10-29-2019

A Novel Polyelectrolyte Multilayer Nanofilm-Based Synthetic Bioresorbable Antimicrobial Matrix Accelerated Healing of Chronic Wounds in a Prospective Clinical Evaluation

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A Novel Bioresorbable Antimicrobial Matrix Accelerated Healing of Chronic Wounds in a Prospective Clinical Trial

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This research was supported (in whole or in part) by HCA Healthcare and/or an HCA Healthcare affiliated entity. The views expressed in this publication represent those of the author(s) and do not necessarily represent the official views of HCA Healthcare or any of its affiliated entities.

Disclosures

The presenter of this presentation has no financial interest.

This research was partially funded by the NIH Small Business Innovation Research Phase II grant (5R43AR061913-02A1)

Co-Authors Schurr, Crawford, Agarwal, and Pranami are affiliated with and/or employed by Imbed Biosciences Inc, manufacturer of MicroLyte® Ag. The terms of this arrangement have been reviewed and approved by the American College of Surgeons in accordance with its policy on objectivity in research.

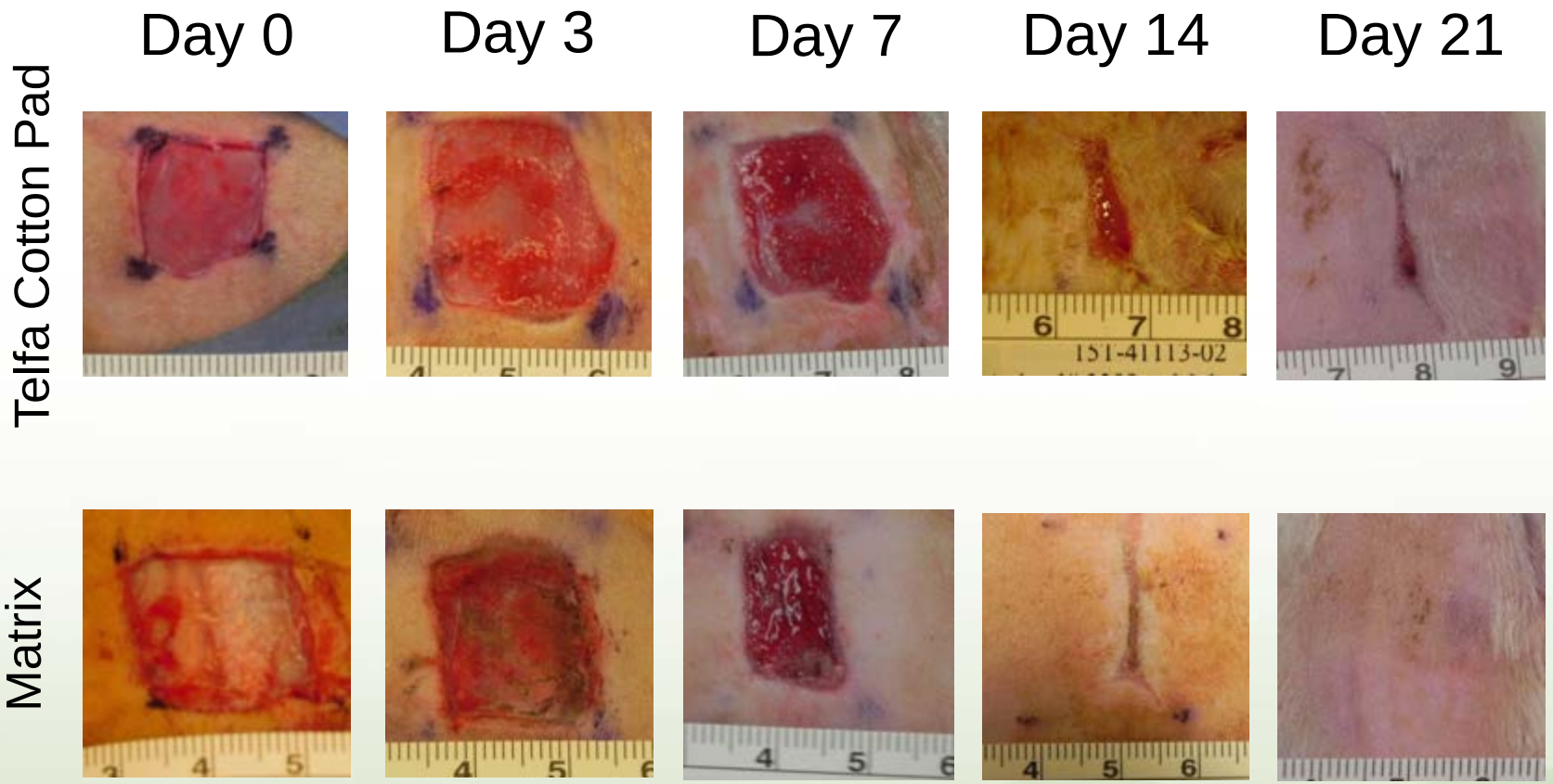
Background

- Chronic wounds affect all medical and surgical disciplines
  - Chronic wound = incomplete healing or lack of treatment response at 6 weeks
  - Annual cost approaches $25 billion in the United States
- New approaches for improving the efficacy of treatment of chronic wounds is an area of significant research
- Surgical debridement reduces bacterial counts, but bacteria regrow from the wound bed interstices
- A nanofilm-based antimicrobial matrix that intimately adheres directly to the wound surface may improve healing in these complex and difficult to heal wounds

Bioresorbable antimicrobial matrix: **heals clean wounds faster**

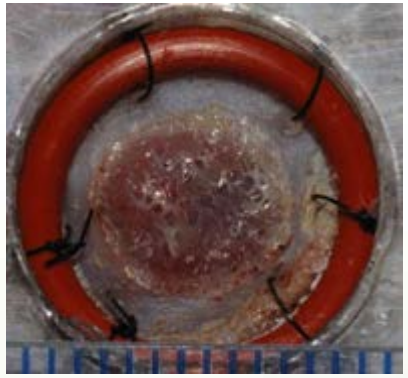
- *in vitro* studies demonstrate that the matrix results in 6 Log_{10} CFU reduction of *S. aureus and P. aeruginosa* over 72 h

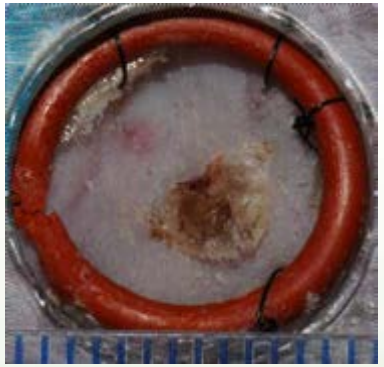
- *in vivo* murine studies demonstrate acceleration of healing in clean wounds



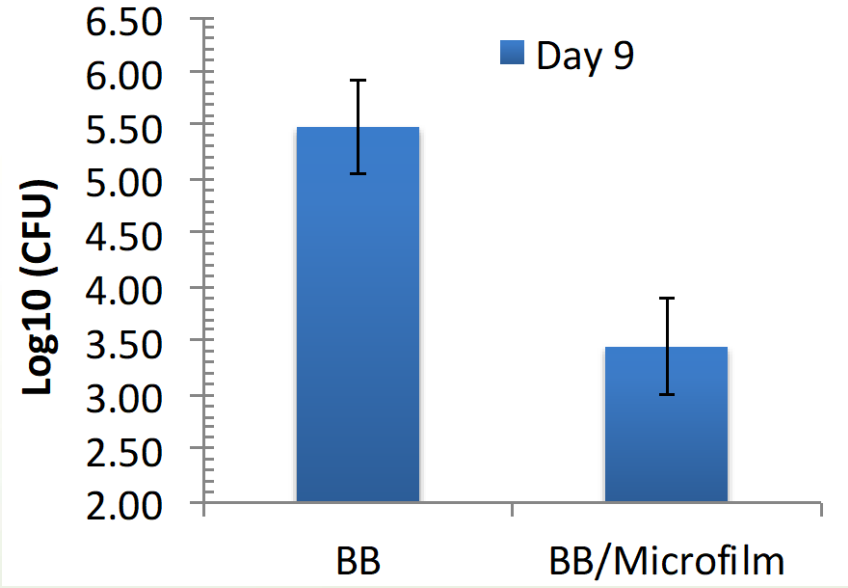
Bioresorbable antimicrobial matrix: **expedites closure of contaminated wounds**

