Soft Materials, Hard Hit on Bacteria: *Antibacterial Medical Foam*

Abstract ID: MHSRS-26-3787
Poster #: 106

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Vital Foams Tactical (VFT)

Polymicrobial and Hemostatic Management for Front-Line Wounds

Within military personnel with deployment-related injuries, 35% were diagnosed with one or more infections during initial hospitalization [1]

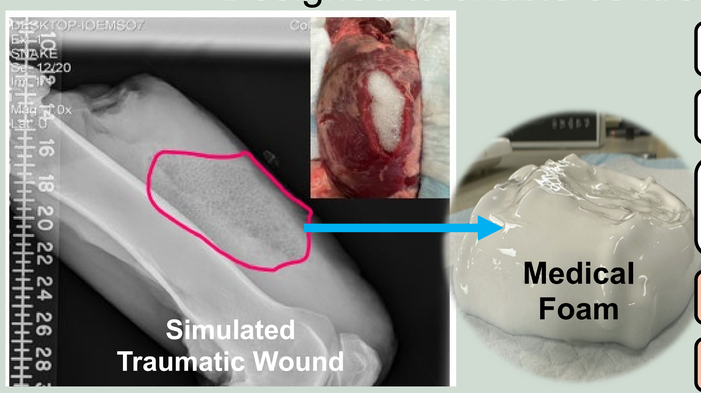
Optimal delivery of therapeutics on the battlefield has yet to be determined

Attributes Needed for Battlefield Efficacy
- ❖ Wound Filling
- ❖ Wound Retention
- ❖ Readily Deployable
- ❖ Rapid & Sustained Therapeutic Action

Our Solution

A flowable, non-solidifying, absorbable biopolymer-based Medical Foam (MF)

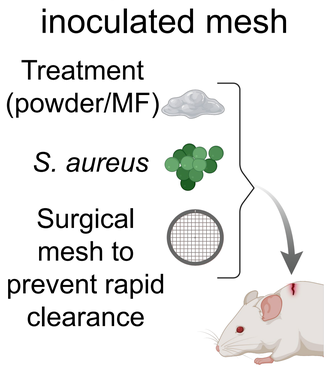
- Designed to enable controlled and uniform topical delivery *in situ* -



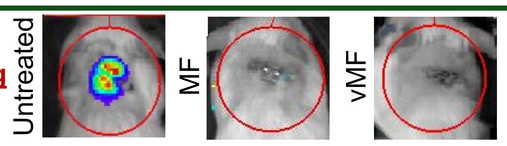
- Fills and conforms to complex wound geometries
- Remains in and penetrates the wound during transport
- Rapid local therapeutic action in wounds with damaged blood supply
- **Provides Polymicrobial Protection**
- **Provides Hemostatic Control**

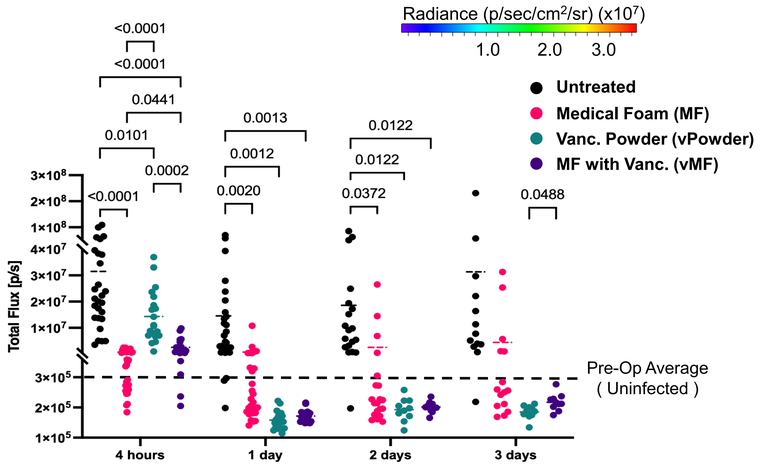
Assessment of Medical Foam in an *In Vivo* Infection Model

Model:
Acute infection and wound model simulated by the implantation of Staph *aureus*-inoculated mesh



1. In Life Antibacterial Testing (IVIS)

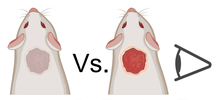


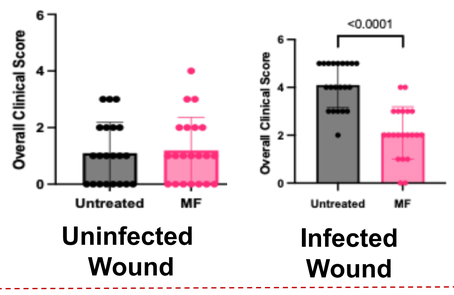


➢ MF alone reduced bacterial bioburden within 4 hours
➢ MF did not diminish the efficacy of integrated antibiotics

2. Screening Local Biocompatibility

Clinical wound scoring of overall appearance by N = 7 blind scorers

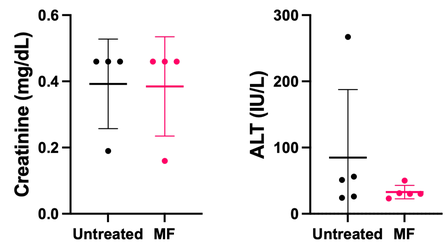




3. Screening Systematic Toxicity

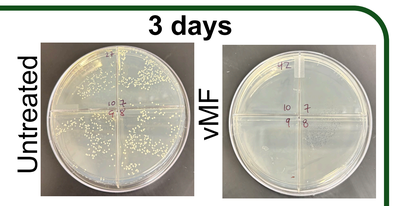
Blood was drawn for CBC and blood chem panels to assess systemic effects

