Evaluation of Field Shield Wound Dressing for Improved Prolonged Field Care Management and Healing Outcomes for Large Burns Contaminated with Multi-Drug Resistant Bacteria in a Swine Model

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Introduction

- Burn injuries are common to all military conflicts, making up 5-10% of casualties, and carry a high risk of infection that can lead to significant delays in healing and return to Service.
- With ~38% of traumatic injuries colonized with infectious bacteria in the field, there is a clear need for improved wound care in the field to mitigate infection development.
- There is a current capability gap for field capable therapeutics that can effectively control infection and positively impact healing outcomes of large TBSA burns.
- The study presented herein evaluates management of large TBSA burn wounds contaminated with MRSA in a simulated prolonged field care (PFC) treatment model.
- This study investigated if a novel spray on wound dressing, Field Shield Wound Dressing (FSWD), can mitigate infection equally or better than the current field SOC antimicrobial dressing (Silverlon) in a validated porcine model at USAISR.

Objectives

- Determine the ability of FSWD wound dressing products to improve management of 17% TBSA burns exposed to methicillin-resistant Staphylococcus aureus (MRSA) in a prolonged field care (PFC) treatment scenario.
- Evaluate if FSWD can mitigate burn progression in PFC.
- Evaluate if FSWD can effectively delay surgical intervention by supporting early wound management when applied at near point-of-injury.

Methods

- 3 female Yorkshire swine each receive 12 large (135cm2) deep partial thickness burn injuries on the dorsum, resulting in approximately 17% TBSA burns.
- Dressings were block randomized per animal, with each receiving all four dressings (FSWD 1, FSWD 2, Silverlon® (SOC), and ASAP silver hydrogel).
- Wounds were unroofed post-burn and micropores were created in the eschar to allow bacterial penetration before inoculating with 108 CFU of MRSA.
- Burns were covered for 2 hours then dressed with one of the four treatments followed by secondary dressings.
- Treatment followed PFC regimen, with only secondary dressing change on Day 1, then beginning SOC treatment regimen at 72 hours after sharp debridement.
- Dressing changes followed SOC after 72 hours until Day 14, with only secondary dressing changes weekly thereafter until Day 35.

Results

Wound closure was ultimately similar between all treatments with closure ranging from 26% to 31% wound closure (FSWD1= 25.93%; FSWD2= 26.90%; Silverlon= 26.07%; ASAP= 30.28%) on Day 35 as compared to Day 0.

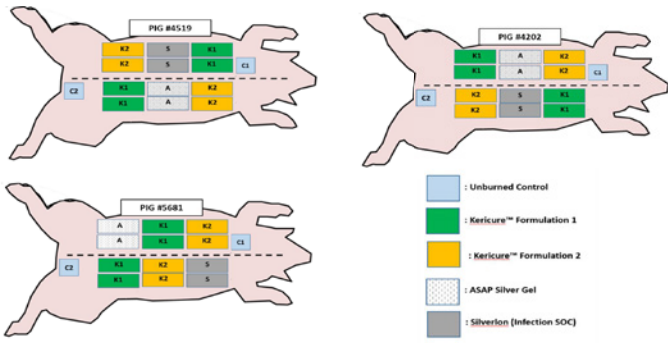


Figure 1. (Top) Schematic of burn placement and block treatment layout. (Bottom) Timeline of study procedures, procedural tasks.

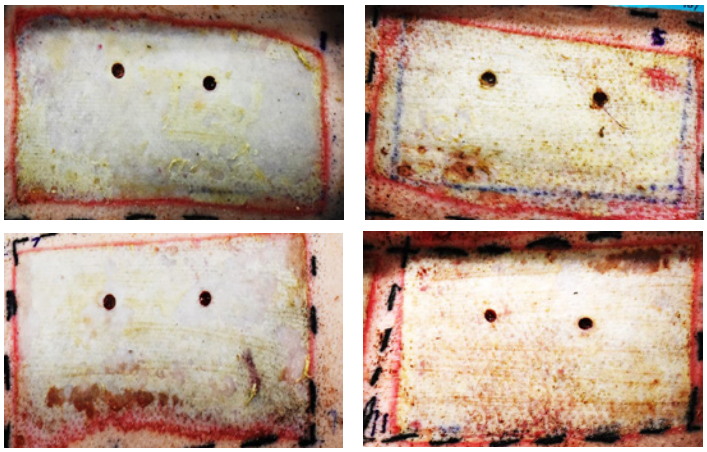


Figure 2. Day 3 dressing removal prior to cleaning and surgical debridement for FSWD1 (top left), FSWD2 (bottom left), Silverlon (top right) and ASAP (bottom right). Slough was easily removed for FSWD, supporting autolytic debridement.

