Comparison of Fully Synthetic Electrospun Matrix to Bi-Layered Xenograft in Healing Full Thickness Cutaneous Wounds in a Porcine Model

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PRIMARY AIM: Compare the performance of synthetic nanofiber wound matrix to commercially available xenograft in healing full thickness cutaneous wounds

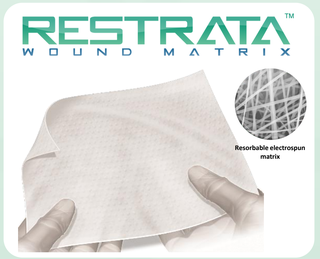
Background: Biologic wound matrix materials possess a number of critical limitations including risk of inflammatory response, premature degradation, and disease transmission. Materials that can promote healing while eliminating these risks could significantly improve the standard of care. The aim of the present study was to compare the performance of a fully synthetic electrospun matrix and a commercially available xenograft in healing full thickness cutaneous wounds.

Methods: The wound healing efficacy of Restrata™ Wound Matrix (treatment) was compared to Integra® Bilayer Wound Matrix (control) in the treatment of full thickness cutaneous wounds on Yucatan miniature swine. Full thickness wounds were created along the dorsum, to which these matrices were applied. The wound area was measured over the course of healing and the wound tissue was scored for evidence of inflammation and healing. Animals were sacrificed at Day 15 and Day 30 and tissue samples from the wound site were harvested for histopathological analysis to evaluate inflammation and tissue healing as evidenced by granulation tissue, collagen maturation, vascularization, and epithelialization.

Results: Average wound area was significantly smaller for treatment group wounds compared to control group wounds at 15 and 30 days (7.7cm^2 ± 0.9 / 3.8cm^2 ± 0.8) and (2.9cm^2 ± 1.1 / 0.2cm^2 ± 0.0) (control/treatment) (p=0.002 / p=0.01). Histopathological analysis of wound sections revealed superior quality of healing with treatment group wounds, as measured by inflammatory response, granulation tissue, and re-epithelialization.

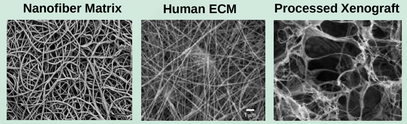
Conclusions: Restrata accelerated wound healing, inducing faster rates of wound closure with granulation tissue, as well as achieving deposition of mature collagen and vascularization at earlier time points than in wounds treated with Bilayer Wound Matrix. The superior wound healing achieved with Restrata may represent the ideal wound healing material and benefit diverse applications for partial and full thickness wounds, chronic wounds (e.g. ulcers), and severe wounds caused by trauma or surgery.

BACKGROUND: Fully-Synthetic Nanofiber Wound Matrix Mimics Human ECM and Supports Cell Ingrowth, Retention, and Differentiation

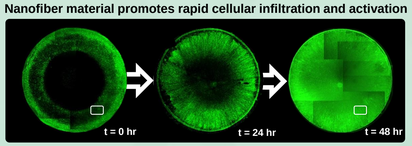


- Restrata™ Wound Matrix is the only persistent, flexible, fully-synthetic, bioengineered skin substitute for use in wound closure
- Restrata™ is composed of non-woven, resorbable synthetic nanofibers whose structure and architecture mimics that of native ECM
- Due to Restrata™'s fully synthetic design, the matrix resists enzymatic degradation, persists in the wound bed, reduces inflammatory response, and supports cellular/tissue ingrowth
- The unique properties of Restrata™ also offers improved ease-of-use, flexibility, and clinical versatility with significant logistical advantages over existing amniotic / allogenic products

- Restrata™ exhibits structural attributes similar to native extracellular matrix
- Electrospun nanofibers support cellular ingrowth, retention, and differentiation while directing and enhancing cellular activity
- The porosity and progressive resorbtion of Restrata™ supports continued cellular infiltration, tissue formation, and neo-vascularization
- Prior studies confirm nanofiber materials are a unique alternative to allografts / xenografts

