# PREVENTION OF SCAR FORMATION IN THE SKIN USING TOPICAL FOCAL ADHESION KINASE INHIBITORS


**GEOFFREY GURTNER, MD, FACS**
Chair and Professor of Surgery
**University of Arizona**

**KELLEN CHEN, PHD**
Assistant Research Professor of Surgery and Biomedical Engineering
**University of Arizona**


## CLINICAL NEED

Injury to the skin in the craniofacial region from trauma, burns, radiation, and surgery can result in hypertrophic scar (HTS) formation, causing disfigurement and psychological distress to the patients. There are over 50 million annual trauma-related emergency department visits in the USA. Burn wounds that are deep, partial, or full-thickness frequently result in excessive HTS formation. There are currently no effective treatment options for these injuries.

## SOLUTION

Recently, it has become apparent that activation of the mechanotransduction pathways underlie many abnormalities in wound healing and result in exuberant fibro-proliferation. Specifically, we have identified that mechanical forces act through integrin-focal adhesion kinase (FAK) pathways to mediate wound repair, and that dysregulation of these processes leads to excessive fibrosis. Based on promising findings in preclinical animal models, we have demonstrated that pharmacological inhibition of the FAK pathway significantly attenuates fibrotic scar formation and accelerates healing in various small and large animal models. These small molecule FAK inhibitors (FAKI) were originally developed as anticancer agents and have shown safety and efficacy in multiple clinical trials against advanced solid tumors. With 6+ years of support from C-DOCTOR, our laboratory has developed a hydrogel dressing that releases the FAKI compound in a controlled manner upon direct contact with healing skin, and we have demonstrated that it is safe and effective for topical use in several animal models. This biodegradable pullulan-collagen hydrogel delivers FAKI and addresses many major challenges in treating traumatic injuries or burns to promote rapid healing, reduce fibrotic scar formation, and enable scarless regeneration.

## COMPETITIVE ADVANTAGE

Our dressing can be easily used in a hospital setting because it is lyophilized (dry), making it lightweight and portable; storable within sterilized packaging at room temperature; and able to encapsulate FAKI. The dressing can be simply unpackaged and soaked in saline to re-hydrate it into a hydrogel, which provides coverage across the wound and prevents desiccation, further promoting proper healing. Application of these hydrogels to burn wounds requires minimal infrastructural and technical changes and can serve as convenient replacements to standard wound dressings. Developing this therapy to promote healing and prevent scarring of burn wounds is of critical relevance to burn patients, especially those who suffer from tremendous post-burn scars and scar contractures. Currently, there is no small molecule or other therapeutic that addresses this need.

## TARGET MARKET

The scar treatment market is domestically (North America) valued at $5 billion USD, and globally valued at $14 billion and estimated to reach approximately $34.5 billion by 2025. Further, the burn injury treatment market and surgical and trauma wound treatment market had revenues of $504 million and $10 billion, respectively, in 2016, and continues to grow about 8% annually. Finally, the total worldwide wound care market revenue is valued at $24.6 billion as of 2019.

## REGULATORY PATHWAY

Investigational New Drug (IND) application.

## INTELLECTUAL PROPERTY

**(1)** Patent Granted US20130165463A1. **(2)** US Patent Application # 63/000,309 Filed: March 26, 2020. Patent Cooperation Treaty (PCT) WO2021194618A1 Published: September 30, 2021. **(3)** US Patent Application # 63/227,811 Filed: July 30, 2021. Patent Cooperation Treaty PCT/US22/38189 Filed May 10, 2022.

## RELATED PUBLICATIONS


**(1)** Wong VW, Rustad KC, Akaishi S, et al. Focal adhesion kinase links mechanical force to skin fibrosis via inflammatory signaling. Nat Med. 2011;18(1):148-152. **(2)** Ma K, Kwon SH, Padmanabhan J, et al. Controlled Delivery of a Focal Adhesion Kinase Inhibitor Results in Accelerated Wound Closure with Decreased Scar Formation. J Invest Dermatol. 2018;138(11):2452-2460. **(3)** Chen K, Kwon SH, Henn D, et al. Disrupting biological sensors of force promotes tissue regeneration in large organisms. Nat Commun. 2021;12(1):5256. **(4)** Chen K, Henn D, Januszyk M, et al. Disrupting mechanotransduction decreases fibrosis and contracture in split-thickness skin grafting. Sci Transl Med. 2022;14(645):eabj9152.



*The Center for Dental, Oral & Craniofacial Tissue & Organ Regeneration is supported by the National Institute of Dental & Craniofacial Research of the National Institute of Health under Award Number U24DE029463.*