

contracted capsule was found only in group 3 patients (3 out of 6 patients). Acromioplasty and an arthroscopic RCR was performed in all cases. There were no manipulations under anesthesia, nor any capsular releases except to improve cuff mobility. One year postoperatively, TROMD in group 1 was reduced to an average of 4°, in group 2 to 12°, and in group 3 to 31°. However, three patients in this group required a second arthroscopy with a capsular release in order to achieve their final level of improvement. The release was performed at an average of 5 months postoperative after poor return of ROM. All had intact repairs and did well after capsular release. All 3 patients had thick, contracted capsules at the time of the initial RCR and at the time of capsular release. Based on this study, patients with TROMD up to 75° will do well with rotator cuff repair and postoperative rehabilitation. Even patients with greater than 75° TROMD will do well if they do not have true capsulitis. Stiff RCT patients who have capsulitis will not do well. We are currently performing a simultaneous RCR and complete capsular release on these patients with very good early clinical results.

Joseph C. Tauro, M.D.

Rotator Cuff Repair: The Effect of Double-Row Fixation Versus Single-Row Fixation on Three-Dimensional Repair Site (SS-03)

In rotator cuff surgery, increasing emphasis is being placed on maximizing the repair site contact area, thereby increasing the tendon-bone interface to potentially enhance more complete healing. Previous studies have demonstrated that traditional repairs using a single row of suture anchors or trans-osseous sutures fail to reproduce the area of the native supraspinatus tendon insertion or "footprint" on the greater tuberosity. The purpose of this study was to demonstrate the superiority of a double-row fixation technique in restoring the normal area of the supraspinatus footprint. Materials and Methods: A cadaveric study was performed using 7 fresh frozen shoulders. Rotator cuff tears were created and then repaired using several techniques: single-row suture anchor fixation (SRSA) using Mitek Fastin RC anchors (Mitek Worldwide, Norwood, MA), double-row suture anchor fixation (DRSA), and trans-osseous suture technique (TOS). The repair footprint area was determined for each technique by three-dimensional digitation, using a MicroScribeG2X digitizer (Immersion Corp, San Jose, CA). The area of the original tendon insertion site was also assessed for comparison. The data was processed using Rhinoceros NURBS modeling software (McNeal and Associates, Seattle, WA) and the repair site areas

were compared for the different repair techniques. Appropriate power analysis was performed to insure adequate sample size and a 2 tailed paired Student *t* test was performed to reveal statistical significance of detected differences. Results: The footprint area of the DRSA technique was larger than that of the other two techniques. These findings were statistically significant ($P < .05$). Furthermore, the DRSA technique consistently reproduced 100% of the original supraspinatus footprint area. Both the SRSA and TOS technique failed to do so. On average, the TOS technique reproduced only 71% of the original insertion site and the SRSA technique reproduced 46%. The differences between the area of the original footprint, TOS and SRSA were all statistically significant ($P < .05$). Conclusions: Double-row fixation in rotator cuff repair reproduces 100% of the supraspinatus footprint while traditional single-row techniques fail to do so. Double-row fixation may be a superior technique by providing a tendon-bone interface better suited for biologic healing and restoring normal anatomy.

Steven W. Meier, M.D., Jeffrey D. Meier, D.O., Andrew S. Levy, M.D.

Outcome of Arthroscopic Repair of High-Grade, Bursal-Sided, Partial Rotator Cuff Tears (SS-04)

The natural history of the high-grade, partial tear of the bursal surface of the rotator cuff is not clearly understood. Recent evidence suggests that arthroscopic subacromial decompression or debridement alone can lead to poor outcome and may allow further deterioration of the rotator cuff. These tears may be particularly well-suited for an arthroscopic repair because of the presumably lower fixation demands afforded by the intact portion of the rotator cuff. We sought to evaluate the outcome of patients who've undergone arthroscopic repairs of high-grade bursal-sided rotator cuff tears. Methods: Between January 2000 and December 2002, 27 patients who had an intact articular surface, but a high-grade bursal-sided tear (>7 mm of exposed tuberosity) were treated with a subacromial decompression and an arthroscopic rotator cuff repair. All patients had a single row repair with at least one suture anchor. No lesion was completed to a full-thickness tear. Outcomes were assessed by serial examination and the L'Insalata shoulder rating questionnaire. Results: Mean follow-up was 24.5 months. 24 of the 25 patients were satisfied. L'Insalata scores increased from 34.7 to 85.1 ($P < .001$). Analysis of variance showed significant increases in abduction postoperatively ($P = .004$). Internal and external rotations were not significantly altered. Conclusions: Arthro-

scopic repair of high-grade, bursal-sided rotator cuff tears offer a high degree of patient satisfaction and functional improvement with low surgical morbidity. These outcomes appear to be favorable to previous reports of arthroscopic decompression and/or debridement.

