Extracellular Matrix Scaffold for TMJ Disc Repair

CLINICAL NEED
Individuals suffering from severe temporomandibular joint (TMJ) disc disease experience painful clicking or locking that can dramatically affect quality of life. Total TMJ reconstruction is often the last-resort surgical intervention for the irreparably damaged joint. Current therapies include joint replacement using alloplastic implants or autogenous grafts; however, long term outcomes with alloplastic implants are unclear, while autogenous grafts are associated with donor site morbidity.

SOLUTION
University of Pittsburgh team of Alex Almarza, PhD, Stephen Badylak, DVM, PhD, MD, William Chung, DDS, MD, and Bryan Brown PhD is developing an extracellular matrix (ECM)-based scaffold device for the reconstruction of the TMJ. In particular, the device is designed to replace the meniscus of the TMJ by inducing the formation of new, patient-specific, functional tissue formation.

COMPETITIVE ADVANTAGE
Unlike currently available alloplastic implants, ECM-based device is biodegradable, and mimics the shape and size of native TMJ meniscus, without the need for autologous tissue harvesting. The device has been validated in canine and porcine models, where the scaffold demonstrated rapid transformation into a fibrocartilaginous tissue with biomechanical and biochemical properties similar to the native TMJ disc, as well as elicited formation of near-normal tissues in only one month following implantation.

ITP SUPPORT
The long-term objective of this program is the development of a safe and effective therapeutic option for reconstruction of the TMJ disc. In preparation for submission to the FDA, the ITP program will support the validation of devices made in a GMP facility, and for the submission of a pre-IDE application to the FDA.

CLINICAL TRANSLATION PATHWAY

|---------------|------------------------|--------------------|-----------------------------|--------------------------|

Michigan-Pittsburgh-Wyss Regenerative Medicine Resource Center is supported in part by the National Institute of Dental & Craniofacial Research of the National Institutes of Health under Award Number U24DE028915. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Contact Information:
Mutsumi Yoshida, PhD | Managing Director, U-M site | yoshidam@umich.edu | www.doctrc.com
ECM Scaffolds for TMJ Disc Repair
Alejandro Almarza, William Chung, Bryan Brown
University of Pittsburgh

UNMET CLINICAL NEED

Temporomandibular Joint (TMJ)
- Temporomandibular joint disorders (TMDs) affect between 10 and 36 million Americans
- For a percentage of these patients, removal of the TMJ disc is the only option which relieves pain and restores motion of the jaw
- However, disc removal leads to bone-on-bone articulation, which predisposes the patient to condyle erosion and the eventual need for total joint replacement
- Some surgeons replace disc with autografts, but radiographic evidence shows resorption of autograft by 9-12 months
- Thus, an off-the-shelf solution is needed to prevent degenerative changes to the bone, which will not require autograft harvest, and remain in the joint space for at least 12 months

MARKET ANALYSIS

- Can expect to capture as much as 30% of this market
- Initially, 5,000+ implanted patients
- Market expected to increase with an available solution
- Oral and maxillofacial surgeons would place a high value on this product

INTELLECTUAL PROPERTY

- Intellectual Property secured
  - Patent No.: US 9,314,340 B2
  - Date of Patent: April 19, 2016
- The IP protects the formulation, size, shape, etc., of the device and its use to reconstruct the disc in temporomandibular joints
- IP already been licensed by ECM Therapeutics
- Interested in commercialization after results of first-in-man study

RESULTS

A Good Laboratory Practices (GLP) large animal study to assess the safety of TMJ Repair Graft manufactured in Good Manufacturing Practices (GMP) at 21 days

Device Placement:
- Capsule is identified
- Joint Exposed
- Disc Removed

21-Day Tissue Harvest:
- No new tissue in empty joint
- Remodeled Device between condyle and fossa

21-Day Magnetic Resonance Imaging (MRI):
- Implant Placed
- Gross Morphology and MRI both show new tissue formation as TMJ Repair Graft is remodeling, while no new tissue forms in joint after disc removal

MANUFACTURING

- Partnered with Cook Biotech to manufacture TMJ Repair Graft under GMP standards
- Device is composed of extracellular matrix (ECM) obtained from the small intestine submucosa of pig
- Device is manufactured as a pillow configuration with ECM powder encased by ECM sheets
- Cook will provide master file record to FDA

REGULATORY PATHWAY

- Several communications with FDA
- Main input is to show device is still in place after 12 months post-implantation
- GMP device in GLP large animal preclinical trial will be last hurdle before first-in-man
- FDA will require PMA application

TIMELINE & FUTURE DIRECTIONS

- Still processing samples from 21-day study for histology and pathological evaluation
- Perform a 12-month study in GLP with GMP device
- In addition to MRI and histology, FDA suggests to perform dynamic mechanical evaluation of the tissue
- Then FDA clearance is expected to perform first-in-man IDE study

Funding

Funding for the 21-day study was provided by Michigan-Pittsburgh-Wyss Resource Center: Advancing Dental, Oral, and Craniofacial Regeneration to Clinical Trial Initiation 1U24 DE029462-01