

Opportunity

Seeking a licensing and development partner to advance the technology toward clinical studies and commercialization in emergency frostbite care and cold injury treatment.

Development Stage

Validated in the lab with in vitro fibroblast testing.

Intellectual Property

Provisional Patent Application
Status: Filed

Publication

Coming Soon

IDF#

24-MST-005

Platform and Method for treatment of frostbite

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PROBLEM STATEMENT

Frostbite leads to amputation in 29% of cases, and that rate climbs sharply without early intervention. The standard of care requires submerging the affected area in a warm water bath for at least 30 minutes before applying anticoagulants and wound dressings. Soldiers and rescue personnel cannot carry warm water into the field. Some body parts cannot be submerged at all. Drugs like heparin cannot be delivered topically to frozen skin because there are no active blood vessels to carry them. Every minute of delay worsens tissue loss and raises the risk of permanent damage.

SOLUTION

Researchers at Missouri University of Science and Technology have developed a three-layer all-in-one frostbite treatment device. The first layer is a 3D-printed bioactive hydrogel dressing applied directly to the frostbitten area, providing continuous hydration and promoting angiogenesis through bioactive borate glass. The second layer is a transdermal patch loaded with thrombolytics, anticoagulants, NSAIDs, and antimicrobial agents. The third layer is the programmable MXene warming pad applied on top. As the pad rewarms tissue to $37 \pm 3^\circ\text{C}$, the rising temperature triggers drug release from the patch the moment skin begins to thaw. The system then steps down to $15 \pm 3^\circ\text{C}$ to prevent refreezing. In testing, ibuprofen-loaded patches showed accelerated drug release upon heating, and hydrogels loaded with 1 to 10 ng/mL ibuprofen produced the highest fibroblast proliferation and migration.

VALUE PROPOSITION

This is the only frostbite treatment that rewarms tissue and delivers drugs simultaneously rather than sequentially. It replaces warm water baths with a portable, battery-powered device that weighs a fraction of a water container and can be used on any body part. The three components can be packaged individually for field application or as a single integrated kit. The same system applies to hot-burn wound healing, making the addressable market significantly larger than that for frostbite alone.

