Clemson University Research Foundation

Multilayerd Osteochondral Implant for Enhanced Bone Healing

Multilayered construct that mimics native osteochondral tissue and is tailored towards supporting bone and cartilage tissue repair

Market Overview

This novel off-the-shelf osteochondral implant exhibits a highly similar microarchitecture to that of native bone and cartilage, allowing better integration and mechanical support to the damaged tissue after implantation. Approximately 2,000,000 surgical procedures were performed to repair chondral defects in the United States between 2004-2011, with a 5% annual incidence growth over that time period. Osteoarthritis presents a monumental societal burden. It was responsible for $185.5 Billion in aggregate annual expenditure in the United States alone in 2008. Symptomatically, approximately 27 Million adults are affected in the United States alone and by the year 2020, over 25% of the US adult population is expected to suffer from OA. Current solutions consist of autograft or allograft tissue plugs. Unfortunately, autografts rely on host tissue availability and can cause further damage to the surgical site. Allografts have a limited availability and shelf-life and also pose the risk of rejection. Clemson University researchers have developed a readily available multilayered osteochondral implant that allows for better integration and mechanical support, decreasing the potential for rejection or revision surgery.

Application

Osteochondral repair, biomaterial implant

Stage of Development

In Vitro Testing

Advantages

- Multilayered construct mimics native microarchitecture, promoting better tissue integration
- Construct possesses mechanical integrity, allowing for better mechanical performance in vivo
- Off-the-shelf readiness, decreasing problems with limited availability

Technical Summary

Following the native microarchitecture of bone and cartilage, this construct consists of three distinct layers, each layer having a composition similar to that of its native counterpart. These layers, each having their own unique material and biochemical properties, are the cartilage analog, tidemark layer, and subchondral bone. The cartilage analog layer consists of decellularized xenogenic tissue that has been modified to improve its mechanical properties. The tidemark layer consists of a relevant combination of hydroxyapatite and poly(lactic-co-glycolic acid) (PLGA) and acts as the adhesive layer for the cartilage analog. The subchondral bone layer is a combination of hydroxyapatite and bioglass and serves as a scaffold-like material. All layers are treated to enhance mechanical properties.

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App Type	Country	Serial No.	Patent No.	CURF Ref. Number	Inventors
Provisional	United States	62/638,422	NA	2018-024	Alan Marionneaux, Dr. Jeremy Mercuri
Provisional	United States	62/638,530	N/A	2018-024	Alan Marionneaux, Joshua Walters, Dr. Jeremy Mercuri

About the Inventors

Alan is a second year Ph.D. student from Augusta, GA, having completed his B.S. in Bioengineering at Clemson in 2015. As an undergraduate student, he participated in research focused on magnetic nanoparticle fabrication, characterization, and functionalization for diagnostic and therapeutic applications. During his undergraduate years, he completed a clinical based co-op with the Steadman Hawkins Clinic of the Carolinas where he worked on evaluating the fixation stability of several novel reverse total shoulder arthroplasty systems. Upon joining the OrthO-X lab in 2014, Alan began working on the development of a novel osteochondral repair construct.

Dr. Mercuri is an Assistant Professor of Bioengineering at Clemson University. He earned his Ph.D. in Bioengineering at Clemson University in 2011 and started as a faculty at Clemson in August of 2013. His area of expertise is in biomaterials development and the application of stem cells towards orthopaedic tissue engineering and regenerative medicine. Dr. Mercuri has spent numerous years in the medical device and pharmaceutical industries. Most recently he was a senior research engineer within Stryker's Orthobiologics division (Malvern, PA) and he had previously been employed by Medtronic Spinal & Biologics (Memphis, TN) as a research engineer within their biomechanical testing group. Dr. Mercuri brings his industry experience to the senior design curriculum as a co-instructor for BIOE401/403 (Biomedical Design Theory / Applied Biomedical Design).

For More Information

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