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**Issue 15, Arthroscopy, Augustus 2018**



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## Upper extremity

Arthroscopy, Volume 34, Issue 8

# Shear Wave Elastography Can Predict Passive Stiffness of Supraspinatus Musculotendinous

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Arthroscopy, Volume 34, Issue 8, Received: September 7, 2017; Accepted: January 15, 2018; Published online: April 21, 2018

DOI: https://doi.org/10.1016/j.arthro.2018.01.059



**Purpose**
To determine the feasibility of shear wave elastography (SWE) with B-mode ultrasound in predicting the stiffness of the rotator cuff muscle before arthroscopic rotator cuff repair to evaluate the difficulty of the surgical procedure, as well as to compare SWE with the Goutallier stage on magnetic resonance imaging (MRI).

**Methods**
Thirty-eight patients with a full-thickness supraspinatus tear requiring arthroscopic rotator cuff repair participated. The Goutallier stage of fatty infiltration on MRI was measured before surgery, as was the SWE modulus of the anterior superficial, anterior deep, posterior superficial, and posterior deep (PD) regions of the supraspinatus muscle. To measure the stiffness of the supraspinatus musculotendinous unit during surgery, the supraspinatus tendon was axially stretched until the anatomic insertion site was reached, and force per deformation was recorded. The correlation between stiffness of the supraspinatus and SWE value in each region of the supraspinatus muscle or Goutallier stage was determined. In addition, patients were divided into 2 groups: (1) In the complete footprint coverage group, greater than 50% of the footprint was covered during the stiffness measurement, and (2) in the incomplete footprint coverage group, less than 50% of the footprint was covered during the stiffness measurement. Differences in SWE value and Goutallier stage were measured between the 2 groups.

**Results**
The best correlation of stiffness with the SWE modulus of the PD muscle of the supraspinatus was $R = 0.69$, and the correlation of stiffness with the Goutallier stage on MRI was $R = 0.48$. The SWE value of the PD region was greater in the incomplete footprint coverage group than in the complete footprint coverage group, although the Goutallier stage was not significantly different.

**Conclusions**
The highest correlation with stiffness of the supraspinatus musculotendinous unit was with the SWE modulus of the PD muscle, as compared with SWE evaluation of the other regions or the Goutallier stage on MRI. Ultrasound SWE can predict the stiffness of the supraspinatus musculotendinous unit best.

**Clinical Relevance**
Rotator cuff retraction adds difficulty to arthroscopic rotator cuff repair. Ultrasound SWE may be used for presurgical planning.

BACK

# Clinical Outcomes and Recurrence Rates After Arthroscopic Stabilization Procedures in Young Patients With a Glenoid Bone Erosion: A Comparative Study Between Glenoid Erosion More and Less Than 20%

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Arthroscopy, Volume 34, Issue 8, Received: October 4, 2017; Accepted: March 2, 2018; Published online: May 24, 2018

DOI: https://doi.org/10.1016/j.arthro.2018.03.009



**Purpose**
To evaluate the clinical outcomes and recurrence rates of arthroscopic stabilization procedures in young patients who had recurrent anterior shoulder instability with a glenoid bone erosion more than 20%, and to compare with those in patients with a glenoid bone erosion less than 20%.

**Methods**
A total of 161 patients who underwent an arthroscopic stabilization procedure for recurrent anterior shoulder instability with anterior glenoid bone erosions and at least 2 years of follow-up were included. Patients were divided into 2 groups based on the glenoid defect size (group I [32 patients]: erosion >20%, group II [129 patients]: erosion <20%). The clinical outcomes were compared using the American Shoulder Elbow Surgeons (ASES) score, Rowe score, and sports/recreation activity level between the 2 groups. Postoperative complications including instability recurrence were documented.

**Results**
The mean glenoid defect size was 22.1 ± 2.1% in group I, and 12.2 ± 3.7% in group II. In group I, clinical outcomes were significantly improved after operation (ASES score: 57.9 ± 14.3 at initial, 88.9 ± 6.2 at the last visit, $P = .001$; Rowe score: 42.1 ± 15.6 at initial, 87.4 ± 7.6 at the last visit, $P = .001$). These results were inferior to the clinical outcomes of patients in group II (ASES score: 91.5 ± 12.7, $P < .001$; Rowe score: 89.3 ± 12.4, $P = .01$). Postoperative recurrences occurred in 5 patients (15.6%) in group I, whereas patients in group II showed 5.4% of recurrence rate ($P = .05$). Competent recoveries to sports/recreation activity were achieved in 84.4% of patients in group I.

