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## Upper extremity

Arthroscopy

Volume 33, Issue 1, p1-238

### **All-Arthroscopic Suprapectoral Versus Open Subpectoral Tenodesis of the Long Head of the Biceps Brachii Without the Use of Interference Screws**

Jamison M. Green, Mark H. Getelman, Stephen J. Snyder, Joseph P. Burns,

Arthroscopy, January 2017, Volume 33, Issue 1, Pages 19–25

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#### Purpose

To compare patient-reported outcomes and healing rates after open subpectoral and all-arthroscopic suprapectoral biceps tenodesis without the use of interference screws in patients with more than 2 years of follow-up.

#### Methods

Patients with at least 2 years of follow-up who underwent open subpectoral biceps tenodesis or all-arthroscopic suprapectoral biceps tenodesis without concomitant rotator cuff repair, labral repair, or Mumford procedure were considered for enrollment in the study. They were evaluated for visual analog scale (VAS), American Shoulder and Elbow Surgeons (ASES) score, and satisfaction with function and biceps contour. Ultrasonography was performed to evaluate the integrity of the tenodesis site and measure biceps muscle diameters on each arm.

#### Results

Forty-nine patients were eligible for our study and of these, 38 were able to participate. Twenty-three patients had open subpectoral biceps tenodesis and 15 received all-arthroscopic suprapectoral biceps tenodesis. The average follow-up time was 4.5 years (range 2-9.1 years). There were no significant differences in anterior shoulder pain VAS, ASES scores, or satisfaction rates. The average anterior shoulder VAS was  $0.7 \pm 1.1$  for the open group and  $0.9 \pm 1.8$  for the arthroscopic group ( $P = .74$ ). The mean ASES score for the open group was  $90.6 \pm 11.4$  and  $91.4 \pm 13.9$  for the arthroscopic group ( $P = .69$ ). All patients had an intact tenodesis site on ultrasonography and the ratio of operative to nonoperative biceps diameters was  $100.2\% \pm 12.8\%$  for the open group and  $99.1\% \pm 10.8\%$  for the arthroscopic group ( $P = .66$ ). There were no infections and no brachial plexus injuries in either group.

#### Conclusions

Open subpectoral biceps tenodesis and all-arthroscopic suprapectoral biceps tenodesis are both successful surgeries with consistently positive outcomes. Tenodesis can be performed in either location without interference screw fixation with durable, reliable results.

#### Level of Evidence

Level III, retrospective comparative trial.

[BACK](#)

## **The “3-Pack” Examination Is Critical for Comprehensive Evaluation of the Biceps-Labrum Complex and the Bicipital Tunnel: A Prospective Study**

Samuel A. Taylor, Ashley M. Newman, Courtney Dawson, Kelli Ann Gallagher, Andrea Bowers, Joseph Nguyen, Peter D. Fabricant, Stephen J. O'Brien

Arthroscopy, January 2017, Volume 33, Issue 1, Pages 28–38

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### **Purpose**

To determine the diagnostic value of the 3-Pack examination for biceps-labrum complex (BLC) disease, assess interobserver reliability, and generate an evidence-based diagnostic and therapeutic algorithm.

### **Methods**

A total of 145 consecutive patients were enrolled in this prospective comparative study. The study included 116 chronically symptomatic patients indicated for arthroscopic subdeltoid transfer of the long head of the biceps tendon to the conjoint tendon and 29 asymptomatic comparison subjects. Each patient underwent examination that included the 3-Pack (active compression test [O'Brien sign], throwing test, and bicipital tunnel palpation) and traditional examination (Speed test; Yergason test; full can test; empty can test) in a blinded, randomized fashion by 3 investigators. Intraoperative BLC disease was prospectively categorized by location (inside, junctional, or bicipital tunnel).

### **Results**

3-Pack tests were highly sensitive (73% to 98%), but less specific (46% to 79%) for BLC in all 3 locations than some of the traditional tests, which were less sensitive (20% to 67%), but more specific (83% to 100%) for BLC disease in all 3 locations. With regard to hidden bicipital tunnel lesions, palpation and O'Brien sign were highly sensitive (97.8% and 95.7% respectively) and revealed high negative predictive value (NPV, 96.4% and 92.6% respectively). Speed and Yergason tests, conversely, were poorly sensitive but had high specificities (86.7% and 97.9%, respectively) and positive predictive value (76% and 92.3%, respectively). Inter-rater reliabilities were substantial to almost perfect for the 3-Pack examination (kappa 70% to 85%) and fair to moderate for the 4 traditional examinations (kappa 25% to 56%).

### **Conclusions**

The 3-Pack has excellent inter-rater reliability, sensitivity, and NPV and is a critical screening tool for BLC disease in all zones. Hidden extra-articular bicipital tunnel disease can reliably be excluded based on negative tenderness to palpation or a negative O'Brien sign (NPV 93% to 96%).

### **Level of Evidence**

Level III, case control study.

[BACK](#)

## Shoulder Arthroscopy in Adults 60 or Older: Risk Factors That Correlate With Postoperative Complications in the First 30 Days

William J. Rubenstein, Christian A. Pean, Alexis C. Colvin

Arthroscopy, January 2017, Volume 33, Issue 1, Pages 49–54

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### Purpose

To investigate the 30-day postoperative adverse event (AE) rates of adults 60 years or older after shoulder arthroscopy and identify risk factors for complications in this patient population.

### Methods

Patients aged 60 or more who underwent shoulder arthroscopy were identified in the American College of Surgeons National Surgery Quality Improvement Program database from 2006 to 2013 using 12 Current Procedural Terminology codes related to shoulder arthroscopy. Complications were categorized as severe AEs, minor AEs, and infectious AEs for separate analyses. Pearson's  $\chi^2$  tests were used to identify associations between patient characteristics and AE occurrence and binary logistic regression for multivariate analysis of independent risk factors.

### Results

In total, 7,867 patients were included for analysis. Overall, 1.6% ( $n = 127$ ) of the older adults experienced at least one AE with 1.1% ( $n = 90$ ) severe AEs, 0.6% ( $n = 46$ ) minor AEs, and 0.4% ( $n = 28$ ) infectious complications. Multivariate analysis revealed that age 80 years or older (odds ratio [OR] = 2.2, 95% confidence interval [CI] = 1.2-2.7,  $P = .01$ ), body mass index greater than 35 (OR = 1.8, 95% CI = 1.1-2.7,  $P = .01$ ), functionally dependent status (OR = 2.9, 95% CI = 1.3-6.8,  $P = .01$ ), American Society of Anesthesiologists class greater than 2 (OR = 1.5, 95% CI = 1.0-2.2,  $P = .04$ ), congestive heart failure (OR = 6.1, 95% CI = 1.8-21.2,  $P = .03$ ), disseminated cancer (OR = 7.9, 95% CI = 1.4-43.9,  $P = .02$ ), and existence of an open wound at the time of surgery (OR = 4.0, 95% CI = 1.1-14.6,  $P = .03$ ) were independently associated with the occurrence of an AE. Nineteen of the patients included in the study required readmission to the hospital within the 30-day period for an overall readmission rate of 0.2%.

### Conclusions

Patients 60 years or older who underwent shoulder arthroscopy for a variety of indications have a low overall 30-day postoperative complication rate of 1.6%. Although low, this is a higher rate than previously reported for the overall shoulder arthroscopy population. Independent patient characteristics associated with increased risk of AE occurrence included age 80 years or older, body mass index greater than 35, functional dependent status, American Society of Anesthesiologists score of 3 or 4, congestive heart failure, disseminated cancer, and existence of an open wound.

### Level of Evidence

Level III, retrospective comparative study.

[BACK](#)

## **Risk Factors for 30-Day Readmission Following Shoulder Arthroscopy**

J. Ryan Hill, Braden McKnight, William C. Pannell, Nathanael Heckmann, Lakshmanan Sivasundaram, Amir Mostofi, Reza Omid, George F. "Rick" Hatch III

Arthroscopy, January 2017, Volume 33, Issue 1, Pages 55–61

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### **Purpose**

The purpose of this study was to evaluate a large population of shoulder arthroscopy cases in order to provide insight into the risk factors associated with readmission following this common orthopaedic procedure.

### **Methods**

The American College of Surgeons (ACS) National Surgical Quality Improvement Program (NSQIP) database was queried using current procedural terminology (CPT) billing codes to identify all patients older than 18 years of age who underwent shoulder arthroscopy between 2011 and 2013. Univariate and multivariate analyses were conducted to identify factors associated with 30-day readmission.

