NOVEL NON-SILVER WOUND DRESSING YIELDS PROMISING RESULTS AGAINST BIOFILMS

Introducing a new reinforced gelling carboxymethyl cellulose dressing with PHMB and anti-biofilm technology

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INTRODUCTION

A new, highly absorbent, gel forming wound dressing has been developed that contains polyhexamethylenebiguanide (PHMB) and a novel anti-biofilm formulation. It has three technologies that work together to manage three predominant barriers to wound healing: Biofilm, contamination by micro-organisms and excess exudate.

1. The novel anti-biofilm formulation may help reduce or disrupt the formation of biofilm within the dressing.
2. PHMB helps reduce microbial contamination within the dressing.
3. CMC fibre technology captures microbial contamination, exudate and wound debris which helps to reduce or to minimise cross infection and prevent maceration.

The gelling dressing containing PHMB is soft, conformable and highly absorbent. It is produced from sodium carboxymethyl cellulose and strengthening cellulose fibre(s) with antimicrobial PHMB and a novel anti-biofilm formulation.

Even when the dressing is moist the structure remains intact. The high vertical absorption of exudate into the dressing forms a gel which assists in maintaining a moist wound environment, supporting autolytic debridement, protecting the wound edge and surrounding skin from maceration, thus supporting the healing process.

The dressing is indicated for the following types of wounds: partial thickness burns, leg ulcers, pressure ulcers and diabetic ulcers, surgical wounds or other traumatic wounds such as post-operative, lacerations and donor or graft sites.

The current study demonstrates the ability of the dressing to be effective against biofilms and to prevent bacterial penetration through the dressing.

METHOD

The biofilm method used in the study was based on a gauze model developed by Bowler and Parsons, 2016. In the first step, circular pieces of 1.6 cm sterile gauze were punched out before being transferred into sterile 100 ml Erlenmeyer flasks and submerged in 25 ml of liquid bacterial culture containing either S.aureus or P.aeruginosa at approximately 1-5 x 105 CFU/ ml. The Erlenmeyer flasks were subsequently shaken for 48h in order to coat the gauze with a mature biofilm. Each piece of gauze was then placed onto an individual agar plate and covered with a 3.2 cm disk of the test dressing and wetted with 1.5 ml of simulated wound fluid (SWF). Finally, the test dressings were covered with a piece of silicon dressing and the agar plate sealed with parafilm.

Bacterial penetration testing was performed by saturating 4.2 x 4.2 cm dressing samples with aliquots of SWF. Dressings were subsequently incubated (preconditioned) at 37°C for 6-days. After this period, the cut samples were placed onto fresh agar plates and inoculated with bacterial suspension containing 1x 108 CFU/ml on top of the dressing. Petri dishes were then incubated for 24h, the dressings removed and plates inspected for growth. The plates were further inspected in another 24h for growth.

RESULTS

Biofilm

The new wound dressings achieved total kill for all the bacteria in the both the S. aureus and P.aeruginosa biofilms (S.aureus is shown in figure 1). In comparison, a silver-based CMC competitor dressing did not remove the biofilm for either bacteria.

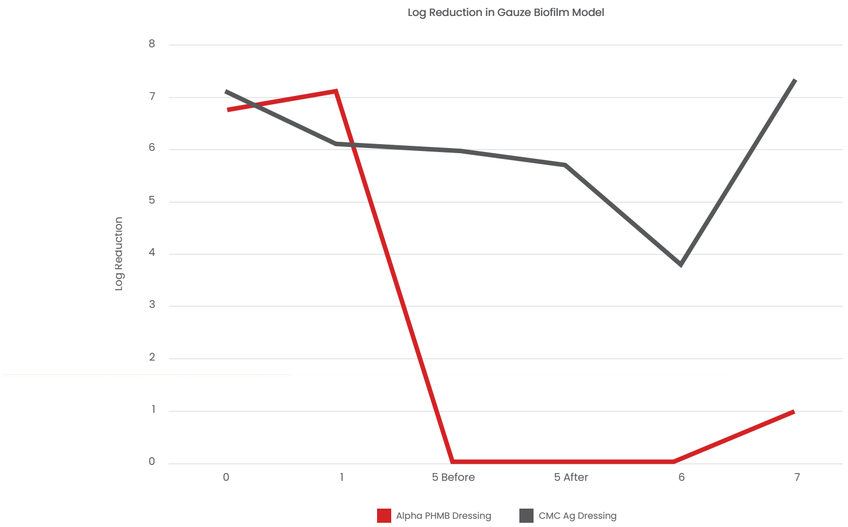

Figure 1: Anti-biofilm performance of the new CMC dressing containing PHMB and a commercially available CMC Ag dressing in the gauze method.

