The Physico-Chemical Properties of Silver Containing Burn Dressings

V M Kershaw, D Pritchard, M Walker

ConvaTec Wound Therapeutics
Global Development Centre
First Avenue, Deeside Industrial Park
Flintshire
United Kingdom

INTRODUCTION

Silver-containing dressings are now widely used to assist in the management of infected wounds and those at risk of infection. Different dressing types may vary in clinical performance due to differences in the physico-chemical properties. When a wound surface is exposed to silver-containing antimicrobial dressings, it is important that there is intimate contact across the wound surface to reduce dead-space where bacteria could otherwise grow and so that the bacterial populations at the wound interface are exposed to the antimicrobial agent. It is also important that the silver is available to counter the increased bioburden, that the dressing retains wound fluid and does not spread infection across the wound surface (via lateral fluid spread). Thus, an all round solution to burn management is to have an anti-microbial dressing combining all four of these attributes.

MATERIALS AND METHODS

In vitro studies were carried out to assess the physico-chemical characteristics of 8 silver containing dressings. The dressings tested were*:

SCMC Ag BURN Dressing: New Silver Hydrofiber® Dressing Reinforced with Nylon for Burns
SCMC Ag Dressing: Silver Hydrofiber® Dressing
Dressings 1-3: Nanocrystalline silver dressings
Dressings 4-5: Silver foam dressings
Dressing 6: Silver tulle dressing

Intimate Contact

To demonstrate how a wound dressing will contour to a wound, an *in vitro* model mimicking the surface of a wound was prepared using belly pork fixed to the side of a standard Petri dish. A strip of each dressing was then applied to the simulated wound bed, physiological saline (sodium and calcium chloride BP solution 0.9 %w/w) containing 0.1% toluidine blue stain was dosed by means of a small ambulatory infusion pump delivering 4ml/hr. Images of the wound model were captured every 15 seconds.

Percentage Fluid Retained Under Compression:

Pre-weighed dressing samples were immersed into physiological saline for 30 mins, then removed and re-weighed. The samples were then placed onto a perforated aluminium plate under a compression load (40mm Hg) for 1min and re-weighed. The percentage of fluid retained was calculated as a percentage of fluid absorbed.

Lateral Spread of Fluid

An *in vitro* study was designed to visualize the lateral spread exhibited by dressings. A plastic cylinder was placed onto the centre of a 5cm x 5cm dressing sample and held securely in place. 2mls of Horse Serum was injected into the cylinder, after 60 seconds the serum was syringed out of the cylinder and the cylinder was removed. The hydrated area of the dressing was calculated, a smaller area corresponding with low lateral wicking or spread of fluid.

Silver Availability

A pre-weighed 5cm x 5cm sample of dressing was placed into a hydrated dialysis membrane bag and sealed. The bag plus sample were immersed into physiological saline and incubated at 37^{O}C, with stirring. Aliquots (10 ml) of the solution were removed at specified time points, filtered and analysed for silver concentration against standards of known silver concentration by Atomic Absorption Spectrometry (AAS). Silver availability in solution (ppm) was then plotted against time to generate an availability profile.

RESULTS AND DISCUSSION

Figure 1A shows the dry SCMC Ag Burn dressing on the simulated wound bed. As fluid is absorbed, the dressing starts to closely contour the wound surface, such that in Figure 1B there is total intimate contact. Figures 1C and 1D highlight the inability of foam dressings to conform to the irregular wound surface. Areas along the simulated wound interface which are not in contact with the dressing could be susceptible to bacterial proliferation in a clinical environment[1].

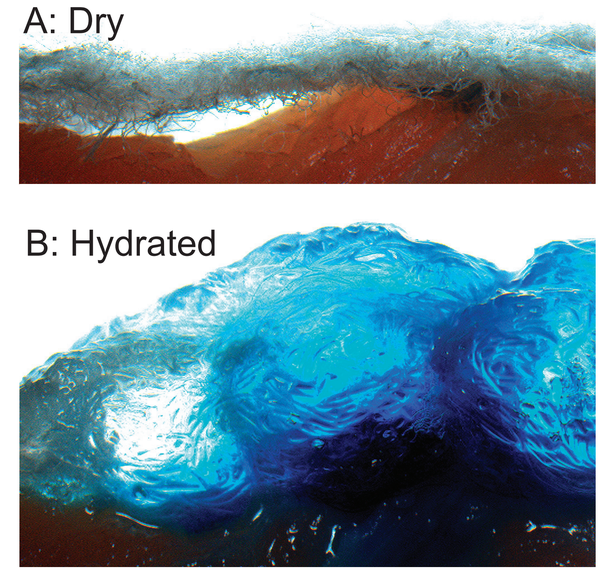

Figure 1. Intimate Contact: A and B - SCMC Ag Burn dressing; C and D - foam dressing