### **Results**

We identified 15,015 patients who had undergone shoulder arthroscopy, with a 30-day readmission rate of 0.98%. The most common reason for readmission was pulmonary embolism (0.09%). On multivariate analysis, operative time > 1.5 hours (odds ratio [OR], 1.80; 95% confidence interval [CI], 1.29 to 2.50), age 40 to 65 years (OR, 3.80; 95% CI, 1.37 to 10.59), age > 65 years (OR, 3.91; 95% CI, 1.35 to 11.35), American Society of Anesthesiologists (ASA) class 3 (OR, 4.53; 95% CI, 1.90 to 10.78), ASA class 4 (OR, 7.73; 95% CI, 2.91 to 27.25), chronic obstructive pulmonary disease (COPD; OR, 2.65; 95% CI, 1.54 to 4.55), and chronic steroid use (OR, 2.96; 95% CI, 1.46 to 6.01) were identified as independent risk factors for readmission.

### **Conclusions**

Operative time > 1.5 hours, age > 40 years, ASA classes 3 or 4, COPD, and chronic steroid use are independent risk factors for readmission following elective arthroscopic shoulder surgery, although the readmission rate following these procedures is low.

### **Level of Evidence**

Level III, retrospective comparative study.

[BACK](#)

## Outcomes of Arthroscopic Decompression of Spinoglenoid Cysts Through a Subacromial Approach

Sung-Jae Kim, Yun-Rak Choi, Min Jung, Jun-Young Park, Yong-Min Chun,

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### Purpose

To describe a spinoglenoid cyst decompression technique through a subacromial approach and its clinical outcomes after 2 years of follow-up.

### Methods

From March 2008 to October 2013, 26 patients underwent arthroscopic decompression of a spinoglenoid ganglion cyst with and/or without superior labral anterior to posterior repair, and patients who were available for minimum of 2 years of follow-up were included. For functional assessments, the visual analog scale (VAS) pain score, subjective shoulder value (SSV), University of California at Los Angeles (UCLA) shoulder score, American Shoulder and Elbow Surgeon (ASES) score, and shoulder active range of motion were used to compare preoperative and postoperative follow-up values. Follow-up magnetic resonance arthrography was taken at 6 months postoperatively to evaluate incomplete decompression or recurrence of the cyst.

### Results

In total, 21 patients were included in this study. At the 2-year follow-up, the VAS, SSV, ASES, and UCLA shoulder scores significantly improved compared with preoperative values ( $P < .001$ ): VAS improved from 3.5 to 0.7 ( $P < .001$ ); SSV improved from 62.9 to 93.1 ( $P < .001$ ); ASES score improved from 64.3 to 94.4 ( $P < .001$ ); UCLA shoulder score improved from 21.6 to 32.9 ( $P < .001$ ). Also, active forward flexion improved from 153° to 158° ( $P = .014$ ), and external rotation improved from 55° to 57° ( $P = .042$ ) significantly, with the exception of internal rotation. The follow-up magnetic resonance arthrography was performed in 18 patients (86%), and there was no recurrence of the spinoglenoid notch cyst.

### Conclusions

For spinoglenoid cyst decompression, the subacromial approach was found to be effective, yielding satisfactory clinical outcomes without recurrence.

### Level of Evidence

Level IV, therapeutic case series.

[BACK](#)

## **Anatomical Evaluation of the Proximity of Neurovascular Structures During Arthroscopically Assisted Acromioclavicular Joint Reconstruction: A Cadaveric Pilot Study**

Daniel Banaszek, Michael Pickell, Evan Wilson, Melissa Ducsharm, Daniel Hesse, Ron Easteal, Davide D. Bardana,

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### **Purpose**

The purpose of this study was to examine the safety of an arthroscopic technique for acromioclavicular joint (ACJ) reconstruction by investigating its proximity to important neurovascular structures.

### **Methods**

Six shoulders from 4 cadaveric specimens were used for ACJ reconstruction in this study. The procedure consists of performing an arthroscopic acromioclavicular (AC) reduction with a double button construct, followed by coracoclavicular ligament reconstruction without drilling clavicular tunnels. Shoulders were subsequently dissected in order to identify and measure distances to adjacent neurovascular structures.

### **Results**

The suprascapular artery and nerve were the closest neurovascular structures to implanted materials. The mean distances were 8.2 (standard deviation [SD] = 3.6) mm to the suprascapular nerve and 5.6 (SD = 4.2) mm to the suprascapular artery. The mean distance of the suprascapular nerve from implants was found to be greater than 5 mm ( $P = .040$ ), while the distance to the suprascapular artery was not ( $P > .5$ ). Neither difference was statistically significant ( $P = .80$  for artery;  $P = .08$  for nerve).

### **Conclusions**

Mini-open, arthroscopically assisted ACJ reconstruction safely avoids the surrounding nerves, with no observed damage to any neurovascular structures including the suprascapular nerve and artery, and may be a viable alternative to open techniques. However, surgeons must remain cognizant of possible close proximity to the suprascapular artery.

### **Clinical Relevance**

This study represents an evaluation of the safety and feasibility of a minimally invasive ACJ reconstruction as it relates to the proximity of neurovascular structures.

[BACK](#)

## Posterior Distal Clavicle Beveling for Chronic Nonincarcerated Type IV Acromioclavicular Separations: Surgical Technique and Early Clinical Outcomes

Daniel D. Buss, Kelly Anderson, Ned Tervola, M. Russell Giveans

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### Purpose

To describe the arthroscopic partial posterior distal clavicle beveling technique for treatment of chronic nonincarcerated type IV acromioclavicular (AC) separations and report clinical outcomes and return to sport.

### Methods

All patients who underwent the arthroscopic partial distal clavicle beveling technique and met eligibility criteria were identified and retrospectively reviewed. Inclusion criteria included the clinical diagnosis of a chronic nonincarcerated type IV AC separation and a minimum follow-up period of 24 months. Subjects completed the American Shoulder Elbow Surgeons shoulder assessment and a study-designed questionnaire. Radiographic images and clinical charts were also reviewed.

### Results

This study identified 15 consecutive patients with 2 lost to follow-up, resulting in inclusion of 13 subjects (9 males and 4 females). Dominant arm was involved in 77% of cases. Mean age at operation was 33.2 years (range, 19-56 years). The mean period between injury and operation was 12.5 months (range, 3-37 months), and follow-up was 48.5 months (range, 24-126 months). The mean preoperative ASES score was  $46.6 \pm 16.9$  (range, 33-68), and the mean postoperative ASES score was  $87.3 \pm 17.4$  (range, 50-100) ( $P < .0001$ ). All 9 athletes in the study returned to competition with a mean recovery period of 2.3 months (range, 2 weeks to 4 months). Mean timeframe for return to work was 2 weeks (range, 1 day to 2 months). One subject underwent a subsequent coracoclavicular ligament reconstruction for continued pain. The mean satisfaction level was 4.3 out of 5, and 91% would choose to have the surgery again. One subject indicated dissatisfaction with shoulder appearance.

### Conclusions

The arthroscopic partial distal clavicle beveling procedure for nonincarcerated type IV AC separations resulted in a significant reduction in pain, improved daily function, and early return to sport.

### Level of Evidence

Level IV, therapeutic case series.

[BACK](#)

## Comparative Outcome Analysis of Arthroscopic-Assisted Versus Open Reduction and Fixation of Trans-scaphoid Perilunate Fracture Dislocations

Won-Taek Oh, Yun-Rak Choi, Ho-Jung Kang, Il-Hyun Koh, Kyung-Han Lim,

Arthroscopy, January 2017, Volume 33, Issue 1, Pages 92–100

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### Purpose

To compare union rates and clinical and radiological outcomes of arthroscopic-assisted reduction and fixation with those of open reduction and fixation in patients with trans-scaphoid perilunate fracture dislocations.

### Methods

This retrospective study included consecutive patients with trans-scaphoid PLFDs who underwent arthroscopic-assisted reduction and fixation (group A) or open reduction and fixation (group O), and who were followed up for a minimum of 2 years between May 2005 and March 2013. We excluded initially missed patients. Each different surgeon who was on call had performed each experienced operation. These clinical outcomes were assessed: range of motion, grip strength, Mayo wrist score, and Disabilities of Arm, Shoulder, and Hand (DASH) score. For radiologic outcomes, the scapholunate angle, radiolunate angle, and lunotriquetral distance were measured.

### Results

The total number of included patient was 20 (11 in group A and 9 in group O). Scaphoid union occurred in all patients except 1 individual (11 of 11 in group A, and 8 of 9 in group O). At the last follow-up, the mean flexion-extension arc was significantly greater in group A (125.0°) than in group O (105.6°) ( $P = .028$ ). The mean grip strength was 81.1% that of the contralateral side in group A and 80.9% in group O ( $P = .594$ ). The mean Mayo wrist score was 85.5 in group A and 79.4 in group O ( $P = .026$ ), and the mean DASH score was 10.6 in group A and 20.8 in group O ( $P = .001$ ); however, only the DASH score showed a minimum clinically important difference. The mean scapholunate angle, radiolunate angle, and lunotriquetral distance were similar between the 2 groups: 47.2°, 1.7°, and 2.0 mm in group A and 48.8°, 5.6°, and 2.1 mm in group O, respectively.

