In vitro microbiological evaluation of surgical cover dressings

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Introduction

- Surgical site infections (SSIs) are associated with significant morbidity and represent one of the most costly healthcare-associated infections in the United States.
- Effective preventative strategies, such as the use of antimicrobial dressings, are critical since wound infections can be difficult to treat once established.
- Surgical cover dressings (SCDs) help protect the incision site and may reduce the risk of postoperative contamination.
- Variations in antimicrobial components and activity across SCDs may influence their ability to prevent or limit bacterial proliferation.

Objective

To evaluate the *in vitro* antimicrobial efficacy of various SCDs against a range of clinically relevant bacteria

Methods

- Test SCDs (n=3 replicates, approximately 5 × 5 cm) were inoculated with 1×10^6 CFU/mL of *S. aureus* (SA; NCIMB 9518) or *P. aeruginosa* (PA; NCIMB 8626) and applied to an agar slice simulating a wound bed (**Table 1**); dressings were incubated in place for 24 or 48 hours at 37°C.
- Following removal, the agar and dressing were swabbed onto Dey–Engley Neutralizing Agar (DENA) to confirm the presence or absence of residual bacterial growth; dressings and agar were incubated for a further 24 hours to assess potential regrowth.
- Scanning electron microscopy (SEM) was performed on one 24- and 48-hour replicate to visualize bacterial presence on the dressing surfaces.
- Dressings were also evaluated using a direct inoculation method, adapted from AATCC Test Method 100[1], assessing total viable counts over 7 days against a panel of Gram-positive and Gram-negative bacteria.

Table 1. Test dressings

SCD	Key dressing component(s)
CISEB*	Carboxymethylcellulose, ionic silver, ethylenediaminetetraacetic acid (EDTA), and benzethonium chloride (BEC)
CMC†	Carboxymethylcellulose only
Foam A‡	Silver-sulfate hydrocellular foam
Foam B§	Silver-sulfate soft silicone foam

*AQUACEL® Ag Advantage SCD ‡Allevyn™ Ag+ Surgical
†AQUACEL® SCD §Mepilex® Border Post-Op Ag

1. Meredith K & Forbes LE. *Surg Infect* 2023;24(7):637-644.

Results

Figure 1. Residual bacterial growth on agar and dressing (*S. aureus* only - *P. aeruginosa* results not shown): Replicates shown following 24h and 48h of dressing application (before and after 24h reincubation)

