ABSTRACTS FROM THE AMERICAN SHOULDER AND ELBOW SURGEONS (ASES) 2011 OPEN MEETING/SPECIALTY DAY

1 PROSPECTIVE RANDOMIZED STUDY OF ARTHROSCOPIC ROTATOR CUFF REPAIR USING AN EARLY VERSUS DELAYED POSTOPERATIVE PHYSICAL THERAPY PROTOCOL
Derek Cuff, MD, Derek Pupello, MBA, Suncoast Orthopaedic Surgery and Sports Medicine, Venice, Florida, USA; Foundation for Orthopaedic Research and Education, Tampa, Florida, USA

Introduction: Physical therapy is often prescribed in the postoperative management of patients undergoing rotator cuff repair. Classical teaching has advocated for early passive range of motion (ROM) in an effort to minimize postoperative adhesions and stiffness. However, this motion may also allow strain or micromotion at the repair site while the rotator cuff is beginning to heal. The purpose of this study was to perform a prospective randomized study to evaluate patient outcomes and rotator cuff healing after arthroscopic rotator cuff repair using a postoperative physical therapy protocol with early passive motion compared with a conventional protocol that limits early passive motion. Materials and Methods: From December 2007 to December 2008, 128 patients underwent arthroscopic rotator cuff surgery; 68 patients (average age 63.2 years) met inclusion criteria and were enrolled in this study. All patients included in this study had a full thickness crescent-shaped tear of the supraspinatus that was repaired using a transosseous equivalent suture-bridge technique along with a subacromial decompression. No other concomitant labral or bicep procedures were performed in these patients. In 1 subset of patients (early group), 33 patients were randomized to passive elevation and rotation that began at the beginning of postoperative week 6. Patients were followed clinically (American Shoulder and Elbow Surgeons [ASES] score, Simple Shoulder Test [SST], self reported satisfaction) for a minimum of 12 months. Postoperative ultrasound was performed after 9 months to assess rotator cuff healing. Patients were videotaped while performing a standard active ROM protocol before and after treatment and these videos were analyzed in a blinded fashion by 3 observers. Results: Both groups had similar improvements in preoperative to postoperative ASES scores (early group, 43.9 to 91.9 [P<.0001]; delayed group, 41.0 to 92.8 [P<.0001]). Both groups had similar improvements in preoperative to postoperative SST scores (early group, 5.9 to 11.1 [P<.0001]; delayed group 5.1 to 11.1 [P<.0001]). Patient satisfaction in the early group was 94% and 97% in the delayed group. In the early group, 85% demonstrated rotator cuff healing on ultrasound compared with 91% in the delayed group (P=.69). At the 12 month follow-up visit there was no significant difference in ROM between the early group or the delayed group with respect to forward elevation (avg. 175° vs. 173.8° [P=.65]), external rotation (avg. 46° vs. 45° [P=.7]), or internal rotation (94% vs. 91% with internal rotation to lumbar spine). Conclusion: Patients who underwent arthroscopic rotator cuff repair and then a prescribed postoperative protocol with early or delayed initiation of passive ROM demonstrated very similar outcomes and ROM at 1 year. There was a slightly higher rotator cuff healing rate in the delayed passive ROM group compared with the early passive ROM group (91% vs. 85%).

2 PROSPECTIVE EVALUATION OF ARTHROSCOPIC ROTATOR CUFF REPAIRS: FUNCTIONAL OUTCOMES AND ULTRASOUND HEALING RATES AT 5 YEARS
Lawrence V. Gulotta, MD, Shane J. Nho, MD, Christopher C. Dodson, MD, Ronald S. Adler, MD, PhD, David W. Altchek, MD, John D. MacGillivray, MD, The Sports Medicine/Shoulder Service at the Hospital for Special Surgery, New York, New York, USA

Introduction/Background: Prospective long-term studies that examine the functional and radiographic results of all-arthroscopic rotator cuff repairs are lacking. The Arthroscopic Rotator Cuff Registry was established at our hospital to prospectively evaluate the effectiveness of all-arthroscopic rotator cuff repairs over a 5-year period with physical exam, clinical outcomes and ultrasonography. The purpose of the present study is to report the preliminary data of patients undergoing arthroscopic rotator cuff repair at 5 years. Our hypothesis was that arthroscopic rotator cuff repairs lead to a significant improvement in clinical outcomes and healing rates with durable results at 5 years. Materials and Methods: A total of 193 patients underwent all-arthroscopic repair of the rotator cuff and were enrolled in the study. Patients were evaluated preoperatively and at 1, 2, and 5 years postoperatively. The outcome measurements included physical examination, manual muscle testing, the American Shoulder and Elbow Surgeons (ASES) score, and ultrasonography. Patient demographics, rotator cuff tear and repair characteristics, and concomitant pathology and procedures were recorded. Outcomes were compared between time points using a paired Student’s t-test with a significance set at P<.05. Results: At 5 years, 106 patients (55%) completed follow-up. Average age was 59.1 years; 61.2% were males. ASES scores improved from 52.6±23.2 preoperatively to 92.6±14.8 at 5 years (P<.001). There were no differences between the ASES score at 2 years and 5 years. However, there was an improvement from 1 year to 5 years (P=.002). Passive forward elevation went from 151.9±29.2 degrees preoperatively, to 168.6±16.8 at 5 years (P<.001). The elevation at 5 years was decreased from the 173±10.3 degrees that was seen at 2 years (P=.02). Passive external rotation increased from 60.5±18.8 degrees preoperatively, to 67.8±19.6 at 5 years (P=.004). The external rotation at 5 years was decreased from the 73.6±21.3 seen at 2 years (P=.04). Patients improved a full motor grade in forward elevation and external rotation strength, and these increases remained stable over the course of the 5 years of follow-up. Healing rates were 64.3% at 1 year, 75.4% at 2 years, and 81.2% at 5 years (1 year → 5 year, P=.001; 2 year → 5 year, P=.05). There were 7 rotator cuffs that were not healed at 2 years that had evidence of healing at 5 years. Only 1 patient that was healed at 2 years was found to have a new defect at 5 years. Discussion: This prospective study shows that the mid-range results of all-arthroscopic rotator cuff repairs are good, with functional results remaining constant over 5 years. However, patients did experience some loss in passive forward elevation and external rotation between years 2 and 5. This may be an indication of deteriorating results in the future. An interesting finding was that the ultrasonographic healing rates continued to improve even 5 years following the surgery. This may also help explain why patients without radiographic evidence of healing can still have excellent clinical results.
3 EFFECTIVENESS OF PHYSICAL THERAPY IN TREATING ATRAUMATIC FULL THICKNESS ROTATOR CUFF TEARS. A MULTI-CENTER PROSPECTIVE COHORT STUDY

John E. (Jed) Kuhn, MD, Warren R. Dunn, MD, MPH, Angel Qi An, MS, Keith M. Baumgarten, MD, Julie Y. Bishop, MD, Robert H. Brophy, MD, James L. Carey, MD, MPH, G. Brian Holloway, MD, Grant T. Jones, MD, C. Benjamin Ma, MD, Robert G. Marx, MD, MPH, Eric C. McCarty, MD, Sourav K. Poddar, MD, Edwin E. Spencer Jr, MD, Armando F. Vidal, MD, Brian R. Wolf, MD, Rick W. Wright, MD, MOON Shoulder Group, Vanderbilt Sports Medicine, Nashville, Tennessee, USA

Introduction: Full thickness rotator cuff tears are extremely prevalent, yet fewer than 5% come to surgical repair. In those that undergo surgical repair and postoperative rehabilitation reported, healing rates have ranged from 13% to 69%, yet patients who have failed repairs report good outcomes and satisfaction with treatment. These data suggest that physical therapy may be effective in treating symptoms associated with full thickness rotator cuff tears. The purpose of this study is to assess the effectiveness of a nonoperative physical therapy program in treating atraumatic full thickness rotator cuff tears using a multicenter prospective cohort study design.

Methods: After IRB approval was obtained at multiple sites, patients who met inclusion criteria (atraumatic full thickness tears and no other pathology) were offered an opportunity to enroll in the study. All patients completed a questionnaire collecting data on demographics, symptom characteristics, co-morbidities, willingness to undergo surgery, and patient related outcomes (SF-12, ASES, WORC, Kim Shoulder Co Sense, Marks Activity Scale). Physicians recorded physical examination and imaging data. Patients began a physical therapy program developed from a systematic review and returned for evaluation at 6 and 12 weeks. At those visits patients could choose 1 of 3 outcomes: 1) Cured - no formal follow-up scheduled, 2) Improved - continue therapy with scheduled reassessment in 6 weeks; or 3) No better - arthroscopic rotator cuff repair scheduled. Patients were contacted by telephone at 1 and 2 years to determine if they had undergone surgery since their last visit. A Wilcoxon signed rank test with continuity correction was used to compare initial, 6-week, and 12-week outcome scores. Results: As of May 1, 2010, 396 patients have been enrolled. Overall, patients elected to undergo surgery <10% of the time. Patients who decided to have surgery generally did so in the first 6 weeks of Table 1. Patient reported outcomes showed significant improvement 6 and 12 weeks for the ASES, WORC, SANE scores. The SF-12 and Marx Activity Scale did not change over time (Table 2). Conclusions: Nonoperative treatment using this systematic review-based physical therapy protocol is effective for treating atraumatic full thickness rotator cuff tears in >90% of patients. Further follow-up of this cohort will be performed to 1) determine predictors of failure of nonoperative treatment, and 2) identify features that may predict risk of rotator cuff tear enlargement and recurrence of symptoms. Level of Evidence: Level II, Prospective Cohort Study, Treatment Study

References

Table 1

<table>
<thead>
<tr>
<th>6 weeks</th>
<th>12 weeks</th>
<th>1 year</th>
<th>2 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No data</td>
<td>370</td>
<td>319</td>
<td>242</td>
</tr>
<tr>
<td>No surgery</td>
<td>20 (5%)</td>
<td>24 (8%)</td>
<td>2 (1%)</td>
</tr>
<tr>
<td>Surgery</td>
<td>313 (85%)</td>
<td>276 (87%)</td>
<td>224 (93%)</td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th>Baseline scores</th>
<th>6 weeks</th>
<th>P value</th>
<th>12 weeks</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF-12 MCS</td>
<td>40.3</td>
<td>.0001</td>
<td>40.9</td>
<td>.79</td>
</tr>
<tr>
<td>SF-12 PCS</td>
<td>35.3</td>
<td>.0001</td>
<td>36.0</td>
<td>.0001</td>
</tr>
<tr>
<td>ASES Score</td>
<td>54.4</td>
<td>.0001</td>
<td>75.3</td>
<td>.0001</td>
</tr>
<tr>
<td>WORC Score</td>
<td>47.0</td>
<td>.0001</td>
<td>69.4</td>
<td>.0001</td>
</tr>
<tr>
<td>SANE Score</td>
<td>46.6</td>
<td>.0001</td>
<td>70.0</td>
<td>.0001</td>
</tr>
<tr>
<td>Marks Activity Scale</td>
<td>9.9</td>
<td>.0001</td>
<td>10.0</td>
<td>.44</td>
</tr>
</tbody>
</table>

4 SERIAL STRUCTURAL AND FUNCTIONAL ASSESSMENT OF ROTATOR CUFF REPAIRS – DO THEY DIFFER AT SIX AND NINETEEN MONTHS POSTOPERATIVELY?

Kyoung-Hwan Koh, MD, Mukesh S. Laddha, MS, Tae-Kang Lim, MD, Min-Soo Shon, MD, Hyun-Ill Lee, MD, Sung-Won Jang, MD, Jun-Hee Kang, MD, Jae-Chul Yoo, MD, Department of Orthopaedic Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea

Introduction: Although rotator cuff tears may not mean frank clinical failure, clinical results after rotator cuff repair can be anticipated given sound structural healing. Some experimental or animal studies have shown that retears occur early after surgery and ultimate failure strength is reached between 3 and 6 months. However, few clinical studies have been reported to support their theory. The purpose of this study was to see if rotator cuff integrity after the repair had any difference at 6 months and at 19 months after surgery. Material and Methods: Within a 1-year time frame, 34 consecutive patients who received complete repair of full-thickness rotator cuff tears and underwent 2 postoperative follow-up MRIs were included in this study. Retear, fatty degeneration and muscle atrophy were evaluated in these 2 consecutive MRI by 2 independent observers. Clinical scores were assessed using American Shoulder and Elbow Surgeons’ (ASES) score, Constant score, and Pain Visual Analogue Scale (PVAS) preoperatively and at the time of 1st and 2nd MRI. Results: Mean time for 2 consecutive MRI was taken at 6.0 month (3.1-8.3 mo) and at 19.2 months (7.6-25.3 mo). There were no retear in 27 patients, 5 partial retears, and 2 full-thickness retears on 1st MRI. In terms of rotator cuff retears, the 2 sets of MRI showed almost identical appearance. The only statistically significant improvement was a reduction in tenosynovitis on 2nd MRI. Muscle atrophy and fatty degeneration were no different in 1st and 2nd MRI (P=0.317). However, progressive significant improvements in clinical statuses were observed between 1st MRI and 2nd MRI period. Conclusion: Six months seems to be sufficient for...
assessing the structural status of repaired rotator cuff tendon. Although definite improvements in functional status occurred with time, the structural status of repaired cuff tendon seems to not change for at least 1 year after the early changes in the postoperative period.