**Conclusions**
Arthroscopic stabilization procedures for recurrent anterior shoulder instability in young patients with glenoid bone erosions more than 20% showed satisfactory clinical outcomes and recurrence rate, although these results were inferior to those of patients with glenoid erosions less than 20%. Arthroscopic stabilization procedures can be applied as the primary treatment of recurrent anterior shoulder instability with a large glenoid bone erosion for functional restoration and return to previous sports activity level.

**Level of Evidence**
Level III, retrospective comparative stud

BACK

# Clinical and Radiologic Outcomes After Medializing and Not Medializing Rotator Cuff Tendon Attachment Site on Chronic Retracted Rotator Cuff Tears

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Arthroscopy, Volume 34, Issue 8, Received: September 17, 2017; Accepted: March 2, 2018; Published online: May 24, 2018

DOI: https://doi.org/10.1016/j.arthro.2018.03.015



**Purpose**
To compare the clinical and radiologic outcomes of chronically retracted rotator cuff tears by arthroscopic medializing and non-medializing repair (restoring anatomic footprint and performing conventional repair).

**Methods**
This study retrospectively reviewed 195 patients who underwent arthroscopic double-row modified Mason-Allen repair for large, full-thickness rotator cuff tears from January 2013 to July 2015. We included a total of 60 of these patients and divided them into 2 groups: those who underwent medialization (n = 24) and those who did not (n = 36). Magnetic resonance imaging was performed at a minimum of 6 months (mean, 15.2 months; range, 6-24 months) postoperatively to assess cuff integrity. Patients were clinically evaluated at least 1 year postoperatively (mean, 18.9 months; range, 12-60 months) with a visual analog scale, the American Shoulder and Elbow Surgeons score, the University of California–Los Angeles Shoulder Rating Scale score, and the Constant score.

**Results**
The mean medialization length was 10.5 mm (range, 6.5-15.6 mm) on magnetic resonance imaging. The retear rate was 8.3% (n = 2) in the medialization group and 31% (n = 11) in the non-medialization group ($P$ = .041). At last follow-up, the mean visual analog scale, American Shoulder and Elbow Surgeons, University of California–Los Angeles, and Constant scores improved significantly from 5.3 ± 1.4, 38.5 ± 8.8, 22.5 ± 3.1, and 41.7 ± 9.9, respectively, to 1.8 ± 1.1, 85.3 ± 7.5, 31.8 ± 2.5, and 90.2 ± 6.9, respectively, with medialization and from 4.0 ± 1.6, 51.5 ± 10.5, 20.0 ± 3.9, and 55.9 ± 10.5, respectively, to 1.4 ± 1.0, 88.6 ± 9.0, 31.0 ± 9.3, and 89.4 ± 9.3, respectively, with non-medialization ($P$ < .001), although there were no significant differences between the groups ($P$ = .165, $P$ = .653, $P$ = .250, and $P$ = .113, respectively).

**Conclusions**
Medialization of approximately 10.5 mm reliably shows good clinical results, and medializing rotator cuff tendons should be considered as a treatment option for repairing rotator cuff tears with chronic retracted tendons.

**Level of Evidence**
Level III, retrospective comparative study.

BACK

# Revisiting the Anterior Glenoid: An Analysis of the Calcified Cartilage Layer, Capsulolabral Complex, and Glenoid Bone Density

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Arthroscopy, Volume 34, Issue 8, Received: September 17, 2017; Accepted: March 3, 2018; Published online: July 07, 2018

DOI: https://doi.org/10.1016/j.arthro.2018.03.017



**Purpose**
In this cadaveric study, we aim to define the basic anatomy of the anterior glenoid with attention to the relationships of calcified cartilage, capsulolabral complex, and osseous morphology of the anterior glenoid.

