

BIOFILM, BIOBURDEN AND ANTIMICROBIALS SIMPLIFIED



This simplified leaflet is intended to give you information about the antimicrobial products available and give you answers to some questions that you may have about treating infected wounds

BIOFILM, BIOBURDEN AND ANTIMICROBIALS

All wounds contain micro-organisms, micro-organisms and microbes (International Consensus Update, 2016).

The influence of microbes on a wound is complex. It is widely accepted that most chronic wounds are colonised with microbes, although most wounds, even chronic can and do heal. In these cases the patient's immune system and the microbes in the wound are in balance (Swanson et al, 2014).

If wound healing is impaired, the patient's immune system is compromised. This balance can shift in favour of the micro- organisms, which multiply and invade tissue, which can prolong wound healing and lead to infection.

BIOFILM

This is a relatively new term in relation to wound care.

It is a structured community of microbes with genetic diversity and variable gene expression (phenotype), which creates behaviours and defences used to produce unique infections (chronic infection). Biofilms are characterised by significant tolerance to antibiotics and biocides while remaining protected from host immunity (International Consensus Update, 2016).

The process of biofilm formation can be divided into 3 stages:

Attachment

Microbes, normally free flowing, move towards an area where nutrients are more concentrated and attach to the surface. This process is initially reversible, eventually becomes irreversible within the first 2-4hrs (Bjarnsholt et al, 2017). They reproduce to form a microcolony.

Maturation

As they mature they start to secrete extracellular polymers (Edward-Jones 2016), that form a protective matrix. As a result the microbe colonies can become increasingly tolerant to biocides once the biofilm is firmly embedded in the wound (Bjarnsholt et al 2017).



Dispersal

Fully mature biofilms cast off microbes and fragments of biofilms on a repetitive basis that disperse and can attach to other parts of the wound bed, or to other areas to form a new biofilm.



Biofilms can exist as single species as well as a multispecies biofilm. (Edward –Jones 2016). Biofilms can be very difficult to visually identify, it can exist deep within a wound. International Consensus Update on wound infection in clinical practice (2016), outlined criteria below as indicative of a potential biofilm:

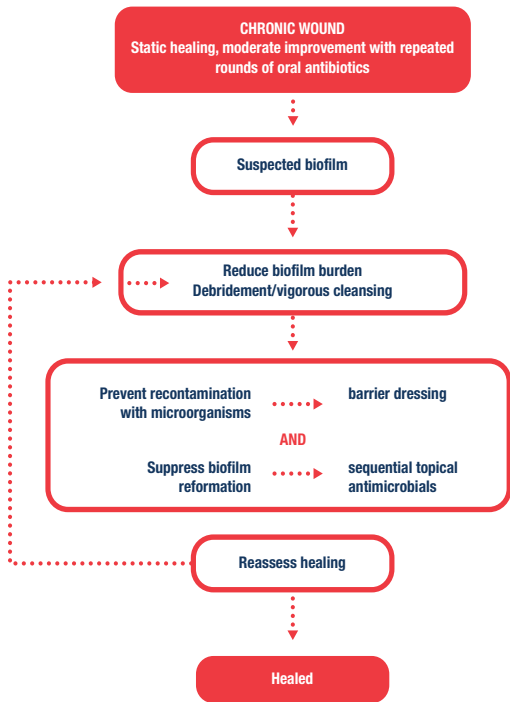
- Failure of appropriate antibiotic treatment
- Recalcitrance to appropriate antimicrobial treatment
- Recurrence of delayed healing upon cessation of antibiotic treatment
- Delayed healing despite optimal wound management and health support
- Increased exudate/moisture
- Low-level chronic inflammation
- Low-level erythema
- Poor granulation/friable hypergranulation
- Secondary signs of infection

Managing Biofilm

There is no one solution to dealing with a wound suspected of having a biofilm.

Following basic wound bed preparation alongside reduction and preventing reconstitution of the biofilm is a common strategy known as Biofilm Based Wound Care.

- Wound bed preparation
- Debridement
- Wound cleansing



BIOBURDEN

Is a degree or load of microorganisms (e.g. bacteria, virus, fungi), which creates contamination in a wound. The amount of bioburden is influenced by the quantity and virulence of microbes. If the balance of the patient's immune system is in favour of the microbes, or if wound healing is impaired, wound bioburden will be raised.