Bacterial Penetration

Visual assessment of bacterial growth on the agar plates after removing the wound dressings was carried out after 24 and 48 hours (figure 2 and 3). Bacterial growth was observed under the CMC control dressing at both time points. The new wound dressing with a novel anti-biofilm formulation demonstrated no growth after both 24 hours for a range of bacteria including S. aureus, E.faecalis, B.subtilis, P.aeruginosa, E.clocae and K.pneumoniae (table 1). In contrast, a commercial silver based wound dressing was also tested for bacterial penetration and whilst the dressing performed well against the majority of bacteria, growth was observed after 48 hours with E.clocae.

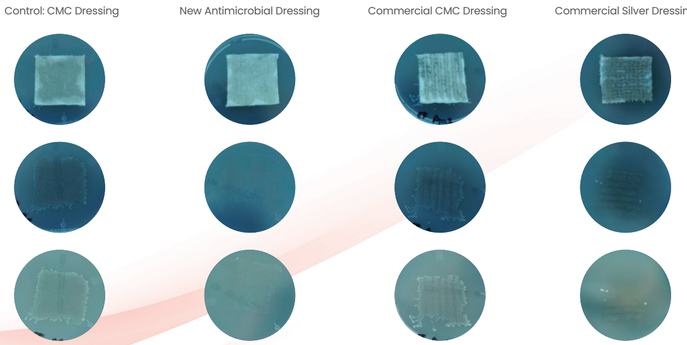

Figure 2: Visual assessment of Enterococcus faecalis with dressing on-top and without after 24 hours (middle) and after 48 hours (bottom)

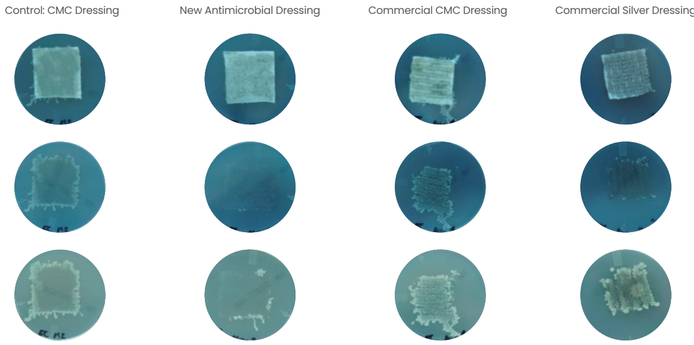

Figure 3: Visual assessment of Enterobacter clocae with dressing (on top) and without after 24 hours (middle) and after 48 hours (bottom). Bacterial growth can be observed under the commercial antimicrobial dressing.

Table 1: Visual inspection of bacterial growth on TSA plates 48 hours in all dressings and test organisms.

Bacterial growth (48h)				
	CMC		CMC+Antimicrobial	
	SFM	Commercial CMC dressing	Commercial silver dressing	Alpha CMC+PHMB
S.aureus	Y	Y	N	N
E.faecalis	Y	Y	N	N
B.subtiilis	Y	Y	N	N
P.aeruginosa	Y	Y	N	N
K.pneumoniae	Y	Y	N	N
E.cloacae	Y	Y	Y	N

DISCUSSION

Initial evidence suggests the new antimicrobial dressing is highly effective against biofilms and preventing bacterial penetration. The dressing totally reduced viable bacteria on the gauze and prevented the penetration of five different bacterial species: S.aureus, E.faecalis, B.subitilis, P.aeruginosa, K.pneumoniae and E.colcae.

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