Mean wound closure: 52%





Mean wound closure: 90%



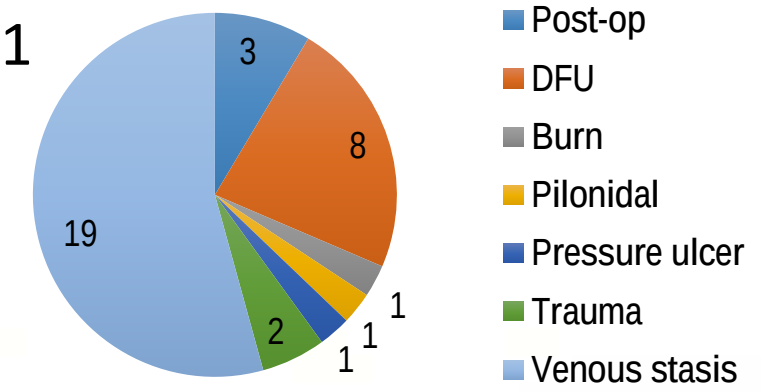
Full-thickness wounds (8 mm dia) in mice, splinted and inoculated with 10^5 CFU of *S. aureus* on day of surgery (n=20 wounds/group), harvested after 9 days post-surgery
Data repeated in mice and pigs with a variety of collagen based dressings

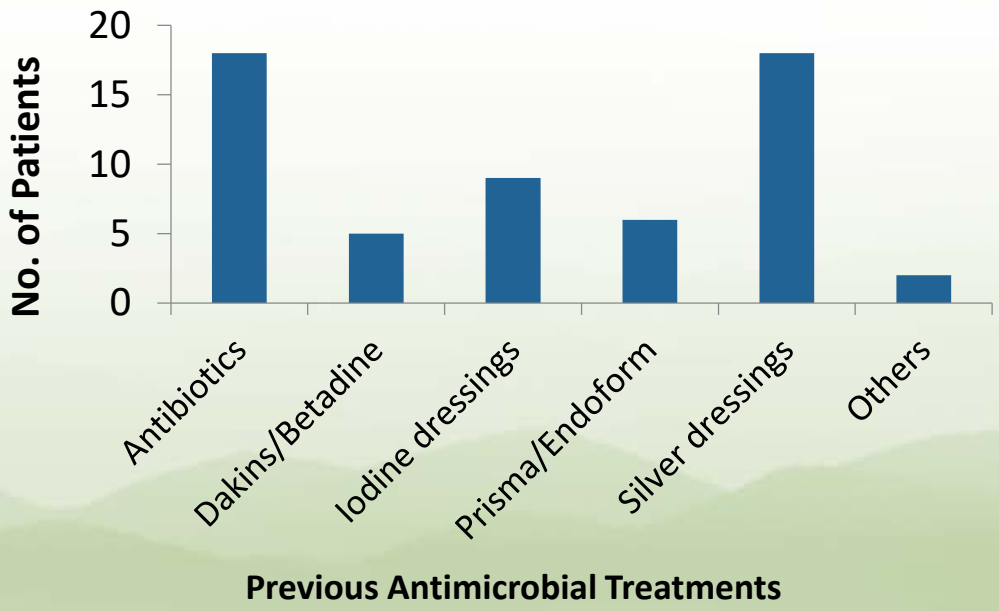
Methods

- IRB-approved prospective evaluation of 32 human subjects (35 total wounds)
  - Existing patients of Wound Care Center
  - Chronic wounds previously treated unsuccessfully
- Antimicrobial Matrix applied at wound care visits over study period
  - Wound measurements
  - Photographs
  - Patient satisfaction survey
- Endpoints
  - Primary: Wound Closure at 3 Weeks
  - Secondary: Wound Closure at up to 12 Weeks

“Clinical evaluation of a bioresorbable nanofilm-based antimicrobial matrix in complex chronic wounds.” ClinicalTrials.gov Identifier: NCT 03204851