**5 PREDICTING SUCCESSFUL TREATMENT OF PATIENTS WITH CHRONIC FULL THICKNESS ROTATOR CUFF TEARS UTILIZING BASELINE CLINICAL INDICATORS**

**Kristie D. More, MSc, Richard S. Boorman, MD, Dianne Bryant, PhD, Kelly Brett, MD, Robert Hollinshead, MD, Ian K.Y. Lo, MD, Preston Wiley, MD, Nick G. Mohtadi, MD, University of Calgary Sports Medicine Centre, Calgary, Alberta, Canada; University of Western Ontario, London, Ontario, Canada**

**Background:** We previously identified that a high percentage of patients with chronic full thickness rotator cuff tears referred to subspecialist orthopaedic surgeons had not undergone appropriate nonoperative treatment, and ultimately did not require surgery. **Objective:** In the first phase of our study, we sought to identify clinical predictors for successful outcome of nonoperative treatment of chronic rotator cuff tear patients. The specific objective of the second phase of our study was to determine if patients who were “successfully” treated in our 3-month nonoperative program, and who declined surgery at the orthopaedic consultation, maintained the same outcome (success or failure) at 12 months. **Methods:** In the first phase of our study, 50 patients between the ages of 40 and 85 years with a documented full-thickness tear on ultrasound or MRI were recruited prospectively. They underwent a 3-month home-based exercise/treatment program under the supervision of an experienced physiotherapist and a sport medicine physician. At the conclusion of the program, the patients were evaluated by an orthopaedic surgeon. “Successful” patients declined surgery following the consultation, whereas “failed” patients elected to undergo rotator cuff repair. In the second phase of our study, 42 patients who were defined as successes at 3 months were followed longitudinally for 12 months (1 patient had a specific re-injury, 1 patient attributed failure to treatment, 3 lost to follow-up). Of the 46 remaining patients who were defined as successes at 3 months, the trend for RCQOL scores remained significant for successful outcome of nonoperative treatment (P<.017). Patients who were successful with nonoperative treatment had a mean baseline RCQOL score of 49/100, whereas patients who failed nonoperative treatment had a mean baseline RCQOL score of 31/100. The 2 factors of patient age and dominant extremity involvement also trended toward significance. Phase 2: At 12 months, 4 patients were not available for follow-up (1 excluded due to worker’s compensation status, 3 lost to follow-up). Of the 46 remaining patients, 7 (15%) had crossed over from one group to the other. Four patients who had been defined as “failures” at 3 months had since improved and become “successes” at 12 months. Three patients who had been defined as “successes” at 3 months had since become more symptomatic and were now considered “failures” at 12 months (1 patient had a specific re-injury, 1 patient attributed increased symptoms to daily use of compression stockings, and 1 patient became more symptomatic). Of the patients who had been defined as successes at 3 months, the trend for RCQOL scores was: baseline, 48.8 (SD 21.5); 3 months, 82.2 (SD 12.2); 6 months, 78.7 (SD 15.5), 12 months, 77.0 (SD 21.3). **Conclusion:** Nonoperative treatment can be an extremely effective option for patients with chronic, full thickness rotator cuff tears. Baseline RCQOL score can help predict which patients can be successfully treated without surgery. Patients who are successfully treated nonoperatively after 3 months have a high probability of ongoing success at 1 year.

**6 POSTOPERATIVE PAIN AFTER OPEN VERSUS ARTHROSCOPIC ROTATOR CUFF REPAIR**

**Raymond R. Ropiak, MD, Benjamin M. Zmistowski, BS, Michael C. Ciccott, BA, Ralph Ryning, MD, Gerald R. Williams Jr, MD, John M. Fenlin Jr, MD, Rothman Institute of Orthopaedics at Thomas Jefferson University, Philadelphia, Pennsylvania, USA**

**Introduction:** Despite the biologic limitations of tendon healing and the relatively high incidence of recurrent tears, rotator cuff repair remains a successful treatment in terms of patient satisfaction and pain relief, regardless of the repair method. Many studies have compared the outcomes of open versus arthroscopic rotator cuff repair using validated shoulder rating scales or the rate of tendon retear; however, no one has evaluated the difference in patient perceived postoperative pain. It is a well-perceived notion that arthroscopic repair is significantly less painful than open repair. The purpose of this study was to compare the results of patient-reported postoperative pain following open versus arthroscopic rotator cuff repair. **Methods and Materials:** This was a prospective, single-institution, 2-surgeon analysis; 102 patients (52 open, 50 arthroscopic) completed the study between May 2007 and May 2010. Preoperatively, patients reported pain levels, self-perceived pain tolerance, and underwent a test for an objective measurement of pain tolerance. Intraoperative variables included surgery duration and size of tear. Postoperatively, these patients maintained a pain diary for 6 weeks, reporting daily pain (visual analog scale) and narcotic consumption. Outcome variables included weekly pain levels, cumulative 5-week pain level, days to zero pain, and presence of residual pain at 6 weeks. **Results:** A statistically significant difference of less than 1 point on the visual analog scale was observed in the second postoperative week, cumulative week 2 pain was associated with significantly increased postoperative pain following open versus arthroscopic rotator cuff repair. The use of arthroscopy should not be based on decreased postoperative pain alone. Predictors of postoperative pain include objective pain tolerance, tear size, and preoperative pain.

**7 IS EARLY PASSIVE MOTION NECESSARY AFTER ROTATOR CUFF REPAIR?**

**Joo-Han Oh, MD, PhD, Yang-Soo Kim, MD, Chung-Hee Oh, MD, PhD, Sae-Hoon Kim, MD, PhD, Joon-Yub Kim, MD, Seok-Won Chung, MD, Hye-Ran Kim, BA, Shang-Mi Shim, BA, Seoul National University College of Medicine, Bundang Hospital, Seongnam-Si, South Korea; Kangnam St. Mary’s Hospital, Seoul, South Korea; S-Seoul Hospital, Suwon, Gyunggi-do, South Korea**

**Introduction:** Early passive motion has long been the standard rehabilitation protocol after rotator cuff repair for the reason that postoperative...
stiffness is the one of the deleterious complication. On the contrary, there are recent approaches that suggest longer immobilization may enhance tendon healing. On this basis, we designed a prospective randomized clinical trial to verify whether early passive motion affects functional outcome and tendon healing after arthroscopic rotator cuff repair. Materials and Methods: Between August 2007 and July 2009 a consecutive 105 patients (44 males, 61 females) of small-to-medium-sized full-thickness rotator cuff tear were included. Patients with large to massive tear and concomitant stiffness or labral tear were excluded. After arthroscopic rotator cuff repair, subscapularis tendon and the posterior-superior tear were included. They all underwent subscapularis-only repair and greater tuberosity fracture. Outcome was further categorized according to patient compliance to early passive motion exercise.

8. ISOLATED SUBSCAPULARIS REPAIR IN THE FACE OF IRREPARABLE POSTERIOR-SUPERIOR CUFF TEARS
Mark D. Lazear, MD, Luke S. Austin, MD, Jason Nydick, DO, Edward S. Chang, MD, Benjamin M. Zmistowski, BS, Rothman Institute of Orthopaedics at Thomas Jefferson University, Philadelphia, Pennsylvania, USA

Introduction: The best surgical treatment for irreparable posterior-superior rotator cuff tear is controversial. We present the results of isolated subscapularis repair in the face of massive 3-tendon tears with the posterior-superior tear not repairable. Materials and Methods: A retrospective review was performed on 950 patients who had arthroscopic rotator cuff repair performed by the senior author between January 2003 and August 2009. Forty-one (4.3%) of these patients had retracted massive rotator cuff tears with involvement of subscapularis tendon and the posterior-superior tear deemed irreparable. They underwent subscapularis repair only (Group 1, 26 patients) or additional posterior-superior rotator cuff repair (Group 2, 15 patients). Patients were assessed using the Hospital of the PENN Shoulder Score, ASES, and SANE score. Outcome was categorized by PENN score as excellent (90-100), good (80-89), fair (70-79), and poor (<70). Results: Patients had an average age at surgery of 62.2 years (95% CI: 59.3-65.1) and 13 (32%; 13/41) were female. With a mean age of 52.4 years (95% CI: 51.8-53.1), 57% of the general rotator cuff repair population was significantly younger than this cohort (P<.0001). Twenty-two (55%) patients were available for follow-up at a mean of 2.9 years (range, 7 months-7 years). Following surgery, a single patient developed a superficial infection that was successfully treated with antibiotics. This was the only surgical complication. Outcome scores averaged 68.9 (range, 10-100), 71.7 (range, 15-100), and 58% for the PENN, ASES, and SANE scores, respectively. The classification of outcomes were 6 excellent (27.3%; 6/22), 6 good (27.3%; 6/22), 1 fair (4.5%; 1/22), and 8 poor (36.4%; 8/22). Conclusion: In the face of an irreparable posterior-superior cuff tear, isolated subscapularis repair offers the possibility of improved pain and function with a low complication rate.

9. INTERMEDIATE OUTCOMES FOLLOWING PERCUTANEOUS FIXATION OF PROXIMAL HUMERUS FRACTURES
Alicia K. Harrison, MD, Konrad I. Gruson, MD, Benjamin M. Zmistowski, BS, Jay D. Keener, MD, Leesa M. Golat, MD, Gerald R. Williams Jr, MD, Bradford O. Parsons, MD, Evan L. Flattow, MD, Mount Sinai School of Medicine and Albert Einstein College of Medicine, New York, New York, USA; Thomas Jefferson University Hospitals, Philadelphia, Pennsylvania, USA; Washington University, Saint Louis, Missouri, USA

Purpose: Percutaneous reduction and fixation has been a good treatment option for proximal humeral fractures with good outcomes and a low incidence of avascular necrosis (AVN) reported with short-term follow-up. However, little data exists with longer follow-up to evaluate possible late AVN or degradation of short-term results. We sought to determine the mid-term results of our multi-center series of percutaneously treated proximal humerus fractures. Methods: Between 1999 and 2006, 39 patients were treated with percutaneous reduction and fixation for proximal humerus fractures at 3 tertiary shoulder referral centers. Twenty-seven of these patients were available for intermediate follow-up at a minimum of 3 years (average, 84 months; range, 37-128 months) from surgery with subjective outcome measures and radiographic analysis to identify AVN, nonunion, and radiographic post-traumatic arthritis (PTA). Results: We found an AVN rate of 26% (7/27) overall, with AVN diagnosed on average 50 months (range, 11-101 months) from the date of percutaneous fixation. AVN was observed in 50% (5/10) of 4-part fractures, 17% (2/12) of 3-part fractures, and 0% (0/5) of 2-part fractures. Similarly, radiographic PTA (including AVN) was observed in 37% (10/27) of fractures. PTA was observed in 60% (6/10) of 4-part fractures, 33% (4/12) of 3-part fractures, and 0% (0/5) of 2-part fractures. Mean ASES score at the latest follow-up was 82 for all patients (77 for patients with AVN, 84 for patients without AVN). Conclusion and Significance: Intermediate follow-up of patients with percutaneously treated proximal humerus fractures demonstrates an increased incidence of AVN and PTA over time, with some cases presenting as late as 8 years postoperatively. This increased incidence over time suggests longer-term follow-up may be necessary for patients treated with this technique. Despite the development of AVN over time, there did not appear to be a significant degradation of subjective outcomes.

