Docket #: S23-082

The use of mechanotransduction inhibitors as a coating for surgical sutures to reduce scarring

Researchers at Stanford have proposed that coating surgical sutures with mechanotransduction inhibitors may reduce scarring of the tissue.

When the skin or other tissues are wounded, the body initiates a healing process. While shallow wounds may heal without a scar, injuries involving thicker tissues, such as the dermis or fascia, often lead to visible scars characterized by abnormal color, contour, rugosity, and breaking strength. Over time, scars may improve in appearance and breaking strength as collagen structures remodel and blood vessels form. However, these characteristics will never fully match those of normal (unwounded) skin, and certain functional elements like hair follicles and sweat glands do not regenerate, resulting in permanent functional losses. Currently, there is no therapeutic strategy to either prevent or reverse scarring.

Upon learning that the primary pathway responsible for scar formation is mechanotransduction, Stanford researchers studied the impact of mechanotransduction inhibitors on fibrosis. Inhibitors targeting proteins such as Focal Adhesion Kinase, Yes Associated Protein, Piezo1 and Piezo2 effectively reduced scarring, restoring both appearance and full function. Surgical sutures, used to close open tissues or attach medical devices, present a promising avenue for scar prevention. Coating sutures with any or combinations of the mechanotransduction inhibitors could reduce future scarring. Also, these sutures could be used in scar revision surgeries to reverse scarring.

Stage of Development
Prototype

Applications

- Skin wounds (ex. Incisional wounds or burns)
- Postpartum recovery
- Surgeries involving joining tissues
- Medical device implant
- Laparotomy surgery
- Scar revision surgery
- Organ fibrosis
- Pathological skin scarring conditions (Dupuytren's disease, fibrotic dermal scarring, hypertrophic scarring, keloid scarring, corneal and other ocular tissue scarring)

Advantages

- Capable of both preventing and reversing scarring
- Can be combined with active agents (antimicrobial, antibiotic, or antiseptic) to improve the prognosis
- Simple fabrication process, making it scalable

Publications

- Chen, K., Henn, D., Januszyk, M., et al. (2022). Disrupting mechanotransduction decreases fibrosis and contracture in split-thickness skin grafting. *Science Translational Medicine, 14*(645).
- Trotsyuk, A. A., Chen, K., et al. (2022). Inhibiting Fibroblast Mechanotransduction Modulates Severity of Idiopathic Pulmonary Fibrosis. *Advances in Wound Care, 11*(10), 511–523.
- Mascharak, S., Talbott H.E., Januszyk M., et al. (2022). Multi-omic analysis reveals divergent molecular events in scarring and regenerative wound healing. Cell Stem Cell, 29(2), 315-327.e6.
- Griffin, M. F., Talbott, H. E., et al. (2023). Piezo inhibition prevents and rescues scarring by targeting the adipocyte to fibroblast transition. *bioRxiv*, 2023.04.03.535302.
- Related Publications:

- Shamik Mascharak et al. (2021) Preventing Engrailed-1 activation in fibroblasts yields wound regeneration without scarring. *Science* 372, eaba2374.
- Heather E. Talbott, Shamik Mascharak, Michelle Griffin, Derrick C. Wan, Michael T. Longaker (2022). Wound healing, fibroblast heterogeneity, and fibrosis. Cell Stem Cell, Volume 29, Issue 8 (1161-1180).

Patents

- Published Application: WO2024191790

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