biofilm and promote growth of healthy tissue.[7]

- Confirm vascular status before debriding.
- Select method based on qualification, experience and confidence.[9]
- Consider mechanical debridement and referral for sharp debridement of devitalised tissue and callus, except in critical ischaemia.[2,8]
- Do not debride individuals with severe ischaemia, unless infection is suspected.[2]
- Remove hyperkeratosis and agitate edges until pinpoint bleeding occurs.[7,8]

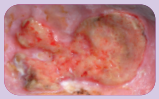
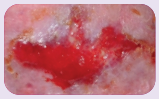
Tissue type	Vigour	Debridement methods
Necrotic,* sloughy and/or unhealthy granulation tissue	Vigorous*	Surgical, sharp, chemical,[13] larval (not on dry necrotic tissue), ultrasound or mechanical
Healthy granulation tissue	Gentle	Chemical, mechanical (gauze, soft pads, wipes)[7]
Epithelial tissue/intact skin	None	None

*Take extra care in ischaemia

Refashion the wound edges, where the primary cells that facilitate epithelialisation are located. Biofilm is most active here, where it promotes cell senescence (loss of cells' power to divide and grow), preventing migration of new, healthy tissue.[8] Refashion the edges using debridement techniques. This will remove necrotic, sloughy and/or unhealthy granulation tissue and promote healing.[7,8] The level and safety of debridement possible can be determined following a comprehensive holistic assessment.



- Aim to make the edges the same height as the wound bed.
- This should remove areas that can harbour biofilm.[7]
- Select a method, from a soft debridement pad or gauze to a blade based on skill level.

Refashioning strategy by edge type			
	Steep (cliffs)		Agitate the wound edges to achieve pinpoint bleeding[8]
	Shallow (beaches)		Gently and selectively rub the wound edges in a circular motion[7]

Dress the ulcer to proactively disrupt and destroy biofilm or to manage residual bacteria to prevent colonisation and, therefore, biofilm reformation.[7,8]

- This should also promote a healthy wound environment.
- Dressing selection should be based on the predominant tissue type, wound depth and its likely exudate volume.
- Avoid trauma at dressing change in insensate patients.

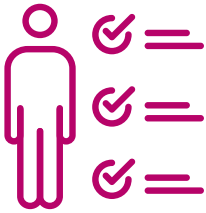
Selecting a dressing

Cleansing and debridement help prepare the wound for dressing. Depending on its properties, a dressing can prevent or reduce biofilm re-formation, but it should always promote the moisture balance needed for healing to occur. The choice of dressing will depend on the wound's position in the healing trajectory:

- DFUs likely to contain significant amount of biofilm (characterised by presence of necrotic, sloughy or unhealthy granulation tissue, as well as excess exudate) will require an antimicrobial dressing with antibiofilm properties;[7,8] its absorbency should reflect the volume and consistency of the exudate being produced.[8]
- When the DFU has improved, with healthy granulation tissue formation and/or epithelialisation present, stepping down to a non-antimicrobial dressing will maintain a moist environment conducive to healing. Wound Hygiene should continue to be implemented at every dressing change.[7,8]

Dressings should be changed frequently to check the status of the DFU, which can change rapidly, and the dressing's effectiveness should be reviewed every 2–4 weeks.

Monitor



The individual's and wound's progress should be re-assessed at each dressing change. This is to monitor the efficacy of the wound management strategy and progress towards the treatment goals of the patient and health professional.

The wound

Each wound assessment should monitor the following:

- Vascular status and perfusion
- Signs of infection and need for antibiotics
- Trends in wound size and appearance
- Changes in wound bed characteristics
- Condition of the wound edges
- Occurrence of malodour, which is indicative of high bioburden
- Presence of undermining or tunnelling.[7]

If there is no timely progression towards healing, a full holistic assessment should be undertaken to determine that any underlying aetiologies, risk factors and comorbidities are being effectively addressed and if any steps of the treatment regimen should be adapted.

Foot screening

At each dressing change, check if the patient's footwear is causing pressure, friction or trauma, and offer support with optimising glycaemic control and nutritional advice.

The patient

The effect of the DFU on the patient's quality of life and general wellbeing should be regularly assessed. Ask the patient if the DFU is having any of the following impacts:

- Pain
- Loss of sleep
- Reduced mobility
- Diminished appetite
- Difficulty in daily activities
- Impaired social life.

If the patient is using an offloading device, check their adherence, ask how they are managing and provide any advice or practical assistance required.

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