The Microbicidal Properties of Silver Containing Carboxymethylcellulose Wound Dressings

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Introduction

The burn wound, although initially free of microbial contamination, provides an environment in which a wide variety of microorganisms can thrive and subsequently increase the probability of infection. Since wound infection is a major cause of increased morbidity and mortality in the burned patient, it is appropriate to use topical antimicrobial dressings that are able to provide sustained broad spectrum antimicrobial protection, thus reducing the risk of wound infection.

Materials and Methods

Dressings Used

- CMC Ag
- CMC Ag BURN
- CMC (negative control)
- CMC BURN (negative control)

Microbial Challenge organisms:

- Antibiotic Resistant Bacteria: Methicillin Resistant Staphylococcus aureus (MRSA NCIMB 12232)
- Vancomycin Resistant Enterococcus (VRE NCTC 12201)
- Yeast: Candida krusei (NCPF 3876)
- Fungi: Aspergillus niger (NCPF 2275)
- Anaerobic bacterium: Bacteroides fragilis (NCTC 9518)
- Aerobic bacterium:*P. aeruginosa* (NCIMB 8626)

Method

An *in vitro* study utilising a simulated wound fluid model was designed to measure the antimicrobial activity of two ionic silver Hydrofiber® wound dressings, one of which was developed particularly for burns (AQUACEL® Ag BURN dressing), against a variety of recognised wound pathogens. Identical dressings, but without ionic silver were used as negative controls. The testing involved three separate inoculation challenges on days 0, 3 and 8 for each wound pathogen. (Reinoculation for *P. aeruginosa* was carried out on days 4 and 9).

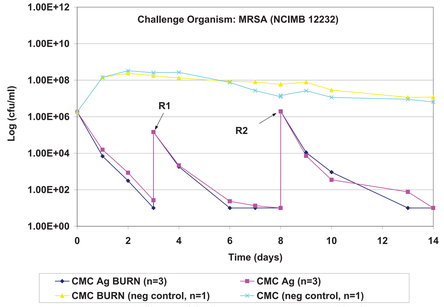

Figure 1. The antimicrobial efficacy of CMC Ag BURN dressing and CMC Ag against MRSA in simulated wound fluid. MRSA re-inoculated at 1.45 x 10^5 (R1) and 1.95 x 10^6 (R2).

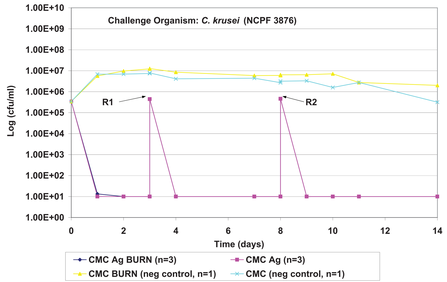

Figure 3. The antimicrobial efficacy of CMC Ag BURN dressing and CMC Ag against *C. krusei* in simulated wound fluid. *C. krusei* re-inoculated at 4.45 x 10^5 (R1) and 4.6 x 10^5 (R2).

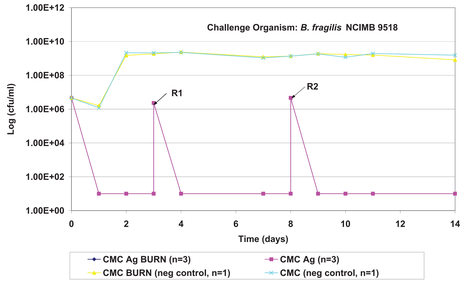

Figure 5. The antimicrobial efficacy of CMC Ag BURN dressing and CMC Ag against *B. fragilis* in simulated wound fluid. *B. fragilis* re-inoculated at 2.3 x 10^5 (R1) and 4.65 x 10^8 (R2).

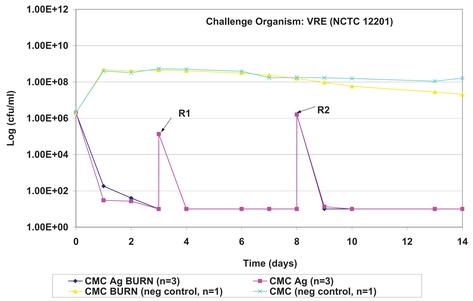

Figure 2. The antimicrobial efficacy of CMC Ag BURN dressing and CMC Ag against VRE in simulated wound fluid. VRE re-inoculated at 1.35 x 10^5 (R1) and 1.6 x 10^6 (R2).

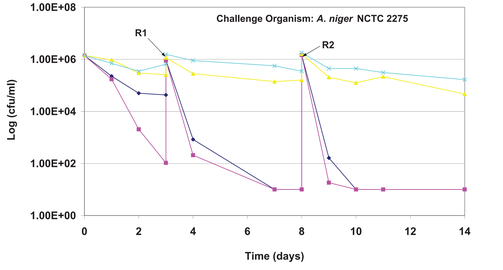

Figure 4. The antimicrobial efficacy of CMC Ag BURN dressing and CMC Ag against *A. niger* in simulated wound fluid. *A. niger* re-inoculated at 9 x 10^5 (R1) and 1.45 x 10^6 (R2).

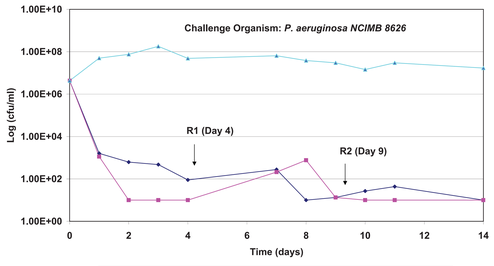

Figure 6. The antimicrobial efficacy of CMC Ag BURN dressing and CMC Ag against *P. aeruginosa* in simulated wound fluid. Re-inoculated at 2.55x10^5 (R1) and 1.1x10^5 (R2).

Results and Discussion

Figures 1 to 6 illustrate the antimicrobial activity of the two silver containing CMC dressings in simulated wound fluid against MRSA, VRE, *C. krusei*, *A. niger, B. fragilis* and *P. aeruginosa* respectively over a 14 day challenge period. Both silver containing CMC dressings were shown to be efficacious against all of the challenge organisms tested. VRE was shown to be highly susceptible to the antimicrobial effects of each dressing as observed by the rapid kill rate of this organism within 24 hours and beyond (figure 2). A similar pattern of antimicrobial activity was observed against the anaerobic challenge, *B. fragilis* (figure 5). Both silver CMC dressings showed effective and prolonged activity against MRSA (figure1).

Both silver containing CMC dressings, AQUACEL® Ag and AQUACEL® Ag BURN dressings, demonstrated comparable activity against *C. krusei, A. niger* and *P. aeruginosa* (figures 3, 4 and 6). Both dressings were highly effective against *C. krusei*; >10,000 fold reduction in challenge inoculum was observed within the first 24 hours. Each dressing demonstrated antimicrobial activity against *A. niger* and *P. aeruginosa*, reducing the challenge over the 14 day period, despite repeated re-inoculations.

Negative control dressings, AQUACEL® and AQUACEL® BURN dressings, failed to exert antimicrobial activity against any of the challenge organisms tested.

Conclusion

Based on these in vitro data using methodology designed to simulate the clinical environment, it can be concluded that AQUACEL® Ag and AQUACEL® Ag BURN dressings can induce an antimicrobial environment with sustained activity against a variety of known wound pathogens over a 14 day dressing wear time.

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