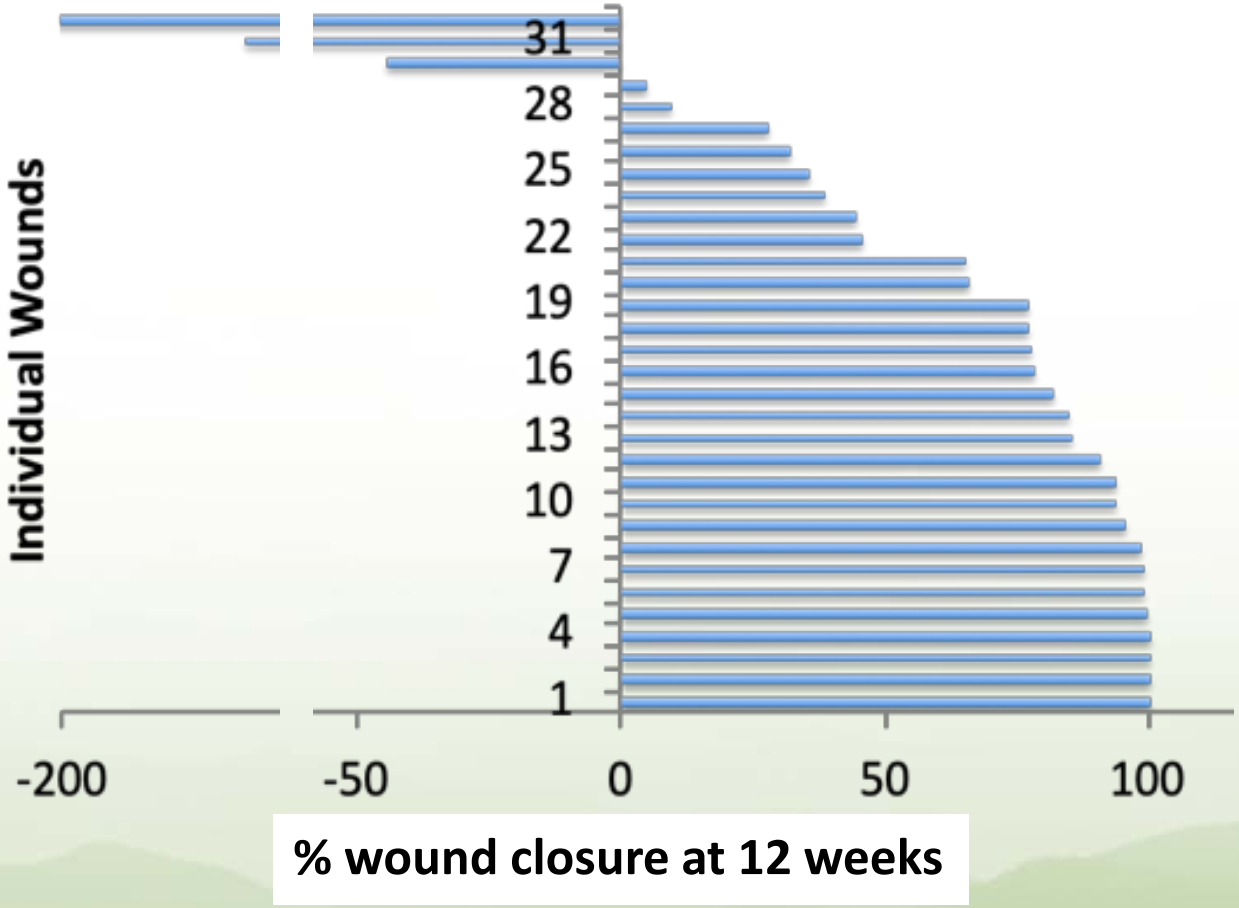
- IRB-approved prospective evaluation
- *At the baseline, all wounds were non-healing for avg 40 weeks and had not responded to systemic antibiotics and topical antimicrobial agents*
- Treatment: standard of care + matrix on the wound surface with each dressing change (1-3x / week)





