

Activity of Antimicrobial Dressings Using Clinically Relevant Organisms MRSA, VRE, and *P. aeruginosa*

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Summary

The purpose of this study was to compare the antimicrobial efficacy of polyhexamethylene biguanide (PHMB) impregnated foam dressing (Kendall™ AMD antimicrobial foam dressing) and other commercially available antimicrobial foam and non-foam dressings in an *in vitro* model. The study was performed at Microbial Research, Inc., Fort Collins, Colorado 80524, USA¹. Clinical isolates of Methicillin-resistant *Staphylococcus aureus* (MRSA), Vancomycin-resistant *Enterococcus* (VRE) and *Pseudomonas aeruginosa* were used as challenge organisms.

The results clearly showed that Kendall™ AMD antimicrobial foam dressings yielded sustained >3.0 log reduction for seven

(7) days against all three challenge organisms. The tested silver based dressings did not exhibit sustained efficacy against all three challenge organisms. Chlorhexidine Gluconate (CHG) based foam dressing also exhibited sustained >3.0 log reduction for seven (7) days against all three challenge organisms.

Introduction

Study reported herein was performed to evaluate the efficacy of Kendall™ AMD antimicrobial foam dressing in an *in vitro* model as compared to nine (9) other available competitive antimicrobial foam and non-foam dressings listed in Table 1.

Materials

Table 1: List of dressings used in study

Dressing	Dressing Type	Antimicrobial Agent	Manufacturer	Lot Number
Kendall™ AMD Antimicrobial	Foam	PHMB	Covidien	623619
Acticoat™* Silcryst™* 7 Day	Gauze	Silver	Smith&Nephew/ Nucryst Pham. Corp.	060628-1
Contreet™* Silver	Foam	Silver	Coloplast	704010
Aquacel Ag™*	Alginate	Silver	ConvaTec	6M13079
Quadrafoam Polymem Silver™*	Foam	Silver	Ferris	30706E1
Allevyn™* Ag	Foam	Silver	Smith&Nephew	0742
Optifoam™* Ag	Foam	Silver	Medline	M864000856
Mepilex™* Ag	Foam	Silver	Molnlycke	0811-4955
Contreet™* Adhesive Silver	Foam	Silver	Coloplast	1513528
Biopatch™*	Foam	CHG	Johnson&Johnson	1061740

Positive Control dressing: Standard foam, Lot 616538 (Covidien)

Table 2: Description of challenge organisms

MRI ID No.	Isolate Identification	Source ID	Isolation Source	Isolate Date
101PS	<i>Pseudomonas aeruginosa</i>	1514	Wound source	3/2/07
116SA	Methicillin-resistant <i>Staphylococcus aureus</i>	389	Left ankle medial	2/20/07
140EF	Vancomycin-resistant <i>Enterococcus species</i>	2	Sacral soft tissue	3/6/07

Media/Reagents: Tryptic Soy Broth (TSB), Difco
Tryptic Soy Agar (TSA), Difco
Sterile Phosphate Buffered Saline (PBS),
Sigma Chemical, P3813
D/E Neutralizing Broth (DE), Difco

Equipment: Sterile disposable 50ml centrifuge tubes
Test tube racks
Test tubes
Sterilized forceps
Vortex mixer
Adjustable pipettes with sterile tips
Autoclave
Incubator maintained at 36±2°C

Methods

A 10⁸ CFU/ml stock suspension of each challenge organism was prepared in sterile saline. This suspension was diluted to 10⁶ CFU/ml with sterile phosphate buffered saline for use as a test suspension. Pre-cut and sterile 25 mm (1 inch) disks of the test and positive control materials were placed into the microbial test suspension. After 24 hour incubation at 37° C, an aliquot was removed from the suspension, neutralized with D/E broth, serially diluted and plated to determine the log counts of each bacterium. The suspension was re-challenged with 1.0x10⁶ CFU/ml of the challenge organism. The procedure was repeated each day for seven (7) consecutive days. The testing also included various controls (negative, inoculum suspension and daily viability) to confirm validity of the procedure and viability of challenge organisms.

Results

Table 3 provides a quick check of daily efficacy for test dressings against all three organisms for seven (7) consecutive days. Detailed information on daily efficacy exhibited by test dressings is illustrated in Figures 1, 2 and 3. The selection criteria for entry in Table 3 is demonstration of a broad spectrum ≥3.0 log reduction covering all three organisms on a given assessment day. The log reduction is defined as the difference in bacterial counts between test and positive control dressings.

Figure 1 shows the daily efficacy for test dressings against *P. aeruginosa*. Clearly, only Kendall™ AMD antimicrobial foam dressing and Biopatch dressings showed efficacy for seven (7) days. All silver based dressings except Allevyn™ dressings yielded significantly lower (either <3.0 logs or not sustained for seven (7) days) efficacy against *P. aeruginosa*. Allevyn™ dressing exhibited <3.0 log reduction on day one (1) but >3.0 log reduction on subsequent days.

Figure 2 shows daily efficacy for all test dressings against MRSA. All dressings except Allevyn™, Optifoam™, Mepilex™ and Contreet™ adhesive dressings met the efficacy criteria of >3.0 log reduction for each of seven (7) days. These four dressings showed <3.0 log reduction on day one (1) of the study.

Figure 3 shows daily efficacy against VRE. All test dressings except Optifoam™, Contreet™ adhesive and Quadrafoam Polymem™ dressings met the efficacy criteria of >3.0 log reduction for each of seven (7) days. Optifoam and Contreet adhesive exhibited <3.0 log reduction on day 1 and >3.0 log reduction on subsequent days. However, Quadrafoam Polymem dressings failed to exhibit >1.0 log reduction throughout the study.