Results

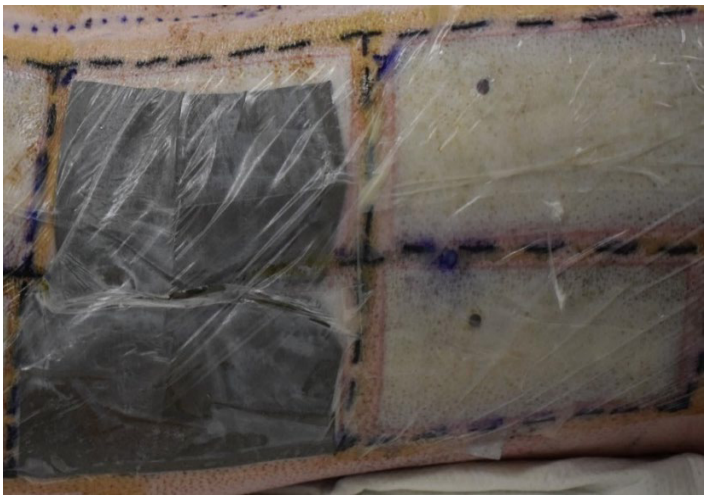


Figure 3. Burn wounds visualized on Day 1 with Tegaderm secured over the treatments. Left column burns are covered with Silverlon. Right column burns are covered with Field Shield (FSWD1).

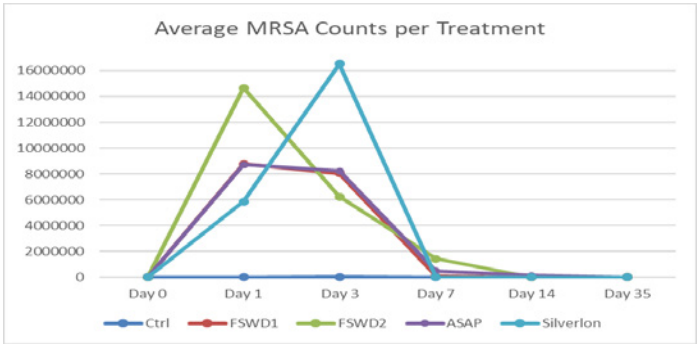


Figure 4. Average MRSA CFU counts for burns throughout the study. MRSA bacterial counts are reported as CFU/gram biopsy tissue.

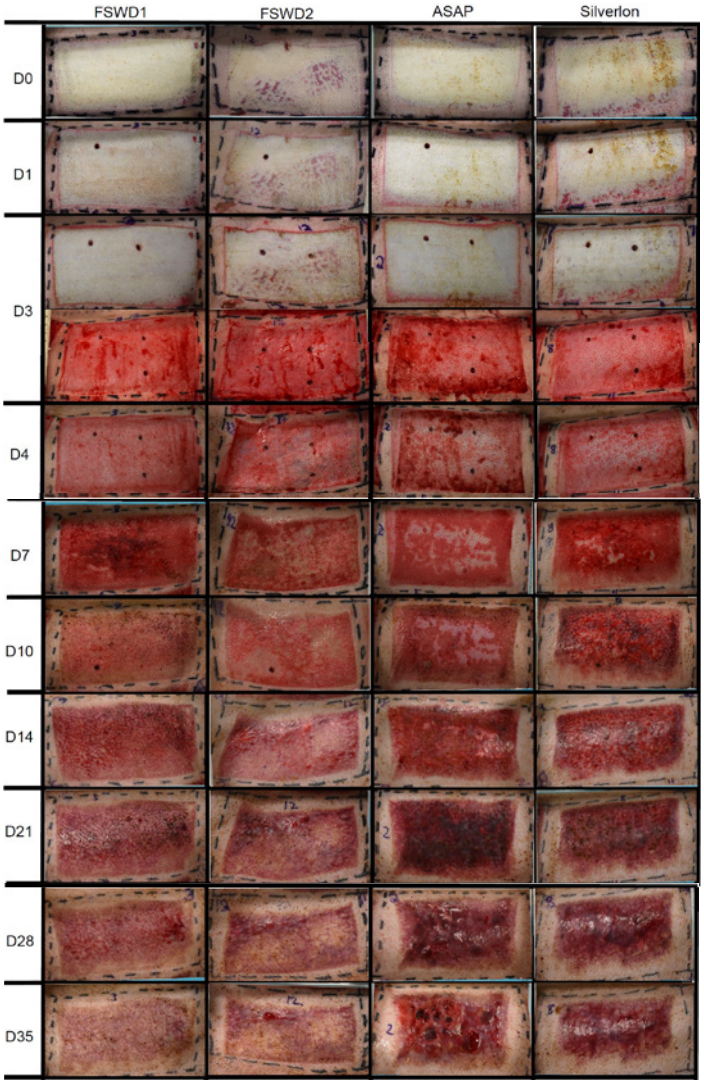


Figure 5. Gross Nikon® images of wounds on each observation day (animal 4202).

