3 or 4, respectively). Conclusions Operative treatment of shoulders with preoperative ISP stage 3 or 4 may be risky for occurrence of large retear after performing SCR or patch procedure, thought the two scores were significantly improved at the final follow-up in the two groups.

**Category: Shoulder - Rotator Cuff**

**Analysis of Cellular Senescence in Human Arthroscopic Rotator Cuff Repairs**

**Abstract ID# 21603**

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**Summary:**

Senescent cells accumulate in aging rotator tears and may contribute to and may impair the healing potential of the rotator cuff with advancing age.

**Data:**

**Purpose:** To quantify cellular senescence in supraspinatus tendon and sub-acromial bursa of humans with rotator cuff tears. To investigate the in vitro efficacy of Dasatinib+Quercetin (D+Q) to eliminate senescent cells and alter markers of tenogenic differentiation. Methods: Tendon and bursa were harvested from patients undergoing arthroscopic rotator cuff tears. In part 1, cellular senescence was quantified utilizing immunohistochemistry and gene expression for senescent cell markers (p16 & p21) and the senescence-associated secretory phenotype (SASP) (IL-6, IL-8, MMP-3, MCP-1). Multiple markers were used due to a lack of specific markers for senescent cells. The amount of senescence was compared between patients <60 and ≥60 years old. In part 2, an in vitro culture model of rotator cuff tears was treated with D+Q or control. The ability of D+Q to kill senescent cells and alter markers of tenogenic differentiation was assessed by gene expression. Results: Part 1 demonstrated an age-dependent significant increase in the relative expression of p21, IL-6, and IL-8 in tendon, and p21, p16, IL-6, IL-8, and MMP-3 in bursa (p<0.05). A significant increase was seen in immunohistochemical staining of bursa p21 (p=0.028). Part 2 demonstrated that D+Q significantly decreased senescent markers in tendon (p21, IL-6, IFN-gamma, IL-8) and bursa (p21 and IL-8) (p<0.05). ELISA analysis demonstrated decreased release of the SASP (IL-6, MMP-3, MCP-1; p=0.002, p=0.024, p=0.001, respectively). Both tendon (p=0.022) and bursa (p=0.027) treated with D+Q significantly increased the expression of type I collagen. Conclusions: While there was an age-dependent increase in markers of cellular senescence, this relationship was not consistently seen across all markers and tissues. D+Q demonstrated moderate efficacy in decreasing senescence in these tissues and increasing type I collagen expression.

**Clinical Relevance:** Cellular senescence contributes to diseases of aging and may impair the healing potential of the rotator cuff with advancing age.

**Category: Shoulder - Rotator Cuff**

**A Biomechanical Evaluation of the Efficacy Of Suture Tape Augmentation for Subscapularis Peel Repair**

**Abstract ID# 21348**

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**Summary:**

Augmentation of subscapularis peel with two inverted mattress suture tapes significantly increases the strength of the repair.

**Data:**

**Background:** Repair of the subscapularis tendon following anatomic total shoulder arthroplasty (aTSA) is important to restore the function of the shoulder. Failure of a subscapularis repair construct can result in difficulty with internal rotation and an increased likelihood of dislocation. While suture tape has been demonstrated to be an efficacious augment for tendinous repairs elsewhere in the body, it has not been investigated as a technique for augmenting subscapularis peel repairs. The purpose of this study is to determine the biomechanical efficacy of suture tape augmentation for the repair of a subscapularis peel. Methods: Twelve human cadaveric shoulders underwent a subscapularis peel. Specimens were randomly split into two groups: one which underwent repair using three Mason-Allen sutures (control) and one which underwent the control repair with augmentation using two suture tapes placed in an inverted mattress fashion and secured to the proximal humerus using a suture anchor (augment). Shoulders underwent biomechanical testing to compare repair displacement with cyclic loading, load at ultimate failure, and construct stiffness. Results: There were no significant differences in displacement after cyclic loading between the two repair groups at the superior (p=0.87), middle (p=0.47), or inferior (p=0.77) portions of the subscapularis tendon. Load to failure was significantly greater in the augmented group (585.1N ± 81.8) than in the control group (585.5N ± 97.4; p=0.001). Stiffness was also greater in the augument group (71.8N/mm ± 13.7) when compared with the control group (48.7N/mm ± 5.7; p=0.003). Conclusions: Subscapularis peel repair with augmentation via two inverted mattress suture tapes secured with an anchor in the proximal humerus conferred significantly greater load at ultimate failure and construct stiffness when compared to a traditional repair using three Mason-Allen sutures.

**Category: Shoulder - Rotator Cuff**

**Bridging Reconstruction For Large-To-Massive Rotator Cuff Tears Has A Low Rate Of Cuff Arthropathy Progression At A Minimum Five-Year Follow-Up**

**Abstract ID# 22515**

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**Summary:**

At a minimum 5-year with a mean follow-up of 7.3 years, bridging reconstruction showed 98% survivorship rate with a low rate of conversion to rTSA and a low progression of cuff.