**Methods**
Seventeen cadaveric glenoid specimens (14 male, 3 female, mean age 53.9 ± 10) were imaged with micro-computed tomography (CT) and embedded in poly-methyl-methacrylate. Specimens were included for final analysis only if the entire glenoid articular cartilage, labrum, capsule, and biceps insertion were pristine and without evidence of injury, degeneration, or damage during the preparation process. Group 1 members (n = 9) were axially sectioned through 3 to 9 o'clock and 4 to 8 o'clock; group 2 members (n = 8) were radially sectioned through 3, 4, 5, and 9 o'clock. A scanning electron microscope (SEM) analysis quantified the percentage of bone within a 5 × 2.5 mm region at the glenoid rim. Micro-CT, SEM, and light microscopy evaluated the capsulolabral complex and calcified fibrocartilage.

**Results**
A 7 ± 2.1 mm region of calcified fibrocartilage at 4 o'clock was identified from the articular face to the medial glenoid neck supporting the overlying capsulolabral footprint and was >3× thicker at the articular attachment (316 ± 153 μm) versus the glenoid neck (92 ± 66 μm). At 3 to 9 o'clock and 4 to 8 o'clock 79.2% ± 5.4% and 75.2% ± 7.8% of the glenoid osseous width was covered with articular cartilage. The labrum accounted for 13.1% ± 3.4% of the glenoid width at 4 o'clock. SEM analysis demonstrated decreased glenoid bone density at 3, 4, and 5 o'clock ($P \leq .015$) and no difference ($P = .448$) at 9 o'clock versus central subchondral bone.

**Conclusions**
The capsulolabral footprint contributes significantly to the glenoid face, inserts directly adjacent to the articular cartilage, and extends medially along the glenoid neck. A layer of calcified fibrocartilage lies immediately beneath the capsulolabral footprint and is 3× thicker at the articular insertion compared with the glenoid neck. Lastly, there is a bone density gradient at the anterior-inferior rim versus the central subchondral bone.

**Clinical Relevance**
Arthroscopic Bankart repair has been reported to have a significant failure rate in many settings. It is felt that reproducing anatomy with the repair could help improve outcomes. Based on this study's findings, an arthroscopic Bankart technique that most closely reproduces native anatomy and potentially optimizes soft-tissue healing could be performed. This includes removal of 1 to 2 mm of articular cartilage from the glenoid face with anchor placement at this location to appropriately reposition the capsulolabral complex.

BACK

# The Influence of Bone Loss on Glenoid Version Measurement: A Computer-Modeled Cadaveric Analysis

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Arthroscopy, Volume 34, Issue 8, Received: July 5, 2016; Accepted: March 5, 2018; Published online: June 21, 2018

DOI: https://doi.org/10.1016/j.arthro.2018.03.019



**Purpose**
To characterize how increasing computed tomography (CT)–quantified glenoid bone loss influences measured version.

**Methods**
Six embalmed cadaveric shoulders were used for this study. Glenoid bone defects were computer modeled in cadaveric shoulders; CT images were obtained and segmented using OsiriX software, creating 3-dimensional en face glenoids. Glenoid defects were made on CT images of intact glenoids superimposed with a glenoid clock face viewed en face to simulate anterior and posterior bone loss. Bony defects in various positions comprising 3%, 9.5%, and 19.5% were created posteriorly. Best-fit circles were superimposed to represent 10% and 25% defects anteriorly. Version was measured using the Friedman method.

**Results**
The average glenoid version measured 4° of retroversion, 2° after 10% anterior bone loss, and neutral version in the 25% bone loss group. Version was significantly altered when we compared intact glenoids versus 10% and 25% anterior glenoid bone loss ($P < .001$). Increasing from 10% to 25% bone loss showed a significant difference in measured version ($P = .025$). Posterior defects from the 6:30 to 8:30 clock-face position averaged 4.6° of retroversion; from the 6:30 to 9:30 clock-face position, 6.2° of retroversion; and from the 6:30 to 10:30 clock-face position, 8.7° of retroversion. When comparing glenoid defects at the 6:30 to 8:30 clock-face position with those involving the 6:30 to 9:30 and 6:30 to 10:30 clock-face positions ($P < .001$), a 1° correction may be used for every 5% of bone loss to account for version changes seen with bone loss.