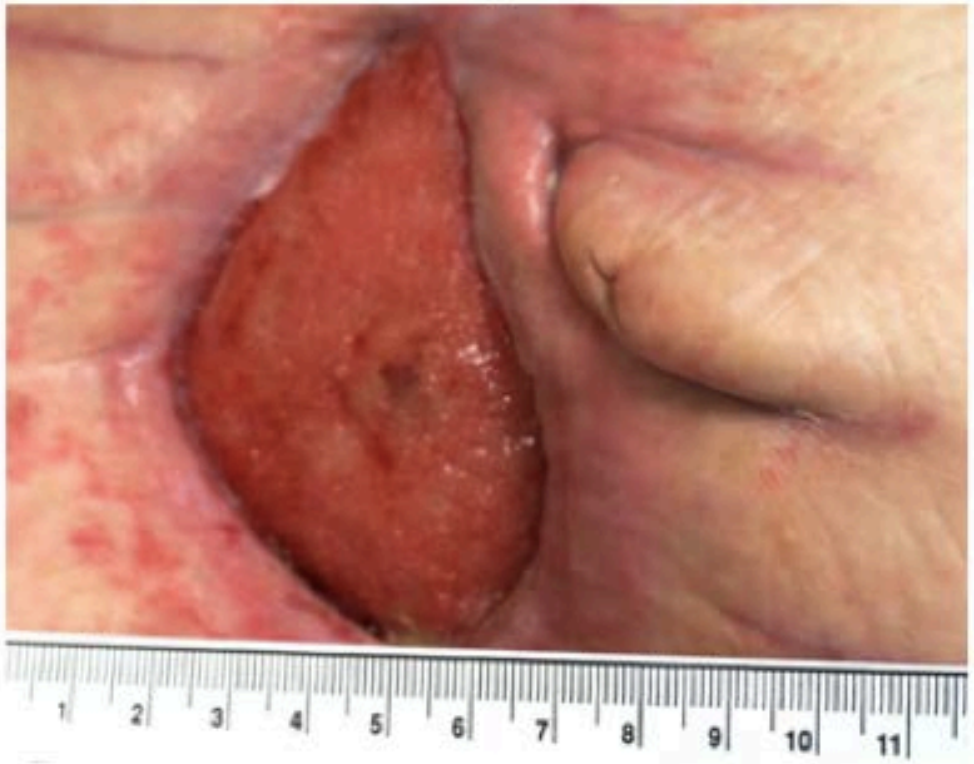
Bioresorbable nanofilm-based antimicrobial matrix: **expedites closure of chronic wounds in patients**

- ***72% (23/32) had average 66% wound closure @ 3wks***
- *91% (29/32) of all wounds improved with an average wound closure of 73% @ 12 wks*

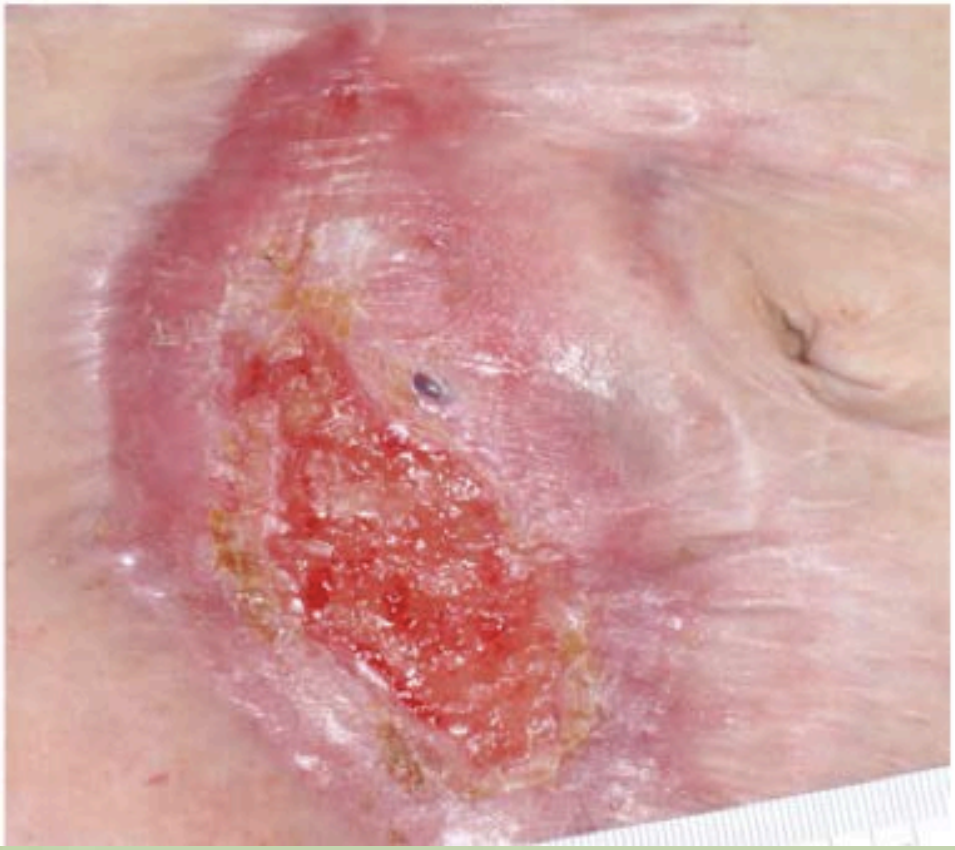


Age	Wound Type	Days Stalled	Initial Wound Size (cm^2)	Final Wound Size (cm^2)	Treatment Days	Application Frequency	Wound Closure (%)
61	Post-op	259	19.5	11.3	95	2-3x / wk	42