### Conclusions

Although both arthroscopic and open techniques achieved stability of the injured wrists in patients with trans-scaphoid PLFDs, it is shown that the arthroscopic-assisted technique showed a clinically meaningful better DASH score and greater flexion-extension arc with other parameters being similar.

### Level of Evidence

Level III, retrospective comparative study.

[BACK](#)

JSES

Volume 26, Issue 1, p1-178, e1-e28

**High altitude is an independent risk factor for venous thromboembolism following arthroscopic rotator cuff repair: a matched case-control study in Medicare patients**

Jourdan M. Cancienne, MD, M. Tyrrell Burrus, MD, David R. Diduch, MD, Brian C. Werner, MD

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**Background**

Although the risk of venous thromboembolism (VTE) following elective shoulder arthroscopy is low, the large volume of procedures performed each year yields a significant annual burden of patients with thromboembolic complications. The purpose of this study was to evaluate the association of high procedural altitude with the incidence of postoperative VTE following arthroscopic rotator cuff repair.

**Methods**

A Medicare database was queried for all patients undergoing arthroscopic rotator cuff repair from 2005 to 2012. All patients with procedures performed at an altitude of 4000 feet or higher were grouped into the “high-altitude” study cohort. Patients with procedures performed at an altitude of 100 feet or lower were then matched to patients in the high-altitude cohort on the basis of age, gender, and medical comorbidities. The rate of VTE was then assessed for both the high-altitude and matched low-altitude cohorts within 90 days postoperatively.

**Results**

The rates of combined VTE (odds ratio [OR], 2.6;  $P < .0001$ ), pulmonary embolism (OR, 4.3;  $P < .0001$ ), and lower extremity deep venous thrombosis within 90 days (OR, 2.2;  $P = .029$ ) were all significantly higher in patients with procedures performed at high altitude compared with matched patients with the same procedures performed at low altitude.

**Conclusions**

Procedural altitude >4000 feet is associated with significantly increased rates of postoperative VTE, including deep venous thrombosis and pulmonary embolism, compared with age-, gender-, and comorbidity-matched patients undergoing the same procedures at altitudes <100 feet.

[BACK](#)

## **The effect of rotator cuff repair on early overhead shoulder function: a study in 1600 consecutive rotator cuff repairs**

Hayden A. Robinson, Patrick H. Lam, PhD, Judie R. Walton, PhD, George A.C. Murrell, MD, DPhil

JSES, January 2017 Volume 26, Issue 1, Pages 20–29

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### Background

Rotator cuff tears are often surgically repaired, generally with good results. However, repairs not infrequently re-tear, and how important repair integrity is with respect to early functional outcomes after rotator cuff repair is unclear. Thus, the purpose of this study was to determine the effect of a re-tear on overhead activities in a large cohort of patients after rotator cuff repair.

### Methods

This was a retrospective cohort study of prospectively collected data from 1600 consecutive rotator cuff repairs. Outcomes were based on patient responses to the L'Insalata Shoulder Questionnaire and findings on examination preoperatively and at 6 months of follow-up. Repair integrity was determined by ultrasound imaging at the 6-month follow-up visit.

### Results

The 1600 patients (885 men, 715 women) were a mean age of 58 years. Postoperative ultrasound imaging found 13% (211 of 1600) of repairs had re-tear. Significant improvements were seen irrespective of rotator cuff integrity in pain levels with overhead activity ( $P < .0001$ ) and range of motion in forward flexion ( $P < .001$ ) and abduction ( $P < .01$ ). Patients with intact repairs had 9.5 N greater supraspinatus strength ( $P < .0001$ ) and 6.9 N greater external rotation strength ( $P < .01$ ) than those with a re-tear.

### Conclusion

To our knowledge, this is the largest study to evaluate the effect of rotator cuff repair integrity on shoulder function. Patients who had an arthroscopic rotator cuff repair reported significant improvements in overhead pain levels irrespective of the repair integrity at 6 months. Repair integrity influenced supraspinatus and external rotation power, where patients with intact repairs were stronger than those with a re-tear.

[BACK](#)

## **Prevalence of asymptomatic rotator cuff tear and their related factors in the Korean population**

Jinyoung Jeong, MD, Dong-Cheul Shin, MD, Tae-Ho Kim, MD, Kyungil Kim, MD

JSES, January 2017 Volume 26, Issue 1, Pages 30–35

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### **Background**

No information is available about asymptomatic rotator cuff tears (RCTs) in the Korean population. This study evaluated the prevalence of rotator cuff tears without symptoms and their related risk factors.

### **Materials and methods**

The study included 486 volunteers (70.4% female; mean age, 53.1; range, 20-82 years) without any shoulder symptom complaints. Background data, medical history, clinical self-assessment, and physical examination were recorded. An ultrasonographic examination was conducted to identify rotator cuff pathology, but only full-thickness RCTs (FTRCTs) were included for the statistical analysis.

### **Results**

FTRCTs were found in 23 subjects (4.7%) but only in those aged  $\geq 49$  years. Subjects aged 50-59, 60-69, and  $\geq 70$  years of age had FTRCT prevalence rates of 3.5%, 13.3%, and 11.1%, respectively. The prevalence of FTRCTs was higher in subjects with diabetes ( $P = .042$ ) and a smoking history ( $P = .002$ ), but no differences were noted for the presence of thyroid disease ( $P = .051$ ). Almost half of those who had FTRCTs had some pain and limited daily activity that was not bothersome. After excluding these subjects from the analysis, the prevalence of asymptomatic FTRCTs decreased to 2.3%.

### **Conclusions**

The prevalence of asymptomatic FTRCTs was lower than expected. Half of asymptomatic FTRCTs were not actually symptom free after the clinical and physical assessments. The risk factors for a FTRCT were age, diabetes, and smoking.

[BACK](#)

## **The Nirschl procedure versus arthroscopic extensor carpi radialis brevis débridement for lateral epicondylitis**

Bong Cheol Kwon, MD, PhD, Jin Young Kim, MD, Kun-Tae Park, MD

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### **Background**

The Nirschl technique and arthroscopic débridement are common surgical procedures for chronic lateral elbow tendinopathy. The purpose of this study was to compare outcomes following the use of these techniques to treat chronic lateral elbow tendinopathy.

### **Methods**

We retrospectively reviewed 59 elbows of 55 patients who did not improve after conservative treatment. Twenty-nine elbows of 26 patients were treated with the Nirschl procedure (Nirschl group), and 30 elbows of 29 patients were treated with arthroscopic débridement (arthroscopy group). Outcomes were assessed subjectively with the quick Disabilities of the Arm, Shoulder and Hand questionnaire and the visual analog scale (VAS) for pain in 3 domains (overall pain, pain at rest, and pain during hard work) and objectively with pain-free grip strength.

### **Results**

The Nirschl and arthroscopy groups showed significant improvements in subjective and objective outcomes at a mean of 28.5 months and 31 months, respectively ( $P < .05$ ). No significant between-group differences were found in postoperative outcomes, including quick Disabilities of the Arm, Shoulder and Hand questionnaire scores; pain-free grip strength; and VAS scores for overall pain and pain at rest ( $P > .05$ ). However, a small but significant difference was found in the postoperative VAS score for pain during hard work ( $1.6 \pm 1.3$  for Nirschl group vs  $2.2 \pm 2.0$  for arthroscopy group,  $P = .042$ ).

### **Conclusions**

Both techniques are comparable and highly effective for treating chronic recalcitrant lateral elbow tendinopathy. Although the Nirschl technique provides slightly superior pain relief during hard work, the effect size is very small and the difference does not appear to be clinically important.

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January 2017, Vol 99-B, Issue 1

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## Lower extremity

Arthroscopy

Volume 33, Issue 1, p1-238

### **The Hip-Spine Effect: A Biomechanical Study of Ischiofemoral Impingement Effect on Lumbar Facet Joints**

Juan Gómez-Hoyos, Anthony Khoury, Ricardo Schröder, Eric Johnson, Ian J. Palmer, Hal D. Martin

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#### Purpose

To assess the relation between ischiofemoral impingement (IFI) and lumbar facet joint load during hip extension in cadavers.

#### Methods

Twelve hips in 6 fresh T1-to-toes cadaveric specimens were tested. A complete pretesting imaging evaluation was performed using computed tomography scan. Cadavers were positioned in lateral decubitus and fixed to a dissection table. Both legs were placed on a frame in a simulated walking position. Through a posterior lumbar spine approach L3-4 and L4-5 facet joints were dissected bilaterally. In addition, through a posterolateral approach to the hip, the space between the ischium and the lesser trochanter was dissected and measured. Ultrasensitive, and previously validated, piezoresistive force sensors were placed in lumbar facet joints of L3-4 and L4-5. Lumbar facet loads during hip extension were measured in native hip conditions and after simulating IFI by performing lesser trochanter osteotomy and lengthening. Four paired t-tests were performed comparing normal and simulated IFI on the L3-L4 and L4-L5 facet joint loads.