10. REVERSE SHOULDER FRACTURE-PROSTHESIS FOR THE TREATMENT OF PROXIMAL HUMERAL FRACTURES IN ELDERLY PATIENTS: EARLY CLINICAL AND RADIOLOGIC RESULTS
Pascal Boileau, MD, Grégory Moinieux, MD, Nicolas Brassart, MD, Philippe Clavert, MD, PhD, Luc Favard, MD, François Sirvenaux, MD, PhD, Kieran O’Shea, MD, Department of Orthopaedic Surgery & Sports Traumatology, Hôpital de l’Archer, University of Nice Sophia-Antipolis, Nice, France; Centre de Chirurgie Orthopédique et de la Main, Service de Chirurgie Orthopédique, Illkirch, France; Hôpital Trousseau, Service de Chirurgie Orthopédique et Traumatologique, Tours, France; Clinique de traumatologie et d’Orthopédie, Sincal, Nancy, France

Background: Because of poor tuberosity healing, associated co-morbidities, and noncompliance with rehabilitation, the results of shoulder hemiarthroplasty for displaced fractures of the proximal humerus in elderly patients are often disappointing. Although the use
of the reversed prosthesis for acute fractures is associated with better postoperative active elevation, the mobility in rotation remains poor as a result of tuberosity migration and resorption. We hypothesized that the reattachment of the humeral tuberosities, performed in combination with bone grafting, around a specific reverse shoulder fracture-prosthesis (RSFP) would favor improved tuberosity healing and shoulder mobility in elderly patients with displaced proximal humerus fractures. 

Methods: A prospective cohort study was carried out of 32 consecutive displaced proximal humeral fractures treated with a specific RSFP implant via a transdeltoid superior approach. Tuberosity reattachment and bone grafting was performed in all cases. The indication was a 4-part fracture in 22 cases, a 3-part fracture in 9 cases, and a head splitting fracture in 1 case. In 2 cases, there were combined glenoid and humeral fractures. In 5 cases there was an associated humeral head dislocation. Clinical and radiologic review was performed on 13 cases with a minimum follow-up of 6 months. Mean follow-up following surgery was 10.6 months (range, 6-18 mo). Tuberosity healing and bone graft integration were evaluated radiographically at a minimum of 6 months postoperatively. Results: Thirty-one patients (28 females, 3 males), with a mean age of 86.0 years (range, 70-91 years) underwent the procedure. The interval between injury and surgery averaged 7 days (range 2-17 days). No complications (instability, infection, hema-
oma) were recorded and no patient required further surgery. At last follow-up, mean active mobility was 126° (range, 80-170°) for anterior elevation, 22° (range, 0-50°) for external rotation, and 5 points (range, 2-8) for internal rotation. Mean Constant score was 61 points (range, 38-83) and 91% (range, 55-122) when adjusted for age and gender. Mean Subjective Shoulder Value (SSV) was 77% (range, 60%-90%). All patients were satisfied with the outcome following surgery. No glenoid or humeral loosening or migration was observed. Twelve patients had complete radiographic tuberosity healing and 1 patient experienced partial lysis and migration was observed. Twelve patients had complete radiographic tuberosity healing and bone grafting around a specific RSFP. Successful peri-prosthetic tuberosity healing is associated with restoration of both active elevation and external rotation. Postoperative complications frequently encountered with conventional reversed prosthesis (such as instability, infection, humeral resorption) were not observed in this series.

11 INTERFRAGMENTARY SUTURE FIXATION FOR DISPLACED ACUTE TYPE II DISTAL CLAVICLE FRACTURES

Xavier A. Duralde, MD, Scott D. Pennington, MD, Douglas H. Murray, MD, Peachtree Orthopaedic Clinic, Atlanta, Georgia, USA

Background: Open reduction and internal fixation (ORIF) of Type II distal clavicle fractures remains a challenge because of distal comminution and the significant deforming forces created by the weight of the shoulder girdle. Current fixation options struggle with distal fixation and often require violation of the AC joint or the subacromial space. Question/Purpose: We hypothesize that a suture technique using coracoclavicular fixation to neutralize the deforming force of the shoulder girdle along with interfragmentary suture fixation leads to a high degree of fracture union. Patients and Methods: We retrospectively reviewed our clinic between 1998 and 2010 with displaced acute Type II distal clavicle fractures treated with suture technique. Patient age ranged between 26 and 76 years (mean age, 44.2 years), with 15 men and 5 women. Mechanism of injury included motor vehicle crash (8), ground level fall (4), bike accident (4), fall from height (11), and high energy blunt trauma (11). Twelve of 20 patients had comminution of the distal fragment. All patients were treated with a uniform surgical technique consisting of circumferential coracoclavicular fixation and interfragmentary suture fixation of the distal fracture fragment(s). All patients were kept in a sling for 6 weeks, followed by protected active range of motion, and all patients were followed until bony union was achieved. Mean time between injury and surgery was 9.8 days (range, 3-21 days) and mean radiographic and clinical follow-up was 887 days. Results: All patients went on to bony union. There were no cases of significant loss of reduction or malunion. No patients developed significant stiffness or loss of function. Complications consisted of a small hematoma that resolved with observation and a superficial postoperative wound infection that resolved with 7 days of oral antibiotics. There were no complications requiring reop-eration and no patients developed acromioclavicular arthrosis or impingement. Conclusions: Suture fixation for ORIF of Type II distal clavicle fractures is a safe and effective technique that obtains secure reduction and fixation with reliable results. It obviates the need for hardware removal and avoids violation and injury to the AC joint and subacromial space.

12 RECONSTRUCTION OF THE CORONOID USING AN ANATOMIC AND AUGMENTED PROSTHESIS: AN IN VITRO BIOMECHANICAL STUDY

Bashar Alolabi, MD, Alla Gray, BEng, MSc, Louis M. Ferreira, BEng, James A. Johnson, PhD, George S. Athwal, MD, Graham J.W. King, MD, Hand and Upper Limb Centre, University of Western Ontario, London, Ontario, Canada

Background: Fractures of the coronoid process typically occur in the setting of complex elbow injuries. Repair of larger coronoid frac-
tures has been shown to be important in restoring elbow stability. In the setting of comminuted fractures where internal fixation is not possible, a coronoid prosthesis may be a useful method in restoring the integrity and stability of the elbow. The optimal design of a coronoid implant is unknown as there are no devices currently available. The purpose of this in vitro biomechanical study was to determine whether an augmented coronoid implant with an extended coro-

noid tip could improve elbow stability when compared with an ana-
tomic prosthesis with and without collateral ligament injuries. Methods: Passive extension was performed using an in vitro elbow simulator in the valgus and varus positions. Seven cadaveric arms were tested using a tracking system to quantify joint motion. The varus/varus laxity of the ulna with respect to the humerus was measured with the elbow intact, and then with the intact coronoid, 40% coronoid fracture, anatomic prosthesis, and augmented prosthesis, with the collateral ligaments sectioned and repaired. Results: Varus/varus laxity increased following simulation of a 40% coronoid frac-
ture with both repaired (P<0.01) and deficient collateral ligaments (P=0.01). There was no significant difference in varus-valgus laxity between the intact coronoid, the anatomic or augmented implants in the setting of a reconstructed coronoid (P=0.09). Sectioning of the collateral ligaments produced severe joint instability, resulting in an average varus/varus laxity (± standard error) of 42.9±4.4 degrees throughout the arc of flexion (P<0.01). With both collateral ligaments sectioned, the augmented coronoid implant reduced varus-valgus laxity by 20.5±6.3 degrees compared with the native coronoid (P<0.05), whereas the anatomic prosthesis produced no change in laxity (P=0.05). Also with collateral ligaments sectioned, the aug-
mented coronoid implant reduced varus-valgus laxity by 23.0±6.0 degrees compared with the anatomic implant (P<0.03).

Conclusions: In the setting of a comminuted unreconstructable coro-

noid in an elbow with residual collateral ligament insufficiency, an augmented coronoid prosthesis with an elongated coronoid process improves elbow stability relative to an anatomic prosthesis. Addi-
tional biomechanical and clinical studies are needed to evaluate the feasibility of this design.

13 ARE TWO PLATES NECESSARY FOR FRACTURES OF THE DISTAL HUMERUS?

Jeffrey D. Watson, MD, Hyunchul Kim, MS, Edward H. Becker III, MD, Michael Shorofsky, BS, Robert V. O'Toole, MD, Daniel Lerman, MD, W. Andrew Eglseder, MD, Anand M. Murthi, MD, University of Maryland School of Medicine,
**14 LOW SENSITIVITY OF PREOPERATIVE MRI AND MR ARTHROGRAM IN DETECTION OF PANLABRAL TEARS OF THE GLENOHUMERAL JOINT**

**Éric T. Riccheti, MD, Michael C. Ciccotti, BA, Michael G. Ciccotti, MD, Gerald R. Williams Jr, MD, Mark D. Lazarus, MD, Rothman Institute, Philadelphia, Pennsylvania, USA**

**Introduction:** Combined lesions of the glenoid labrum involving tears of the anterior, posterior, and superior labrum have been infrequently reported in the literature. Detection of these lesions preoperatively and distinguishing them from unidirectional labral tears can be difficult, even in the presence of advanced imaging. The purpose of this study was to evaluate the sensitivity of preoperative MRI in detecting combined lesions of the anterior, posterior, and superior labrum.

**Methods:** A retrospective review of 62 patients who underwent arthroscopic repair of combined tears of the anterior, posterior, and superior labrum was performed. Preoperative MRI was available in 46 cases (mean age 42.6 years); including 23 noncontrast MRI studies and 24 contrast-enhanced MR arthrogram studies. MRI findings were compared with intraoperative findings, including examination under anesthesia (EUA) and status of the labrum at arthroscopy. Arthroscopy confirmed combined tears of the anterior, posterior, and superior labrum in all 46 patients; these findings were used as the gold standard in comparison to MRI and EUA results. The sensitivity of MRI in detecting combined lesions was determined, including comparison of noncontrast MRI to MR arthrogram. Findings on EUA were also compared with both MRI and arthroscopic results.

**Results:** Overall, MRI showed evidence of combined lesions of the anterior, posterior, and superior labrum in 10/47 studies (21.3%). Only 2/23 (8.7%) were detected by noncontrast MRI, compared with 8/24 (33.3%) by MR arthrogram (P=0.07). Noncontrast MRI showed no evidence of a labral tear in 4/23 patients (17.4%), while no MR arthrogram was completely negative for a labral tear (0%) (P=0.05). EUA suggested an additional direction of instability compared with the MRI findings in 18/39 patients (46.1%), including 12/21 (57.1%) with a noncontrast MRI and 6/18 (33.3%) with a MR arthrogram (P=1.4). All patients with evidence by report of combined lesions of the anterior, posterior, and superior labrum on MRI had evidence of instability in more than one direction on EUA. **Discussion and Conclusion:** Combined tears of the anterior, posterior, and superior glenoid labrum are frequently missed on both noncontrast MRI and MR arthrogram. Intraoperative EUA can increase the index of suspicion for these combined lesions when not suggested by MRI. Thorough evaluation of the labrum at the time of arthroscopy is essential in patients with signs of labral pathology, as combined lesions may be found.
16 MRI APPEARANCE OF DISTAL BICEPS TENDON REPAIR AND COMPARISON WITH FUNCTIONAL OUTCOME
Christopher C. Schmidt, MD, Veronica A. Diaz, MD, David M. Weir, MS, Carmen Latona, MD, Mark C. Miller, PhD, Allegheny General Hospital and the University of Pittsburgh, Pittsburgh, Pennsylvania, USA; South Florida Orthopaedics & Sports Medicine, Stuart, Florida, USA
Purpose: The purpose of this study was to determine whether MRI appearance and insertion site location of the repaired distal biceps tendon correlated with clinical outcome. Methods: Nineteen patients were randomly recruited from a single surgeon series of distal biceps repairs to undergo FABS protocol MRI of the involved elbow an average of 4.1 years after repair (range, 1.0–6.3 years). Ten healthy volunteers also underwent MRI imaging and acted as controls. The biceps tendon was reattached to cortical bone at the insertion site with the aid of a cortical button. All patients were men, with an average age of 49 years (range, 33–67 years). There were 11 dominant and 8 nondominant extremities involved, and in all but 1 case, a discrete injury involving forceful or eccentric contraction of the biceps was identified. A musculoskeletal radiologist and an upper extremity fellow read each MRI and characterized each repair independently. Specifically, the integrity of the repair (healed or not healed), the amount of heterogeneity within the tendon substance (> or <50%), and the presence or absence of heterotopic ossification were recorded by each examiner for each patient. The angle of tendon insertion on the tuberosity, insertion site angle, was used to quantify the repair site location in both the patient and volunteer groups. The insertion site angle was defined as an angle between the apex of the tuberosity and the center of the biceps tendon footprint. Additionally, 17 of the 19 patients underwent isometric supination strength testing with a validated custom device at 3 forearm positions: 60° of supination, neutral, and 60° of pronation. All 19 patients also completed Disabilities of the Arm, Shoulder, and Hand (DASH) and Visual Analog Pain Scale (VAPS) scores. Analysis was conducted using paired t-tests with Bonferroni correction. Results: MRI characterization of the tendon showed substantial inter-observer reliability with kappa, κ = 1.0 for repair integrity, κ = 0.79 for the degree of heterogeneity, and κ = 0.89 for the presence of heterotopic bone. All of the repairs healed to cortical bone. There was wide variability in the appearance of the repaired tendon with respect to footprint dimensions and overall morphology, with 9 of the patients (47%) having intra-substance heterogeneity involving >50% of the tendon. Eight patients (42%) had heterotopic bone present within the tendon substance as detected by MRI. The insertion site angle of the repaired tendons was 73° more radial (anterior) than the unjured controls (P < 0.001). Average DASH was 7.7 (range, 0.49–2) and VAPS 0.7 (range, 0–5). No patient had an elbow or forearm ROM deficit of greater than 10° at final follow-up and there were no permanent nerve injuries. With the forearm in neutral and 60° of pronation, the average of the supination torque ratios of the injured side to that of the contralateral side was 90% and 101%, respectively. A statistically significant difference in supination strength between injured and uninjured sides was found with the forearm in 60° of supination (average 67% of uninjured side; P < 0.01). Comparisons of subgroups of the patients based on the presence of heterotopic bone and degree of heterogeneity from the MRI did not yield statistically significant differences in supination strength measures, DASH, or VAPS scores. Discussion and Conclusion: In this study of distal biceps repairs, 11 of 19 patients had either heterogeneity or heterotopic bone. Tendon morphology did not correlate with functional outcome as measured by DASH, VAPS, and isometric supination strength. Clinical decisions for reoperation of a painful distal biceps repair should not be solely based on MRI appearance of the tendon. We also observed that the distal biceps tendon predictably heals to cortical bone, suggesting that the creation of a bone trough in the proximal radius may not be necessary. The insertion site angle of 73° showed that the repaired tendon healed with a footprint radial to its native position. This radialization of the footprint could explain the decrease in strength only observed at 60° of supination.1 This research was supported in part by a grant awarded by the Albert B. Ferguson, MD Orthopaedic Fund of The Pittsburgh Foundation.

