In-vitro Bacterial Barrier Properties Of Silver Containing Carboxymethylcellulose Wound Dressings

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Conclusion

Acquired infections are usually attributed to direct contact between an infected or colonised person and the patient.[1] The challenge organisms, *Staphylococcus aureus* and *Pseudomonas aeruginosa,* are common pathogens found in wound infections. Bacterial concentrations which are representative of the levels found on normal skin were selected for challenging the dressings.[2] Two challenge methods were devised to simulate infection by contaminated wound fluid (liquid challenge) or by touch (solid challenge).

Both silver containing carboxymethylcellulose wound dressings (AQUACEL® Ag dressing and a Hydrofiber® Burn dressing), under the conditions of the experiment, were observed to be effective as a barrier to bacteria arising from sources external to the patient. These results suggest that both silver containing carboxymethylcellulose dressings tested may act as a barrier to the transfer of infectious material from a patient with an infected wound into the external environment.

Introduction

The aim of this study was to evaluate the bacterial barrier properties of two silver containing carboxymethylcellulose wound dressings, (AQUACEL® Ag dressing and a Hydrofiber® Burn dressing). Jelonet™ dressing, a common paraffin impregnated gauze dressing was also evaluated as a control.

Materials and Methods

Wound dressings tested

AQUACEL® Ag dressing, lot number 8F42155, expiry date 06/2010.

Hydrofiber® Burn dressing, lot number HF-2007/164-33A, expiry date 04/2009.

Jelonet™ dressing, lot number H0839 expiry date 09/13.

Challenge organisms

Inoculum, *Staphylococcus aureus,* NCIMB 9518, 10^3 cfu/mL and 10^4 cfu/mL.

Inoculum, *Pseudomonas aeruginosa*, NCIMB 8626, 10^3 cfu/mL and 10^4 cfu/mL.

Method

All the following procedures were carried out asceptically. The luer tips of the 20 mL syringes were cut off and the plungers drawn back to the 5mL graduation mark. 4 mL of liquid tryptone soy agar (TSA) was poured into the syringes and allowed to set. (See figure 1). Once set, 0.1 mL of each 10^4 cfu/mL *Staphylococcus aureus* inoculum was pipetted onto the surface of the agar and allowed to soak in. Six 5 cm x 5 cm samples of each test dressing were cut and placed in the centre of a 90 mm TSA plates. 1.0 mL of the 10^3 cfu/mL *Staphylococcus aureus* inoculum, (liquid challenge), was pipetted onto the centre of 3 test dressing replicate samples. The remaining test dressing samples were inoculated, (solid challenge), by extruding the agar from the syringe (figure 2) so that the surface was free from the syringe barrel and touching the exposed agar to the centre of the dressing surface. This process was repeated for the *Pseudomonas aeruginosa* challenge. All plates were incubated for 4 hours at room temperature. After this time, the dressing samples were removed and the plates incubated at 35°C ± 3°C.

All plates were examined for signs of bacterial proliferation at 24 and 48 hours. Digital photographs were taken at the 48 hour time point.

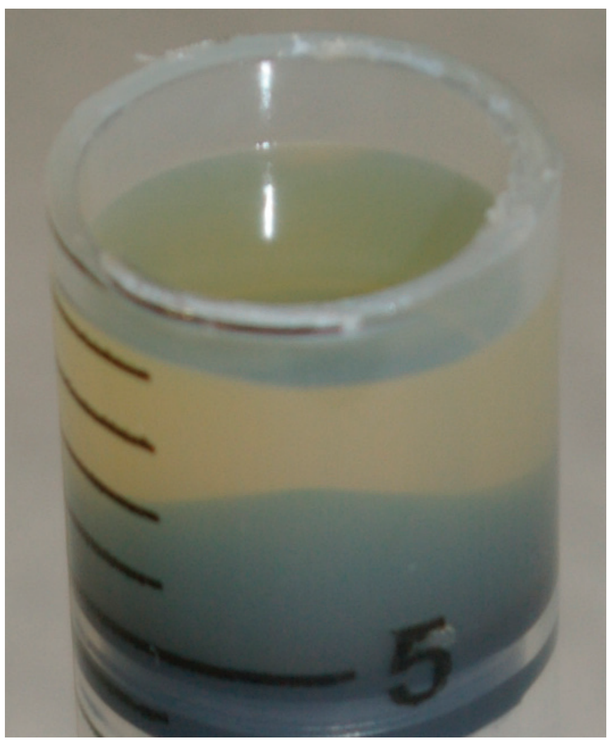

Figure 1.

