HealSuture: A Suture that Deposits a Regenerative Medicine to Prevent Scarring During Wound Healing

Technology Readiness Level 5: Validated in Relevant Environment

Lead Investigator

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Unmet Need

Scars are an inescapable consequence of surgical wound healing, because of normal processes of repair in mammals. For functional and cosmetic reasons, there is great interest in developing tools for non-scarring regeneration of normal tissue after a surgical procedure. While considerable effort has been dedicated to improving suturing and wound healing strategies that reduce scarring, more effective approaches are still needed.

Basic research into the regenerative capabilities of amphibians and the MRL mouse strain that can regenerate lost appendages, where scars do not develop at the injury site as a result of epimorphic healing, has now led to the development of a novel suture formulation that limits scarring. This clinical device – referred to as *HealSuture* due to its deposition of a compound LIMR scientists have determined can promote epimorphic regenerative healing – offers an off-the-shelf modality to reprogram the capabilities of a tissue microenvironment, limiting the formation of scar tissue during the healing of surgical wounds.

Opportunity

HealSuture is conceptualized in two forms for different surgical uses. The first is a dissolvable suture infused with an active compound. The second is a compound-coated silk suture with similar properties. In essence, these sutures locally re-activate a latent fetal program of stem cell-based regenerative healing that avoids fibrotic deposition (scar tissue).

Using the suture as a time-release depot, an active compound that inhibits prolyl 4-hydrolases (i.e. a PHD inhibitor) is released into the local tissue over a ~2-week period as the suture dissolves or a coated silk suture is removed. Varying doses released by different dissolvable suture preparations are envisioned to tailor treatments to maximize non-scarring healing of various types or locations of surgical wounds. This technology does not interfere with other methodologies that may be applied by surgeons to improve wound healing, including to limit scar formation, infection risk or other factors that influence optimal wound healing in a patient.

In summary, *HealSuture* offers an off-the-shelf clinical device to capture a latent capability for epimorphic healing, a non-scarring process of tissue regeneration suppressed in mammals after fetal development that can locally re-activated by this technology.

Unique Attributes

To our knowledge, there is no suture technologies that prevent scarring. LIMR technology is unique in re-activation of the natural latent process of epimorphic regenerative healing at a surgical wound site that is characteristic of fetal tissue (which does not scar after injury but regenerates without fibrosis). Unlike other technologies, the active compound deposited by the suture acts to reprogram local inflammatory and stem cell functions in the wound. This technology promotes regeneration in a variety of tissue types damaged by trauma, surgical resection, infection, and age-related degeneration. Accordingly, *HealSuture* may have special utility to promote optimal healing of many types of surgical wounds.

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Clinical Applications

HealSuture applications are based on preclinical studies suggesting that deposition of the active compound can promote regeneration of normal cartilage, nerve, bone, vasculature, muscle, and organ tissues while limiting the formation of fibrotic tissue, the major constituent of wound scars. Thus, the technology is expected to be suitable for repairing not only surgical wounds, but also wounds caused by trauma, infection, tissue degeneration or other causes requiring suturing, e.g., heart surgery. Accordingly, we envision broad general applications in diverse tissues where clinical proof of concept is testable.

Stage of Development

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Preclinical genetic and therapeutic proof of concept in mice for drug-induced tissue regeneration has been published (see below). Suture formulations of regenerating drugs of interest are at the stage of preclinical proof of concept. Ongoing investigations focus on drug deposition efficiency and clearance after suturing wounds with dissolvable polymer or silk-based forms of *HealSuture*.

Intellectual Property

US Patent Application 20220176011 published 6-9-2022.

EP Patent Application 3927383A1 published 12-29-2021.

EP Patent Application 3927383A4 published 11-9-2022.

NB: Key claims include experimental and approved drugs for HealSuture formulations.

Collaboration Opportunity

LIMR seeks partners to generate clinical suture prototypes that can advance *HealSuture* as novel clinical device for non-scarring regenerative healing of surgical wounds.

References and Publications

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- Cheng J, Amin D, Latona J, Heber-Katz E and Messerschmidt PB. (2019). Supramolecular polymer hydrogels for drug-induced tissue regeneration. ACS Nano. 13: 5493-5501.
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