References

17 SLAP LESIONS OF THE SHOULDER: INCIDENCE RATES, COMPLICATIONS, AND OUTCOMES AS REPORTED BY ABOS PART II CANDIDATES
Stephen C. Weber, MD, Soheil Payvandi, DO, David F. Martin, MD, John J. Harrast, MS, Sacramento Knee and Sports Medicine, Sacramento, California, USA
Introduction: SLAP lesions of the shoulder are rare injuries. Snyder reported that SLAP lesions made up 3% of shoulder cases in a large subspecialty surgical referral practice. It is the authors’ impression that the percentage of young orthopedists cases that are SLAP lesion repairs is far higher and that complications with this increased rate of repair are not insignificant. Methods: As a part of the certification process, Part II candidates submit a 6-month case list to the American Board of Orthopedic Surgery. In the present study, we searched the American Board of Orthopedic Surgery Part II database to evaluate changes in treatment over time and to identify available outcomes and associated complications arthroscopic repair of SLAP lesions. The ABOS Part II database was searched for all SLAP lesions (ICD-9 codes 840.7) and SLAP repairs (CPT codes 29807) for the years 2003 through 2008. Utilization was analyzed by geographic region and compared with regard to complications and outcomes as self-reported by candidates during the online application process. Incidence rates were also obtained based on applicant subspecialty declaration. Results: There were 4,975 SLAP repairs, representing 9.4% of all applicants shoulder cases. Mean follow-up was 8.9 weeks due to the time-limited case collection period; 78.4% were male, 21.6% female. The rate of repair increased over the study period to 10.1% by 2008. Mean age of male patients was 36.4 years (SD=13.0) with a maximum of 85 years of age. Mean age of female patients was 40.9 years (SD=14.0), with a maximum of 88 years of age. Pain was reported as absent in only 26.3% of patients at follow-up, and function as normal in only 13.1%; 40.1% of applicants self-reported their patients to have an excellent result. The self-reported complication rate was 4.4%. Declared sports medicine specialists had a higher percentage of SLAP repairs than general orthopedists (12.4% vs. 9.2%). Conclusions: The percentage of Part II Candidates cases that are SLAP repairs is 3 times the published incidence supported by the current literature for subspecialty referral practice. It might be anticipated that this rate should be even lower for general orthopedists. Especially worrisome is the rate of repair in middle aged and elderly patients. This incidence of repair is associated with a significant rate of complications and poor outcomes. Focusing on educating young orthopedists to recognize pathologic SLAP lesions from incidental degeneration of the labrum may bring the rate of SLAP repair down to the incidence rates reflected in the literature, and hopefully decrease the complication rate and improve the outcomes of arthroscopic SLAP repair. Level of Evidence: Therapeutic Level III.

18 OUTCOMES OF REVISION ARTHROSCOPIC TYPE II SLAP REPAIRS
Sang Do Park, MD, Ronald E. Glousman, MD, Kerlan-Jobe Orthopaedic Foundation, Los Angeles, California, USA
Introduction: Outcomes of arthroscopic Type II SLAP repairs have been reported with success. However, published data regarding outcomes of revision arthroscopic Type II SLAP repairs is lacking.
Methods: A retrospective chart review was performed to identify patients from January 1, 2003 to July 1, 2009 who have undergone revision arthroscopic Type II SLAP repairs at our institution. Patients who underwent concomitant rotator cuff repairs or labral repairs for instability were excluded. Twelve patients were contacted and the following outcome data were prospectively gathered: ASES score, patient satisfaction level, return to work, return to sports, and physical examination. Demographics and intraoperative report data were also collected from the charts. Results: Mean age at the time of revision arthroscopic Type II SLAP repairs was 32.6 years (range, 19-67 years) with mean follow-up of 50.5 months (range, 8-81 months). Pain was the chief complaint at the time of initial and revision SLAP repairs. Mean ASES score was 72.5, patient satisfaction level 6.4 (scale from 0 to 10), mean return to work at 57.8% of previous level, and mean return to sports at 42.2% of previous level. Mean range of motion (ROM) values were available in 7 patients and are as follows: forward elevation 159.3±24.7, supine abducted external rotation 93.6±23.8, and supine abducted internal rotation 50.1±7.0. The mean values for all outcome data and ROM values were lower in worker’s compensation patients. There were no postoperative complications, 12 patients required additional arthroscopic surgeries. Lack of healing of central portion of the superior labrum directly underneath the biceps tendon was the predominant finding at the time of revision surgery. Discussion: Arthroscopic revision Type II SLAP repairs yields worse results than primary repairs as reported in the literature with worker’s compensation patients showing worse outcomes. A larger prospective study of this relatively rare procedure is needed to better determine which patients may benefit from this procedure.

19 REVERSE TOTAL SHOULDAR ARTHROPLASTY: A REVIEW OF REVISION RATES IN 265 CONSECUTIVE CASES

John G. Costouros, MD, Ronald A. Navarro, MD, Tadashi T. Funahashi, MD, Mary F. Burke, MPH, Tony S. Huon, BS, Christopher F. Ake, PhD, Edward H. Yan, MD, The Permanente Medical Group, San Jose, California, USA; Southern California Permanente Medical Group, Irvine, California, USA

Background: Although reverse total shoulder arthroplasty (RTSA) provides an effective surgical treatment for select complex shoulder conditions, reported revision and complication rates are higher when compared with non-constrained shoulder arthroplasty. The purpose of this study was to analyze the early to mid-term complication and revision rates for RTSA in a consecutive series of patients. Methods: All reverse shoulder arthroplasties performed between 2005 to 2009 at 1 state-wide health maintenance organization were captured using a standardized electronic database. Validation of cases and complications was performed using Centers for Disease Control (CDC) guidelines and Agency for Healthcare Research and Quality (AHRQ) patient safety indicators. Complications were stratified into those requiring revision surgery (infection, instability, implant failure, hematoma) or those managed nonoperatively (thromboembolic events, superficial infection). The role of age, gender, diagnosis, surgeon volume, and medical comorbidities as risk factors for complications was assessed statistically. Results: Of 3,181 shoulder arthroplasties performed during this period, 265 were RTSA revisions. 222 patients required additional procedures, and 43 patients were lost to follow-up. Revision surgery was performed in 75% of these replacements. There were 12 patients lost to follow-up due to termination of insurance and 14 deaths, yielding 239 total patients. Member retention rate was 96% during the study period with average follow-up of 25.3 months. There were 150 female patients and 89 males, with a mean age of 76 years. The overall rate of revision surgery was 8% (21 patients). Reasons for surgical revision included instability (52%, 11 patients), glenosphere failure/scapular notching (33%, 7 patients), deep infection (19%, 4 patients), and hematoma (5%, 1 patient). Average duration of time between the index procedure and revision surgery was 311 days (range, 3-1,446 days, SD=381). Non-surgical complications included 2 cases of deep vein thrombosis (0.01%) and 3 cases of pulmonary embolism (1%) treated nonoperatively. Only female gender was associated as a risk factor for surgical revision (P<.04). Conclusions: RTSA is associated with high complication and revision rates relative to primary non-constrained shoulder arthroplasty in the community setting. At early to mid-term follow-up, instability is the primary reason for revision surgery. Further longitudinal studies and understanding of wear mechanisms are needed to determine long-term failure rates.

20 INFERIOR TILT OF THE GLENOID COMPONENT DOES NOT DECREASE SCAPULAR NOTCHING IN REVERSE SHOULDAR ARTHROPLASTY: RESULTS OF A PROSPECTIVE RANDOMIZED STUDY

T. Bradley Edwards, MD, George J. Trappey IV, MD, Clay Riley, MD, Daniel P. O’Connor, PhD, Cary M. Gartsman, MD, Hussein A. Elkousy, MD, Fondren Orthopaedic Group, Houston, Texas, USA

Introduction: Notching of the scapula occurs within 4 years of surgery in 88% of the patients who undergo reverse shoulder arthroplasty. The best way to avoid scapular notching is debatable. Technical recommendations have included initially placing the glenoid component inferiorly on the glenoid face and introducing slight inferior tilt during glenoid reaming. The purpose of this study is to determine if inferior tilt of the glenoid component can decrease the amount of radiographic scapular notching after reverse shoulder arthroplasty. A secondary goal is to determine if inferior tilt has any effect on outcome measures or range of motion (ROM).

Materials and Methods: A prospective randomized trial of 52 consecutive reverse shoulder arthroplasties performed for cuff tear arthropathy by a single surgeon was conducted from November 2005 to August of 2008. The subjects were randomly assigned to 1 of 2 groups using a random numbers table. The first group received a glenoid component that was translated 3 mm inferiorly to slightly overlap the inferior glenoid with no inferior tilt (control group). The second group received a glenoid component that was inferiorly tilted 10 degrees to protect the inferior glenoid, in addition to being translated inferiorly (inferior tilt group). Glenoid component tilt was precisely controlled intraoperatively using surgical navigation. Two orthopaedic surgeons independently reviewed the subjects’ 1 year postoperative radiographs on 2 occasions at least 6 weeks apart, to obtain intra- and interrater data. The severity of radiographic notching was graded according to the classification of Nerot. The 2 groups were statistically compared with regards to their outcome scores (Constant and ASES) and ROM. Results: Minimum 1 year postoperative radiographs and follow-up data was available on 42 of 52 subjects (81%). Follow-up time did not differ between groups (P=.723). One subject had died and 9 subjects were lost to follow-up. Twenty patients were in the inferior tilt group and 22 patients were in the control group. The raters demonstrated good intrarater (intraclass correlation coefficients = 0.88 and 0.97, respectively) and interrater (intraclass correlation coefficient = 0.94) agreement. Fifteen of 20 patients (75%) in the inferior tilt group and 19 of 22 patients (86%) in the control group had notching scores of 1 or greater. Ten of 20 patients (50%) in the inferior tilt group and 11 of 22 patients (50%) in the control group had notching scores of 2 or greater. The groups did not differ significantly on the notch ratings when averaged across raters (P=.531) nor did they differ significantly for any single scoring occasion of any rater. The improvement in outcome measures and ROM were not significantly different between groups; all measures improved significantly over time (P<.001) in both groups. Conclusion: Placing the glenoid component with inferior tilt does not appear to reduce the incidence or severity of radiographic scapular notching following reverse shoulder arthroplasty. In addition, there appears to be no clinical benefit to this technique. Despite the theoretic advantage of placing the reverse glenoid component in an inferiorly tilted position to protect the inferior glenoid from notching after reverse shoulder arthroplasty, this prospective randomized study does not support this technique.
21 ROTATOR CUFF TEAR ARTHROPATHY: HEMIARTHROPLASTY OR REVERSE TOTAL SHOULDER ARTHROPLASTY?  
Brian C. Leung, MD, Thomas W. Wright, MD, MaryBeth Harodyski, EdD, ATC, LAI, Aimee Struk, MEd, ATC, LAI, University of Florida, Department of Orthopaedic Surgery, Gainesville, Florida, USA  
Orthopaedic Surgery, Columbia University, New York, New York, Louis U. Bigliani, MD, Christopher S. Ahmad, MD, Department of  
Rodrigo Vargas, BA, Thomas Gardner, MCE, William N. Levine, MD, Comron Saifi, BS,  

SHOULDER ARTHROPLASTY

HEIGHT ON GLENOHUMERAL MOTION FOR REVERSE TOTAL SHOULDER ARTHROPLASTY?  

