

# Local Management of Diabetic Foot Ulcers (DFU)

## Guideline Summary

WORLD UNION  
OF  
WOUND HEALING SOCIETIES



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# Epidemiology and Risk Factors of DFU

## Epidemiology

### Global facts and figures

Incidence of diabetes has almost quadrupled in the past 30 years with 422 million adults worldwide now diagnosed.

- Global prevalence has increased from 4.7–8.5%
- Incidence of DFU among diabetics is 4–10%
- 1-in-4 risk of ulceration during a lifetime

### A patient with DFU has

- an increased risk of hospitalization due to infection a high risk of amputation
- a high risk of a further amputation in less than 3 years after the first amputation
- higher mortality rate  
(greater than the 5-year mortality rate of breast, colon and prostate cancer combined)

A person  
with diabetes has  
a **25%**  
risk to develop  
DFU

# Definitions of DFU

**Diabetic foot** Infection, ulceration or destruction of tissues of the foot associated with neuropathy and/or peripheral artery disease in the lower extremity of people with diabetes.

**Diabetic foot lesion** Abnormalities associated with damage to the skin, nails or deep tissues of the foot.

**Diabetic foot ulcer** Full thickness lesion of the diabetic foot. May be superficial (not penetrating any structure deeper than the dermis) or deep (penetrating below the dermis to subcutaneous structures, such as fascia, muscle, tendon or bone).

# Assessment of DFU

## General assessment

- Diabetes management and blood glucose control habits (smoking and substance abuse)
- Symptoms & signs of late complications
- Systemic sign of infection pain
- Socioeconomic circumstances, ...

## Local treatment

- Characteristics of the leg
- Characteristics of the ulcer
- Loss of sensation
- Vascular assessment
- Presence of infection, ...

# Aetiology of Indication



## Neuropathic

Impaired sensitivity of the foot (unnoticed injuries)

Abnormal biomechanical loading of the foot (foot deformities, callus formation)

- Dry skin, fissuring, cracking
- Warm foot, bounding pulses
- On plantar aspect of the foot and of the toes



## Ischemic

Mostly due to PAD (Peripheral Artery Disease)

Minority of all DFUs (10–15%)

- Pale, shiny skin, lack of hair
- Cool foot, absent pulses
- Punched out wounds, demarcated edges
- Over the toes, heels, and bony prominences of the foot



## Neuro-Ischemic

Combined by both neuropathy and ischemia

Majority of all DFUs

- Located on margins of the foot, on the tips of the toes and beneath thickened toe nails
- Present with necrosis and are prone to infection

# Management & Strategy of DFU

## Management

### Wound closure

Ultimate goal

**If not realistic (e.g. palliative patient), need re-adjustment:**

- Prevention of infection
- Management of exudate
- Odour, pain, improved quality of life, simplified wound dressing procedures

### Prevention of recurrence

- Role of protective footwear, patient education and regular foot examination
- Dressings (film, hydrocolloid, foam) may be used for 1–2 weeks after wound closure for protection

### Limb preservation

- Multifactorial treatment
- Multidisciplinary approach
- Preventive strategy
- Patient and staff education may decrease amputation rate by more than 50%

## Strategies<sup>1,2</sup>

### Treatment of underlying disease

- All comorbidities must be treated
- Multidisciplinary team

### Establishment of adequate blood supply

- Conservative treatment
- Surgical revascularization

### Pressure offloading

- Total contact casts
- Removable cast walkers...

### Local wound care

- Total contact casts
- T.I.M.E. framework recommended

## T.I.M.E. Framework of DFU<sup>1,2</sup>



### Non-viable, deficient tissue

Debride and clean the wound



### Presence of inflammation and/or infection

Reduce inflammatory cytokines, protease activity, bacterial burden



### Moisture balance

Absorb exudate, maintain moist environment and clean wound bed



### Edges of wound-epithelial advancement

Readdress T.I.M.E., enable epithelialization

# T Non-viable, deficient tissue Cleansing & Debridement

Allows removal of necrotic, senescent tissues, foreign and infected materials from a wound.

