

Self-Assembled Ligament for ACL and Rotator Cuff Reconstruction

A BioFabUSA Project / Department of Defense Manufacturing Innovation Institutes



Technology: Self-assembled ligament for ACL and rotator cuff reconstruction; skeletal muscle unit (SMU) for the treatment of volumetric muscle loss

Project Participants: STEL Technologies, University of Michigan, DEKA Integrated Solutions Corp., Rockwell Automation, University of New Hampshire

Institutes' Role: The institute led the development of a scalable, modular, automated and closed production line for self-assembled tissue constructs. The system was prototyped for the production of ligaments and is now being adapted to the production of skeletal muscle. The institute's diverse membership includes culture system OEMs, automation providers, engineering expertise in fluid handling and in the culture of diverse types of human cells, and in deep product characterization for the development of QC specifications.

Technology Description: The platform technology relies on the secretion of tissue matrices from cells in culture rather than on seeding of cells onto a scaffold material, in this case either ligament or muscle. Tissue engineered ligament grown in the Tissue Foundry. The cell generated graft for ACL and rotator cuff reconstruction is a cell-generated tissue comprising ligament tissue derived from bone marrow- or fat-derived stem cells. Culturing muscle cells in place of stem cells in the manufacturing system facilitates the production of skeletal muscle.

Impact: The ligament and skeletal muscle products are expected to improve restorative treatments and rehabilitative care to maximize function for return to duty (RTD) or civilian life following ACL injury or volumetric muscle loss (VML). Current approaches to repair the ACL rely primarily on grafts from cadaveric donors. Availability of an off-the-shelf on-demand graft will reduce reliance on donors. The SMU addresses a need for cell-based tissue engineering strategies to treat Warfighters who have suffered blast injuries, burns, lost limbs, or other injuries of the extremities, for which there is no current treatment. This will maximize function for RTD or civilian life.