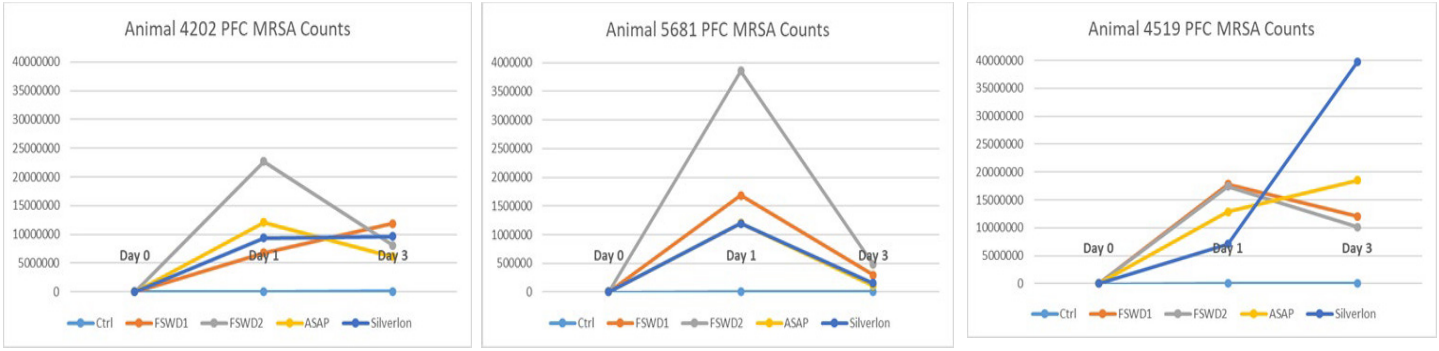
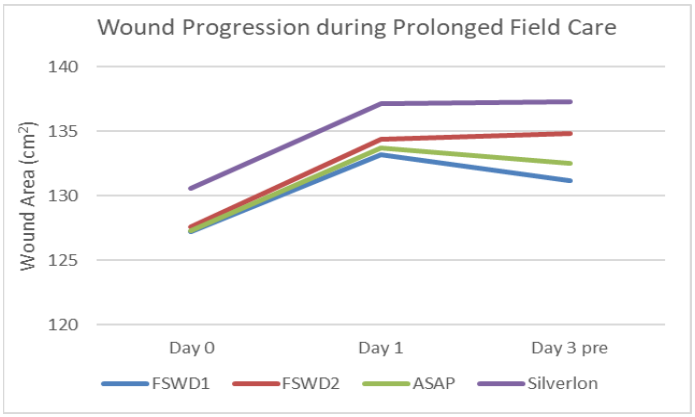


Figure 6. Expanded data for PFC treatment period. All 3 hydrogel dressings (Field Shield and ASAP) showed a marked decrease in the number of CFUs from Day 1 (baseline infection amount) to Day 3 (prior to surgical debridement), whereas Silverlon's data was highly variable, with an average increase to 1.6x107 CFU/gram on Day 3.

Results



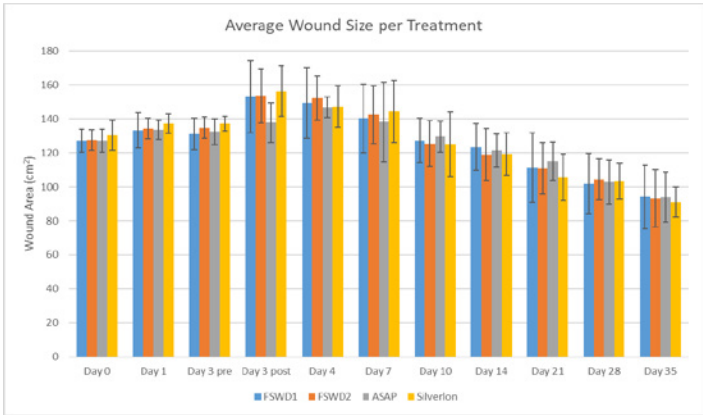


Figure 7. Silhouette Star® data of wound surface area taken throughout the study (bottom) and expanded for PFC period (Day 0 to 3 pre-debridement) (top). Data represents the average of all 3 animals. Silverlon burns had statistically significant expansion during PFC treatment window, whereas FSWD1 and ASAP dressings showed early wound healing and significantly less expansion during the same period. All burns had statistically similar wound closure by Day 35.

Conclusions

- FSWD showed a greater propensity for mitigating infection during PFC with a single dressing application than Silverlon, with all treatments having significantly reduced colony counts by Day 7 and non-infectious levels by Day 14.
- Histologically, bacterial scores of 0 to 0.5 were recorded for throughout the study, where presumably the MRSA scores in Figures 4 and 6 were limited to surface bacteria, indicating the dressings minimized infection within the burns, mitigating infection, biofilm or sepsis development in PFC.
- Lower surface area expansion was measured for the Field Shield managed burns as compared to Silverlon in PFC, with early wound healing initiated during this period for FSWD1.
- FSWD wounds appeared cleaner overall, with observed autolytic debridement at dressing changes and less exudate observed throughout treatment and absence of necrosis or edema at Day 35 as compared to Silverlon and ASAP.
- The data from this study supports the hypothesis that Field Shield Wound Dressings effectively mitigates infection development, sepsis, and burn wound expansion when applied at point-of-injury in prehospital care settings.

Acknowledgements

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