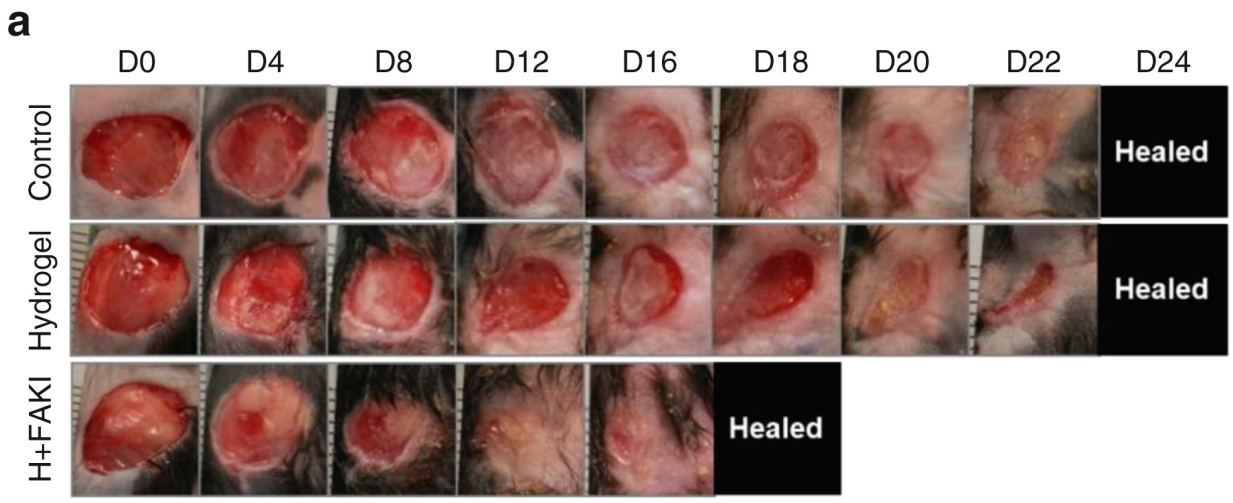
Docket #: S14-447

Drug-imprinted hydrogel for controlled-release wound healing therapy with FAK inhibitors

A team of Stanford researchers has developed a precisely controlled hydrogel drug delivery system that prevents scarring and promotes wound healing in large, full thickness wounds. This biomimetic scaffold targets the delivery of focal adhesion kinase inhibitors (FAKIs), anti-scarring agents that attenuate fibrotic activity (Stanford Docket S11-417). By directly targeting the active agent to a large wound, this pullulan collagen biomatrix can avoid the toxicity from systemic oral delivery and can deliver the drug over larger areas than are possible with injection. In addition, the rate of drug delivery can be adjusted by molecular imprinting techniques, tailoring the hydrogel to the nature of the wound. Therefore, the drug formulation can be delivered either rapidly (for applications such as surgical excisions) or sustained over time (for applications such as burns). This combination of biomimetic scaffolds with pro-regenerative small molecules (FAKIs) creates a potent regenerative therapeutic ready for near term clinical translation for enhanced wound healing and regeneration of large and deep dermal wounds.



Photographs of full-thickness contact burn wounds treated with and without FAKI hydrogel show improved wound healing with FAKI hydrogel treatment (H+FAKI).

Stage of Research
The inventors have developed two distinct drug-laden pullulan collagen hydrogels, one for rapid release and one for sustained release. FAKI therapy delivered with these hydrogels significantly accelerated healing and reduced scar formation in mouse models of full-thickness excisional wounds (sustained delivery) and burn wounds (rapid delivery).

Applications

- **Drug delivery for wound healing:**
  - bioscaffolds imprinted with active agents to promote healing and prevent scarring
  - particularly useful for large areas such as extensive burns, traumatic blast injuries or excisional skin surgeries

Advantages

- **Localized, controlled-release delivery:**
  - adjustable release for either sustained or rapid delivery of active compound according to the nature of the wound (e.g., surgical excision vs. burn)

    - active compound directly targeted to wound
    - circumvents systemic absorption and associated toxicity/adverse effects
- **Large area of delivery:**
    - unlike injections, hydrogel biomaterial sheets can cover a large wound, such as deep dermal wounds from burns
    - highly translatable to clinical setting

Publications

- Ma, K., Kwon, S. H., Padmanabhan, J., Duscher, D., Trotsyuk, A. A., Dong, Y., ... & Gurtner, G. C. (2018). Controlled Delivery of a Focal Adhesion Kinase Inhibitor Results in Accelerated Wound Closure with Decreased Scar Formation. *The Journal of investigative dermatology.*

Patents

- Published Application: WO2019222520
- Published Application: 20210361833
- Issued: 12,178,940 (USA)

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