IN VITRO ANTIMICROBIAL EFFICACY TESTING OF A NEW PHMB FOAM DRESSING

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Introduction: Advanced Medical Solutions have developed a foam dressing (adhesive and non-adhesive) containing Polyhexamethylene Biguanide (PHMB) impregnated into the dressing. The dressing is indicated for moderate to heavily exuding chronic and acute wounds that are at risk of infection. It may be used throughout the healing process on wounds including pressure ulcers, venous leg ulcers, arterial leg ulcer, diabetic ulcers, lacerations, abrasions and other wounds inflicted by trauma.

The majority of chronic wounds (e.g., leg ulcers, foot ulcers, and pressure ulcers), just like contaminated surgical wounds are characterised by a polymicrobial aerobic-anaerobic microflora[1], therefore the ability of the dressing to have broad- spectrum antimicrobial activity is necessary in the management of clinically infected chronic wounds.

The study aims to assess the antimicrobial activity of the PHMB foam dressing against the following microorganisms: *MRSE* (ATCC 51625), *MRSA* (ATCC43300), *E. faecalis* (ATCC 51299), *S. pyogenes* (ATCC 19615), *S.epidermidis* (ATCC 12228), *E. coli* (ATCC 8739), *C.albicans* (ATCC 10231), *S. aureus* (ATCC 6538), and *P. aeruginosa* (ATCC 9027), over a 7 day period using a simulated wound fluid model.

Method: Representative colonies of the challenge organisms were harvested, separately, in 0.1% Peptone Solution and adjusted to approximately 2x108cfu/ml using a spectrophotometer. A 0.2ml volume of the challenge suspension was added to a 20ml volume of Simulated Wound Fluid (SWF). A standard plate count (T0hr) was performed on this working suspension.

Each test and control (2cm x 2cm) item was added to the inoculated wound fluid flask and shaken for approximately 15 seconds, prior to being incubated at 37°C (±1°C) for the duration of the 7 day test period.

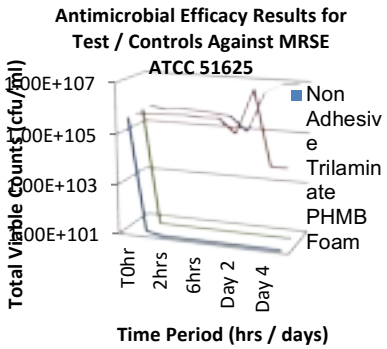
The incubation time points tested were 0, 1, 2, 4, & 6 hrs, and 1,2,3,4,& 7 days.

At each time point, the sample was manually shaken for at least 15 seconds prior to removing a 0.5ml volume of the suspension and transferring it into a 4.5ml volume of Recovery Medium 2 (RM2). Serial dilutions were performed in RM2 and duplicate pour plates prepared to determine the remaining concentration of microorganisms. The plates were poured with Tryptone Soya Agar for the bacteria and Sabouraud Dextrose Agar, for the yeast.

All agar plates were allowed to dry, prior to inverting and incubating at the appropriate temperature (e.g. 30-35°C, 20-25°C) for a minimum of 48hrs.

Following incubation the colonies on each plate were counted and the result expressed as average cfu/ml, and adjusted for the

Results



The Effect of the PHMB Trilaminate Foam Dressing on the Viability of MRSE Over A 7 Day Period.

Discussion

The *in vitro* antimicrobial efficacy testing of the PHMB foam dressing (adhesive and non-adhesive) developed at Advanced Medical Solutions, has demonstrated that the product has broad spectrum antimicrobial activity. The data generated has allowed for the time period to be determined at which a significant log reduction (i.e > 4) is obtained for the 2 dressing types against each challenge organism, which demonstrates the majority of the organisms tested, including *MRSA, VRE, S. pyogenes* and *P. aeruginosa* to have excellent antimicrobial efficacy following 1-6hrs treatment

References

[1] 'Microbiological evaluation of antibiotic resistance in bacterial flora from skin wounds' Adenike A.O. Ogunshe *et al*... JPBMS, 2012, 22 (06)

COMPARATIVE *IN VITRO* STUDY ASSESSING THE ANTIMICROBIAL ACTIVITY OF SEVERAL FOAM DRESSINGS.

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Background

Antimicrobial foam dressings have been used to prevent or manage infection in a wide variety of wounds. Even greater significance maybe placed on to the role of topical antiseptics/antimicrobial agents, especially with the lack of new antibiotic therapies emerging. PHMB (Polyhexamethylene Biguanide) is a broad spectrum antimicrobial agent that has been used commercially for over 60 years in contact lens solution. The PHMB agent has the ability to disrupt the bacterial cell wall. This polymeric biguanide reacts with acidic membrane lipids and permeability, and eventual organism death[1]
Advanced Medical Solutions have developed a trilaminate foam dressing (adhesive and non adhesive) with PHMB impregnated into the dressing. The dressing is indicated for moderately to heavily exuding chronic and acute wounds that are at risk of infection.