#### Results

After simulating IFI, mean absolute differences of facet joint load were 10.8 N (standard error of the mean [SEM]  $\pm 4.53$ ,  $P = .036$ ) for L3-4 at 10° of hip extension, 13.71 N (SEM  $\pm 4.53$ ,  $P = .012$ ) for L3-4 at 20° of hip extension, 11.49 N (SEM  $\pm 4.33$ ,  $P = .024$ ) for L4-5 at 10° of hip extension, and 6.67 N (SEM  $\pm 5.43$ ,  $P = .245$ ) for L4-5 at 20° of hip extension. A statistically significant increase in L3-4 and L4-5 lumbar facet joint loads of 30.81% was found in the IFI state as compared with the native state during terminal hip extension.

#### Conclusions

Limited terminal hip extension due to simulated IFI significantly increases L3-4 and L4-5 lumbar facet joint load when compared with non-IFI native hips.

#### Clinical Relevance

This biomechanical study directly links IFI to increased lumbar facet loads and supports the clinical findings of IFI causing lumbar pathology. Assessing and treating (open or endoscopic) hip disorders that limit extension could have benefit in patients with concomitant lower back symptoms.

[BACK](#)

## **Does the Hip Capsule Remain Closed After Hip Arthroscopy With Routine Capsular Closure for Femoroacetabular Impingement? A Magnetic Resonance Imaging Analysis in Symptomatic Postoperative Patients**

Alexander E. Weber, Benjamin D. Kuhns, Gregory L. Cvetanovich, Paul B. Lewis, Richard C. Mather, Michael J. Salata, Shane J. Nho,

Arthroscopy, January 2017, Volume 33, Issue 1, Pages 108–115

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### **Purpose**

The purpose of this study was to examine the hip capsule in a subset of symptomatic patients who underwent capsular closure during hip arthroscopy.

### **Methods**

All patients undergoing primary hip arthroscopy for femoroacetabular impingement (FAI) with routine capsular closure between January 1, 2012, and December 31, 2015, were eligible. Only patients with unilateral surgery and a postoperative magnetic resonance imaging (MRI; ordered for persistent symptoms) were included. Four independent reviewers evaluated each hip capsule for thickness and the absence or presence of defects.

### **Results**

During the study, 1,463 patients had hip arthroscopy for FAI with routine capsular closure, and 53 (3.6%) underwent a postoperative MRI. Fourteen of the 53 were excluded owing to revision status or additional procedures. The final study population included 39 patients (23 female patients and 16 male patients), with an average patient age of  $31.7 \pm 11.4$  years and an average body mass index of  $23.3 \pm 2.9$ . There were 3 (7.5%) capsular defects, and the intraclass correlation coefficient (ICC) was 0.82. The operative hip capsule was significantly thicker in the zone of capsulotomy, and subsequent repair as compared with the unaffected, contralateral hip capsule ( $5.0 \pm 1.2$  mm vs  $4.6 \pm 1.4$  mm;  $P = .02$ ), ICC 0.83. Additionally, males had thicker hip capsules as compared with their female counterparts, on the operative side ( $5.4 \pm 1.1$  mm vs  $4.5 \pm 1.2$  mm;  $P = .02$ ) and the nonoperative side ( $4.8 \pm 1.6$  mm vs  $4.1 \pm 0.9$  mm;  $P = .08$ ).

### **Conclusions**

In a subset of symptomatic patients after hip arthroscopy for FAI, the majority (92.5%) of the repaired hip capsules remained closed at greater than 1 year of follow-up. The hip capsule adjacent to the capsulotomy and subsequent repair is thickened compared with the same location on the contralateral, nonoperative hip. Aside from gender, patient-related and FAI-related factors do not correlate with capsular thickness nor do they seem to correlate with the propensity to develop a capsular defect.

### **Level of Evidence**

Level IV, prognostic case series.

[BACK](#)

## **Preemptive Analgesia in Hip Arthroscopy: A Randomized Controlled Trial of Preemptive Periacetabular or Intra-articular Bupivacaine in Addition to Postoperative Intra-articular Bupivacaine**

Amir Shlaifer, Zachary Tuvya Sharfman, Hal David Martin, Eyal Amar, Efi Kazum, Yaniv Warschawski, Matan Paret, Silviu Brill, Michael Drexler, Ehud Rath

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### **Purpose**

To evaluate and compare the efficacy of intra-articular and periacetabular blocks for postoperative pain control after hip arthroscopy.

### **Methods**

Forty-two consecutive patients scheduled for hip arthroscopy were randomized into 2 postoperative pain control groups. One group received preemptive intra-articular 20 mL of bupivacaine 0.5% injection, and the second group received preemptive periacetabular 20 mL of bupivacaine 0.5% injection. Before closure all patients received an additional dose of 20 mL of bupivacaine 0.5% intra-articularly. Data were compared with respect to postoperative pain with visual analog scale (VAS) and analgesic consumption, documented in a pain diary for 2 weeks after surgery.

### **Results**

Twenty-one patients were treated with intra-articular injection, and 21 patients with periacetabular injection. There were no significant differences with regards to patient demographics or surgical procedures. VAS scores recorded during the first 30 minutes postoperatively and 18 hours after surgery were significantly lower in the periacetabular group compared with in the intra-articular group ( $0.667 \pm 1.49$  vs  $2.11 \pm 2.29$ ;  $P < .045$  and  $2.62 \pm 2.2$  vs  $4.79 \pm 2.6$ ;  $P < .009$ ). There were no differences between the groups with regard to analgesic consumption.

### **Conclusions**

Periacetabular injection of bupivacaine 0.5% was superior to intra-articular injection in pain reduction after hip arthroscopy at 30 minutes and 18 hours postoperatively. However, total analgesic consumption over the first 2 postoperative weeks and VAS pain measurements were not significantly affected.

### **Level of Evidence**

Level I, randomized controlled trial.

[BACK](#)

## **A Prospective Randomized Controlled Trial Comparing the Efficacy of Fascia Iliaca Compartment Block Versus Local Anesthetic Infiltration After Hip Arthroscopic Surgery**

Malgorzata Garner, Zeiad Alsheemeri, M.R.C.S., Anand Sardesai, Vikas Khanduja

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### **Purpose**

To compare the efficacy of fascia iliaca compartment block (FICB) with local anesthetic infiltration (LAI) of the arthroscopy portals for pain control after hip arthroscopy.

### **Methods**

A prospective single-blinded randomized controlled trial that involved patients who underwent hip arthroscopy was performed. Participants were randomized to receiving either FICB or LAI of the portal tracts with local anesthetic. Supplemental analgesia was also used in both groups on an on-demand basis. The primary outcome measure was the postoperative level of pain as assessed by numeric pain score at 1, 3, 6, and 24 hours after the procedure in both groups. Secondary outcome measures were the frequency and the dose of morphine and other medications consumed at 1 and 24 hours after surgery as well as any other adverse events relating to pain or medications used for pain relief in both the groups.

### **Results**

The study had to be terminated early because there was a significant statistical difference in the primary outcome measure after the recruitment of 46 patients: 20 in the LAI group and 26 in the FICB group. Severity of pain in the FICB group was higher especially during the first hour postoperatively ( $P = .02$ ). This was associated with a higher consumption of opioids and other analgesics, which resulted in more side effects such as nausea and vomiting.

### **Conclusions**

LAI provided a better analgesia after arthroscopic surgery of the hip in comparison with FICB and was also associated with reduced consumption of opioids and a lower rate of side effects.

### **Level of Evidence**

Level I, single-blinded randomized controlled study.

[BACK](#)

## **In Vivo Anterolateral Ligament Length Change in the Healthy Knee During Functional Activities—A Combined Magnetic Resonance and Dual Fluoroscopic Imaging Analysis**

Willem A. Kernkamp, Samuel K. Van de Velde, M.P.H., Ali Hosseini, Tsung-Yuan Tsai, Jing-Sheng Li, Ewoud R.A. van Arkel, Guoan Li

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### **Purpose**

To measure the in vivo anterolateral ligament (ALL) length change in healthy knees during step-up and sit-to-stand motions.

### **Methods**

Eighteen healthy knees were imaged using magnetic resonance and dual fluoroscopic imaging techniques during a step-up and sit-to-stand motion. The ALL length change was measured using the shortest three-dimensional wrapping path, with its femoral attachment located slightly anterior-distal (ALL-Claes) or posterior-proximal (ALL-Kennedy) to the fibular collateral ligament attachment. The ALL length measured from the extended knee position of the non-weight-bearing magnetic resonance scan was used as a reference to normalize the length change.

### **Results**

During the step-up motion (approximately 55° flexion to full extension), both the ALL-Claes and ALL-Kennedy showed a significant decrease in length of 21.2% (95% confidence interval 18.0-24.4,  $P < .001$ ) and 24.3% (20.6-28.1,  $P < .001$ ), respectively. During the sit-to-stand motion (approximately 90° flexion to full extension), both the ALL-Claes and ALL-Kennedy showed a consistent, significant decrease in length of 35.2% (28.8-42.2,  $P < .001$ ) and 39.2% (32.4-46.0,  $P < .001$ ), respectively. From approximately 90° to 70° of flexion, a decrease in length of approximately 6% was seen; 70° of flexion to full extension resulted in an approximately 30% decrease in length.

