Table 1

	Forward elevation (degrees)	External rotation (degrees)	Internal rotation Score	SST score	ASES score
RSA-A	132.19	36.14	4.36	9.86	81.58
RSA-C	145.6	41.76	4.64	10.27	84.25
P-value	.0013	.0647	.3195	.3055	.3760

reported in one patient in the RSA-SA group but did not result in a revision during the study period. The RSA-C group had significantly higher forward elevation than the RSA-A group. There were no significant differences in external rotation, internal rotator score, SST scores, or ASES scores between the RSA-A and RSA- C groups (Table 1).

Conclusion: Results of RSA with superior and posterior-superior augmented baseplates demonstrate improved clinical outcomes without increased risk of glenoid baseplate failure in patients with superior and posterior-superior glenoid wear.

Paper #30 TUBEROSITY HEALING IMPROVES ROM AND FUNCTIONAL OUTCOME FOLLOWING TREATMENT OF PROXIMAL HUMERUS FRACTURES WITH REVERSE SHOULDER ARTHROPLASTY

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Introduction: Reverse shoulder arthroplasty (RSA) is a common treatment for proximal humeral fractures in the elderly. The aim of this study was to evaluate the influence of tuberosity healing on functional outcome following a 135° humeral inclination RSA for proximal humeral fracture.

Methods: A retrospective evaluation was performed of all patients during a two-year period with an acute proximal humeral fracture treated with a 135° humeral inclination RSA at 4 centers were included. Minimum follow-up (FU) was 1 year. Visual analog pain scale (VAS)), range of motion, Constant score, American Shoulder and Elbow Surgeons (ASES) score and subjective shoulder-value (SSV) were recorded. In addition, tuberosity healing and glenoid notching were analyzed.

Results: Sixty-four patients with a mean age of 76 ± 7 years were available for follow-up at 22 ± 8 months postoperative. The mean adjusted-constant score was 72%, the mean ASES score was 72 ± 15, the mean SSV was 71% ± 14 and the mean VAS was 2 ± 2. The healing rate of the greater tuberosity (GT) was 77%. Healing of the GT resulted in significantly improved forward flexion (116° vs. 92°; $P = .002$), external rotation (33° vs. 17°; $P = .02$) and adjusted-constant score (78% vs. 54%, $P < .001$). Only 33% of the cases with an inferior eccentric glenoid demonstrated tuberosity healing. The complication rate was 8% and revision rate was 3%; however, the implant survival rate was 100%.

Conclusion: RSA with a 135° humeral inclination leads to acceptable functional outcome and a high rate of tuberosity healing in the treatment of proximal humerus fractures. The revision rate is low in the short-term. Tuberosity healing is associated with improved ROM and functional outcome.

Paper #31 SALVAGE REVERSE TOTAL SHOULDER ARTHROPLASTY FOR FAILED OPERATIVE TREATMENT OF PROXIMAL HUMERAL FRACTURES IN PATIENTS YOUNGER 60 YEARS: LONG-TERM RESULTS

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Introduction: Serious concerns exist about the longevity of salvage RTSA in the working population. It was the purpose to analyze the long-term outcome of RTSA as a salvage procedure for failed operative treatment of complex proximal humeral fractures in patients younger than 60 years.

Methods: Thirty patients with a mean age of 52 (range, 30-59) years were personally reviewed after a mean follow-up of 11 (range, 8-18) years. There were seven patients (23%) with RTSA for failed ORIF and 23 patients (77%) for failed hemiarthroplasty. Clinical and radiographic outcome were assessed longitudinally.

Results: At final follow-up, the absolute and relative, mean Constant scores improved from preoperatively 21 (range, 5-45) to 49 (range, 19-82) points ($P < .001$); and from 25% (range, 5-53%) to 58% (range, 25-94%; $P < .001$), respectively. Significant improvements were seen in mean SSV (20% to 56%), active elevation (45° to 106°), abduction (42° to 99°), pain scores and strength ($P < .001$). Clinical outcome did not significantly deteriorate over 10 years and the functional results of patients with RTSA for failed primary hemiarthroplasty (n = 10) were not inferior to those after failed ORIF (n = 6). Patients with RTSA for failed secondary hemiarthroplasty (n = 8) compared with those after failed ORIF showed inferior elevation (93° vs. 113°; $P = .190$) and abduction (77° vs. 116°; $P = .023$). Patients with a healed greater tuberosity (n = 8) showed significantly better external rotation compared with patients with a resorbed greater tuberosity (n = 13; 8° vs. 15°; $P = .014$). One or more complications occurred in 21 shoulders (71%), and six (20%) resulted in explantation of the RTSA.

Conclusion: Although salvage RTSA in patients younger than 60 years is associated with a substantial complication rate, it leads to significant subjective and functional improvement without clinical deterioration beyond 10 years. Inferior shoulder function is associated with greater tuberosity resorption and with RTSA for failed secondary hemiarthroplasty.

Paper #32 EFFECTS OF AGING ON THE MOLECULAR PROFILE OF CULTURED TENDON CELLS

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Introduction: Rotator cuff tears affect millions of individuals each year, with increased prevalence in the elderly. Although surgical repair improves function and reduces pain, rotator cuff repair failure is common. To improve surgical outcomes, repair augmentation has been investigated. We recently found that autologous biceps cells delivered via scaffold during supraspinatus repair improved healing in juvenile and aged rats, but not adult rats. However, the molecular mechanisms behind these differential effects are not well understood. The objective of this study (funded by the American Shoulder and Elbow Surgeons Research Grant) was to determine the differences in the RNA signature of primary tendon-derived cells cultured from the long head of the biceps of juvenile, adult, and aged rats. This study is the first in a planned sequential line of work to determine the "ideal" autologous or allogeneic cell source for rotator cuff repair augmentation. Our hypotheses for this study were: 1) Tendon-derived cells from juvenile rats would exhibit a molecular profile with a more stem-cell character than other ages, and 2) Tendon-derived cells from aged rats would show increased expression of genes associated with tendon homeostasis and differentiation.