Introduction: Rotator cuff tear arthropathy continues to pose significant challenges regarding its management. Though hemiarthroplasty has been the treatment of choice for this patient population prior to the introduction of the reverse total shoulder, its outcomes have been variable. The early results of reverse total shoulder arthroplasty (TSA) are encouraging. The purpose of this study is to compare our outcomes for hemiarthroplasty and reverse TSA both clinically and functionally. Our hypothesis is that patients undergoing reverse total shoulder arthroplasty for cuff tear arthropathy would do better in terms of pain relief, function, and postoperative ROM. 

Methods: Patients with the diagnosis of rotator cuff tear arthropathy who received either a hemiarthroplasty or reverse TSA from 1997-2007 were retrospectively reviewed. Those with a minimum of 2-year follow-up were included. Functional scores were obtained with the use of the Shoulder Pain and Disability Index (SPADI). The lower the SPADI score the better the outcome. Active shoulder external rotation (ER) and elevation were clinically measured. All data was prospectively collected. Statistical analysis was performed comparing hemiarthroplasty to reverse TSA at the preoperative time period, 3 months, 6 months, 1 year, and ≥2 years. 

Results: In total, 56 shoulder arthroplasties in 50 patients were identified with a minimum of 2-year follow-up. There were 20 hemiarthroplasties and 36 reverse TSA performed. Average follow-up for the hemiarthroplasty group was 4.4 years (range, 2-12 years) vs 2.97 years (range, 2-5 years) for the reverse TSA group. The average age for the hemiarthroplasty group was 64 years vs 72 years for the reverse TSA (P < .05). SPADI scores significantly improved for both the hemiarthroplasty group and the reverse TSA group. However, at ≥2 years, the reverse TSA had a significantly better SPADI score compared with the hemiarthroplasty group (34 vs. 58; P < .05). Active elevation was significantly better for the reverse TSA compared with the hemiarthroplasty at all postoperative time periods. Up to 1 year, active ER was significantly better for the hemiarthroplasty group vs. the reverse TSA group (35° vs. 15°; P < .05). At ≥2 years, there was no ER difference between the 2 groups. There was a 25% complication rate for the reverse TSA. These included 1 deep infection, 1 instability, 2 acromion fractures, 1 periprosthetic humerus fracture, 2 metaglene loosening, and 1 nerve dysysesthesias. Complication rate for the hemiarthroplasty group was 30%. These included 2 revisions for persistent pain, 1 deep infection, 1 superficial infection, 1 RSD. 

Conclusions: In the treatment of rotator cuff tear arthropathy, reverse total shoulder arthroplasty performs better than hemiarthroplasty in terms of pain relief, function, and active elevation at 2-year follow-up. Hemiarthroplasty patients have better external rotation compared with reverse TSA up to 1 year. However, after 2 years, there is no longer an external rotation difference between the 2 groups. The complications for reverse total shoulder arthroplasty are significant. Further long-term studies need to be performed before it can be recommended as the treatment of choice for rotator cuff tear arthropathy.

22 DEPENDENCE OF IMPLANT DESIGN & BASEPLATE HEIGHT ON GLENOHUMERAL MOTION FOR REVERSE TOTAL SHOULDER ARTHROPLASTY  
Comron Saifi, BS, R. Michael Greiwe, MD, Charlie Yongpravat, MSc, Rodrigo Vargas, BA, Thomas Gardner, MCE, William N. Levine, MD, Louis U. Bigliani, MD, Christopher S. Ahmad, MD, Department of Orthopaedic Surgery, Columbia University, New York, New York, USA  

Introduction: Reverse total shoulder arthroplasty (RTSA) has increased significantly over the past decade. Implant design factors and surgical technique have been shown to affect in vitro range of motion (ROM). This study evaluates computer simulated abduction ROM as a function of 2 commercially available implant designs and the vertical baseplate position on the glenoid. 

Materials and Methods: Three-dimensional (3D) computer models of the shoulders of 12 patients who underwent RTSA were created from their preoperative shoulder CT scans. Computer simulated glenoid reaming was performed on the 3D shoulder models creating 10° of inferior tilt and 0° of retroversion. Computer models of 2 commercially available RTSA implants were also created, 1 design with an implant neck angle of 60 degrees and a comparatively lateral center of rotation and the second design with an implant neck angle of 65 degrees and a relatively medial center of rotation. The baseplate was positioned relative to the center of the glenoid at -10 mm, -5 mm, 0 mm, 5 mm, or 10 mm (Fig. 1). Simulations were performed and the resulting ranges of motion were computed with custom written software in

Figure 1 (A) Transparent view of the shoulder with RTSA indicating ROM in abduction. (B) GH ROM in abduction, (C) adduction deficit, (D) maximum abduction as a function of implant design and vertical baseplate position from the center of the glenoid. Error bars denote standard deviations.
Mathematica. Statistical analysis (P<.05) was performed with a two-way ANOVA to determine the effect of baseplate position and prosthesis design on adduction deficit, abduction, and the ROM in abduction. Results: Positioning the glenosphere 10 mm inferior to the glenoid center resulted in maximum glenohumeral abduction (74.6 ± 8.2°) and greatest ROM in abduction (72.3 ± 7.8°), while reducing the adduction deficit to only 3.3 ± 4.5°. By translating the glenoid inferiorly in 5 mm increments, maximum abduction and ROM significantly increased (P<.05) with inferior translation from 10 mm above the glenoid center to 10 mm below the glenoid center. Additionally, the adduction deficit decreased as the baseplate was translated inferiorly (P<.0001). The 60 degree implant with a lateralized center of rotation significantly decreased the adduction deficit compared with the 65 degree implant by 35% (P<.0001); whereas there was no statistical difference for maximum abduction or ROM in abduction between the 2 implants (P>.05). Conclusions: Simulating different baseplate heights and implant designs for the same patient using 3D computer models eliminated confounding variables such as operating surgeon and patient-specific anatomy. Previous studies have shown a correlation between adduction deficit and scapular notching in patients treated with RSA. This study found that for both implant designs, positioning the glenosphere 10 mm below the glenoid center provides patients who undergo RSA the maximum potential ROM in abduction and may protect against scapular notching. An implant with a 60 degree implant neck angle and lateralized center of rotation may further reduce the risk of scapular notching.

23 PATTERNS OF LOOSENING OF CEMENTED POLYETHYLENE KEELED GLENOID COMPONENTS IN PRIMARY OSTEOARTHRITIS - RESULTS OF A MULTICENTER STUDY
Gilles Walsh, MD, Allan A. Young, MD, Pascal Boileau, MD, Markus Loew, MD, Dominique Gazielly, MD, Daniel Molé, MD, Centre Orthopédique Santy, Lyon, France; Royal North Shore Hospital, Department of Orthopaedic and Traumatic Surgery, Sydney, Australia; Hospital de L’Arche II, Department of Orthopaedic Surgery & Sports Traumatology, Medical University of Nice-Sophia Antipolis, Nice, France; ATOS Clinic Heidelberg, Orthopaedic Surgery & Sports Traumatology, Medical University of Sydney, Australia; Hopital des Enfants Malades, Department of Orthopaedic Surgery, Paris, France; Hospital Trousseau, CHRU de Tours, France; Hopitaux Universitaires de Geneve, Geneva, Switzerland; Hôpitaux Universitaires de Genève, Service de Chirurgie Orthopédique, Geneva, Switzerland; Clinique de Traumatologie, Nancy, France.

Background: Rotator cuff tears are relatively uncommon in glenohumeral osteoarthritis. However, secondary tears or dysfunction of the cuff are a recognized complication of shoulder arthroplasty. We hypothesized that the rate of secondary cuff failure would increase with follow-up and result in less satisfactory clinical and radiological outcomes. Our aim was to investigate the rate of secondary cuff failure, as indicated radiographically by moderate to severe superior subluxation of the prosthetic humeral head, following shoulder arthroplasty in primary osteoarthritis and attempt to identify specific prognostic factors. Methods: Between 1991 and 2003, in 10 European centers, 704 total shoulder arthroplasties were performed for primary osteoarthritis. There were 518 shoulders with complete radiographic and clinical follow-up >5 years. Secondary rotator cuff failure was diagnosed radiographically by the presence of moderate or severe superior subluxation of the prosthetic head. Kaplan-Meier survivorship analysis was performed with an end point being secondary rotator cuff failure. Clinical outcome was assessed with the Constant score, subjective assessment, and range of motion (ROM). Results: At an average of 103.6 months (range, 60 to 219 months), the rate of secondary rotator cuff failure diagnosed radiographically was 17% and found to be significantly correlated with preoperative fatty infiltration of the supraspinatus (P<.01), infraspinatus (P=.011), and subscapularis (P<.05); implantation of the glenoid with superior tilt (P<.01); and duration of follow-up (P<.0001). Survivorship free of secondary cuff failure was 100% at 5 years, 84% at 10 years, and 43% at 15 years. Preoperative supraspinatus tear was not found to be associated with secondary cuff failure (P=.16). Patients with secondary cuff failure had significantly worse clinical outcomes (Constant score, subjective assessment, and ROM; P<.0001) and radiographic results (radiolucence line score, glenoid component migration; P<.0001). Conclusions: In this study investigating a large number of patients, secondary rotator cuff failure as indicated by moderate to severe superior subluxation of the prosthetic humeral head was demonstrated to become a significant long-term problem following RSA performed for primary osteoarthritis. Preoperative fatty infiltration of the cuff muscles and implantation of the glenoid with superior tilt were found to be prognostic factors. Furthermore, secondary rotator cuff failure was associated with worse clinical and radiological outcomes.

25 RADIOGRAPHIC SURVIVAL IN TOTAL SHOULDER ARTHROPLASTY
Tyler J. Fox, MD, Antonio M. Foruria, MD, PhD, Brian J. Klika, MD, John W. Sperling, MD, MBA, Cathy D. Schleck, BS, Robert H. Cofield, MD, Mayo Clinic, Rochester, Minnesota, USA.

Background: Despite advances in total shoulder arthroplasty aseptic glenoid component loosening remains a major cause of implant failure. The purpose of this study was to determine rates of loosening with keeled polyethylene components.
radiographic failure in total shoulder arthroplasty and identify factors which may be predictive of loosening. Methods: Between January 1st, 1995, and September 8th, 2005, 157 total shoulder arthroplasties were implanted in 143 patients at our institution utilizing a cemented Coefeld II all polyethylene keeled glenoid component design with at least 4 years of radiographic follow-up available for review. Median radiographic follow-up was 8.4 years. All patients who required component revision for implant reasons were included for review. Preoperative glenoid erosion was scored according to the Walch classification with the direction and degree of preoperative humeral head subluxation recorded. Initial postoperative radiographs were reviewed scoring glenoid and humeral component lucent lines as well as humeral head subluxation. Late postoperative radiographs were likewise reviewed, scoring glenoid and humeral component lucent lines, humeral head subluxation, and any shift in component position was noted. Results: Nine of the 157 total shoulders implanted were revised for implant related reasons. In addition, at latest follow-up 146 glenoid components showed either a shift in position or a complete lucent line of 1.5 mm or greater indicating radiographic failure. Four humeral component lucent lines were noted on the polyethylene component at least a 2 mm lucent line in 3 or more zones indicating radiographic failure. Glenoid component survival free from radiographic failure at 5 and 10 years, respectively, were 98.7% and 68.2%. No statistically significant associations had shifted in position or showed at least a 2 mm lucency in 3 components. No statistically significant association could be shown between radiographic survival and age, gender, preoperative diagnosis, preoperative glenoid erosion, or preoperative humeral head subluxation. Conclusions: As yet, no glenoid component loosening remains an unsolved problem in total shoulder arthroplasty.