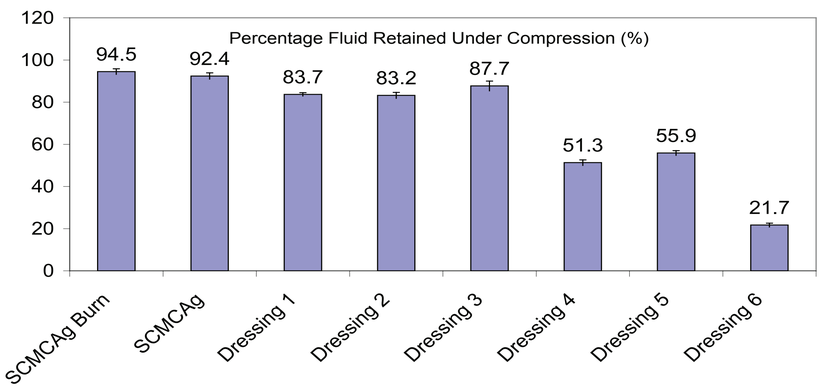

Figure 2. Percentage of fluid retained by each dressing under compression (%)

Figure 2 demonstrates that the Hydrofiber® dressings (SCMC Ag Burn and SCMC Ag) have the highest percentage fluid retention value under compression, and Table 1 illustrates that their lateral spread is amongst the lowest.

The silver release profiles of the tested wound dressings were plotted over a 96 hour period (Figure 3) demonstrating that the SCMC Ag Burn dressing has similar silver availability in this test model compared to the other silver dressings tested.

Dressing	Lateral Spread (mm)
SCMCAg Burn	55
SCMCAg	41
Dressing 1	100
Dressing 2	71
Dressing 3	112
Dressing 4	41
Dressing 5	41
Dressing 6	108

Table 1. Lateral spread (mm)

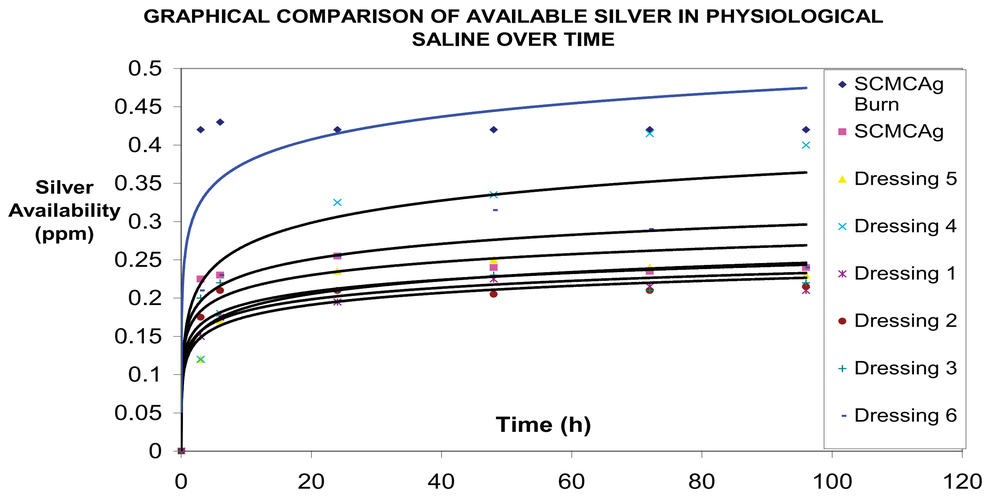

Figure 3. Comparative plot showing the availability of silver from each dressing over time

CONCLUSION

The new SCMC Ag Burn dressing demonstrates intimate contact with the wound bed (Figure 1), a high percentage fluid retention (Figure 2), low lateral spread of fluid across the dressing surface (Table 1) and an availability of silver (Figure 3) similar to other silver dressings tested.

REFERENCE

1. Jones SA, Bowler PG, Walker M, 2005. Antimicrobial activity of silver-containing dressings is influenced by dressing conformability with a wound surface. WOUNDS, 17: 263-270.

*SCMC Ag - AQUACEL® Ag Dressing, Dressing 1 - Acticoat® Dressing, Dressing 2 - Acticoat® 7 Dressing, Dressing 3 - Acticoat® Flex Dressing, Dressing 4 - Allevyn® Ag non-Adhesive Dressing, Dressing 5 - Mepilex® Ag Dressing and Dressing 6 - Urgotul® SAg Dressing

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