**Conclusions**
In this cadaveric analysis, glenoid version was altered in the setting of increasing posterior and anterior bone loss. A correction factor may be considered to account for this. When comparing glenoid defects at the 6:30 to 8:30 clock-face position with those involving the 6:30 to 9:30 and 6:30 to 10:30 clock-face positions ($P < .001$), a 1° correction may be used for every 5% of bone loss to account for version changes seen with bone loss.

**Clinical Relevance**
This cadaveric study shows that glenoid bone loss alters glenoid version, as measured by CT, in a meaningful way. This information is important in managing anterior and posterior shoulder instability, and correction of measured version should be considered in this setting to provide an accurate and comprehensive evaluation.

BACK

# Diagnostic Value of Clinical Tests for Supraspinatus Tendon Tears

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Arthroscopy, Volume 34, Issue 8, Received: November 6, 2017; Accepted: March 7, 2018; Published online: May 22, 2018

DOI: https://doi.org/10.1016/j.arthro.2018.03.030



**Purpose**
The purpose of this study was to analyze the diagnostic value of 7 clinical tests for the diagnosis of supraspinatus tendon tears, to investigate the ability of these tests to distinguish between partial- and full-thickness tears, and to compare 3 different ways of interpreting positive test results (weakness and pain): (1) in case of pain, (2) in case of weakness, regardless if with pain or not, and (3) when any of the 2 symptoms occurs, regardless if in combination or not. Moreover, this study aimed to investigate whether a combination of tests can improve the diagnostic accuracy.

**Methods**
A total of 115 consecutive patients who presented with different shoulder symptoms were prospectively enrolled in the study from March 2015 to April 2017. The inclusion criterion was that a shoulder arthroscopy was scheduled. Patients with the following characteristics were excluded from the study: patients (1) with shoulder instability, (2) with adhesive capsulitis, or (3) with any history of previous shoulder surgery including rotator cuff repair or patients (4) who did not provide informed consent. To assess the sensitivity, specificity, positive and negative predictive values, accuracy, diagnostic odds ratio, positive and negative likelihood ratio, and area under the curve (AUC) of each test, the intraoperative findings were compared with the results of the preoperative clinical examination of 7 established clinical tests: the empty can test, the full can test, the zero-degree abduction test, the Whipple test, the scapular retraction test, the drop arm test, and the modified drop arm test.

**Results**
A significant correlation was found between the findings for the empty can ($P$ = .004) and full can ($P$ = .001) tests and the intraoperative findings, wherein the full can test achieved better AUC. Muscle weakness showed the best diagnostic precision compared with pain or using both criteria. No single clinical test was found to be useful to distinguish between partial- and full-thickness tears. A combination of at least 3 or more tests improved the diagnostic value. The combination of the empty can, the full can, and the zero-degree abduction tests showed the best AUC (0.795) and correlation with the intraoperative findings ($P$ = .02).

**Conclusions**
The results of the present study indicate that of all clinical tests studied, only the empty can and full can tests were effectively able to diagnose tears of the supraspinatus tendon accurately. The greater AUC and correlation with the arthroscopic findings suggest that muscle weakness should be considered the gold standard when interpreting the test results. Furthermore, the present study showed that the analyzed tests are not capable of distinguishing between partial- and full-thickness tears of the supraspinatus tendon and that the combination of at least 3 tests, including the empty can, the full can, and the zero-degree abduction tests, improved the diagnostic value significantly. In addition, the empty and full can tests have showed higher diagnostic precision and fair AUC when supraspinatus tendon tears were more than 1 cm in size.

**Level of Evidence**
Level 1, diagnostic study

BACK

# Transcoracoacromial Ligament Glenohumeral Injection Technique: Accuracy of 116 Injections in Idiopathic Adhesive Capsulitis

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Arthroscopy, Volume 34, Issue 8, Received: September 29, 2017; Accepted: April 13, 2018; Published online: July 07, 2018

DOI: https://doi.org/10.1016/j.arthro.2018.04.016



**Purpose**
To describe a transcoracoacromial ligament glenohumeral injection technique that does not require radiographic guidance and to explore the accuracy of this injection technique in patients with idiopathic adhesive capsulitis.