26 LONG-TERM RESULTS OF ANATOMIC TOTAL SHOULDER ARTHROPLASTY WITH METAL-BACK GLENOID COMPONENTS IMPLANTED FOR PRIMARY GLENO-HUMERAL JOINT OSTEOARTHRITIS

Gregory Maïneu, MD, Nicolas Morin-Salvo, MD, Gilles Walch, MD, Daniel Molé, MD, Christophe Lévygne, MD, Luc Favard, MD, Pascal Boileau, MD, Department of Orthopaedics, L’Archet 2 Hospital, Nice, France

Introduction: The aim of this study was to assess the results of anatomic total shoulder prostheses with metal-back glenoid component implants in primary gleno-humeral osteoarthritis. Materials and Methods: Multi-centre retrospective study of primary omarthrosis treated between 1994 and 1999 using a non-constrained total shoulder arthroplasty with an un-cemented metal-back glenoid component. Outcome was assessed both clinically (active mobility and Constant score) and radiologically (polyethylene wear, loosening, instability). A prosthetic survival curve was constructed with the end point defined as either partial or complete revision and using 100% confidence intervals. Results: One hundred sixty-nine patients at a mean age of 68 years (range, 35-89 years) were included; 67 patients were re-operated (40%), including 61 revision procedures (36%) at a mean interval of 70 months from primary surgery. Problems relating to the glenoid component accounted for revision in 54 cases, including 21 cases of loosening and 27 cases of polyethylene wear. Dislocation of the glenoid component or metal base-plate was responsible for failure in 6 patients. Thirteen re-operations were secondary to soft tissue problems including 10 subscapularis tendon ruptures. The rate of prosthetic survival was 78% (range, 62%-82%) and 48% (range, 33%-64%) at 6 and 12 years, respectively. The 108 patients, who retained their prostheses [21 deceased, 24 lost to follow-up], were assessed at a mean duration of 102 months following surgery (range, 24-191 months). Active forward elevation was 137° ± 33° and external rotation averaged 33° ± 17°. The Constant score was 65 ± 18 points and 94% ± 26% when adjusted for age and gender. Forty-eight prostheses had presented with a complication not requiring revision. Radiologically, there were 11 cases of glenoid loosening and 25 cases of complete polyethylene wear. Conclusions: Glenoid resurfacing using a metal-backed glenoid component is not a viable long-term therapeutic option. At 12 years follow-up, approximately one half of the prostheses have been revised.

27 HEMIARTHROPLASTY AND TOTAL SHOULDER ARTHROPLASTY (TSA) REVISION RATES: ANALYSIS OF 1,285 ELECTIVE SHOULDER REPLACEMENTS IN A COMMUNITY SETTING

Edward H. Yian, MD, Ronald A. Navarro, MD, Tadashi T. Funahashi, MD, Mary F. Burke, MPH, Tomy S. Hsien, MS, Christopher F. Ake, PhD, John G. Costouros, MD, Southern California Permanente Medical Group, Harbor City and Irvine, California, USA; Kaiser-Permanente, SPCMG Clinical Analysis Department, San Diego, California, USA; Kaiser-Permanente Medical Group, San Jose, California, USA

Introduction: This study analyzed demographic data and revision rates for elective non-traumatic shoulder arthroplasties in a community setting. We hypothesized that revision rates between replacement procedures would be different. Methods: Primary/revision shoulder arthroplasties were confirmed from electronic databases in a health maintenance organization during 2005-2008. Traumatic and posttraumatic cases were omitted. Revision analysis and statistical analysis between procedure groups were performed. Results: There were 455 hemiarthroplasties and 830 total shoulder arthroplasties (TSA). Ten surgeons performed 31% of primary hemiarthroplasties and 50% of TSAs. Patient retention was 91.3% with average follow-up of 42 months. Males made up 48% hemiarthroplasties and 51% of TSAs (P<.04). Average age for primary hemiarthroplasty was 68 years (min27max95; IQR 60-77), 70 (min38max 96; IQR 64-76) for TSAs (P<.0007). Infection rates were 0.4% for hemiarthroplasties and 0.2% for TSA (P=.02), while revision rates were 4.2% and 1.9% (P=.02), respectively. Average revision age was 62 years for hemiarthroplasty and 67 for TSA (P=.25). Revision reasons in hemiarthroplasty group included glenoid wear (3.0%; 13) and postoperative rotator cuff tear (rct) (0.2%；1); those in TSA group included symptomatic glenoid implant loosening (0.7%；6) and rct (0.6%；5). Average duration to conversion of hemiarthroplasty to TSA was 20 months (range, 8-52 months). Survival curves were not statistically different by the logrank test (P=.053), but were by the Wilcoxon test (P<.022), in favor of TSA. In a cox proportional hazards regression with age and gender as covariates, the risk ratio for failure was 1.73 for hemiarthroplasty in comparison to TSA (95%CI 1.29; 2.31; P<.0002). Conclusion: Hemiarthroplasty had a higher revision rate than TSA at mid-term follow-up. Glenoid wear pain was the primary reason for hemiarthroplasty revision and may be related to younger age demands. Symptomatic glenoid loosening was the main reason for TSA reoperation and its overall incidence was low. This may justify glenoid implantation in symptomatic arthritic patients. Summary: Total shoulder arthroplasty revision rate was lower than hemiarthroplasty at mid-term follow-up in this retrospective cohort study. Glenoid wear pain was the main reason for hemiarthroplasty revision.

28 DOES THE “BUMPER” CREATED DURING BANKART REPAIR CONTRIBUTE TO SHOULDER STABILITY?

Nobuyuki Yamamoto, MD, Takayuki Muraki, PhD, John W. Speirling, MD, MBA, Scott F. Steinmann, MD, Robert H. Cofield, MD, Eiji Itoku-NanAn, MD, PhD, Biomechanics Laboratory, Division of Orthopaedic Research, Mayo Clinic College of Medicine, Rochester, Minnesota, USA; Department of Orthopaedic Surgery, Mayo Clinic College of Medicine, Rochester, Minnesota, USA; Department of Orthopaedic Surgery, Tohoku University School of Medicine, Sendai, Japan

Introduction: It has been suggested that a Bankart lesion should be repaired with a “bumper” of the capsulolabral tissue created to
obtain a more stable shoulder. Also, some recommend that the suture anchors should be placed on the glenoid surface a few millimeters from the glenoid rim in order to effectively create the bumper effect. However, it has not been biomechanically determined that these surgical techniques really contribute to stability. The purpose of this study was to determine: 1) whether the shoulder would become stable by creating a “bumper”; and 2) whether placing the suture anchors on the glenoid surface would make the shoulder more stable. **Materials and Methods:** Nine fresh-frozen cadaveric shoulders (mean age, 75 years) were investigated. A custom testing machine with a 6-degree-of-freedom load-cell was utilized. With a 50-N axial force applied to the humerus, the humeral head was translated in the anterior direction and the peak translational force was measured at both the end-range (60° of abduction relative to the scapula and maximum external rotation) and mid-range (60° of abduction and neutral rotation) positions with the intact capsule, with a Bankart lesion, and after Bankart repair with and without a “bumper.” Bankart repair was performed at 5 different positions (glenoid rim), glenoid surface-2 mm (2 mm inside from the glenoid rim), glenoid surface-5 mm, scapular neck-2 mm (2 mm medial on the scapular neck from the glenoid rim), and scapular neck-5 mm. “Bumper” was created gathering up the capsule to form a thickened mass of tissue. **Results:** The peak translational force which significantly decreased after creating a Bankart lesion returned to almost the intact condition level after Bankart repair at both arm positions. However, there were no significant differences between the forces after Bankart repair with and without the “bumper.” The force significantly decreased after scapular neck fixation-2 mm and -5 mm compared with the one after glenoid rim fixation. However, there were no significant differences between the forces after glenoid rim fixation and glenoid surface fixation-2 mm at both arm positions. On the other hand, the force significantly increased at the end-range position and decreased at the mid-range position after glenoid surface fixation-5 mm. **Discussion:** It was demonstrated that the shoulder did not become more stable even after creating the “bumper.” Glenoid surface fixation did not make the shoulder more stable either end-range or mid-range positions. Scapular neck fixation is not acceptable in terms of stability.

### 30 ARTHROSCOPIC LABRAL REPAIR AND POSTERIOR CAPSULO-TENODESIS FOR ANTERO-INFERIOR INSTABILITY OF THE SHOULDER ASSOCIATED WITH LARGE HILL-SACHS DEFECTS

**Pascal Bailleau, MD, Kieran O’Shea, MD, Pablo Vargas, MD, Miguel Pineda, MD, Jason Old, MD, Matthias A. Zumstein, MD, Department of Orthopaedics and Sports Traumatology, L’Arcet 2 Hospital – University of Nice-Sophia-Antipolis, Nice, France**

**Introduction:** The aim of this study was to evaluate the clinical and radiographic results of arthroscopic labral (Bankart) repair combined with posterior capsulodesis and infraspinatus tenodesis (Hill-Sachs remplissage) in cases of recurrent anterior shoulder instability with significant humeral head defects. Our hypothesis was that the capsulotenodesis heals without any adverse effect on shoulder mobility. **Materials and Methods:** Prospective mono-centric series of 59 patients presenting with recurrent anterior shoulder instability and large, Callandra Grade III, humeral head defects but without glenoid bone-loss. Eight patients represented failures of prior instability surgery. The insertion of the posterior capsule and infraspinatus tendon into the humeral head defect was performed using 2 suture-anchors. All patients were followed up at 3, 6, and 12 months and yearly thereafter. Clinical photographic imaging was used to precisely measure range of motion. The healing of the capsulotenodesis in the humeral head defect and the percentage filling was assessed using CT arthrography at 6 months postoperatively. **Results:** At a mean follow-up of 24 months (range, 12-39 months) only 1 patient presented with a recurrent post-traumatic episode of instability (1.7%). The mean Duplay-Walch and Rowe scores were 85 and 88 points, respectively. The mean Subjective Shoulder Value (SSV) was 87% and Constant score was 92 points. No significant limitation in forward elevation or internal rotation was observed. The mean deficit in external rotation was 10.9 degrees in ER1 and 11.9 degrees in ER2. The capsulotenodesis healed in all cases. The percentage filling was >75% in 43 cases and >50% in 15 cases. **Conclusion:** The posterior capsule-tenodesis heals predictably without any significant adverse effect on shoulder mobility. The mild deficits observed in ER2 suggest that this procedure may not be an appropriate therapy for the throwing athlete; neither is it indicated in those patients presenting with glenoid side bone loss.

### 31 CONTRIBUTION OF OSSEOUS AND MUSCULAR STABILIZING EFFECTS WITH THE LATARJET PROCEDURE FOR ANTERIOR INSTABILITY

**Joshua S. Dines, MD, Christopher C. Dodson, MD, Michelle H. McGarry, MS, Joo-Han Oh, MD, PhD, David W. Altchek, MD, Thay Q. Lee, PhD, Sports Medicine and Shoulder Service, The Hospital for Special Surgery, New York, New York, USA; Orthopedics Biomechanics Lab, Long Beach VA Healthcare System, Long Beach, California, USA**

**Introduction:** The Latarjet procedure is becoming increasingly popular given its excellent track record for treating anterior shoulder instability. It has been hypothesized that the procedure works because of its “Triple Effect:” 1) osseous by coracoid fixation to glenoid neck; 2) ligamentous by CA ligament reinforcement
inferior glenohumeral ligament; 3) muscular through conjoint tendon transfer. Many authors contend that the main concept of the operation is to use the conjoint tendon as a sling to lower the subscapularis to reinforce the anterosuperior capsule. Unfortunately, given the difficulty associated with modeling of the conjoint tendon and subscapularis in cadaver models, the effects of the "sling" as well as stability and range of motion (ROM) after the Latarjet have not been accurately documented. In this paper, we describe a novel biomechanical model to test the Latarjet procedure that accurately accounts for the effect of the conjoint tendon. We then use the model to characterize the stabilizing mechanism of the Latarjet procedure.

**Materials and Methods:** Six cadaveric shoulders were tested at 90° abduction in the intact state, after simulation of anterior instability by anterior capsulotomy, and following Latarjet. A custom shoulder testing apparatus was designed that allowed for spring loading of the conjoint tendon. Rotational ROM was quantified using a 360° goniometer. Glenohumeral translation was assessed at neutral rotation with 20N and 30N loads. All measurements were made with the MicroScribe 3DLX digitizer. After conclusion of testing in the Latarjet group, the conjoint tendon was released and specimens were re-tested to determine how much (rarily) attributable to the "sling" effect versus the osseous effect alone. Statistical analysis was performed using a nonparametric test, the Wilcoxon Matched Pair test with a significance level of .05. Results: There were no statistically significant differences with regards to ROM after the Latarjet procedure. The Latarjet procedure significantly decreased anterior-inferior translation. However, when the conjoint tendon was unloaded, there was a significantly decreased resistance to anterior translation. After conjoint tendon release, there was no effect on anterior-inferior translation. Conclusion: The Latarjet procedure to treat anterior instability of the shoulder is gaining in popularity based on its successful clinical results. To date, however, performing biomechanical tests of the procedure has been difficult given an inability to successfully account for the contribution of the conjoint tendon. In this paper, we designed a novel model to test the Latarjet procedure, which can serve as the basis for future testing. Additionally, this study confirmed that the Latarjet can successfully decrease anterior-inferior translation while maintaining ROM. Interestingly, our study did not support previous arguments that inferior stability is provided by the sling effect since release of the conjoint tendon did not affect inferior translation. It is possible that the osseous effect provides inferior stability.