Day 0

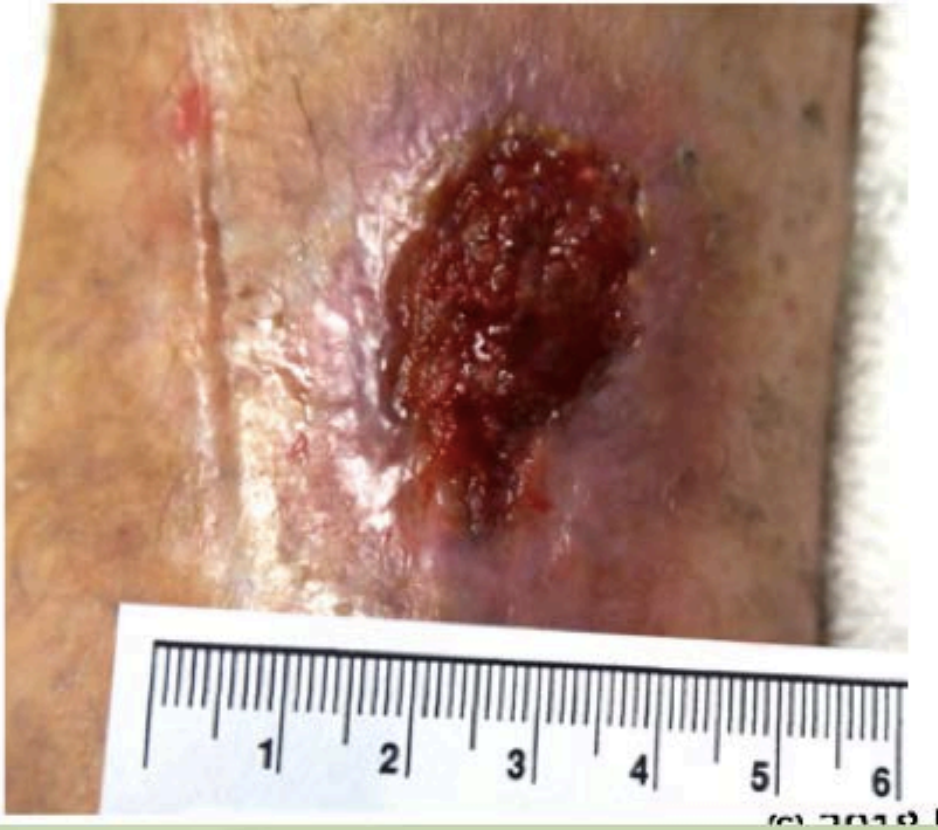


Day 95

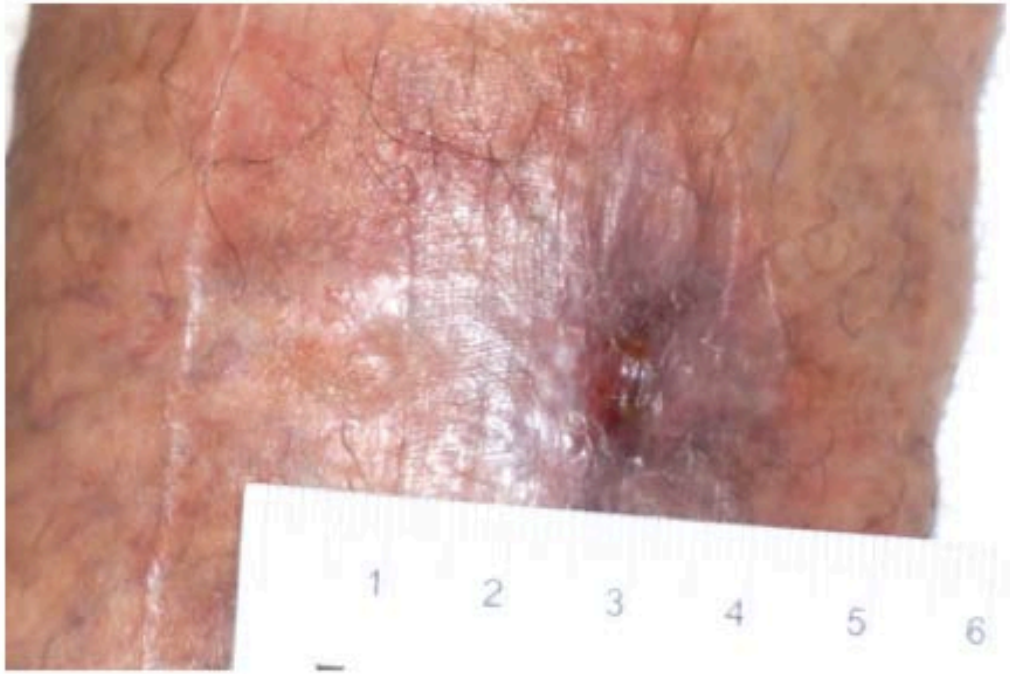


Age	Wound Type	Days Stalled	Initial Wound Size (cm^2)	Final Wound Size (cm^2)	Treatment Days	Application Frequency	Wound Closure (%)
58	Venous Stasis Ulcer	363	4.6	0.0	85	1x / wk	100

