**Purpose:** Surgical Site Infections (SSIs) and Hypertrophic scars (HSs) are the most common complications of wound healing. Most SSIs are superficial infections involving the skin and subcutaneous tissue (SQ) only. Abnormal scaring is driven by ongoing dermal inflammation in high skin tension areas (e.g. anterior and posterior chest). For prevention, proper suturing techniques are required, in particular for subcutaneous adipose tissue, to reduce high skin stretching tension and prevent ischemia. While adipose lobules cannot be sutured, superficial fascia (SF) -the membranous structure of adipose stroma- must be sutured. However, the exact anatomy and characteristics such as number and thickness of SF throughout the body regions are still lacking. This is the first study to present a detailed quantitative analysis of SF anatomy. We believe such details will help in optimization of subcutaneous sutures.

**Methods:** Superficial and deep fascia (DF) were analyzed using ultrasound imaging in predefined 73-point locations, distributed among eleven body regions of ten healthy male volunteers; Anterior chest: 9 points, abdomen: 10, posterior chest: 9, lumbar region: 6, gluteus: 2, arm: 8, elbow: 3, forearm: 8, thigh: 9, knee: 3 and leg: 6. Using ImageJ software, thickness of SF and DF layers, dermis and SQ were measured along SF percentage. Three random measurements were taken for each variable then averaged and used this average for statistical analysis. In addition, number of SF layers was counted, total thickness of SF was calculated by summing the average thickness of all SF layers and total membranous layers thickness by summing total SF and DF thicknesses.

**Results:** Overall, 730 means were analyzed with multilevel mixed linear model for all variables except average layer thickness of SF which had 1635 means; since each point had one or more layers of SF, DF and dermis were significantly thickest in posterior chest region which had the highest layer thickness of SF measuring 0.64 ± 0.01 mm. Anterior chest and gluteus had the highest content of SF due to having the highest layers number (3.67 ± 0.08, 3.45 ± 0.143), yet significantly thickest gluteus SQ and lowest SF percentage. SF changed inconsistently within subcutaneous adipose tissue; SF, DF and dermis jointly handles stretching tension, therefore, to understand the effect of environment, analysis of the variable’s interaction was performed and showed significant accelerated increase in the thickness of SF and dermis in anterior and posterior chest as compared to lower tension regions (all p<0.001).

**Conclusion:** Our results showed that dermis and subcutaneous membranous layers tend to be thick in the high-tension areas such as the upper trunk. It was suggested that SSIs and HSs could be prevented by realizing the tension applied on the operated area; finding then suturing the membranous layers during the operation.

**QS5**

**Cryopreserved Adipose for Hypodermal Augmentation After Full-thickness Burns**

**Shawn J. Loder, MD, Patricia A. Leftwich, MS, Somaiah Chinnapaka, PHD, Wayne V. Nerone, BS, Phoebe L. Lee, BS, Kacey G. Marra, PHD, Ejaz Asim, PHD, Lauren E. Kokai, PHD, J. Peter Rubin, MD**

**University of Pittsburgh, Pittsburgh, PA**

**Purpose:** Burn and blast injuries to the face and extremities are highly morbid injuries affecting quality of life, ability to work, and psychosocial well-being. Without exception, extensive burn injuries require surgical debridement, with standard of care reconstruction involving autologous skin grafting to restore cutaneous integrity. This treatment modality is limited in extensive burns or in highly visible areas by lack of donor site and/or soft tissue deficits resulting in significant disfigurement. Hypodermal restoration via autologous adipose transplantation provides padding for the overlying skin, helps restore native features, and enhances contour and texture. However, this technique is limited by graft retention and often requires multiple rounds of grafting and consequently, multiple rounds of surgery, each with separate anesthesia, to achieve adequate results. The goal of this study was to demonstrate the therapeutic validity and efficacy of utilizing cryopreserved adipose to avoid multiple liposuction events when serial skin and fat grafting procedures are performed to restore epidermal, dermal, and hypodermal integrity after full-thickness burn.

**Methods:** Adipose was collected from female Yorkshire swine and processed day-of-collection for immediate cryopreservation. This adipose was preserved for 3 months prior to initiation of the next stage of the experiment. After three-month elapse, female Yorkshire swine received 16, 4×4 cm full-thickness burns using an electric brand. After 48 hours, eschar was removed down to fascia. Skin grafts were collected as split-thickness skin grafts. The pigs were maintained for 8 weeks from time of engraftment and interval serum, photography, ultrasound, and biopsies were collected. At 8 weeks post-engraftment animals were sacrificed.
and all wounds were collected for histology and proteomic evaluation.