**Data:**

**Background:** Rotator cuff tears cause pain, muscle weakness, and difficulty with overhead activity. While smaller tears are easier to repair, large-to-massive cuff tears (>3 cm in size) are considered irreparable. For patients with large-to-massive cuff tears, surgical options include maximal repair, superior capsular reconstruction, bridging reconstruction, tendon transfers and reverse total shoulder arthroplasty (rTSA). Bridging reconstruction was developed to improve outcomes and to avoid the morbidity associated with other technique. Bridging reconstruction, also known as graft interposition, has been shown to have superior outcomes as compared to maximal repair with better patient-reported outcomes at two-years post-operatively as recently demonstrated in a randomized controlled trial. These positive results are maintained at five years, however the midterm changes in progression of rotator cuff arthropathy and conversion to rTSA have not been assessed. Purpose: To assess the progression of rotator cuff arthropathy in bridging reconstruction patients at a five-year follow-up. Methods: Forty-four patients who underwent bridging reconstruction between 2012 and 2017 for large-to-massive rotator cuff tears were included. All patients had a minimum five-year follow-up. Data collected included demographics, pre- and post-operative Western Ontario Rotator Cuff (WORC) Index, conversion to rTSA, and X-ray readings (including acromiohumeral distance (as measured on anterior-posterior pre/post-operative radiographs) and Hamada grades for rotator cuff arthropathy). Furthermore, a sub-group analysis was performed on post-operative MRIs for graft status. Results: The mean age at
surgery was 59.9± 10.8 years with a mean follow-up of 7.3±1.4 years. The population was mostly male (70.5%). Pre-operatively, seven patients had mild rotator cuff arthropathy with Hamada grade 2-3, and one patient had Hamada grade 4B. The rest of the patients had Hamada grade one preoperatively. At a minimum five-year postoperative follow-up, only one patient had a rTSA, resulting in a survivorship rate of 98%. Two patients (4.6%) had post-operative Hamada grade 4. One patient had progression of cuff arthropathy from pre-operative Hamada 3 to post-operative Hamada 4A. The other patient maintained Hamada grade 4B from pre-operative to post-operative. Patients with progression of cuff arthropathy (i.e. higher post-operative Hamada grade) appeared to have a higher possibility of complete post-operative graft tears. There were no correlations between progression of cuff arthropathy and WORC score at five years. Conclusion: At a minimum 5-year with a mean follow-up of 7.3 years, bridging reconstruction showed 98% survivorship rate with a low rate of conversion to rTSA and a low progression of cuff

Category: Shoulder - Rotator Cuff

Physiologic Tensioning During Lower Trapezius Transfer For Irreparable Posterosuperior Rotator Cuff Tears Is Important For Improvement Of Shoulder Kinematics

Abstract ID # 21737

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Summary:
Lower trapezius transfer was most effective in improving glenohumeral kinematics following an irreparable posterosuperior rotator cuff tear when maintaining the physiologic tension of the lower trapezius muscle. However, the lower trapezius transfer did not completely restore native kinematics, regardless of tensioning.

Data:
Background: Lower trapezius transfer (LTT) has been proposed for restoring the anteroposterior muscular force couple in the setting of an irreparable posterosuperior rotator cuff tear (PSRCT). Adequate graft tensioning during surgery may be a factor critical for sufficient restoration of shoulder kinematics and functional improvement. The purpose of this study was to evaluate the effect of tensioning during LTT on glenohumeral kinematics using a dynamic shoulder model. It was hypothesized that an LTT, maintaining the physiologic tension of the lower trapezius muscle, would improve glenohumeral kinematics more effectively than an under-tensioned or over-tensioned LTT. Methods: Ten fresh-frozen cadaveric shoulders were tested using a validated shoulder simulator. Glenohumeral abduction angle (gAA), superior migration of the humeral head (SM) and cumulative deltoid forces (cDF) were compared across five conditions: (1) native; (2) irreparable PSRCT; (3) LTT with 12N load (under-tensioned); (4) LTT with 24N load (physiologic cross-sectional area ratio); (5) LTT with 36N load (over-tensioned). gAA and SM were measured using 3-dimensional motion tracking, cDF was recorded in real time throughout dynamic abduction motion by load cells connected to actuators. Results: The physiologically tensioned (Delta 13.1°, P<.002), under-tensioned (Delta 7.3°, P<.038), and over-tensioned LTT (Delta 9.9°, P<.044) each significantly increased gAA compared to the PSRCT (P<.001, respectively). The physiologically tensioned LTT achieved a significantly greater gAA than the under-tensioned (Delta 5.9°, P<.001) or over-tensioned LTT (Delta 3.2°, P<.038). SM was significantly decreased in LTT compared to the PSRCT, regardless of tensioning. The physiologically tensioned LTT resulted in a significantly lower SM compared to the under-tensioned LTT (Delta 5.3mm, P<.004). A significant decrease in cDF compared to the PSRCT was only observed in the physiologically tensioned LTT (Delta -19.2N, P<.044). However, compared to the native state, LTT did not completely restore native glenohumeral kinematics, regardless of tensioning. Conclusion: LTT was most effective in improving glenohumeral kinematics following an irreparable PSRCT when maintaining the physiologic tension of the lower trapezius muscle. However, the LTT did not completely restore native kinematics, regardless of tensioning. Tensioning during LTT for an irreparable PSRCT is important to sufficiently improve glenohumeral kinematics and may be an intraoperatively modifiable key variable to ensure postoperative functional success.

Category: Shoulder - Rotator Cuff

Three-Dimensional Scapular Kinematics in Patients with Rotator Cuff Tears before Arthroscopic Repair

Abstract ID # 22366

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