CBC Results for 48 hours

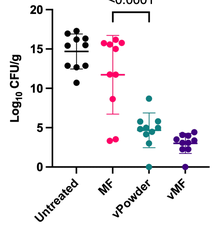


➢ MF did not demonstrate systematic toxicity

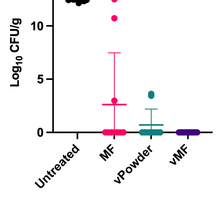
4. Muscle Biopsy Bacteria Counts (Quantitative Culture)



1 Day

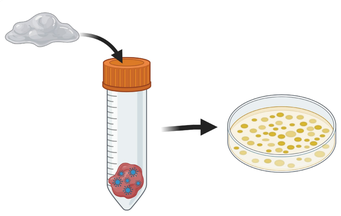


3 Days



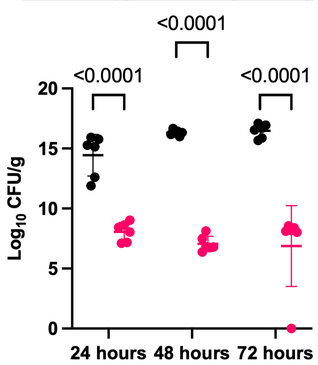
➢ MF demonstrated continuous bacteria killing

Assessment of Extended *In Vitro* Antibacterial Activity

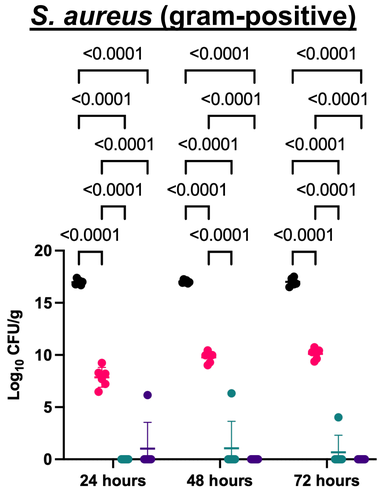


- Untreated
- Medical Foam (MF)
- Vancomycin Powder (vPowder)
- MF with Vancomycin (vMF)

***E. coli* (gram-negative)**



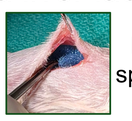
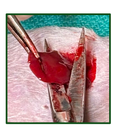
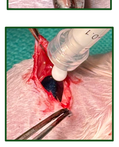
***S. aureus* (gram-positive)**



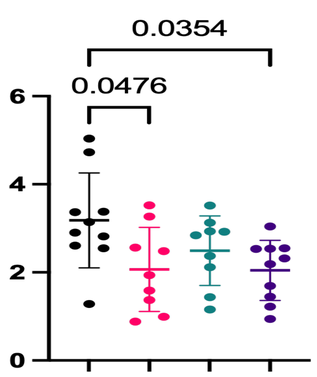
➢ MF was effective against gram-positive & gram-negative bacteria

Assessment of *In Vivo* Hemostatic Efficacy

Model: Uncontrolled hemorrhagic shock modeled via liver laceration in mice [2]

1.  Pre-weighed absorbable sponges were placed in the abdominal cavity
2.  75% of the left middle liver lobe was resected and weighed
3.  Treatment applied to the non-compressible wound
4.  After 10 min, sponges were retrieved and weighed to quantify blood loss

- Untreated
- Medical Foam (MF)
- Tranexamic acid (TXA)
- MF with Tranexamic acid (MF + TXA)



➢ MF alone reduced blood loss by 45% compared to untreated injury
➢ MF effectively topically delivered TXA

Current Work

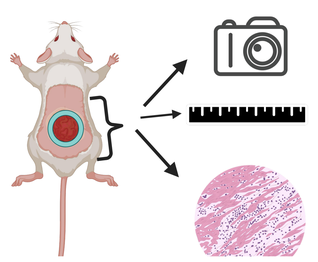
Delivery Device

Prototype a field-deployable SWAP-optimized device

Target Product Profile (TPP)
- ❖ One-handed Deployment
- ❖ < 10 sec. application time
- ❖ No cold-chain requirements
- ❖ 18-month shelf life
- ❖ IFAC compatible by size and weight
- ❖ Distribution of a football-sized amount of Medical Foam

Assessment of Wound Healing Capabilities via an Open Wound Rodent Model

Hypothesis: Inherent properties of MF will expedite wound healing due to the bioactivity of chitosan [3]



In vivo tracking the wound over time via photos and area measurements

Ex vivo tissue-level analysis via histology

Acknowledgements and Disclosures : This work was supported by the Department of War under Award No. HT9425-25-1-0066, titled *Multifunctional Medical Foam (MF) to Enhance Acute Wound Management In Situ*. The authors McGilvray, Pezzanite, Dow, and Alfonso are co-founding members of Vital Foams, Inc., which holds the intellectual property underlying the technology described herein. The technology discussed in this work is investigational and has not been approved by the U.S. Food and Drug Administration.

References [1] Tribble, D., et al. 2018
[2] Dyer, M., et al. 2017; [3] Singh, R., Shitiz, K., Singh, A. 2017