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Clemson University Research Foundation

Bioadhesive Hydrogel for Surgical Repair of High Risk Wounds (2013-056)

Biocompatible Hydrogel Demonstrates Superior Strength over Traditional Sutures Patterning

Market Overview

This surgical bioadhesive mitigates the complications associated with traditional suturing practices, potentially decreasing surgery and recovery times. By 2017, the market for high strength medical adhesive is projected to reach $800 million. Clinical need for bioadhesives has risen due to the movement to laparoscopic and minimally invasive surgery over the last decade. Traditionally, sutures are used to close lacerations and stop soft tissue bleeding. Current sutures, however, lack adequate mechanical strength, compliance, and require additional surgical tools. Clemson University researchers have developed a hydrogel adhesive that combines thermally-induced physical crosslinking for near instantaneous gelation on contact with tissue and rapid chemical crosslinking via conjugate addition reactions. Ultimately, this bioadhesive overcomes suture limitations by chemically bonding to the soft tissue for wound closure, providing an appropriate adhesive to mitigate the complications associated with traditional suturing techniques.

Application

Surgical repairs; wound closure

Stage of Development

Preliminary Prototype

Advantages

- Exhibits superior strength compared to current internal surgical adhesives, improving clinical outcome in terms of time and cost
- Demonstrates tunable adhesive properties, avoiding suturing complications
- Is biocompatible and compliant for expandable organs, allowing easy and safe incorporation for various surgical adhesive applications

Technical Summary

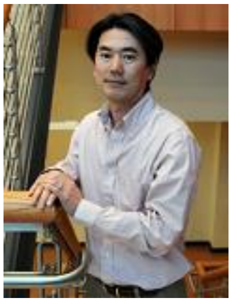
To overcome inadequate strength, compliance and biocompatibility limitations of adhesives and sealants currently available, Clemson University researchers have developed an effective hydrogel surgical adhesive. Preliminary testing has shown that this formulation crosslinks within minutes and exhibits significantly reduced post-gelation swelling and higher tissue bond strength relative to PEG-based sealants. Additionally, this hydrogel adhesive has shown superior mechanical strength in burst tests performed on rat bladders that exceed physiological requirements. With modular functionalization of the hydrogel system, this bioadhesive has tunable properties for many surgical applications.

App Type	Country	Serial No.	Patent No.	CURF Ref. Number	Inventors
Utility	United States	14/495,103	9,283,298	2013-056	Charles Webb, Jiro Nagatomi, Olin Mefford, Lindsey Sanders, Roland Stone

About the Inventors

Dr. O. Thompson Mefford is an Associate Professor of Materials Science & Engineering at Clemson University. He earned his Ph.D. in Macromolecular Science and Engineering from the Virginia Polytechnic Institute and State University. Dr. Mefford has numerous publications in multiple academic journals, has received the Award of Distinction from the Clemson University National Scholars, the Clemson University college of engineering and Science Collaboration Award, and has secured a substantial amount of outside funding to promote his research. His main research areas include synthesis and modification of polymers and nanomaterials, magnetism, and environmental applications for his work.

Dr. Ken Webb is an Associate Professor of Bioengineering and Associate Chair of Undergraduate Affairs at Clemson University. He earned his Ph.D. in Bioengineering from the University of Utah. Prior to joining Clemson, Dr. Webb worked at the Keck Center for Tissue Engineering as a post-doctoral research associate and research assistant professor. His research interests include hybrid hydrogels for gene delivery and tissue engineering; capillary channel polymer fibers, vibratory mechanotransduction, and hydrogel sealants. He holds one issued patent.



Dr. Jiro Nagatomi is an Associate Professor of Bioengineering at Clemson University. He earned his Ph.D. in Biomedical Engineering from Rensselaer Polytechnic Institute. Prior to joining Clemson, Dr. Nagatomi completed his Postdoctorate in Bioengineering at the University of Pittsburgh. His research interests focus on Mechanobiology, Biomechanics, and Functional Tissue Engineering. He holds one issued patent.

For More Information

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