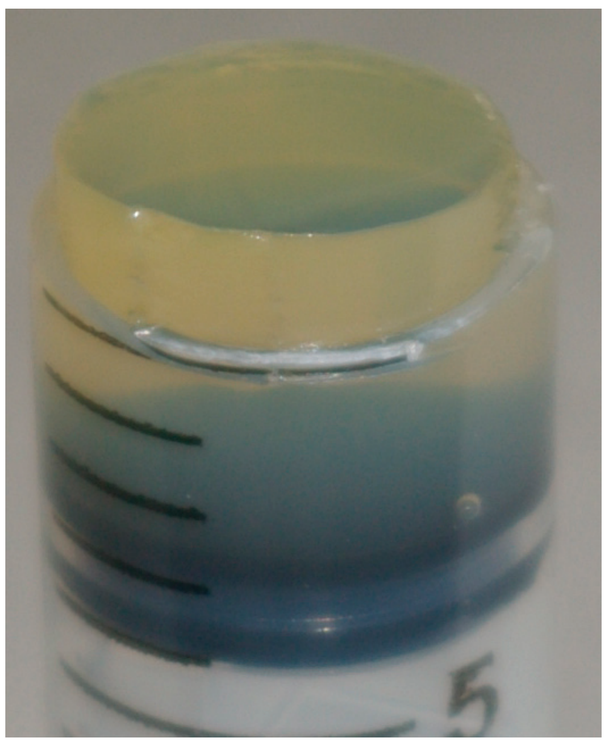

Figure 2.

Results and Discussion

After 24 hours incubation there was no growth on any of the AQUACEL® Ag dressing or Hydrofiber® Burn dressing plates, regardless of challenge organism or inoculation method. This remained the same at the 48 hour time point. (Figures 3 to 10).

In contrast, Jelonet™ dressing showed growth on all plates at 24 and 48 hours (Figures 11 to 14)