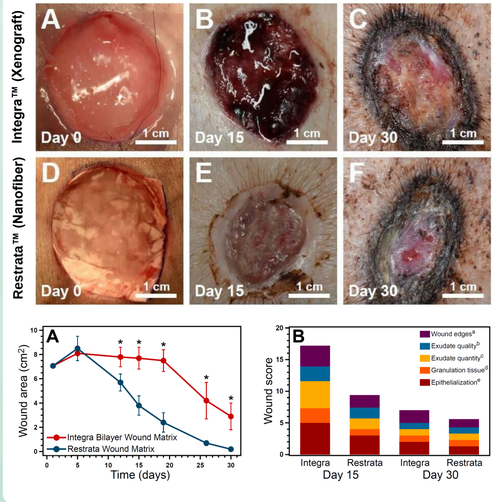


Nanofiber material promotes rapid cellular infiltration and activation

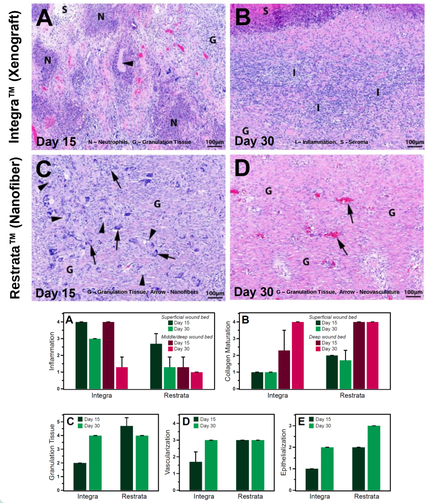


RESULTS: Fully-Synthetic Nanofiber Wound Matrix Supports Faster Time to Closure, Increased Granulation Tissue, Greater Neovascularization, and Reduced Inflammation

Restrata™ Facilitated Significantly Greater Speed and Quality of Wound Healing Compared to Integra™ Wound Matrix



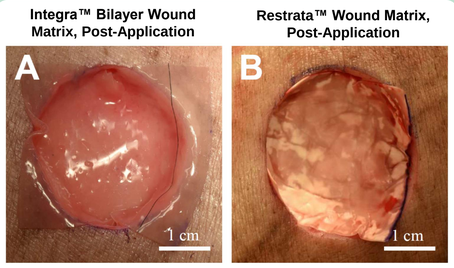
Restrata™ Significantly Increased the Quantity of Granulation Tissue and Neovascularization, While Reducing Inflammation



- Average wound area was significantly smaller for wounds treated with Restrata™ as compared to wounds treated with Integra™ Wound Matrix at 15 and 30 days (7.7cm2 ± 0.9 / 3.8cm2 ± 0.8) and (2.9cm2 ± 1.1 / 0.2cm2 ± 0.0) (control/ treatment) (p=0.002 / p=0.01)
- Histopathological analysis of wound sections revealed superior quality of healing in wounds treated with Restrata™ as compared to Integra™ Wound Matrix
- Histopathological analysis of wound sections additionally demonstrated significantly less inflammation within wound beds treated with Restrata™ as compared to Integra™ Wound Matrix
- Histopathological analysis of wound sections also showed greater neovascularization and more collagen maturation in wounds treated with Restrata™ as compared to Integra™ Wound Matrix

METHODS: Porcine Full-thickness Wound Model Utilized to Compare Nanofiber / Xenogenic Grafts

- Wound healing efficacy of a nanofiber wound matrix (Restrata™ Wound Matrix) was compared to a bovine collagen xenograft (Integra® Bilayer Wound Matrix) in a full thickness cutaneous wound model (Yucatan miniature swine)
- Full thickness wounds (n=6 / group, 3.0cm dia) were created along the dorsum and then treated with either the experimental or control wound matrix, moist gauze, and barrier dressing
- Wound area was measured over the course of healing and wound tissue was scored for evidence of inflammation and healing
- Animals were sacrificed at Day 15 and Day 30 and tissue samples from the wound site were harvested for histopathological analysis



CONCLUSIONS: Nanofiber Wound Matrix Accelerates Wound Healing and Increases the Quality of Newly Formed Tissue, Mirroring Results Observed in Chronic Wounds Treated with Restrata™

- Restrata™ Wound Matrix induced faster rates of wound closure with increased granulation tissue and vascularization at earlier time points compared to Integra™ Wound Matrix.
- Results of the present study mirror human clinical results observed upon treatment of chronic diabetic foot ulcers, venous leg ulcers, and pressure ulcers using Restrata™
- Restrata™ a unique and effective wound healing material that may offer significant clinical benefits in the setting of partial and full thickness wounds, chronic wounds (e.g. diabetic, venous, or pressure ulcers), and severe wounds caused by trauma or surgery.