Results: Split thickness skin graft take was greater than 95% in all injuries. Adipose grafts from Group B, were noted to remain present and incorporated into the granulation tissue in absence of skin graft with viability confirmed on biopsy. Initial increase in granulation layer thickness was noted in presence of fat graft with Group B vs. Group A. On serial ultrasound assessment, penetrating adipose grafts from Group D were noted to be present without gross resorption at all time points. Cryopreserved adipose remained viable throughout the duration of the experiment with histologic evidence of incorporation at 8 weeks post-operative.

Conclusion: Burn and blast injuries predominantly affect military personnel and first responders for whom improvement in protective equipment has decreased mortality without resolving the risk of morbidity to the face or extremities. Hypodermal augmentation with lipografting as part of a strategy of autologous skin grafting addresses contour deficits and skin quality, however is limited by the need for multiple liposuction and grafting procedures, requiring multiple trips to the operating room with increased surgical and anesthetic risk and high economic burden. Here we demonstrate cryopreservation of adipose as an avenue to alleviate that burn.

QS6

Collagen-glycosaminoglycans Scaffold Can Improve Muscle Function Recovery After Volumetric Muscle Loss Injury in Rat Model

Mehran Karvar, MD, Yori Endo, MD, Atousa Nourmahnad, BS, Indranil Sinha, MD

Brigham and Women’s Hospital, Boston, MA, USA.

Propose: Skeletal muscle regenerative capacity fails in restoring muscle function following major injuries in which significant skeletal muscle is lost or damaged. As such, volumetric muscle loss (VML), ultimately results in permanent disability. Therapeutic options are limited in VML and currently no standard of care exists. Biodegradable scaffolds hold great potentials in the regeneration of lost muscle tissue by replacing the lost structural framework of the defect. In this study we aim to evaluate the effects of a porous collagen-glycosaminoglycans scaffold (CGS) on muscle function recovery following VML injury in a rat model.

Methods: Fifteen male 12-week old Sprague-Dawley rats were randomly divided into three groups of 5 rats in each: 1) Sham group, 2) VML Untreated (control) group, and 3) VML+CGS group. A standard model of VML injury was performed to bilateral Tibialis Anterior (TA) muscles in VML Untreated and VML+CGS groups. The muscle defect in VML+CGS group was filled with 3 sheets of CGS cuts while the muscle defects in VML control group left untreated. Animals in Sham group underwent the same surgical procedure (skin and fascia opening and closure) but without any muscle injury. Pick isometric twitch and tetanus forces of foot dorsiflexion were measured in vivo prior, immediately after, and four weeks post injury using a dual mode muscle lever system. In situ TA muscle twitch and tetanic contraction strengths were also determined six weeks after injury.

Results: Prior, and immediately after injury no statistically significant differences was seen between VML Untreated and VML+CGS groups in terms of the means of twitch and tetanus foot isometric dorsiflexion forces. Four weeks after injury, TA of VML+ CGS group showed significant functional recovery as compared with VML Untreated group in twitch (76 ± 22.7% vs 51.3 ± 22.3%, p<0.01) and tetanus (77.4 ± 22.1% vs 59.8 ± 22.4%, p<0.05) foot dorsiflexion forces. In situ muscle strength measurements of TA at six weeks post injury, also showed significantly higher twitch (35.2 ± 12.5 mN/mm² vs 23.7 ± 6.9 mN/mm², p<0.05) and tetanus (115.0 ± 35.3 mN/mm² vs 87.9 ± 20 mN/mm², p<0.05) forces in TA of VML+CGS group when compared with the VML Untreated group. On histology of the TA performed six weeks following initial injury, placement of CGS decreased fibrosis across the injury, as defined as percentage of positive area in trichrome staining compared with VML Untreated group (1.3 ± 0.1% vs. 7.1 ± 1.3%, p<0.01). In addition, immunofluorescence tissue staining confirmed positive myosin heavy chain staining within the scaffold, indicating the formation of nascent myofibers within the area of injury.

Conclusions: Application of CGS to the muscle defect following VML injury can improve muscle function recovery, limit fibrosis, and promote muscle regeneration in rodent model. These findings can foster future research in larger animals and human subjects.*p<0.05, **p<0.01. Error bars: Standard Deviations.