Day 0

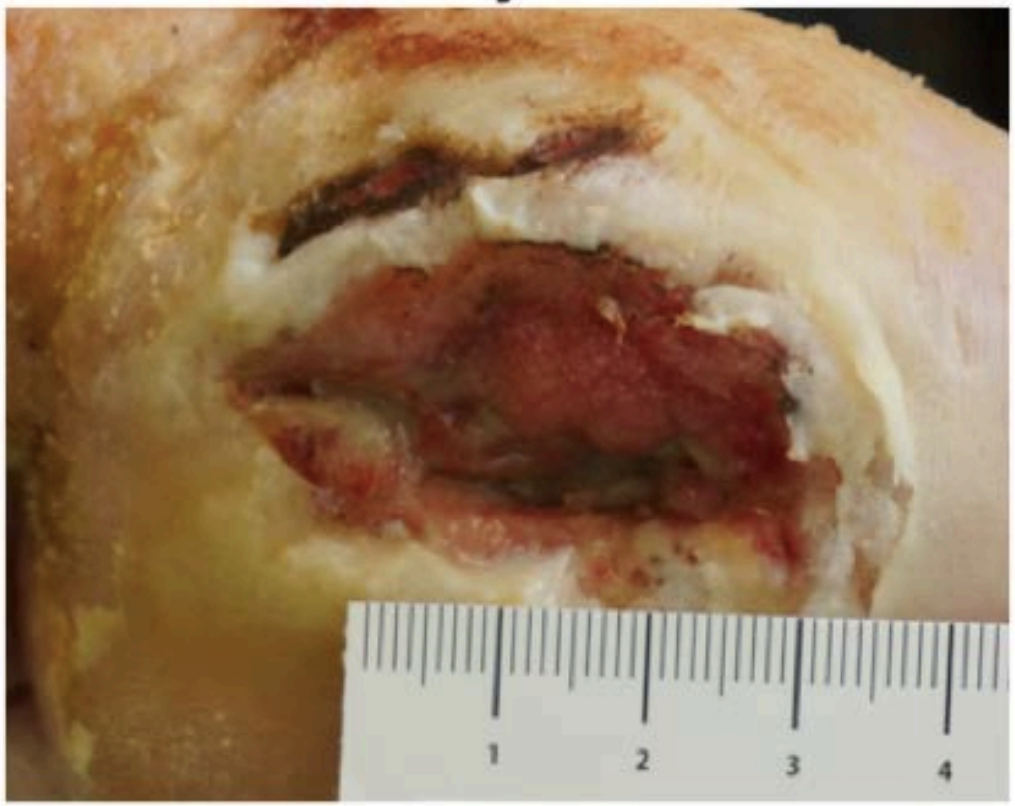


Day 85

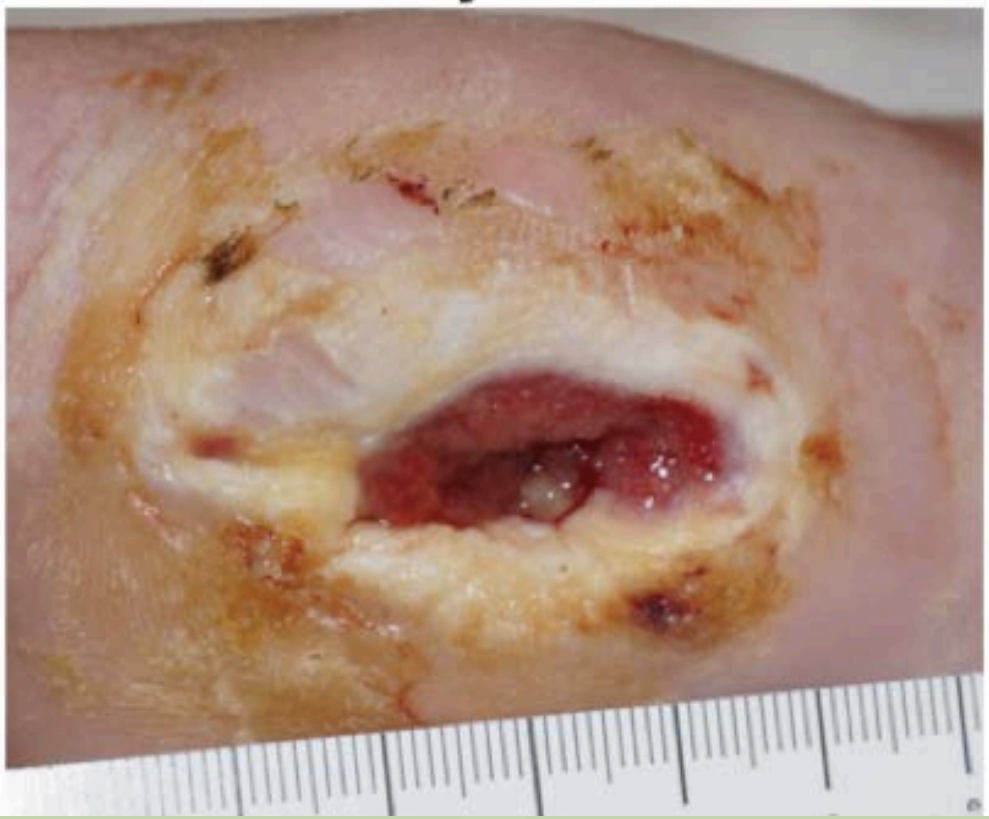


Age	Wound Type	Days Stalled	Initial Wound Size (cm^2)	Final Wound Size (cm^2)	Treatment Days	Application Frequency	Wound Closure (%)
68	Diabetic Foot Ulcer	215	10.6	2.4	26	2-3x / wk	77

Day 0



Day 26



Results/Conclusions

- Average non-healing time prior to trial = 40 weeks
- Average wound closure rate at three weeks was 66%
- Average wound closure rate at 12 weeks was 73%

Novel antimicrobial matrix was efficacious in accelerating the healing of stalled chronic wounds.

Future Directions

- Lidocaine, 0.4 mg/cm^{2,} >80% release in 30 min
- Gallium/silver synergistically disrupt biofilm
- *Cerium (0.6 mg/cm^2) penetrates deeper into burn eschar at a lower dose*

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Table 4: Outcomes for each wound type at primary and secondary endpoints. Total number of wounds = 35. Three wounds were excluded from analysis due to incomplete data set. At 12-weeks, all wounds had shown improved wound closure except for three venous stasis ulcers whose wound surface area had increased.

Wound type	Non-healing	Primary Endpoint	Secondary Endpoint
	Weeks (avg.)	Wound closure at the end of 3 weeks	Wound closure over 12 weeks