The bodies response to bacterial contamination of a wound is to elicit an inflammatory response where inflammatory cells infiltrate and clean the wound in an effort to prevent infection. However, if pathogens are in excess they can cause problems, initially delaying healing but eventually leading to a wound infection.

Chronic wounds are known to have a higher bioburden and as this increases, wound healing is delayed. The normal inflammatory response intensifies with higher levels of matrix metalloproteinases (MMPs), this breaks down the extracellular matrix (ECM). The result is a prolonged inflammatory phase.

Managing Bioburden

Evidence shows that as wounds heal, there is a reduction in the microbial load. Removal and management of any biofilm will assist in the management of the bioburden of the wound. This in turn, allows for the appropriate dressing selection, dependant on the type, signs and symptoms of the wound. One of the commonest ways to reduce bioburden is to use topical antimicrobial dressings.

ANTIMICROBIALS

Are substances that act directly on a microbe in a way that will either kill the organism or significantly hinder development of new colonies. The term incorporates disinfectants, antiseptics and antibiotics.

Antimicrobial therapy may be required when other methods are insufficient to manage localised wound infection, or when the infection is systemic and spreading.

Antimicrobial dressings normally act as a barrier, either to prevent microbes from gaining access to the wound, or to prevent them from escaping from the wound and contributing to cross-infection. In some dressings, the active antibacterial component migrates into the wound bed, whereas in others it is confined within the dressing.

CONCLUSION

The basic steps for the prevention of biofilm are: removal (clean, de-slough and debride), prevention of reformation (use of an antimicrobial agent). Provide a framework for the treatment and management of a biofilm.

ANTIMICROBIAL AGENT	RATIONALE FOR USE	WOUND TYPES
Enzyme alginogel	<ul style="list-style-type: none"> Autolytic debridement Moisture balance Wound edge and epithelial cell protection 	<ul style="list-style-type: none"> Pressure ulcer Diabetic foot ulcer Acute wound Arterial ulcer Superficial partial-thickness burns
Iodine (povidone, cadexomer)	<ul style="list-style-type: none"> Effective against MRSA Reduced selection for bacterial resistance 	<ul style="list-style-type: none"> VLU Diabetic foot ulcer Cavity wounds (cadexomer only)
Medical-grade honey	<ul style="list-style-type: none"> Autolytic debridement Odour management 	<ul style="list-style-type: none"> Leg ulcer Superficial or partial-thickness burn Diabetic foot ulcer Pressure ulcer Surgical wound Graft site
Octenidine dihydrochloride	<ul style="list-style-type: none"> Autolytic debridement Donate moisture to the wound bed Wound cleansing 	<ul style="list-style-type: none"> Superficial or partial-thickness burn Pressure ulcer Leg ulcer Diabetic foot ulcer
Polyhexamethylene biguanide (PHMB)	<ul style="list-style-type: none"> Odour management (dressing) Removal of encrusted dressings (solution) Debridement (gel) Wound bed preparation (gel and solution) Wound cleansing No known bacterial resistance in wounds 	<ul style="list-style-type: none"> Partial-thickness burn Surgical wound Graft site Leg ulcer Pressure ulcer Diabetic foot ulcer
Silver (metallic, nanocrystalline, ionic)	<ul style="list-style-type: none"> No known bacterial resistance in wounds Manage exudate, fill cavity wound, protect vulnerable tissue (combined with alginates or contact layers) 	<ul style="list-style-type: none"> All wound types With caution in children
Silver sulfadiazine	<ul style="list-style-type: none"> Soothe painful wounds 	<ul style="list-style-type: none"> Partial- or full- thickness burn Leg ulcer Pressure ulcer

Adapted from Swanson T, et al ,2014

References:

Bjarnshalt T, Eberlein T, Malone M, Schultz G; Management of Biofilm, *Made Easy. Wounds International* .May 2017. *Essential Microbiology for Wound Care*, edited by Valerie Edward-Jones, Oxford University Press 2016. *International Wound Infection Institute; Wound Infection in Clinical Practice, Principles of Best Practice, International Consensus Update 2016*. Vowden Peter, Vowden Kathryn, Carville Keryn: *Antimicrobial Dressings, Made Easy, Wounds International* Feb 2011. *Best Practice Statement: The Use of Topical Antiseptic/Antimicrobial Agents in Wound Management, 2nd Edition* May 2011. Swanson T, Grothier L, Shultz G: *Wound Infection, Made Easy, Wounds International* 2014. Flannagan M: *Wound Healing and Skin Integrity, Principles and Practice*, Wiley Blackwell 2013.