Clean drinking water or saline solution may be used for cleaning.

Antiseptic solutions for cleaning controversial – to be used with caution, where benefits greatly outweigh possible detrimental effects on wound tissues.

- ### Effects
- Decreases bacterial counts
  - Stimulates production of growth factors
  - Reduces pressure
  - Allows inspection & evaluation of the wound bed
  - Facilitates wound drainage
  - Stimulates healing

## Many debridement methods available

### Sharp debridement

Most common, requires experienced practitioners with specialist training (in order to distinguish tissue types, avoid damage to blood vessels, nerves and tendons). Is an invasive, often radical procedure.

### Autolytic debridement

Popular method, based on a natural process that uses a moist wound dressing to soften and remove devitalized tissue.

### Other methods available

Surgical, enzymatic, larval...

**Debridement should be repeated as necessary (maintenance debridement).**



\*Cover dry until appropriate vascular assessment and corrective measures

## Autolytic debridement

Selective debridement by release of patient's own proteolytic enzymes and phagocytes cells which soften and break down necrotic and sloughy tissue, removed at subsequent dressing changes.



**HydroClean® plus** plays an important role in aiding autolytic debridement, significantly reducing necrotic/sloughy tissue.<sup>3,4</sup>

Dual mode of action: Wound dressings which provide autolytic debridement and at the same time donate fluid to the wound bed and absorb excessive tissue-damaging wound exudate components (e.g., proteinases such as Matrix Metallproteinases (MMPs).

# I Inflammation & infection control

## If inflammation and infection is present, main strategies focus on

- Decreasing inflammatory cytokines and protease activity
- Decreasing bacterial burden
- Treatment of infection

- Cleansing, debridement!**
- Antimicrobial dressings?**

Infection present	Increased bacterial burden	2-weeks rule
In combination with systemic antibiotics.	May reduce bacterial load and prevent spread of bacteria to deeper tissues.	Re-evaluate effectiveness.

## HydroClean® plus

HydroClean® plus supports cleaning and debridement, removes factors involved in infection and assists with inflammation (including MMPs) control.<sup>5,6,7</sup>





## Moisture balance

### Strategies to create moisture balance include

Absorption of exudate  
 Maintenance of moist environment  
 Prevention of maceration  
 Maintenance of clean wound bed



\*Dressings and their frequency of change have to be complementary to the compression therapy

- ✓ Promotes further autolysis of slough
- ✓ Supports cell migration and proliferation
- ✓ Encourages growth factors activity

### HydroClean® plus

HydroClean® balances moisture by its Rinsing-Absorption-Mechanism.<sup>4,8</sup> HydroTac® selectively absorbs and donates moisture according to the wound needs.<sup>4,9,10</sup>



## Edges of the wound (epithelial advancement)

If epithelialization is impaired, re-assessment and re-adjustment of T.I.M. strategies are needed.

### Advanced technologies to consider

#### HydroTac® (part of HydroTherapy)<sup>9,11</sup>

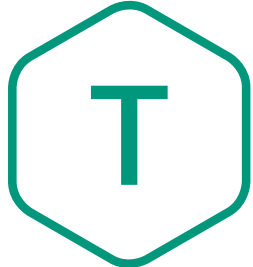
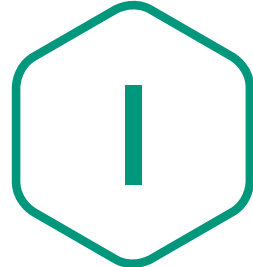





Increases growth factor concentration  
 Boosts epithelialization

#### Other advanced dressings

Collagen dressings, bioengineered tissue products

# Overview of Local Wound Management

(by HARTMANN according to T.I.M.E. framework)