Venous Stasis ulcer	45	11 out of 16 venous stasis ulcers improved by an average closure of 60%	13 out of 16 venous stasis ulcers improved by an average closure of 76%. Wound surface area of three wounds had increased.
Diabetic foot ulcer	53	6 out of 8 diabetic foot ulcers improved by an average closure of 79%. One wound had 94% closure at week 2, and the patient did not return for follow-up	An average wound closure of 79% was achieved
Postop	29	2 out of 3 post-op wounds improved by an average wound closure of 58%	An average 42% wound closure was achieved
Trauma	27	1 out of 2 trauma wounds improved by 85% at week 2, and this patient did not return for follow-up	An average 59% wound closure was achieved
Pressure ulcer	6	The pressure ulcer had 45% wound closure after week 1, and this patient did not return for follow-up	The pressure ulcer had 45% wound closure after week 1, and this patient did not return for follow-up
Pilonidal cyst	4.5	The pilonidal cyst had 94% wound closure	Achieved 98% closure in 6 weeks
Burn	5	The burn wound had 38% wound closure	Achieved 100% closure in 9.5 weeks
Overall	40	72% (23/32) of wounds improved by an average 66% wound closure	91% (29/32) of wounds had improved with an average wound closure of 73%, and 12 wounds had an average closure >90%