Aim

The primary objective of this study was to assess the antimicrobial activity of several PHMB and Silver foam dressings, against 3 common wound isolates, *P. aeruginosa* (NCIMB 8626), *S. aureus* (NCIMB 9518) and *C. albicans* (NCPF 3179), over a 7 day period.

Method

Representative colonies of the challenge organisms, were dispersed, separately, into 0.1% Bacteriological Peptone solution until a final population concentration of approximately 2 x 10^7 cfu/ml was determined with the use of an optical density (OD_{550nm}) machine.
A 2ml volume of the challenge microorganism suspension was added to an 18ml volume of simulated wound fluid (SWF), giving approximately 2.0 x 10^6 cfu/ml per test / control container. A standard plate count (T0hr) was performed on this working suspension to confirm the initial inoculum concentration.

A 2cm x 2cm sample of each sterile, test dressing was aseptically cut and added to the inoculated SWF and swirled to mix (Figure 1). A negative control dressing was also prepared. All test / control containers were incubated at 37°C (±2°C) during the 7 day test. At each test point (i.e. 6hrs, 24hrs, 48hrs, 72hrs, 96hrs and 7 days) the containers were removed from the incubator and gently swirled. A volume of the test / controls were sampled and serial dilutions performed in D/E Neutralising Broth (DENB), with the appropriate dilutions being plated out, in duplicate onto pre- dried nutritional agar plates, and incubated at the appropriate temperature (e.g. 30-35°C, 20-25°C) for at least 48hrs.
Following incubation, the number of colonies on each plate were counted and expressed as cfu/ml, taking into consideration the dilution factor. The average count (i.e. mean of the duplicate count plates) was calculated, and this is used with the initial inoculum count to determine the log reduction.

Results

The average total viable counts per ml of the test / control dressings against the challenge organisms P. aeruginosa, S.aureus and C. albicans, and the calculated log reductions are illustrated in Figures 2-7

Discussion

The test results demonstrate the test dressings to have excellent antimicrobial activity against the challenge organisms within the 7 day test period. The data does indicate the PHMB foam dressings to have an increased antimicrobial efficacy within a shorter time period i.e. 6 hrs, compared to the silver foam dressing, for challenge organisms *Pseudomonas aeruginosa* and *Staphylococcus aureus*

Conclusion

The study has enabled for comparisons to be determined with regards to the antimicrobial activity of the PHMB and Silver containing foam dressings

The study has enabled for comparisons to be determined with regards to the antimicrobial activity of the PHMB and.
In-vitro data supports PHMB foam dressing as an optimal choice for the health care provider when treating moderately to heavily exuding chronic and acute wounds that are infected or at risk of infection.

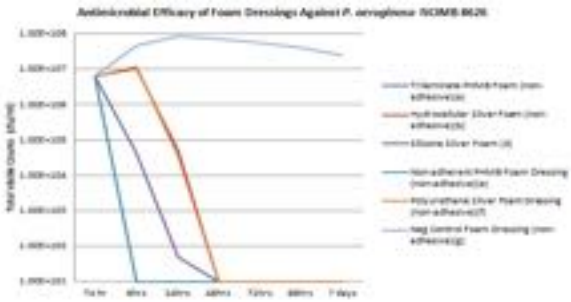

Figure 2 : Average TVCs for test/control Dressings Against *P. Aeruginosa* NCIMB 8626 Over 7 Days.

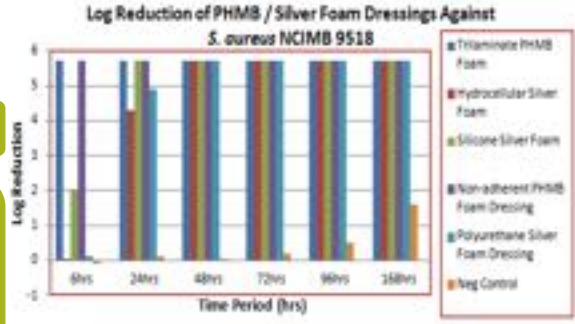

Figure 7: Log Reduction Values of PHMB / Silver Foam Against *C. albicans* Over 7 Days

References
[1] 'Efficacy of Polyhexamethylene Biguanide-containing Antimicrobial Foam Dressing Against MRSA Relative to Standard Foam Dressing' *Kelly R. Kirker, et al* (WOUNDS 2009;21(9):229–233)