### **Conclusions**

The ALL was found to be a nonisometric structure during the step-up and sit-to-stand motion. The length of the ALL was approximately 35% longer at approximately 90° of knee flexion when compared with full extension and showed decreasing length at lower flexion angles. Similar ALL length change patterns were found with its femoral attachment located slightly anterior-distal or posterior-proximal to the fibular collateral ligament attachment.

### **Clinical Relevance**

These data suggest that, if performing anatomic ALL reconstruction, graft fixation may be performed beyond 70° flexion to reduce the chance of lateral compartment overconstraint. Anatomic ALL reconstruction may affect the knee kinematics more in high flexion than at low flexion angles.

[BACK](#)

## **Assessment of the Anterolateral Ligament of the Knee by Magnetic Resonance Imaging in Acute Injuries of the Anterior Cruciate Ligament**

Camilo Partezani Helito, Paulo Victor Partezani Helito, Hugo Pereira Costa, Marco Kawamura Demange, Marcelo Bordalo-Rodrigues

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### **Purpose**

To evaluate the epidemiology of injuries and abnormalities of the anterolateral ligament (ALL) by magnetic resonance imaging (MRI) in cases of acute anterior cruciate ligament (ACL) injury.

### **Methods**

MRIs of patients with acute ACL injury were evaluated. Acute injuries of the ACL were considered in cases in which the patient reported knee trauma occurring less than 3 weeks prior and when bone bruise in the femoral condyles and tibial plateau was identified. ALL abnormality was considered when it showed proximal or distal bone detachment, discontinuity of fibers, or irregular contour associated with periligamentous edema. The ALL was divided into femoral, tibial, and meniscal portions, and the lesions and/or abnormalities of each portion were characterized. The correlation of ALL injury with injuries of the lateral meniscus was evaluated.

### **Results**

A total of 101 MRIs were initially evaluated. The ALL was not characterized in 13 (12.8%) examinations, resulting in 88 (87.1%) cases of injury evaluation. Of these, 55 (54.4%) patients had a normal ALL, and 33 (32.6%) showed signs of injury. Among the cases with injury, 24 (72%) patients showed proximal lesions, 7 (21%) showed distal lesions, and 2 (6.0%) patients presented both proximal and distal lesions. The meniscal portion of the ALL appeared abnormal in 16 (48%) patients. No relationship was found between ALL injury and lateral meniscus injury.

### **Conclusions**

Based on MRI analysis of acute ACL injuries with bone bruising of the lateral femoral condyle and lateral tibial plateau, approximately a third demonstrated ALL injuries of which the majority was proximal.

### **Level of Evidence**

Level IV, case series.

[BACK](#)

## **Prevalence and Classification of Injuries of Anterolateral Complex in Acute Anterior Cruciate Ligament Tears**

Andrea Ferretti, Edoardo Monaco, Mattia Fabbri, Barbara Maestri, Angelo De Carli,

Arthroscopy, January 2017, Volume 33, Issue 1, Pages 147–154

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### **Purpose**

To report on the prevalence of injuries of the lateral compartment occurring in cases of apparently isolated acute anterior cruciate ligament (ACL) tears and to present a classification system of anterolateral complex injuries based on the data obtained.

### **Methods**

Sixty patients operated on for an acute apparently isolated ACL tear, revealed by clinical examination and confirmed by magnetic resonance imaging, were prospectively selected. The lateral compartment was exposed and injuries were detected. Based on the data obtained, lesions of the anterolateral complex were classified as follows:

Type I: multilevel rupture with individual layers torn at different levels with macroscopic hemorrhage involving the area of the anterolateral ligament (ALL) and extended to the anterolateral capsule.

Type II: multilevel rupture with individual layers torn at different levels with macroscopic hemorrhage extended from the area of the ALL and capsule to the posterolateral capsule.

Type III: complete transverse tear involving the area of the ALL near its insertion to the lateral tibial plateau, distal to the lateral meniscus.

Type IV: bony avulsion (Segond fracture).

The pivot-shift test was repeated intraoperatively after repair of lateral tears before the ACL reconstruction.

### **Results**

Although magnetic resonance imaging was able to detect only bony injuries (Segond fracture), macroscopic tears of the lateral capsule were clearly identified at surgery in 54 of 60 patients and classified as follows:

Type I: 19/60

Type II: 16/60

Type III: 13/60

Type IV: 6/60

In all cases, repair resulted in a marked reduction or apparent disappearance of the pivot-shift phenomenon. Statistical analysis showed a positive correlation between lesions of the lateral compartment, regardless of the type described, and a pivot shift graded 2 or 3.

### **Conclusions**

Because injuries of secondary restraints often occur in cases of acute ACL tears, recognition and repair of such lesions could be considered to help ACL reconstruction to better control rotational stability.

### **Level of Evidence**

Level IV, therapeutic case series.

[BACK](#)

## **Efficacy of Prophylactic Antibiotics in Simple Knee Arthroscopy**

Ronald W.B. Wyatt, Gregory B. Maletis, Liisa L. Lyon, Joan Schwalbe, Andrew L. Avins

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### **Purpose**

To determine the association between the use of preoperative antibiotics and the risk of postoperative infection after simple knee arthroscopy.

### **Methods**

The electronic medical records of a large integrated health care organization were used to identify patients who underwent simple knee arthroscopy between 2007 and 2012. Patient demographics, potential infection risk factors, and antibiotic administration data were extracted. Simple knee arthroscopy included debridement, meniscectomy, meniscus repair, synovectomy, microfracture, and lateral release. Complex knee arthroscopy, septic knees, and cases involving fractures were excluded. Deep infection was defined as a positive synovial fluid culture or signs and symptoms of infection and gross pus in the knee. Superficial infection was defined as clinical signs of infection localized to a portal site and treatment with an antibiotic.

### **Results**

Of 40,810 simple knee arthroscopies, 32,836 (80.5%) received preoperative antibiotics and 7,974 (19.5%) did not. There were 25 deep infections in the antibiotic group (0.08%) and 11 in the no-antibiotics group (0.14%) (risk ratio = 0.55, 95% confidence interval: 0.27 to 1.12,  $P = .10$ ). There were 134 superficial infections in the antibiotic group (0.41%) and 32 in the no-antibiotics group (0.40%) (risk ratio = 1.01, 95% confidence interval: 0.29 to 1.49,  $P = .93$ ).

### **Conclusions**

In our large sample of patients who underwent simple knee arthroscopy, there was no association between preoperative antibiotic use and postoperative deep or superficial infection rates at the 95% confidence level ( $P = .05$ ). There was an association between preoperative antibiotic use and a decreased deep infection rate at the  $P = .10$  level.

### **Level of Evidence**

Level IV, case series. January 2017, Volume 33, Issue 1, Pages 157–162

[BACK](#)

## **In Vivo Arthroscopic Temperatures: A Comparison Between 2 Types of Radiofrequency Ablation Systems in Arthroscopic Anterior Cruciate Ligament Reconstruction—A Randomized Controlled Trial**

Brent Matthews, Matthew Wilkinson, Peter McEwen, Kaushik Hazratwala, Kenji Doma, Varaguna Manoharan, Zaid Bahho, Shannon McEwen

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### **Purpose**

To compare a plasma ablation device with a standard ablation device in anterior cruciate ligament (ACL) reconstruction to determine which system is superior in terms of intra-articular heat generation and diathermy efficiency.

### **Methods**

This was a prospective, randomized controlled trial. The inclusion criteria were adult patients undergoing primary ACL reconstruction. Patients were randomized preoperatively to the standard ablation group or the plasma ablation group. A thermometer was inserted into the inferior suprapatellar pouch, and the temperature, time, and duration of radiofrequency ablation were measured continually.

### **Results**

No significant differences were found between the standard ablation system and the plasma ablation system for maximum temperature (29.77°C and 29.34°C, respectively;  $P = .95$ ), mean temperature (26.16°C and 26.99°C, respectively;  $P = .44$ ), minimum temperature (22.66°C and 23.94°C, respectively;  $P = .54$ ), and baseline temperature (26.80°C and 27.93°C, respectively;  $P = .35$ ). Similarly, no significant differences were found for operative time (82.90 minutes and 80.50 minutes, respectively;  $P = .72$ ) and mean diathermy activation times (2.6 minutes for both systems;  $P = .90$ ). The between-system coefficient of variation for the measured parameters ranged from 0.12% to 3.69%. No intra-articular readings above the temperature likely to damage chondrocytes were recorded. The mean irrigation fluid temperature had a significant correlation with the maximum temperature reached during the procedure (Spearman rank correlation,  $r = 0.87$ ;  $P < .01$ ).