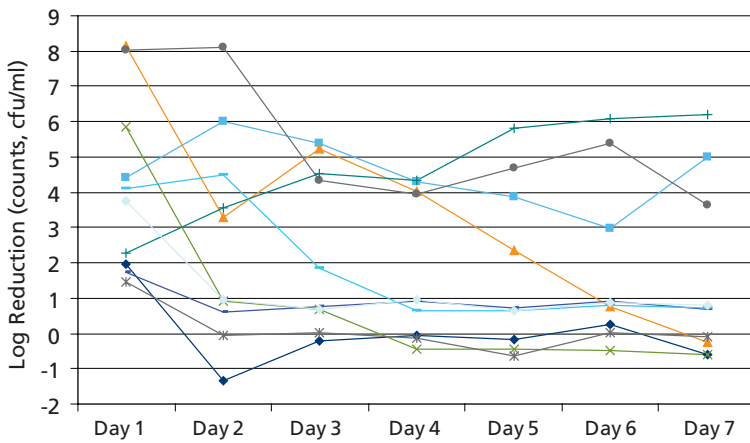
Table 3: 7-Day Efficacy Quick Check

Test Organisms: *P. aeruginosa*, MRSA and VRE

Selection Criteria: ✓ is ≥3.0 log reduction for all three test organisms

Dressing	Efficacy on Day						
	1	2	3	4	5	6	7
Kendall™ AMD Antimicrobial Foam	✓	✓	✓	✓	✓	✓	✓
Acticoat™ Silcryst™ 7 Day	✓	✓	✓	✓			
Contreet™ Silver							
Aquacel™ Ag	✓						
Quadrafoam Polymem Silver™							
Allevyn™ Ag		✓	✓	✓	✓	✓	✓
Optifoam™ Ag							
Mepilex™ Ag		✓					
Contreet™ Adhesive Silver							
Biopatch™	✓	✓	✓	✓	✓	✓	✓

Figure 1: Daily Efficacy as Log Reduction - *P. aeruginosa*



Key (Figures 1-3)

- Kendall™ AMD Antimicrobial Foam
- ▲— Acticoat™ Silcryst 7 Day
- ◆— Contreet™ Silver
- ×— Aquacel™ Ag
- Biopatch™
- *— Quadrafoam Polymem Silver™
- +— Allevyn™ Ag
- Optifoam™ Ag
- Mepilex™ Ag
- ◇— Contreet™ Adhesive Silver

Discussion

PHMB, CHG and silver are broad spectrum antimicrobial agents.²⁻⁴ The activity of these agents when impregnated in wound dressings may vary depending on the total amount, method of impregnation, dressing properties and sustained availability to be effective against microbial contamination during clinical use.⁴⁻⁷ In addition, activity of each agent may be affected differently due to binding with components of wound fluid, negating its antimicrobial attributes.^{4,7} The current study tested PHMB, CHG and silver containing wound dressings via microbial challenge for seven (7) consecutive days in a media without the presence of any component that could significantly and negatively impact the performance of any of the agents in tested dressings. The results indicate that most silver containing dressings exhibited variable and only short term broad spectrum activity per criteria set in the study. Comparatively, PHMB and CHG containing foam dressings showed sustained activity lasting the entire duration of the study.

Conclusion

Under the test conditions, only Kendall™ AMD antimicrobial foam dressings and Biopatch™* dressings exhibited sustained efficacy of ≥ 3.0 log reduction in all three challenge organisms for all seven (7) days. Allevyn™* Ag dressings did not meet the selection criteria on day one (1) but were effective on the subsequent six (6) days. The remaining tested silver containing dressings, regardless of the type, exhibited >3.0 log broad spectrum reduction only for short term of zero (0) to four (4) days.

Figure 2: Daily Efficacy as Log Reduction - MRSA

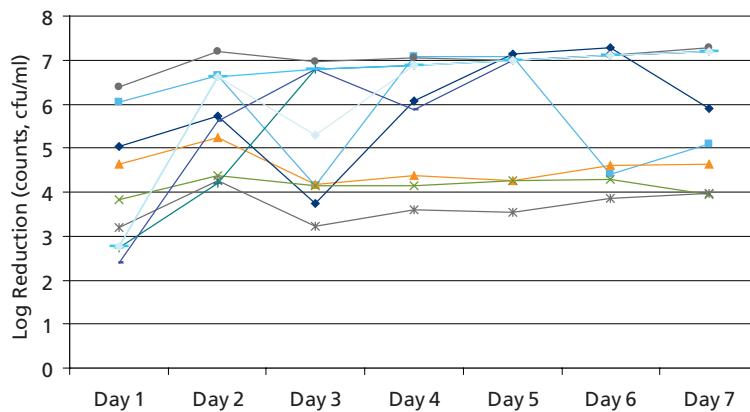
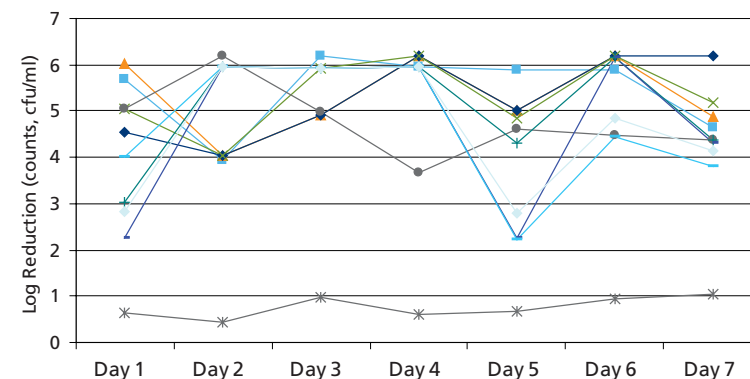


Figure 3: Daily Efficacy as Log Reduction - VRE



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