

## TECHNOLOGY UPDATE:

### The role of PHMB in delayed wound healing

Infection is a significant factor in delayed wound healing and clinicians have sought to define levels of wound infection in order to prevent confusion and the misuse of antibiotics. Recently there has been renewed interest in antiseptics. PHMB is a multi-modal antiseptic that has been shown to be useful in reducing colonisation in both acute and chronic wounds. However, more research into its use in delayed healing is required.

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#### Page points

1. Antibiotic resistance and emergence needs to be addressed
2. Topical antiseptics are an underused resource in the prevention and management of wound infection

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#### WOUND INFECTION

Infection is the single most important contributory factor in delayed wound healing and its prevention and management has been the focus of several guidelines and reviews<sup>[1-6]</sup>.

However, the lack of consensus among clinicians about what defines infection and what constitutes a chronic wound has always been a stumbling block in determining the optimal management of delayed healing. This is compounded by the wide choice of antimicrobial treatments available for the management of wound infection (for example antibiotics, antiseptics and disinfectants).

#### CURRENT PRACTICE

Antibiotics should be reserved for systemic infections; however, poor stewardship has led to the rise in resistant organisms (notably methicillin-resistant *Staphylococcus aureus*) and emergent infections such as *Clostridium difficile*.

This has led to a renewed interest in the use of antiseptics, which are indicated for topical use only. Unlike antibiotics, antiseptics are not associated with a risk of resistance or emergent organisms. However, their use has attracted controversy, with some clinicians stating that they are toxic when used on open wounds<sup>[7]</sup>. Disinfectants – including hypochlorites such as Dakin's solution, Milton's fluid and Edinburgh University solution of lime (Eusol) – are also considered toxic to healing tissues, but have anecdotally found a role in debridement and in wound-bed preparation prior to skin grafting, but no work has been published to confirm this claim.

There is a common belief that if you cannot put a topical agent in your eye, you should not apply it to a wound; this has been substantiated with a biocompatibility index (BI)<sup>[8]</sup>. However, there have been few meaningful randomised clinical trials on the use of topical antiseptics in wounds<sup>[9,10]</sup> and it is unlikely that there will be many more in the future.

A wound-infection continuum ranging from contamination, colonisation, critical colonisation through to infection is a useful aid to understanding the level of bacteria in a wound<sup>[11]</sup>. The concept of 'critical colonisation' has been used to describe a situation where bacteria may cause delayed healing in the absence of any obvious indicators of inflammation. This may also be referred to as 'localised' infection<sup>[5]</sup>. Although further research is needed to understand the factors involved in the transition from colonisation to localised infection or critical colonisation, there is general agreement on the need for invention to prevent deterioration and to facilitate wound healing<sup>[5]</sup>.

The use of antibiotics for critical colonisation is not justified and should be reserved for local cellulitis and lymphangitis, systemic signs (such as redness, swelling and increasing pain), or when certain bacteria, such as  $\beta$ -haemolytic streptococci, have been identified<sup>[1,5]</sup>.

Iodine-containing compounds (polyvinylpyrrolidone-iodine and the iodophores) and chlorhexidine have been widely used to control bioburden<sup>[12,13]</sup>, and the use of silver has become increasingly popular<sup>[14]</sup>, although some clinicians have challenged this technique<sup>[15,16]</sup>. The use of antibiotics and antiseptics in wound management should always be subject to

clearly defined reasons for use, treatment goals and duration of use<sup>[5]</sup>.

## PHMB

Polyhexamethylene biguanide (PHMB) has a long history as a swimming pool and contact lens cleanser, but there is now increasing evidence that it may also safely be used in open wounds to reduce wound bioburden<sup>[9]</sup> and has a role in the management of critically colonised or local infected wounds.

The antiseptic properties of PHMB have been shown to be effective against a wide range of wound-related bacteria and fungi with little reported toxicity or allergy<sup>[9]</sup>. It is thought that PHMB might act as a barrier to open-wound colonisation by micro-organisms through its low surface tension properties, which may also aid debridement, and appears to promote healing by stimulation of epithelialisation<sup>[17]</sup>.

Like all antiseptics PHMB's action is non-specific and multimodal<sup>[18,19]</sup>, the effects being mediated through several mechanisms, including the disruption of cell walls, membrane proteins and efflux pumps; denaturation of cytoplasmic organelles and cell respiratory processes; denaturation of nuclear proteins and enzymes; and inhibition of cell respiratory processes.

PHMB has a biocompatibility index of <1 and is active against biofilms<sup>[20]</sup>. Several studies have demonstrated how PHMB reduces colonisation in acute wounds, MRSA infections and chronic diabetic, venous and arterial ulcers, and burns<sup>[21-28]</sup>.

PHMB is available in a variety of products used for chronic and acute wound care, including irrigating solutions such as Lavasept® and Prontosan® (B. Braun), gels and antiseptic dressings (for example antimicrobial dressings such as Kerlix AMD® [Covidien], Excilon AMD® [Covidien] and Telfa® [Covidien]).

## CONCLUSION

Further clinical evaluation of the use of PHMB in wounds healing by primary intention (surgical and traumatic sutured wounds) and secondary intention (chronic ulcers of all types) are needed to confirm that this antiseptic has a role to play in delayed healing.

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## Page points

1. A diagnostic tool for 'critical colonisation' is yet to be introduced. Experienced clinicians, however, can recognise from colonisation to early infection in chronic wounds
2. PHMB is a safe and effective broad spectrum antimicrobial, available in solutions, gels and dressings

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