### **Conclusions**

No difference in temperature was observed between the standard ablation and plasma ablation probes during ACL reconstruction. Temperatures did not exceed critical temperatures associated with chondrocyte death.

### **Level of Evidence**

Level I, randomized controlled trial.

[BACK](#)

## **Braking Reaction Time After Right-Knee Anterior Cruciate Ligament Reconstruction: A Comparison of 3 Grafts**

Bradley R. Wasserman, Brian C. Singh, Daniel J. Kaplan, Maxwell Weinberg, Robert Meislin, Laith M. Jazrawi, Eric J. Strauss,

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### **Purpose**

To determine when patients recover the ability to safely operate the brakes of an automobile after a right-knee anterior cruciate ligament reconstruction (ACLR).

### **Methods**

A computerized driving simulator was used to determine braking ability after an isolated right-knee ACLR. Thirty healthy volunteers were tested at 1 visit to determine normal mean values, and 27 treatment subjects were tested at 1 week, 3 weeks, and 6 weeks after ACLR. Nine study subjects were treated with a patella tendon (BPTB) autograft, 9 were treated with a hamstring (HS) autograft, and 9 were treated with a tibialis anterior (TA) allograft. The driving simulator collected data on brake reaction time (BRT), brake travel time (BTT), and total brake time (TBT) at each visit.

### **Results**

The control group generated a BRT of 725 milliseconds, BTT of 2.87 seconds, and TBT of 3.59 seconds. At week 1, all treatment patients had significant differences compared with controls for BRT, BTT, and TBT, except the BTT of the HS group. At week 3, all measures for the allograft group and the BRT for both autograft groups were no longer significantly different compared with controls, but significant differences were found for TBT in the HS and BPTB groups ( $P = .03$ ,  $P = .01$ ). At week 6, BRT, BTT, and TBT were no longer significantly different for either the HS group or BPTB group.

### **Conclusions**

Patients who underwent a right-knee ACLR with a TA allograft regained normal braking times by week 3 postoperatively. In contrast, those treated with a BPTB or HS autograft demonstrated significantly delayed braking times at 3 weeks but returned to normal braking ability by week 6. Those treated with an autograft had an earlier return of normalized BRT than BTT.

### **Level of Evidence**

Level III, case-control series.

[BACK](#)

## **Return to Play of Rugby Players After Anterior Cruciate Ligament Reconstruction Using Hamstring Autograft: Return to Sports and Graft Failure According to Age**

Yuji Takazawa, Hiroshi Ikeda, Yoshitomo Saita, Takayuki Kawasaki, Muneaki Ishijima, Masataka Nagayama, Haruka Kaneko, Kazuo Kaneko

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### **Purpose**

To assess return to play and the frequencies of graft failure in rugby players after anterior cruciate ligament (ACL) reconstruction using a hamstring autograft augmented with an artificial ligament and to compare outcomes between rugby players aged <20 and ≥20 years over the long term.

### **Methods**

A consecutive series of 146 rugby players who underwent ACL reconstruction with a hamstring autograft augmented with an artificial ligament were retrospectively reviewed. The study population was further divided into 2 groups aged <20 years and >20 years and compared.

### **Results**

Twenty-five patients could not be followed up, and 121 (83%) were evaluated. Most patients (90%, <20 years; 92%, ≥20 years) returned to play after ACL reconstruction. At an average follow-up period of 56.5 months, 16% of the patients sustained an ACL graft rupture. Regarding age, <20 years (n = 58, 48%) and ≥20 years (n = 63, 52%), younger players had a significantly higher failure rate (23% vs 5%, respectively; P = .006) and a shorter time to failure ( $22.8 \pm 13.2$  vs  $35.4 \pm 15.4$  months, respectively; P = .006) than older players.

### **Conclusions**

Rugby players were likely to return to play after ACL reconstruction with a hamstring autograft. However, there was a higher risk of graft failure in younger players than in older players. On the basis of this study, we conclude that the hamstring autograft may not be an appropriate graft source to use in a younger active population, including rugby players.

### **Level of Evidence**

Level III, retrospective comparative study.

[BACK](#)

## **Knotless Suture Anchor With Suture Tape Quadriceps Tendon Repair Is Biomechanically Superior to Transosseous and Traditional Suture Anchor–Based Repairs in a Cadaveric Model**

Michael C. Kindya, John Konicek, Angelo Rizzi, P.A., David E. Komatsu, James M. Paci

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### **Purpose**

To compare the biomechanical properties of a knotless suture anchor with suture tape quadriceps tendon repair technique with transosseous and suture anchor repair techniques.

### **Methods**

Twenty matched pairs of cadaveric knees underwent a quadriceps tendon avulsion followed by repair via the use of transosseous tunnels with #2 high-strength sutures, 5.5-mm biocomposite fully threaded suture anchors with #2 high-strength sutures, or 4.75-mm biocomposite knotless suture anchors with suture tape. Ten knees were repaired via transosseous repair and 10 via fully threaded suture anchor repair, and their matched specimens were repaired with suture tape and knotless anchors. Biomechanical analysis included displacement during cyclic loading over 250 cycles, construct stiffness, ultimate load to failure, and failure mode analysis.

### **Results**

Compared with transosseous repairs, quadriceps tendons repaired with knotless suture tape demonstrated significantly less displacement during cyclic loading (cycles 1-20  $3.6 \pm 1.3$  vs  $6.3 \pm 1.9$  mm,  $P = .003$ ; cycles 20-250  $2.0 \pm 0.4$  vs  $3.1 \pm 0.9$  mm,  $P = .011$ ), improved construct stiffness ( $67 \pm 25$  vs  $26 \pm 12$  N/mm,  $P = .001$ ), and greater ultimate load to failure ( $616 \pm 149$  vs  $413 \pm 107$  N,  $P = .004$ ). Our repair technique also demonstrated improved biomechanical parameters compared with fully threaded suture anchor repair in initial displacement during cyclic loading (cycles 1-20  $3.0 \pm 0.8$  vs  $5.1 \pm 0.9$  mm,  $P < .001$ ), construct stiffness ( $62 \pm 20$  vs  $28 \pm 10$  N/mm,  $P = .001$ ) and ultimate load to failure ( $579 \pm 129$  vs  $399 \pm 87$  N,  $P = .006$ ).

### **Conclusions**

Repair of quadriceps tendon ruptures with this knotless suture anchor with suture tape repair technique is biomechanically superior in cyclic displacement, construct stiffness, and ultimate load to failure compared with transosseous and fully threaded suture anchor techniques in cadaveric specimens.

### **Clinical Relevance**

The demonstration that our repair technique is biomechanically superior to previously described techniques in a cadaveric setting suggests that consideration should be given to this technique.

[BACK](#)

## Does Release of the Superficial Medial Collateral Ligament Result in Clinically Harmful Effects After the Fixation of Medial Meniscus Posterior Root Tears?

Kyu Sung Chung, Jeong Ku Ha, Ho Jong Ra, Jin Goo Kim

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### Purpose

To investigate pain and tenderness, stress testing, clinical outcome scores, complications, and operation time at 24 months and magnetic resonance imaging (MRI) analysis at 12 months after the release of the distal attachment of the superficial medial collateral ligament (sMCL) during medial meniscus posterior root tear (MMPRT) fixation.

### Methods

Patients who received MMPRT fixation with a follow-up of at least 2 years were included. During fixation, the release of the distal attachment of the sMCL on the proximal tibia was performed to improve visualization and provide sufficient working space. Pain and tenderness at the released area, manual valgus stress tests of 30° and 0° flexion (grade 0/1/2/3), and subjective instability during weight bearing were evaluated serially at postoperative 3, 6, 12, and 24+ months. The contour of detachment area was assessed using MRI 12 months postoperatively. As a subgroup analysis, tourniquet time (minutes) and final clinical scores were compared between release and nonrelease groups.

### Results

The numbers of participants in the release and nonrelease groups were 118 and 20 patients, and their mean follow-up durations were  $42.4 \pm 19.3$  (24-95) and  $37.2 \pm 7.8$  (30-55) months, respectively. In the release group, percentages of patients with pain and tenderness at 3 months were 15% and 18%, respectively; however, no patients had symptoms at 12 months. In valgus stress tests (30°, 0°), 12% and 2% of patients showed grade 1 laxity at 3 months, and 7% had grade 1 laxity in only 30° flexion at the final follow-up. However, no patients had subjective valgus laxity. An intact contour was confirmed in all cases among 94 patients checked by performing follow-up MRI. Tourniquet time was significantly shorter in the release group ( $42.4 \pm 19.3$ ) than in the nonrelease group ( $58.5 \pm 9.5$ ;  $P < .001$ ). Between release and nonrelease groups, Lysholm ( $84.4 \pm 12.1$ ,  $88.1 \pm 12.8$ ;  $P = .117$ ) and International Knee Documentation Committee scores ( $73.6 \pm 11.2$ ,  $77.5 \pm 11.9$ ;  $P = .112$ ) did not differ.