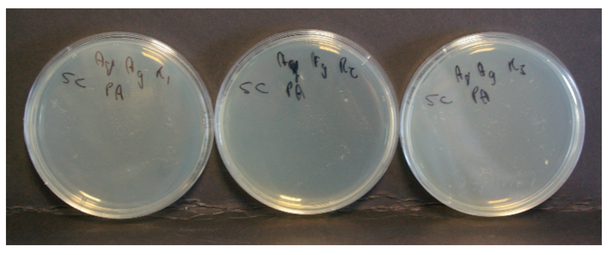

Figure 3. AQUACEL® Ag dressing solid challenge *Pseudomonas aeruginosa*

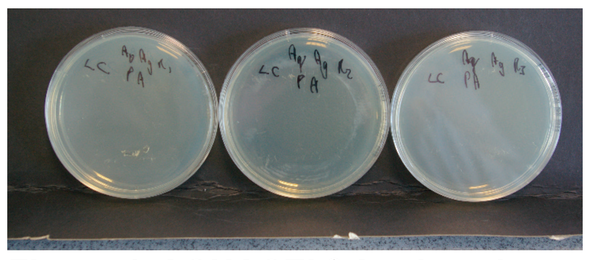

Figure 4. AQUACEL® Ag dressing liquid challenge *Pseudomonas aeruginosa*

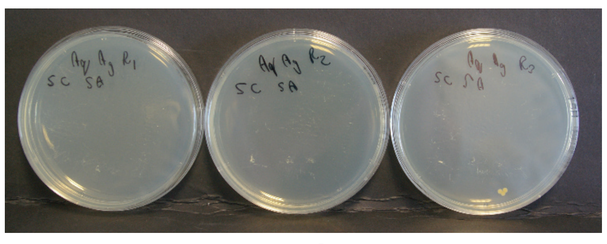

Figure 5. AQUACEL® Ag dressing solid challenge *Staphylococcus aureus*

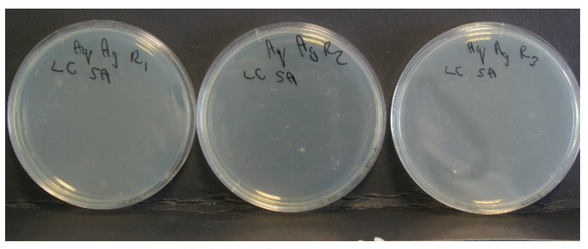

Figure 6. AQUACEL® Ag dressing liquid challenge *Staphylococcus aureus*

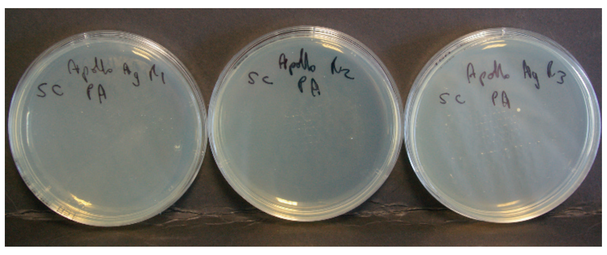

Figure 7. Hydrofiber® Burn dressing solid challenge *Pseudomonas aeruginosa*

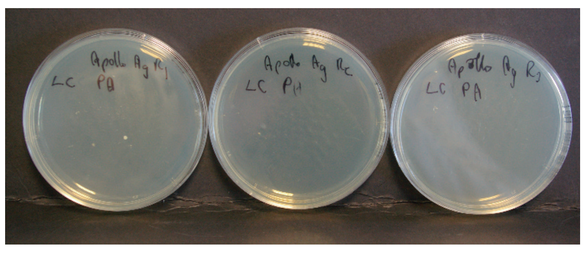

Figure 8. Hydrofiber® Burn dressing liquid challenge *Pseudomonas aeruginosa*

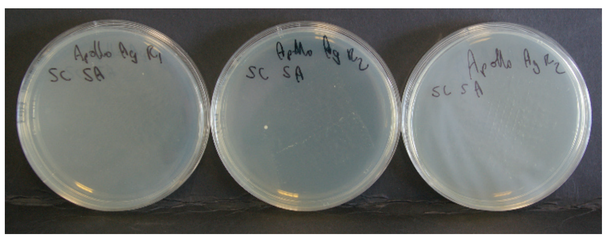

Figure 9. Hydrofiber® Burn dressing solid challenge *Staphylococcus aureus*

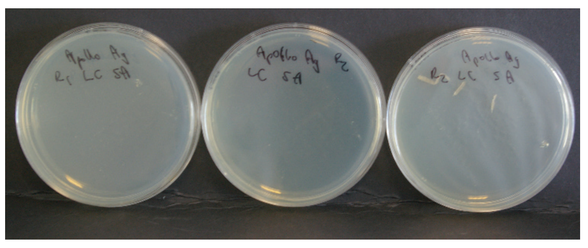

Figure 10. Hydrofiber® Burn dressing liquid challenge *Staphylococcus aureus*

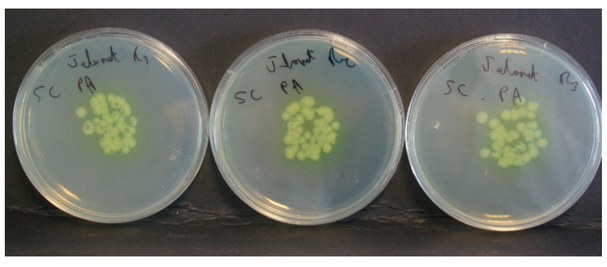

Figure 11. Jelonet™ dressing solid challenge *Pseudomonas aeruginosa*

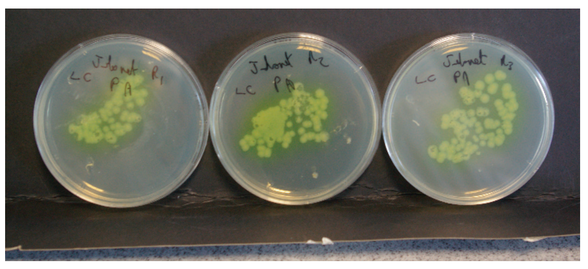

Figure 12. Jelonet™dressing liquid challenge *Pseudomonas aeruginosa*

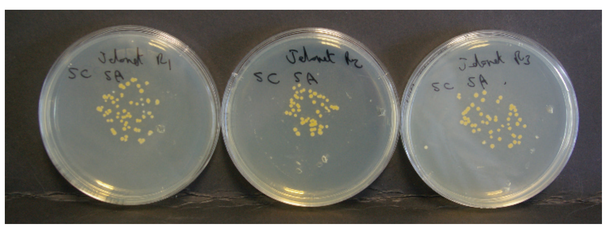

Figure 13. Jelonet™ dressing solid challenge *Staphylococcus aureus*

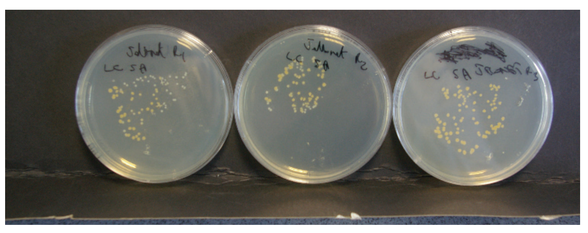

Figure 14. Jelonet™ dressing liquid challenge *Staphylococcus aureus*

References

1. Gadi Borkow, Jeffery Gabbay. Biocidal textiles can help fight nosocomial infections. Medical Hypotheses (2008) 70, 990-994.

2. Andrej Trampuz MD and Andreas F Widmer MD, MS. Hand Hygiene: A Frequently Missed Lifesaving Opportunity During Patient Care. Mayo Clin Proc 2004;79:109-116.

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