Kyle Anderson, M.D. Daniel Aschenbrenner, D.O.

Arthroscopic Repair of Full-Thickness Tears of the Rotator Cuff in Patients Under the Age of 40 (SS-05)

Recent reports document excellent outcomes with arthroscopic repair of rotator cuff tears (RCT). However, full-thickness RCT are uncommon in patients under age 40, and few reports document results after repair in this population. We report results of arthroscopic repair of full-thickness RCT in patients under 40. **Materials and Methods:** Twenty-three consecutive patients under age 40 with full-thickness RCT underwent arthroscopic repair with suture anchors. Mean age was 37 years (range 21-39). Mean size of RCT was 2.4 cm in largest dimension (range 1-4 cm). Mean number of anchors used was 2.5 (range 1-4). Concomitant procedures included subacromial decompression (22), distal clavicle resection (13), SLAP repair (2), biceps tenodesis (2), anterior capsulorrhaphy (1), and capsular releases (1). Twenty-two patients (95%) recalled a single incipient trauma; two patients sustained a dislocation. Ten patients (43%) claimed workers' compensation (W/C). Mean follow-up was 15 months (range 12-18 months). **Results:** Mean preoperative ASES score was 42 (range 22-60); mean postoperative score was 92 (range 65-100; $P < .01$). Twenty-one patients (90%) returned to previous level of activity and employment, including 9 (90%) with W/C claims. All patients (100%) reported diminished pain and 22 (95%) reported improvement with activities of daily living. Complications included superficial wound infection (1) and axillary nerve palsy after initial dislocation (1). Twenty-two patients (95%) would have same procedure again. **Discussion:** Full-thickness RCT in patients under 40 appear to be traumatic in etiology. Successful repair returns patients to pre-injury level of function. These results support arthroscopic rotator cuff repair in young, active patients.

Sumant G. Krishnan, M.D., Wayne Z. Burkhead, M.D.

Postoperative Cuff Integrity After Arthroscopic Full-Thickness Rotator Cuff Repair: Single-Row Versus Dual-Row Fixation (SS-06)

Purpose: A dual-row fixation for rotator cuff repairs has been developed to strengthen the anchoring of the tendon to bone interface. However, there are no published clinical articles supporting the superiority of the dual-row fixation over the conventional single-row fixation meth-

ods. The purpose of this study was to compare the clinical outcome, including cuff integrity evaluated through MRI, of a single-row and a dual-row fixation after arthroscopic full-thickness rotator cuff repair using suture anchors. **Methods:** A consecutive series of 83 shoulders in 81 patients with full-thickness rotator cuff tears were evaluated using the University of California Los Angeles (UCLA) scoring system at an average of 36 months (range, 24-60) after arthroscopic full-thickness rotator cuff repair using either a single-row or dual-row fixation method with use of metal suture anchors loaded with No. 2 permanent sutures. All were also evaluated for cuff integrity through MRI at one to two years postoperatively. A consecutive series of 41 shoulders were repaired using the single-row fixation method, followed by a consecutive series of 42 shoulders using the dual-row fixation method. The average follow-up was 43 and 29 months, respectively. Postoperative cuff integrity was determined through MRI, which was performed respectively at 15 and 12 months postoperatively on average, and was classified into 5 categories using oblique coronal, oblique sagittal, and transverse views of T2 weighted images: type I: sufficient thickness with homogeneously low intensity; type II: sufficient thickness with partial high intensity; type III: insufficient thickness without discontinuity; type IV: presence of minor discontinuity suggesting a small tear; type V: presence of a major discontinuity suggesting a medium or large tear. Mann-Whitney *U* test was used for statistical analysis. **Results:** Postoperative UCLA scores improved significantly both in the single-row ($P < .01$) and in the dual-row ($P < .01$) groups. The average postoperative UCLA score was 33.5/35 in the single-row group and 33.7/35 in the dual-row group. However, there was no statistical difference between these two groups ($P > .05$). Postoperative MRI examination of cuff integrity revealed 12 type I, 7 type II, 12 type III, 4 type IV, and 6 type V in the single-row group, and 21 type I, 8 type II, 8 type III, and 5 type IV in the dual-row group. A statistical difference was observed between these two groups ($P < .05$). **Conclusions:** Arthroscopic full-thickness rotator cuff repair using both single-row and dual-row fixation yielded successful outcomes evaluated by the UCLA scoring system without significant difference between the fixation methods. However, the dual-row fixation excelled in postoperative cuff integrity over the single-row fixation. This evidence provides validity of the dual-row fixation for arthroscopic full-thickness rotator cuff repair.

Hiroyuki Sugaya, M.D., Joji Moriishi, M.D., Izumi Kanisawa, M.D., Akihiro Tsuchiya, M.D.