### Conclusions

The release of the distal attachment of the sMCL during fixation of MMPRT did not result in pain and tenderness, residual instability, and complication. An intact contour of the sMCL was confirmed in all cases with MRI. This procedure reduced operation time and showed similar clinical results when compared between the release and nonrelease groups. However, this study had low power to detect the difference for clinical scores between the 2 groups.

### Level of Evidence

Level IV, therapeutic case series.

[BACK](#)

## **Osteochondral Allograft Transfer for Treatment of Osteochondral Lesions of the Talus: A Systematic Review**

Richard J. VanTienderen, John C. Dunn, Nicholas Kusnezov, Justin D. Orr

Arthroscopy, January 2017, Volume 33, Issue 1, Pages 217–222

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### **Purpose**

The purpose of this study is to present a systematic review of the literature regarding the use of fresh bulk osteochondral allograft transfer for treatment of large osteochondral lesions of the talus (OCLT) in an effort to characterize the functional outcomes, complications, and reoperation rates.

### **Methods**

A search of the PubMed, CINAHL, Embase, and Cochrane Databases was performed between January 1, 1990, and March 1, 2016, and included all articles related to outcomes after fresh talar allograft transplantation for OCLT. Inclusion criteria were series (1) published in the English language, (2) using fresh talar allograft, and (3) reporting at least one outcome measure of interest including American Orthopaedic Foot and Ankle Society (AOFAS) score, pain visual analog scale (VAS) score, reoperation rate, and rate of allograft collapse. Weighted averages of outcome data were used.

### **Results**

Five studies involving 91 OCLT met the inclusion criteria. The mean age of the cohort was 39 years (range, 15 to 74), and 53% were male. Fresh talar allograft was transplanted into 71 medial, 18 lateral, and 2 central OCLT. At a mean follow-up of  $45 \pm 3.3$  (range, 6 to 91) months, AOFAS scores improved from 48 preoperatively to 80 postoperatively. Pain VAS scores improved from 7.1 preoperatively to 2.7 postoperatively. Twenty-three of the 91 (25%) patients required at least one reoperation, for a total of 28 operations. The most common indications for reoperation were development of moderate to severe osteoarthritis (14%), pain due to hardware (9%), extensive graft collapse (3%), and delayed or nonunion of osteotomy site (1%). Ultimately 12 (13.2%) of the cases were considered failures, with 8 (8.8%) resulting in tibiotalar arthrodesis or ankle replacement.

### **Conclusions**

Fresh bulk allograft transplantation can substantially improve functional status as well as effectively prevent or delay the eventual need for ankle arthrodesis or replacement. However, patients must be carefully selected and counseled on the morbidity of the procedure as well as the high incidence of clinical failure (13%) and need for reoperation (25%) and revision surgery (8.8%).

### **Level of Evidence**

Level IV, systematic review of Level IV studies.

[BACK](#)

JSES

Volume 26, Issue 1, p1-178, e1-e28

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AJSM

January 2017, Vol 45, Issue 1

## **Return to Sport After Primary and Revision Anterior Cruciate Ligament Reconstruction**

Nicolas Lefevre, MD, Shahnaz Klouche, MD, Guillaume Mirouse, MD, Serge Herman, MD, Antoine Gerometta, MD, Yoann Bohu, MD

The American Journal of Sports Medicine Vol 45, Issue 1, pp. 34 – 41

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**Background:** Few studies have reported the return-to-sport rate at 1-year follow-up after primary and revision anterior cruciate ligament (ACL) reconstruction.

**Purpose:** To compare the return-to-sport rate 1 year after primary and revision ACL reconstruction in the same cohort according to 2 modalities: any kind of sport and the patient's usual sport at the same level as before the injury.

**Study Design:** Cohort study; Level of evidence, 3.

**Methods:** A single-center, prospective cohort study of patients undergoing ACL reconstruction (French prospective Acl Study [FAST]) was begun in 2012. A comparative study was performed based on a retrospective analysis of data collected prospectively. Included were all athletes aged 18 to 50 years who underwent primary or revision isolated ACL reconstruction between 2012 and 2014. Two groups were formed: primary reconstruction and revision reconstruction. The main criterion was return to sport at 1-year follow-up (yes/no); secondary criteria were return to the usual sport at 1-year follow-up, knee function (International Knee Documentation Committee [IKDC] and Knee injury and Osteoarthritis Outcome Score [KOOS] scores), and psychological readiness (ACL–Return to Sports after Injury [ACL-RSI] score) at 6 months and 1 year.

**Results:** A total of 552 patients (primary reconstruction group:  $n = 497$ , revision reconstruction group:  $n = 55$ ) were included in the study. There were 373 men and 179 women (mean [ $\pm$ SD] age,  $30.2 \pm 8.4$  years). No significant difference in the return-to-sport rate was found between the 2 groups at 1-year follow-up (primary reconstruction group: 90.9%, revision reconstruction group: 87.3%;  $P = .38$ ), but patients in the primary reconstruction group resumed their usual sport significantly more often (primary reconstruction group: 63.6%, revision reconstruction group: 49.1%;  $P = .04$ ). Eight (1.4%) retears occurred during a new sport-related injury within a mean  $8.9 \pm 2.9$  months: 7 (1.4%) in the primary reconstruction group and 1 (1.8%) in the revision reconstruction group ( $P = .8$ ). At 1-year follow-up, functional scores were significantly better in the primary reconstruction group for subjective IKDC ( $82.6 \pm 13.3$  vs  $78.4 \pm 16.6$ ;  $P = .04$ ); KOOS

Symptoms/Stiffness ( $73.3 \pm 15.2$  vs  $67.7 \pm 19.6$ ;  $P = .02$ ), Activities of Daily Living ( $96.3 \pm 6.4$  vs  $94.3 \pm 9.1$ ;  $P = .04$ ), Sport ( $79.7 \pm 19.1$  vs  $69.1 \pm 24.8$ ;  $P = .0004$ ), and Quality of Life ( $69.6 \pm 22.7$  vs  $54.7 \pm 24.8$ ;  $P < .00001$ ) subscales; and ACL-RSI ( $65 \pm 23$  vs  $49.5 \pm 24.8$ ;  $P < .00001$ ). On multivariate analysis, patients who were more likely to resume their usual sport at 1 year were high-level players (odds ratio [OR], 2.2) who underwent primary reconstruction (OR, 2.0) and had better KOOS Quality of Life (OR, 1.7) and subjective IKDC (OR, 2.1) scores at 6-month follow-up without complications or retears during the first postoperative year (OR, 2.6).

Conclusion: At 1-year follow-up, there was no significant difference in the return-to-sport rate between primary and revision ACL reconstruction. Patients who underwent primary reconstruction returned to their usual sport significantly more often.

[BACK](#)

## High Rate of Return to Running for Athletes After Hip Arthroscopy for the Treatment of Femoroacetabular Impingement and Capsular Plication

David M. Levy, MD, Benjamin D. Kuhns, MD, MS, Rachel M. Frank, MD, Jeffrey S. Grzybowski, MD, Kirk A. Campbell, MD, Sara Brown, DO, Shane J. Nho, MD, MS

The American Journal of Sports Medicine Vol 45, Issue 1, pp. 127 – 134

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**Background:** Femoroacetabular impingement (FAI) is most commonly diagnosed in athletes who sustain repetitive flexion loading to their hips. No studies to date have focused solely on patients' return-to-running ability after hip arthroscopy.

**Purpose:** To evaluate patients' ability to return to running after hip arthroscopy for FAI and capsular plication.

**Study Design:** Case series; Level of evidence, 4.

**Methods:** Clinical data were retrospectively retrieved for 51 consecutive patients with FAI (22 men, 29 women) who had undergone hip arthroscopy for the treatment of FAI and identified themselves as recreational or competitive runners on intake forms. Two-year outcome measures included the modified Harris Hip Score (mHHS) and the Hip Outcome Score Activities of Daily Living (HOS-ADL) and Sport-Specific (HOS-SS) subscales. A postoperative return-to-running survey was used to obtain running-specific information.

**Results:** Patient age and body mass index (BMI) were a mean ( $\pm$ SD) of  $26.3 \pm 7.8$  years and  $23.7 \pm 3.3$  kg/m<sup>2</sup>, respectively. Before surgery, patients had refrained from running because of pain for a mean of  $8.1 \pm 5.7$  months. After surgery, 48 patients (94%) returned to running at a mean of  $8.5 \pm 4.2$  months. Patients who had discontinued running for more than 8 months before surgery had a longer return-to-running time than did those who had stopped for less than 8 months ( $10.6 \pm 4.2$  vs  $7.6 \pm 4.1$  months;  $P = .01$ ). After 2 years, mean preoperative distance had decreased significantly ( $P < .01$ ) from  $9.5 \pm 6.5$  miles per week when healthy to  $6.4 \pm 5.8$  miles postoperatively. Despite decreased mileage, all 2-year outcomes scores improved significantly ( $P < .001$ ).

