Objective Evaluation of a Novel Antimicrobial Topical Spray to Reduce Wound Bioburden

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Introduction

Chronic infection of wounds are commonplace [1, 2] accounting for significant economic and quality of life burdens for patients [1, 3]. High levels of bacteria, multi-resistant organisms, and biofilm may be imperceptible to the naked eye of providers. Wound biofilm exists in most chronic wounds and plays a significant role in infection and delayed wound healing. Currently, weekly surgical debridement is used to disrupt biofilm and prophylactic antibiotics are often employed in attempt to control local wound infection and prevent its systemic spread . The overuse of antibiotics has led to serious consequences in the overall management of patients, and weekly surgical debridement options are not practical for all patients or within the scope of some care providers.

Disruption of the biofilm strategies other than debridement include wound cleansing. However, a previous study[5] demonstrates that normal saline was not effective in reducing wound bioburden. Commercial cleansers may include non-selective biocides that are detrimental to wound healing[6] or address only the planktonic microorganisms. When considering the use of a commercial cleanser, the clinician must also take into consideration the potential cytotoxicity of the solution, appropriate concentrations and the individual wound or patient impact as may be found with the odor of the product.

This evaluation looks at the disruption of the biofilm extracellular polymeric substances (EPS) which creates much of the microbial resistance of biofilm using of a novel antimicrobial wound cleansing spray (AWC). This AWC has been formulated with synergistic mechanisms intended to safely eliminate biofilms by disrupting the EPS so that the antimicrobial can target and kill microbes.

Methods

Wound bioburden was documented using a hand-held bacterial tissue fluorescence device** prior to treatment, after standard saline cleansing procedure, 15 seconds after AWC application and after a 5-minute dressing application of AWC in wounds of multiple etiology. Bacterial fluorescence imaging, when excited by 405 nm violet light, tissues fluoresce green while bacteria fluoresce red (e.g. Staphylococcus aureus) or cyan (e.g. Pseudomonas aeruginosa). This enables real-time, point-of-care detection and localization of bioburden (≥ 10^4 CFU/g) within and around wounds. Bacterial tissue fluorescence provides real time noninvasive results of bacterial bioburden and activity of bacterial species.
Mature Biofilm eradication was also reviewed in a pig explant model through a research laboratory***. Treatment was performed as 10-minute soak in cleanser, wipe with sterile swab, apply gauze soaked with cleanser.Single treatment: half of samples only treated at time zero and then not touched until 72 hours when kill efficacy was determined. Daily treatment; half of samples were treated at time zero, 24 hours and 48 hours (total of 3 times). Then at 72 hours kill efficacy was determined.

Methods

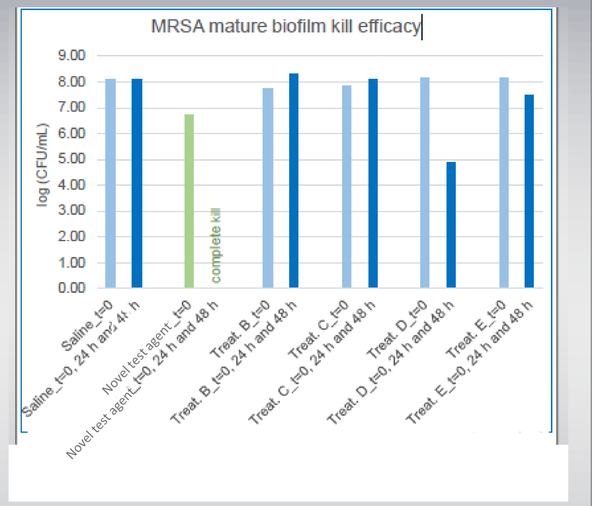


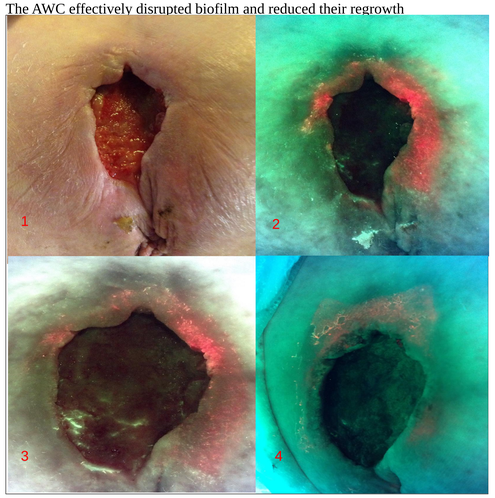
Figure #1

In the ex-vivo pig model, the mature biofilm model AWC reduced MRSA mature biofilm versus other commercial cleansers. (Fig 1) The explants for this study were a standard 7/16" diameter porcine dermal tissue samples, with an artificial wound of approximately 2mm diameter and 1-1.5 mm depth. The tissue was sterilized with chlorine gas prior to use. The explants incubated on soft agar plates containing AWC or commercial agent with daily treatment (time 0, 24 hrs, 48 hrs) and single evaluation time of 72 hours.

The AWC demonstrated a superior performance to other commercial cleansers for not only MRSA mature biofilm, but also when tested in the same manner against Pseudomonas aeruginosa and Candida albicans mature biofilms.

Results

- ✓ Fluorescence images after initial saline cleanse, demonstrated bacterial (red) fluorescence present to all periwound areas
- ✓ 15 seconds after use of the novel AWC, fluorescence changes were noted consistent with disruption of biofilm and biocidal activity of planktonic organisms
- ✓ The wound microbial biofilms demonstrated biocidal activity by both AWC spray and soak applications
- ✓ The AWC effectively disrupted biofilm and reduced their regrowth



1) Wound and Periwound Pre-fluorescence after saline cleanse
2) Fluorescence after saline cleanse prior to AWC treatment
3) 15 Seconds after AWC - Note the dispersing red porphyrins are endogenously produced in the bacterial heme pathway
4) Day 7 – Patient received daily 5-minute AWC soak to wound bed only

Conclusions

Use of this novel AWC can be readily implemented during standard wound care in any clinical setting by any provider to impact the wound bioburden that is present in most wounds. The AWC provides a clean scent which may impact patient morale and satisfaction. The results of this evaluation also indicated that the AWC is effective against planktonic, immature and mature biofilms, and reduced their regrowth.

Reduction in wound bioburden with an AWC may allow for the discontinuation of prophylactic antibiotic therapy in chronic wounds consistent with Centers for Disease Control recommendations for antibiotic stewardship programs.

Further study is warranted including long-term healing outcomes and systemic antibiotic usage.

References

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* BIAKÖS™, Sanara Med Tech, Fort Worth, Texas.
** Moleculight i:X™, Smith & Nephew, Dallas, Texas
*** Rochal Industries LLC, San Antonio, Texas