### 32 ARTHROSCOPIC REVISION REPAIR OF POSTOPERATIVE RECURRENT ANTERIOR INSTABILITY OF THE SHOULDER

**Seung-Ho Kim, MD, Jin-Hyup Shin, MD, Dae-Hak Chung, MD, Jae-Hyun Park, MD, Chang-Woo Seok, MD, Department of Orthopaedic Surgery, Madi Hospital, Seoul, Korea**

**Introduction:** Limited outcome reports are available on arthroscopic revision repair of postoperative traumatic anterior instability of the shoulder. The purpose of this study was to evaluate outcomes of arthroscopic revision repair of all instability lesions regardless of bone defect. **Materials and Methods:** Sixty-seven consecutive shoulders with arthroscopic revision surgery for anterior instability were retrospectively evaluated for the outcomes after a mean follow-up of 21 months (range, 24 to 56 months). All patients regardless of bone defect were included without exception. Arthroscopic revision involved repair of Bankart lesion using bioabsorbable suture anchors with or without repair of extended Bankart lesion (extension of Bankart lesion to inferior and posterior labrum), posterior capsular plication, or posterior capsulodesis for Hill-Sachs lesions. Three objective measurements (UCLA, ASES, Rowe) were used for outcome evaluation. **Results:** Male was predominant (65 male, 2 female). Mean age was 24 years (range, 18 to 40 years). Fifty-two shoulders (78%) had an extended Bankart lesion and 28 (42%) had an engaging Hill-Sachs lesion. Sixty-one shoulders (91%) had anterior glenoid defect (mean 17%, range 5%–35%). Multiple associated procedures are required in 59 shoulders (88%) such as removal or impaction of suture anchors, anterior or posterior capsular repair including HAGL and posterior HAGL lesions, subscapularis repair, and microfracture for glenoid surface erosion. Overall shoulder scores and function improved (P < .05). There were 3 failures (5%) including 2 shoulders with recurrent subluxation and 1 dislocation by trauma after revision. Fifty-five shoulders (82%) returned completely to the previous level of sports, while the others intentionally reduced their level of activity although they do not have apprehension. ROM was limited on average 7 degrees of external rotation and 3 spine degree of internal rotation. **Conclusion:** Arthroscopic revision repair of all instability lesions including extended Bankart repair, posterior capsular plication, and posterior capsulodesis provides excellent results. A large glenoid defect is not a contraindication of arthroscopic revision repair.
**Introduction:** Voluntary shoulder instability is characterized by a patient’s ability to sublux or dislocate their shoulder using selective muscle contraction and relaxation. Previous reports indicate a high failure rate with surgery in this group of patients. The purpose of this study was to report the outcomes for patients with voluntary instability treated with arthroscopic stabilization. **Methods:** All patients with voluntary instability from 2006 and 2008 treated with arthroscopic stabilization were included in the study. All patients had documentation of pre- and postoperative American Shoulder and Elbow Surgeons (ASES) questionnaire score, Visual Analogue Scale (VAS) of pain, and Simple Shoulder Test, and range of motion. Subjective satisfaction and return to sport was also determined. **Results:** Eleven patients were identified during the study period. At the time of the operation, the average age of the 6 male and 5 female patients was 17.1 ± 3.97 years. Average clinical follow-up was 31 ± 6.3 months. No patients were lost to follow-up. The subjective result was excellent for all 11 shoulders. VAS scores improved from 5.71 ± 3.35 preoperatively to 1.5 ± 1.9 postoperatively, ASES scores improved from 6.0 ± 16.7 to 85.5 ± 14.1, and the SST improved from 7.14 ± 3.68 to 11.3 ± 1.05. All of the functional evaluation scores improved postoperatively (P < 0.05). There was no case of postoperative dislocation or subluxation, and all but 1 patient returned to their previous level of sports (90%). **Conclusion:** Good and excellent outcomes can be obtained with arthroscopic stabilization for patients with voluntary instability. Improved results from previous results may be related to improved patient selection, surgical technique, and postoperative rehabilitation. Arthroscopic stabilization is an acceptable treatment option for patients who fail nonoperative treatment.

**35 INTERLEUKIN 17 IN HUMAN TENDINOPATHY: A CRITICAL REGULATOR**

Neal L. Millar, MD, Axel J. Hueber, MD, George A.C. Murrell, MD, PhD, Iain B. McInnes, MD, PhD, Division of Immunology Infection and Inflammation, University of Glasgow, Glasgow, Scotland, United Kingdom; Orthopaedic Research Institute, St. George Hospital, Sydney, New South Wales, Australia

**Aim:** We have previously reported increased expression of key cytokines in human and rodent models of tendinopathy. Interleukin-17 is the founding member of a group of cytokines called the IL-17 family and induces the production of IL-1, IL-6, TNF-α, inducible NO synthase, matrix metalloproteinases (MMPs), and chemokines by fibroblasts, macrophages, and endothelial cells. Based on its key role in fibroblast driven inflammation we hypothesized that it would be overexpressed in human tendinopathy and that it may cause matrix dysregulation. **Methods:** Twenty torn supraspinatus tendon and matched intact subscapularis tendon samples were collected from patients undergoing arthroscopic shoulder surgery. Control samples of subscapularis tendon were collected from 10 patients undergoing arthroscopic stabilization surgery. Human tendon derived cells were explanted from hamstring tendon tissue of 4 patients undergoing hamstring tendon ACL reconstruction. Samples were evaluated using Quantitative RTPCR, Luminex cytokines assays, immunohistochemistry/immunofluorescence, and Annexin V FACS staining. Immunohistochemistry/immunofluorescence staining revealed mast cells were the predominant source of IL-17 production. IL-17 treated tenocytes resulted in significantly (P < 0.001) increased production of proinflammatory cytokines, significantly (P < 0.01) altered matrix regulation with increased production of Collagen III and MMP 13 and significantly (P < 0.01) promoted tendon cell apoptosis. Neutralizing antibodies against IL-17 significantly (P < 0.01) reduced these effects. **Conclusions:** IL-17 increases tendon cell apoptosis, promotes proinflammatory mediators and significantly alters tendon cell matrix regulation. Neutralizing antibodies to IL-17 significantly reduce this effect. This study is the first to suggest that blockade of a specific cytokine may significantly alter the course of human tendinopathy and targeting of this molecule may offer novel treatment modalities.

**References**


**36 ROTATOR CUFF REPAIR IN AN OVINE MODEL USING A COMBINATION PRODUCT COMPRISED OF A TYPE I BOVINE COLLAGEN MATRIX AND rhPDGF-BB**

Joshua S. Dines, MD, David M. Dines, MD, A. Simon Turner, DVM, Amy Lyons, Brandon Santoni, Charlie K. Hee, PhD, Hospital for Special Surgery, New York, New York, USA; Colorado State University, Fort Collins, Colorado, USA; BioMimetic Therapeutics, Franklin, Tennessee, USA

**Introduction:** Optimal healing of rotator cuff injuries involves reinsertion of the tendon into bone at the repair site, which may be augmented by growth factors such as platelet-derived growth factor-BB (PDGF-BB). We hypothesized that rhPDGF-BB combined with type I collagen matrix at the site of repair would improve tendon reattachment to the humerus. **Methods:** The infraspinatus tendon of 60 skeletally mature ewes (n = 12/group) was detached from the humerus. The footprint was decontaminated and the bone perforated with 3 drill holes. Test articles (1) suture, (2) suture+collagen, (3) suture+collagen+75 μg rhPDGF-BB (low), (4) suture+collagen+150 μg rhPDGF-BB (mid), or (5) suture+collagen+500 μg rhPDGF-BB (high) were placed interpositionally and the tendon was secured with a single-row repair through bone tunnels. Animals were sacrificed after 12 weeks. Tensile testing (n = 9/group) consisted of cyclic preconditioning followed by a quasi-static load-to-failure ramp. Histologic specimens (n = 3/group) were decalcified and sections were stained with H&E and evaluated using a semi-quantitative scoring system assessing the quality of the reparative/healing tissue. Statistical analysis was performed using a one-way ANOVA and Fisher’s LSD test. **Results:** The ultimate load at failure was increased in the low- and mid-dose groups relative to the suture (63.7% and 63.3%; P < 0.03) and high-dose groups (120% and 119.3%; P = 0.23). Sample failure in the suture, suture+collagen, and high-dose groups occurred in the repair tissue, while specimens in the low- (6/9) and mid-dose (5/9) groups exhibited some degree of bony avulsion. Histologically, the suture, suture+collagen, and...
high-dose groups had similar tendon retraction, inflammatory cells, vascularization, and Sharpey's fibers. The low- and mid-dose groups displayed increased tendon repair and interdigitation (Sharpey’s fibers) of tendon collagen into bone. Discussion: A type I collagen matrix saturated with rhPDGF-BB significantly enhanced repair in a dose responsive manner compared with a standard treatment (suture), as assessed biomechanically and histologically. The combination of a type I collagen matrix and low- or mid-doses of rhPDGF-BB may have promise for the augmentation of rotator cuff repair.

References

37 INTERCELLULAR ADHESION MOLECULE-1 (ICAM-1, CD54) IS INCREASED IN THE FROZEN SHOULDER
Yang-Soo Kim, MD, Jung-Man Kim, MD, Ji-Hoon Ok, MD, Jong-Hoon Ji, MD, Yun-Kyoung Lee, MS, Department of Orthopaedic Surgery, Seoul St. Mary's Hospital, College of Medicine, Catholic University of Korea, Seoul, Korea.

Introduction: Frozen shoulder (adhesive capsulitis) is a very common cause of shoulder disability and pain. This disorder is characterized by dense fibrosis of the glenohumeral capsule, which restricts the shoulder motion. But the pathophysiology of this disorder is poorly understood and there are very limited reports regarding the cytokines and their expression in the frozen shoulder. Inflammation is thought to have a central role in the pathophysiology of the frozen shoulder. Recent studies have suggested a crucial role for intercellular adhesion molecule (ICAM-1) in inflammatory process because ICAM-1 mediates the leukocyte’s adhesion and migration to the endothelial cell at the inflammation site. In this study, we compared the expression of ICAM-1 at joint capsule, joint fluid, blood stream of patients with frozen shoulder to normal controls. And we also investigated whether the expression of this molecule can be reduced with treatment of steroid that is frequently used at the clinic.