**Conclusion:** Recreational and competitive runners with FAI returned to running 94% of the time at a mean of 8.5 months after hip arthroscopy. However, runners should be counseled before their surgery that they may run fewer miles than when they were pain free. Additionally, patients with a higher BMI and/or longer preoperative lull may have a longer recovery time.

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JBJS

December 21, 2016: volume 98, issue 24

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## Miscellaneous

Arthroscopy

Volume 33, Issue 1, p1-238

### **Suture Anchor Fixation in Osteoporotic Bone: A Biomechanical Study in an Ovine Model**

Levent Horoz, Onur Hapa, F. Alan Barber, Buğra Hüsemoğlu, Mustafa Özkan, Hasan Havitçioğlu

Arthroscopy, January 2017, Volume 33, Issue 1, Pages 68–74

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#### Purpose

To evaluate the load to failure strength of anchor techniques suitable for osteoporotic bone.

#### Methods

Using an osteoporotic ovine model in 72 humeri, 6 fixation techniques were tested. Group 1: two interlocking 5-mm anchors with fewer, wider threads; group 2: one 5-mm anchor; group 3: one 5-mm anchor reinforced laterally by a 6.5-mm cancellous screw; group 4: one 5-mm anchor in an area reinforced with a cancellous plug; group 5: two interlocking 5-mm anchors with smaller threads; group 6: one 5-mm smaller threaded anchor. After a 10-N preload, the specimens were cyclically loaded between 10 N and 30 N for 50 cycles and then destructively tested. Peak-to-peak displacement, cyclic elongation, ultimate load, stiffness, and failure mode were recorded.

#### Results

Group 1 had lower peak-to-peak displacement than group 3 ( $P = .001$ ), group 5 ( $P = .001$ ), and group 6 ( $P = .033$ ). In addition, group 1 showed lower cyclic elongation than group 3 ( $P = .001$ ), group 5 ( $P = .035$ ), and group 6 ( $P = .001$ ). Group 1 had a higher ultimate load than group 2 ( $P = .002$ ), group 3 ( $P = .019$ ), and group 6 ( $P = .006$ ). Group 1 also showed higher stiffness than group 2 ( $P = .007$ ) and group 3 ( $P = .022$ ). Mode of failure was predominantly caused by anchor pullout for all of the groups except group 3, which mainly failed by suture rupture.

#### Conclusions

Two interlocking suture anchors are stronger than a single anchor in osteoporotic bone. The anchor with fewer, wider threads and a smaller core diameter showed greater strength and less elongation than the other constructs. Reinforcement by cancellous autografting increased suture anchor strength.

#### Clinical Relevance

Considering concerns about suture anchor pullout from osteoporotic bone, interlocking a second suture anchor with the first increases load to failure resistance. Anchors with small core diameters and fewer but wider threads are more efficient in osteoporotic bone.

[BACK](#)

## **A Review of Databases Used in Orthopaedic Surgery Research and an Analysis of Database Use in Arthroscopy: The Journal of Arthroscopic and Related Surgery**

Jeffrey H. Weinreb, Ryu Yoshida, Mark P. Cote, D.P.T., C.T.R., Michael B. O'Sullivan, Augustus D. Mazzocca

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### **Purpose**

The purpose of this study was to evaluate how database use has changed over time in Arthroscopy: The Journal of Arthroscopic and Related Surgery and to inform readers about available databases used in orthopaedic literature.

### **Methods**

An extensive literature search was conducted to identify databases used in Arthroscopy and other orthopaedic literature. All articles published in Arthroscopy between January 1, 2006, and December 31, 2015, were reviewed. A database was defined as a national, widely available set of individual patient encounters, applicable to multiple patient populations, used in orthopaedic research in a peer-reviewed journal, not restricted by encounter setting or visit duration, and with information available in English.

### **Results**

Databases used in Arthroscopy included PearlDiver, the American College of Surgeons National Surgical Quality Improvement Program, the Danish Common Orthopaedic Database, the Swedish National Knee Ligament Register, the Hospital Episodes Statistics database, and the National Inpatient Sample. Database use increased significantly from 4 articles in 2013 to 11 articles in 2015 ( $P = .012$ ), with no database use between January 1, 2006, and December 31, 2012.

### **Conclusions**

Database use increased significantly between January 1, 2006, and December 31, 2015, in Arthroscopy.

### **Level of Evidence**

Level IV, systematic review of Level II through IV studies.

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JSES

Volume 26, Issue 1, p1-178, e1-e28

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AJSM

January 2017, Vol 45, Issue 1

## **A Prospective Clinical and Radiological Evaluation at 5 Years After Arthroscopic Matrix-Induced Autologous Chondrocyte Implantation**

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The American Journal of Sports Medicine Vol 45, Issue 1, pp. 59 – 69

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**Background:** While midterm outcomes after matrix-induced autologous chondrocyte implantation (MACI) are encouraging, the procedure permits an arthroscopic approach that may reduce the morbidity of arthrotomy and permit accelerated rehabilitation.

**Hypothesis:** A significant improvement in clinical and radiological outcomes after arthroscopic MACI will exist through to 5 years after surgery.

**Methods:** We prospectively evaluated the first 31 patients (15 male, 16 female) who underwent MACI via arthroscopic surgery to address symptomatic tibiofemoral chondral lesions. MACI was followed by a structured rehabilitation program in all patients. Clinical scores were administered preoperatively and at 3 and 6 months as well as 1, 2, and 5 years after surgery. These included the Knee injury and Osteoarthritis Outcome Score (KOOS), Lysholm knee scale (LKS), Tegner activity scale (TAS), visual analog scale for pain, Short Form–36 Health Survey (SF-36), active knee motion, and 6-minute walk test. Isokinetic dynamometry was used to assess peak knee extension and flexion strength and limb symmetry indices (LSIs) between the operated and nonoperated limbs. High-resolution magnetic resonance imaging (MRI) was performed at 3 months and at 1, 2, and 5 years postoperatively to evaluate graft repair as well as calculate the MRI composite score.

**Results:** There was a significant improvement ( $P < .05$ ) in all KOOS subscale scores, LKS and TAS scores, the SF-36 physical component score, pain frequency and severity, active knee flexion and extension, and 6-minute walk distance. Isokinetic knee extension strength significantly improved, and all knee extension and flexion LSIs were above 90% (apart from peak knee extension strength at 1 year). At 5 years, 93% of patients were satisfied with MACI to relieve their pain, 90% were satisfied with improving their ability to undertake daily activities, and 80% were satisfied with the improvement in participating in sport. Graft infill ( $P = .033$ ) and the MRI composite score ( $P = .028$ ) significantly improved over time, with 90% of patients demonstrating good to excellent tissue infill at 5 years. There were 2 graft failures at 5 years after surgery.

**Conclusion:** The arthroscopically performed MACI technique demonstrated good clinical and radiological outcomes up to 5 years, with high levels of patient satisfaction.

[BACK](#)

## Cell Viability in Arthroscopic Versus Open Autologous Chondrocyte Implantation

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The American Journal of Sports Medicine Vol 45, Issue 1, pp. 77 – 81

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**Background:** Autologous chondrocyte implantation (ACI) is an effective method of repair of articular cartilage defects. It is a 2-stage operation, with the second stage most commonly performed via mini-arthrotomy. Arthroscopic ACI is gaining popularity, as it is less invasive and may accelerate early rehabilitation. However, handling and manipulation of the implant have been shown to cause chondrocyte cell death.

**Purpose:** To assess the number and viability of cells delivered via an open versus arthroscopic approach in ACI surgery.

**Study Design:** Controlled laboratory study.

**Methods:** Sixteen ACI surgeries were performed on young cadaveric knees by 2 experienced surgeons: 8 via mini-arthrotomy and 8 arthroscopically. Live and dead cells were stained and counted on implants after surgery. The cell number and viability were assessed using confocal laser scanning microscopy. Surgery was timed from knife to skin until the end of cycling the knee 10 times after implantation of the cell-membrane construct.

**Results:** On receipt of cell membranes after transportation from the laboratory,  $\geq 92\%$  of the cells were viable. There were significantly more remaining cells ( $8.47E+07$  arthroscopic vs  $1.41E+08$  open;  $P < .001$ ) and 16 times more viable cells ( $3.62\%$  arthroscopic vs  $37.34\%$  open;  $P < .001$ ) on the implants when they were inserted via mini-open surgery compared with the arthroscopic technique. Open surgery was of a significantly shorter duration (6 vs 32 minutes;  $P < .001$ ).

**Conclusion:** In this study, there were significantly more viable cells on the implant when ACI was performed via mini-arthrotomy compared with an arthroscopic technique.

**Clinical Relevance:** The viability of cells delivered for ACI via an arthroscopic approach was 16 times less than via an open approach. The mini-arthrotomy approach is recommended until long-term clinical comparative data are available.

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