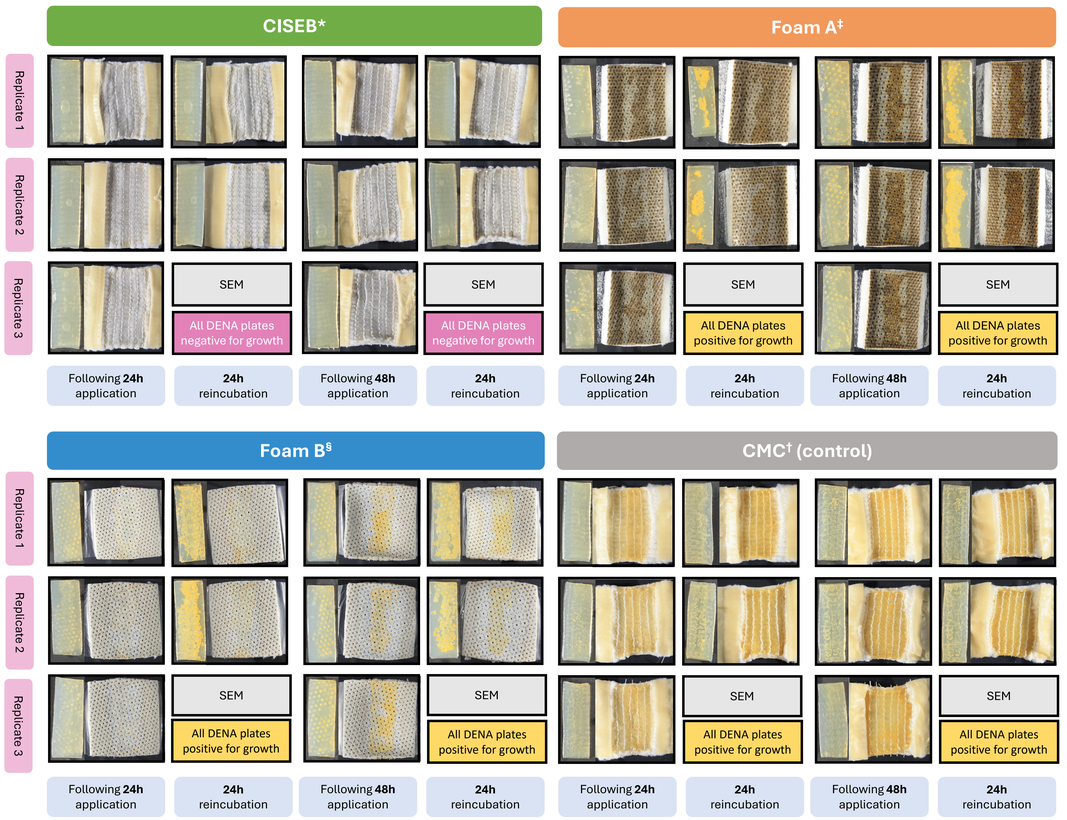


Figure 2. SEM: representative image for each SCD, following 24h and 48h dressing application

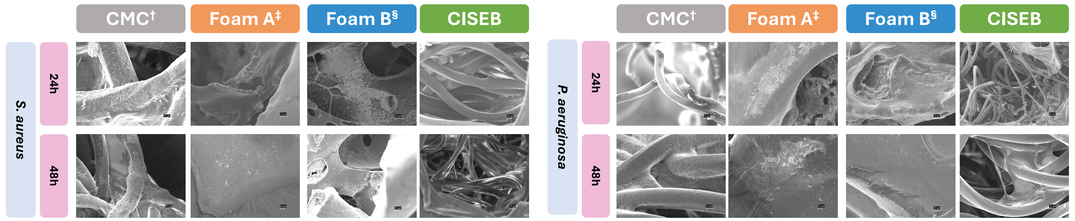
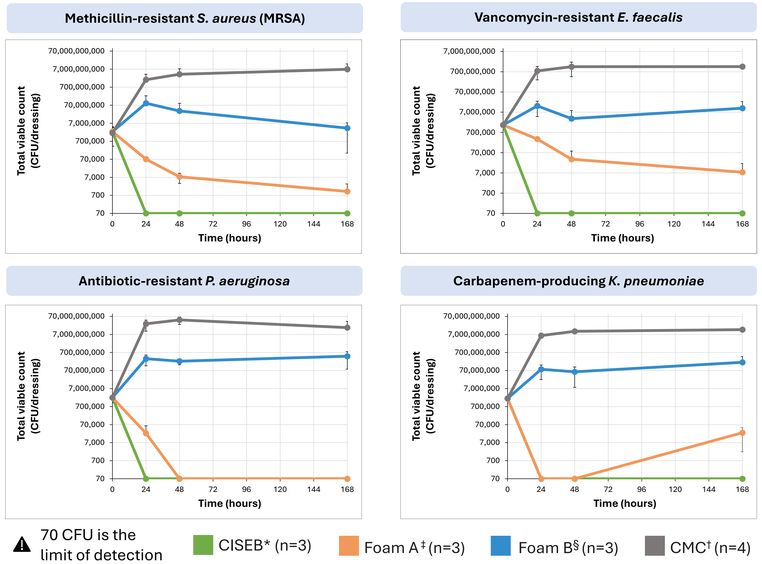


Figure 3. Total viable counts (adapted AATCC Test Method 100)



Discussion

- **CISEB** demonstrated complete antimicrobial efficacy, with no detectable SA growth on either the dressing, the underlying agar or DENA plates across all replicates (**Figure 1**); similar findings were observed for PA (data not shown).
- In contrast, **CMC** (non-antimicrobial), **Foam A**, and **Foam B** all exhibited visible bacterial growth (SA & PA) on both the dressings, the agar and DENA plates for all replicates (**Figure 1**).
- It was observed that **Foam A** and **Foam B** allowed bacterial growth on the underlying agar to develop in a pattern that mirrored the silicone wound-contact layer. This was not observed for **CMC**, where growth was present but less than that seen for the Foam A & B (**Figure 1**).
- SEM analysis supported these findings by revealing residual bacterial presence, both SA and PA, on the surfaces of the less effective dressings (**Figure 2**).
- In the adapted AATCC method, **CISEB** reduced all antibiotic-resistant bacteria tested to the detection limit (<70 CFU) by 24 hours and maintained this activity over 7 days, whereas the other test dressings failed to achieve this (**Figure 3**).

Conclusion

CISEB was the only SCD tested to eliminate wound-related pathogens in these *in vitro* models, demonstrating superior antimicrobial performance against a range of clinically relevant bacteria

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