Acellular Porcine Intestinal Submucosa as a Fascial Graft: Possible Applications for Revision Tympanoplasty

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Introduction
The temporoparietal fascia and its overlying loose areolar tissue remain the most commonly used graft sources for tympanic membrane repair. The popularity of these tissues results from the ease of harvest through a standard postauricular incision, minimal donor site morbidity, and the ability to further process the graft for various applications. This fascia has been used as a vascularized or acellular graft material, in tympanic membrane perforation repair, tympanic membrane fistula repair, and tympanic membrane reconstruction. Since the advent of the acellular matrix, the use of acellular fascia has become more popular. Acellular fascia is reseeded with autologous fibroblasts to form a collagenous matrix. The graft material is then reinfused with connective tissue and vessels for vascularization. The fascia, containing the patient’s own biologic materials and vessels, would then be available for tympanic membrane repair. This fascia, containing the patient’s own biologic materials and vessels, would then be available for tympanic membrane repair.

Methods
A 1.5 x 1 cm segment of fascia was removed, preserving the fascia, from porcine small intestinal submucosa. Using a rat model, the graft material was placed in a fascial defect at the time of surgery. The graft was sutured in place. The Surgisis graft was identified and excised en-bloc with the underlying rectus abdominis muscle. Specimens were examined with a dissecting microscope for signs of vascularization. The resulting tissue was fixed and processed for histology employing H&E and Sirius Red stain. Specimens were examined with a dissecting microscope for vascular patterns in the graft fascia. Specimens were examined with a dissecting microscope for vascular patterns in the graft fascia.

Results
The temporalis fascia and its overlying loose areolar tissue remain the most commonly used graft sources for tympanic membrane repair. The popularity of these tissues results from the ease of harvest through a standard postauricular incision, minimal donor site morbidity, and the ability to further process the graft for various applications. This fascia has been used as a vascularized or acellular graft material, in tympanic membrane perforation repair, tympanic membrane fistula repair, and tympanic membrane reconstruction. Since the advent of the acellular matrix, the use of acellular fascia has become more popular. Acellular fascia is reseeded with autologous fibroblasts to form a collagenous matrix. The graft material is then reinfused with connective tissue and vessels for vascularization. The fascia, containing the patient’s own biologic materials and vessels, would then be available for tympanic membrane repair. This fascia, containing the patient’s own biologic materials and vessels, would then be available for tympanic membrane repair.

Discussion
Surgisis grafts were well tolerated, and integrated well into the native fascial plane. Histologically, the graft initially underwent an acute inflammatory response, which subsided over the study period. Collagen bundle organization underwent active remodeling. Vascular tissue developed and matured within the graft. At the final 9 week timepoint, abundant fibroblasts were seen, and a mature collagen matrix was noted. Previous studies have looked at the use of acellular matrix grafts for direct tympanic membrane repair. Most human studies have used AcellDerm (LifeCell Corp., Branchburg, New Jersey), a human dermis derived material. Surgisis studies for direct repair remain at the animal stage.

Our study demonstrates the feasibility of Surgisis implantation as a means of muscle fascia regeneration. This provides a potential benefit to the otologist. At the time of initial fascial graft harvest for tympanoplasty, a graft of Surgisis could be sutured in place. At the time of the second look or revision surgery, an easily available plane of fascia with the patient’s own cells would be available for regrafting, allowing development of a surgical plane. The predominantly yellow/green birefringence with Sirius Red stain indicates mature, well organized collagen bundles.

Acknowledgements
Penn State/Milton S. Hershey Medical Center Institutional Animal Care and Use Committee. A cohort of 16 male Sprague-Dawley rats was obtained. Rats were placed under general anesthesia using inhaled isoflorane, and lidocaine was infiltrated into the wound. Sterile technique was used. The surgical site was then prepared and draped. The temporalis fascia was exposed. The Surgisis graft was identified and excised en-bloc with the underlying rectus abdominis muscle. Specimens were examined with a dissecting microscope for vascular patterns in the graft fascia. Specimens were examined with a dissecting microscope for vascular patterns in the graft fascia.

References