Materials and Methods: The glenohumeral capsule tissue was obtained intraoperatively from 20 patients. They were divided into 2 groups: 15 patients with adhesive capsulitis and 5 controls from the patients with proximal humerus fracture and anteriorinferior instability. All human tissues were obtained with the approval of our institutional review board. RNA Extraction and Oligo-Array Analysis for Gene Expression in capsule tissue: Capsule tissues were obtained during the surgery and stored in the RNAlater (Ambion, Carlsbad, CA) at -20°C. Total RNA from the capsule tissues were extracted using TRIZOL (Invitrogen, Rockville, MD) according to the manufacturer’s instructions. GEArray Series (Bioscience Corp., Frederick, MD) for human extracellular matrix & adhesion molecules were used. Gene detection in capsule tissue by real-time reverse transcription-polymerase chain reaction (RT-PCR): We can confirm the difference of gene expression between the capsule tissue from frozen shoulder (15 patients) and the normal capsule tissue (5 patients) from the fracture and instability patients. Real time PCR was performed up to 40 cycles using the SMART Cycler (Cepheid, Sunnyvale, CA) and Syber Green dye. Each sample were tested in duplicate and 18s gene was used as reference gene. ICAM-1 detection in the joint capsule by immunohistochemical staining.: Samples were fixed with 10% buffered formalin overnight, washed, and dehydrated through a graded series of alcohol and were embedded in paraffin. Primary antibody mouse monoclonal anti-human ICAM-1 was incubated for overnight at 4°C. Slides were counterstained with hematoxylin, and examined by light microscopy to determine ICAM-1 distribution. For a negative control, the primary antibody was omitted. ICAM-1 detection in the joint fluid by western blotting: Joint fluid was extracted from the patients with frozen shoulder (7 patients) and anterior instability (2 patients). Anti-human ICAM monoclonal antibody was used. Staining was detected with a chemiluminescence kit, and quantified by densitometry with Image Analyzer LAS-3000 Multi Gauge software. sICAM-1 (soluble ICAM-1) detection in the blood serum by enzyme-linked immunosorbent assay (ELISA): Total sICAM-1 levels were quantified in blood serum from 32 patients with frozen shoulder, 20 patients with diabetes mellitus and 14 normal candidates without any disease. Serum samples were diluted 1:100 in 1 X assay buffer and added into wells with an enzyme conjugate of horseradish peroxidase-anti-sICAM-1 antibody. Joint capsule cell culture: The capsular cells from 3 patients with frozen shoulder and 2 patients with anteriorinferior instability as control were cultured in DMEM containing 10% FBS. Only the third cell passages were used in this experiment. ICAM-1 mRNA expression in cultured capsular cells after steroid treatment by real-time RT PCR: One day after seeding, all cultured cells from frozen shoulder and controls were replaced with SFM and treated with a 10 nM of dexamethasone and the medium were exchanged every 24 hours. ICAM-1 mRNA in each sample cells was detected by real-time RT-PCR and compared the expression with control samples before steroid treatment, 1 day and 3 day of culture following steroid treatment. Gene expressions of cytokines related with inflammation and fibrosis in cultured normal human synovial cells at 1 day and 3 days after ICAM-1 treatment with/without glucose: Human synoviocyte cells were cultured and were treated with only human recombinant ICAM-1 and ICAM-1 with high-glucose. The cells were harvested for RNA extraction with Trizol reagent at 24 and 72 hours after treatment. The genes of cytokines related fibrosis and inflammation were detected using real time RT-PCR. Genes of cytokines related with inflammation and fibrosis in the rat joint capsule tissue at 3 days following ICAM-1 injection into the shoulder joint of rat: Six rats were randomly assigned into 2 groups: ICAM-1 injection group into shoulder joint and PBS injection group into shoulder joint as sham controls. The capsule tissue was harvested at 3 days after the operation. Gene expression of cytokines related with inflammation and fibrosis was analyzed using quantitative real time RTPC Statistical analysis: Student test and Mann-Whitney U test were used for comparison between the frozen shoulder and control groups. P-values less than 0.05 were considered significant. Results: The gene expression of ICAM-1 was significantly increased in frozen shoulder compared with control in array (P<.05). The average relative intensity of expression of frozen shoulder was 14666.44 unit and those of control was 5881.22 unit. The immunoreactivity for ICAM-1 showed that there was increased expression of the ICAM-1 molecule in the capsule of the patient of frozen shoulder compared with that of control. Gene detection in capsule tissue by real time reverse transcription-polymerase chain reaction (RT-PCR): Expression levels of ICAM-1 mRNA were significantly higher in the patient with frozen shoulder compared with control (P<.05). Average expression level was 1.698±0.186 in frozen shoulder group and 0.999±0.236 in control. ICAM-1 detection in the joint fluid by western blotting: The expression of ICAM-1 protein in the glenohumeral joint fluid of the patients with frozen shoulder (7 patients) was increased definitely compared with control (2 patients).

Frozen Control

sICAM-1 expression in the blood serum by ELISA: The sICAM-1 concentration was significantly increased in serum of the patient with frozen shoulder (633.219 ± 59.144 ng/ml) and diabetes mellitus (625.253 ± 27.080 ng/ml) compared with control (49.864 ± 44.286 ng/ml, P<.05). Downregulated expression of ICAM-1 in the cultured capsular cells after treatment with steroid: The expression level of ICAM-1 mRNA was significantly increased in frozen shoulder capsule cells (1.6364 ± 0.2509) than control cells (0.7004 ± 0.21165; P<.05) before steroid treatment. After 3 days of culture following steroid treatment, ICAM-1 mRNA levels
were significantly decreased in cultured cells from frozen shoulder (0.435 ± 0.056), while that of the control cells is little changed (1.0 ± 0.554). In contrast to ICAM-1 expression in dexamethasone treated cells from control for 3 days has tend to increase gradually, ICAM-1 treated normal human synovial cells showed increased gene expression of cytokines related with fibrosis: Real time RT-PCR data showed higher gene expression of all fibrosis related cytokines including CD 44, MMP 9, 14, TIMP 2, CTGF and TGF beta 1 in the synoviocytes treated both with ICAM-1 only and ICAM-1 with high glucose than control at 1 and 3 days culture. ICAM-1 injected joint capsule tissue showed increased gene expression of cytokines related with inflammation and fibrosis in rat model: The type-III to type-I collagen gene ratio increased at 3 days in ICAM-1 injection groups (0.019±0.0097) than sham controls(0.008±0.0028). The gene expression of TGF beta 1, fibronectin, TIMP-2, IL-1b, TNF-alpha were increased in ICAM-1 injection group compared with sham control at day 3 after the injection. Discussion: This study demonstrated that ICAM-1 expression is significantly increased in capsule tissue and joint fluid of the shoulder joint and blood serum of the patients with frozen shoulder compared with those of control. And we also demonstrated that the expression of ICAM-1 increased in cultured capsular cells and reduced after steroid treatment, which provides biological evidence for the injection of corticosteroid into glenohumeral joint as a treatment of frozen shoulder. One another novel finding was that the ICAM-1 could cause synovial cell proliferation and increase the gene expression of the cytokines related with inflammation and fibrosis in the normal joint capsule. The results imply this specific molecule might play an important role in immune-mediated inflammatory response and causing the stiffness in frozen shoulder. Therefore, regulation of ICAM-1 expression might be a key of anti-adhesion agent for treatment of frozen shoulder. Acknowledgment: This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education, Science and Technology (2009-0074794).

Figure 1 RNA extraction, oligo-array analysis for gene expression and immunohistochemical staining for ICAM-1 in joint capsule tissue.

38 THE LONG-TERM OUTCOME OF TOTAL ELBOW ARTHROPLASTY IN JUVENILE RHEUMATOID ARTHRITIS
Justin A. Jacobson, MD, Thomas R. Duquin, MD, Bernard F. Morrey, MD, Joaquin Sanchez-Sotelo, MD, PhD, Mayo Clinic, Rochester, Minnesota, USA
Introduction: Total elbow arthroplasty (TEA) is commonly considered for end-stage rheumatoid arthritis (RA). However, little is known regarding its long-term outcome, which could be affected adversely by the small bone size, stiffness and young patient age in this population. The goal of this study was to determine the long-term outcome of TEA in a consecutive series of juvenile rheumatoid elbows. Methods: Between 1983 and 2005, 29 elbows (24 patients) underwent TEA for JRA using a linked semiconstrained implant and followed for a mean of 9 years. Clinical outcome was graded using the Mayo Elbow Performance Score (MEPS) and survivorship analyses were performed according to the Kaplan-Meier method. The results were compared with a larger series of arthroplasties performed for adult-onset rheumatoid arthritis (RA). Results: TEA resulted in statistically significant improvements in pain, extension (mean improvement, 15 degrees), flexion (mean improvement, 17 degrees), and total arc of motion (from 65 to 99 degrees; P<.001). The intraoperative arc of motion was greater than at final evaluation (from 121 to 99 degrees; P<.001). Fourteen elbows (48%) were noted to have small bone size, and implant modification due to this finding was required in 4 cases. Complications included revision surgery (6) and superficial infection (1). The mean final MEPS was 84 points, compared with 86 points for patients with RA (P=.22). With the numbers available there were no statistically significant differences in implant survival between JRA and RA at 1 year (100% vs 99.6%), 5 years (96.2% vs 95.6%), and 10 years (78.2% vs 91.7%). Conclusion: TEA in JRA is associated with a reasonable long-term survival and a high rate of satisfactory functional results that are similar to RA. The treating surgeon should be aware of the small bone size, and be prepared to modify the procedure as needed.

39 COMPLICATIONS OF TOTAL ELBOW ARTHROPLASTY IN NON-RHEUMATOID PATIENTS: LESSONS LEARNED WITH APPLICATION IN AN ACTIVE POPULATION
William H. Seitz Jr, MD, Hisham Bismar, DO, Peter J. Evans, MD, PhD, The Cleveland Clinic, Cleveland, Ohio, USA
Total elbow arthroplasty has become an accepted surgical tool for the reconstruction of advanced rheumatoid arthritis involving the elbow. Expanded application has been reported in patients with osteoarthritis, posttraumatic arthritis and in cases of severe trauma precluding fracture reconstruction, with reports of successful outcomes. Such patients, however, tend to be younger, more active, and therefore potentially place higher demands and stresses on current less than physiologic implants. Over a 10-year period, the authors have implanted 64 linked total elbow arthroplasties in 64 patients (age range, 38-84; mean, 58 years; 39 men, 29 women) with osteo- or posttraumatic arthritis, or unreconstructable fractures. Initial results at 2 years demonstrated satisfactory results with a high satisfaction rate and a low complication rate with 4 early reoperations (6.4%), comparable to other published reports. But longer-term follow-up at 4-10 years has demonstrated a higher implant related complication rate. These complications include bursing failure with dissociation in 7, humeral stem failure in 2 ulnar stem failure in 2, ulnar loosening in 3, periarticular fracture in 6 with 1 late infection. Reoperation was required in an additional 21 patients (32.8%). Total elbow arthroplasty has added immensely to our armamentarium of tools for the treatment of rheumatoid arthritis, especially in low demand patients who lead a sedentary lifestyle. Clearly, as indicators for application of this technique have expanded to include a more active patient population, implant stresses and resultant failure rates have been found to increase with longer-term follow-up. These findings suggest a need to rethink implant design to become more responsive to physiologic loads demanded in more active patients and to counsel future patients as well as existing patients with current implants regarding the limits and potential failure of existing implant designs. Future implant designs should incorporate more anatomic load sharing characteristics to accommodate the demands of this more active population of patients.

40 PRIMARY ARTHRITIS OF THE ELBOW: DOES ARTHROSCOPIC ULNORHUMERAL ARTHROPLASTY RESULT IN IMPROVED OUTCOMES OVER SIMPLE ARTHROSCOPIC DEBRIDEMENT?
Thomas V. Giel III, MD, Bryan C. Fagan, MD, Larry D. Field, MD, Felix H. Savoie III, MD, Mississippi Sports Medicine & Orthopaedic Center, Jackson, Mississippi, USA
Introduction: Primary arthritides of the elbow is an uncommon entity that can cause disabling pain and functional limitations. The therapeutic arsenal for the treatment of primary arthritis of the elbow in...
young, active patients is somewhat limited. Arthroscopic debride-
ment both with and without concurrent ulnohumeral arthroplasty
have been shown to be effective. Methods: A retrospective chart re-
view of 35 patients who underwent elbow arthroscopy for primary
osteoarthritis of the elbow was completed. 20 patients underwent
arthroscopy with debridement alone; 15 patients underwent ar-
throscopy with debridement and ulnohumeral arthroplasty. Preoper-
ative motion, pain, and Mayo Elbow Performance Index scores for
both groups were compared. Results: For those undergoing arthro-
scopic debridement only, the average follow-up was 37 months
(range, 8 to 57 months). Preoperatively, mean flexion was 115°
(range, 100°-130°) and mean extension loss was 26° (range, 7°-
70°). Postoperatively, mean flexion was 129° (range, 110°-145°)
and mean extension loss was 8° (range 0°-25°). The total arc of mo-
tion averaged 89° preoperatively and 121° postoperatively. Mayo
Elbow Performance Index scores improved from an average of 57
preoperatively to 90 postoperatively. The mean subjective pain level
improved from 6.6 preoperatively to 1.4 postoperatively. For those
undergoing arthroscopic debridement with combined ulnohumeral
arthroplasty, the average follow-up was 34 months (range, 10-60
months). Preoperatively the mean flexion was 102° (range, 90°-
130°) and mean extension loss was 31° (range 10°-50°). Postoper-
atively, mean flexion was 128° (range, 110°-145°) and mean ex-
tension loss was 6° (range 0°-25°). The total arc of motion
averaged 71° preoperatively and 122° postoperatively. Mayo El-
bow Performance Index scores improved from an average of 55 pre-
operatively to 83 postoperatively. The mean subjective pain level
improved from 6.6 preoperatively to 2.7 postoperatively. When
comparing the 2 techniques, a statistically significant difference
was found for the average arc of motion improvement. Those pa-
tients undergoing ulnohumeral arthroplasty had an average change
of 53° compared with 28° for those undergoing debridement only
(\(P=.033\)). The change in Mayo Elbow Performance Index scores
and subjective pain level were not found to be statistically signifi-
cant. Conclusions: Based on these results, ulnohumeral arthroplasty
may provide greater improvement in postoperative arc of motion.
Pain relief and Mayo Elbow Performance Index scores are essen-
tially equivalent for the 2 techniques.