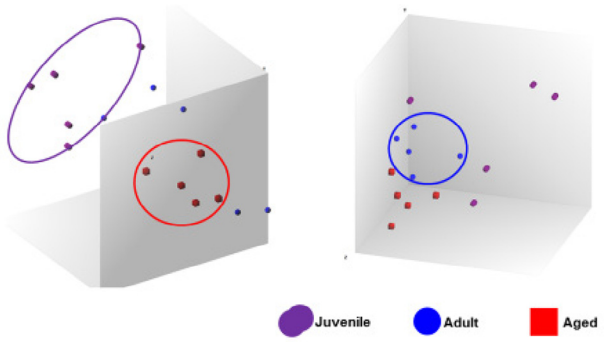

Figure 1 Two 2D views of Principle Component Analysis (PCA) plots of from Rat Transcriptome Analysis. PCA plot shows distinct expression regions by age (circled). Juvenile, purple cylinders; Adult, blue circles; Aged cells, red squares.

Table 1 Number of upregulated (red) and downregulated (green) genes between groups listed as row compared to column.

	JUVENILE	ADULT	AGED
JUVENILE		216 203	640 531
ADULT			54 101
AGED			

Methods: 27 Fisher 344 rats were used from three age groups: juvenile (4 weeks), adult (8 months) and aged (16 months). Animals were sacrificed (n = 5 for microarray, n = 4 for qRT-PCR) and the intra-articular biceps tendons were collected. Biceps tendon cells were harvested via morselization and cell migration. At passage 1 (P1), cells were stained and imaged or used for RNA isolation via TRIzol. cDNA was synthesized and run on a Clariom™ D Rat Transcriptome Array 1.0. Bioinformatics processing was performed using Transcriptome Analysis Console Software and DAVID analysis (cut-offs set at $|FC| > 2$ and $P < .05$ for all age comparisons). qPCR validation was run using TaqMan assays. Data was analyzed using the $\Delta\Delta Ct$ method, Kruskal-Wallis tests, and post-hoc Dunn's tests.

Results: Principle component analysis (PCA) showed that there were distinct regions separating cell expression profiles by age (Fig. 1) and the majority of gene expression clustered into six distinct patterns when comparing between ages (data not shown). Differential gene expression is shown in Table 1. No qualitative differences were observed in cell morphology (Fig. 2). Gene ontology identified differences in genes related to cell adhesion, wound healing, and chondrocyte differentiation between adult and juvenile cells; in wound healing and vasculogenesis between aged and adult cells; and in cell division and cell adhesion between aged and juvenile cells. qPCR confirmed decreased expression of *Postn* with age, and downregulation of *Fgf10*, *Il6,* and *Il6st* in aged cells compared to adults (Fig. 3).

Discussion: These results demonstrate distinct molecular profiles for juvenile, adult, and aged animals. Supporting our first hypothesis, juvenile cells upregulate expression of genes associated with mesenchymal stem cells, such as *Postn*. Furthermore, although other stem cell markers such as *Fgf10* are present in juvenile and adult cells, they are decreased in aged cells, suggesting that a greater population of aged tendon cells may have terminally differentiated into tenocytes. Although these findings support our first hypothesis, our second hypothesis was not substantiated since a consistent increase in the expression of tendon markers in aged cells was not observed. Instead, aged cells displayed a decreased pro-inflammatory signature, including lower expression of both *Il6* and its signaling receptor *Il6st*. These results demonstrate distinct molecular profiles and gene expression between age groups. Future work will focus on protein level changes and their related functions in tendon healing with age. This data will guide future studies to develop an optimized tissue engineering approach for rotator cuff repair augmentation.

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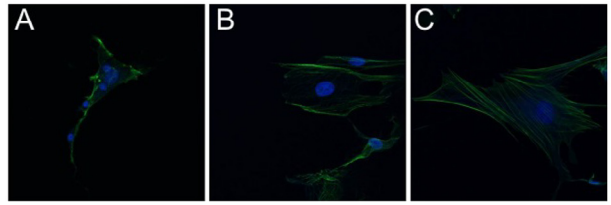

Figure 2 Representative juvenile (A) adult (B) and aged (C) cells when stained for actin (green) and nuclei (blue). No qualitative differences were observed in cell morphology.

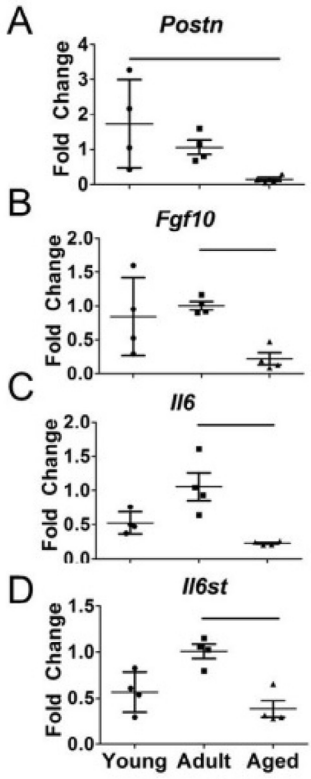

Figure 3 qRT-PCR. Decreased expression of (A) Postn, (B) Fgf10, (C) Il6, and (D) Il6st in aged cells. Significance is noted by solid bars.