				
<b>Clinical finding</b> <b>Clinical condition</b>	Necrotic, devitalized tissue	Inflammation and/or infection	Moisture imbalance	Impaired epithelialization
<b>Our recommendation</b>	Clean and debride	Decrease bacterial burden inflammatory cytokines, MMPs**	Absorb excess exudate, hydrate wound bed	Reassess T.I.M. Support epithelialization
<b>Our 1st line recommendation</b> majority of chronic wounds low to moderate exudate	 <p>HydroClean<sup>®</sup> plus</p>		 <p>Zetuvit<sup>®</sup> Plus Zetuvit<sup>®</sup> Plus Silicone</p>	
			 <p>HydroTac<sup>®</sup></p>	

## Other Considerations in Local Wound Management

### Dressing fixation and change frequency

Considering risk of constriction and further damage due to ischemia and/or fragile skin – avoid strong bandaging and strong adhesives

Frequent inspection, especially if wound is infected

Dressing must be suitable for use under the off-loading device

### Pain and odour

Address the cause  
(infection? putrefaction of necrotic tissue? dressing?)

Use pain medication if needed, appropriate dressing selection to reduce pain and odour

### Peri-wound skin

Prevent skin maceration by protecting peri-wound skin and by choosing dressing with appropriate exudate absorption capacity

## Overview of Treatment Recommendations for Special Considerations by HARTMANN

Special Considerations	Strategy required	Our recommendation
Dry ischemic wound	Cover dry until revascularization/Specialist recommendation	Zetuvit® E
Infection/high risk for infection	Consider antimicrobial dressing	Atrauman® Ag HydroClean® plus
Highly exudative wound	Highly absorbent dressing	Zetuvit® Plus Zetuvit® Plus Silicone
Tunneled and pocket wounds	Alginate dressing	HydroClean® plus cavity HydroClean® plus mini
Fragile epithelialized wound	Protect 1–2 weeks after wound closure	Atrauman® Silicone + Zetuvit® Plus, Hydrosorb® Gel HydroTac®
Fragile peri-wound skin	Protect peri-wound skin	Atrauman® Silicone



[1] EWMA, Wound bed preparation in practice, Position Document, 2004. [2] Wounds International, Best Practice Guidelines: Wound Management in DFU, 2013. [3] Atkin, L. and Ousey, K. (2016). Wound bed preparation: A novel approach using HydroTherapy. British Journal of Community Nursing 21 (Suppl. 12), pp. S23-S28. [4] Ousey, K. et al. (2016). HydroTherapy Made Easy. Wounds UK 12(4). [5] Spruce, P. et al. (2016). Introducing HydroClean® plus for wound-bed preparation: a case series. Wounds International 7(1), pp. 26-32. [6] Ousey, K. et al. (2016). Hydro-Responsive Wound Dressings simplify T.I.M.E. wound management framework. British Journal of Community Nursing 21(Suppl. 12), pp. S39-S49. [7] Humbert, P. et al. (2014). Protease-modulating polyacrylate-based hydrogel stimulates wound bed preparation in venous leg ulcers – a randomized controlled trial. Journal of the European Academy of Dermatology and Venereology 28(12), pp. 1742-1750. [8] Apelqvist, J., Willy, C., Fagerdah, A.M. et al. (2017). Negative Pressure Wound Therapy – overview, challenges and perspectives. J Wound Care, 26 (3), Suppl 3, S1–S113. [9] Smola, H. (2016). Simplified treatment options require high-performance dressings – from molecular mechanisms to intelligent dressing choices. EWMA 2016. Bremen, 11-13 May, 2016. [10] Spruce, P. et al. (2016). A case study series evaluation of HydroTac®. HydroTherapy Symposium: A New Perspective on Wound Cleansing, Debridement and Healing. London, 3 March, 2016. [11] Smola, H. et al. (2016). Hydrated polyurethane polymers to increase growth factor bioavailability in wound healing. HydroTherapy Symposium: A New Perspective on Wound Cleansing, Debridement and Healing. London, 3 March, 2016.

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