**Methods**
From February 2015 to April 2017, 89 consecutive patients (116 injections) with idiopathic adhesive capsulitis were included in the study. All of them received unguided glenohumeral injection via the transcoracoacromial ligament technique, and postprocedural fluoroscopic images were used to determine accuracy. The anterolateral corner of acromion, the superior lateral border of coracoid tip, and the curved depression of distal clavicle were identified. The needle entry site was located at the trisection point between the distal third and middle third of the superior lateral border of coracoid tip–curved depression of the distal clavicle line; needle trajectory was perpendicular to the plane formed by the 3 points, and the needle was advanced toward the humeral head. An injection was rated a success if the first fluoroscopic picture showed intra-articular contrast; it was rated a failure if contrast was not intra-articular or the needle needed to be redirected more than 2 times.

**Results**
Out of 116 injections, 111 (95.7%) were successful. For 5 failed injections, there was 1 shoulder with more than 3 redirections and 4 shoulders with no intra-articular contrast (the needle hit the coracoid process in 1 shoulder, the needle rested in the anterior glenoid labrum in 2 shoulders, and the needle was inserted into the subscapularis in 1 shoulder).

**Conclusions**
The transcoracoacromial ligament glenohumeral injection technique is highly accurate and reproducible in patients with idiopathic adhesive capsulitis.

**Level of Evidence**
Level IV, therapeutic retrospective case series.

BACK

Knee Surgery, Sports Traumatology, Arthroscopy (KSSTA), Volume 26, Issue 8

# Arthroscopic double bone block augmentation is a salvage procedure for anterior and posterior shoulder instability secondary to glenoid bone loss

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KSSTA, August 2018, Volume 26, Issue 8, pp 2447–2453

https://doi.org/10.1007/s00167-018-4975-6



**Purpose**
The aim of this study was to describe a one-step arthroscopic anterior and posterior bone block augmentation technique for bidirectional shoulder instability and to present preliminary results.

**Methods**
Seven consecutive patients who underwent a concomitant anterior and posterior bone block procedure between 2007 and 2015 were retrospectively reviewed. Clinical scores, return to sport rate, and complications were assessed. Radiological outcome, with CT scan at 6 months and plain radiographs at final follow-up were reviewed. Patient reported functional outcomes were also assessed via phone or email interview.

**Results**
Seven consecutive patients were included in the study with a median age at surgery of 27 years. Median clinical and radiological follow-up was 7 months (4–72 months). Walch-Duplay score and Rowe scores were improved. Four patients were able to return to sport. One patient experienced recurrent dislocation, and one subjective instability/subluxation without confirmed recurrence. CT scan showed union in all cases, with one case of anterior bone block osteolysis and one case of partial posterior bone block osteolysis. Radiographs showed no detectable progression of osteoarthritis using the Samilson and Prieto classification. At final follow-up the median WOSI score was 187 (100–1140).

**Conclusions**
An all-arthroscopic technique for the treatment of combined anterior and posterior glenoid bone loss as a cause of shoulder instability can provide fair to good clinical outcomes, with a low incidence of intra-operative complications. The rate of failure in our series remains higher than that seen in primary stabilization procedures. As such we consider this largely as a salvage procedure for cases in which alternative treatments have failed or are unlikely to succeed.

**Level of evidence**
IV.

BACK

American Journal of Sports Medicine (AJSM), Volume 46, Issue 8

# Large Critical Shoulder Angle Has Higher Risk of Tendon Retear After Arthroscopic Rotator Cuff Repair

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First Published May 3, 2018; pp. 1892–1900

http://journals.sagepub.com/doi/full/10.1177/0363546518767634



**Background:**
The critical shoulder angle (CSA) is the angle created between the superior and inferior bone margins of the glenoid and the most lateral border of the acromion. A few studies recently investigated the relation between CSA and functional outcomes after rotator cuff repair. However, there is a lack of research investigating the effect of CSA on postoperative tendon integrity after rotator cuff repair.

**Purpose:**
To assess the effects of the CSA on postoperative tendon integrity after rotator cuff repair.

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

**Methods:**
All patients who underwent rotator cuff repair for full-thickness supraspinatus tears by 1 senior surgeon between January 2010 and January 2014 were included in this study. All patients had standardized anteroposterior shoulder radiographs the day before surgery. CSA and acromial index (AI) were measured. AI was derived by measuring the distance from the glenoid plane to the lateral border of the acromion and dividing it by the distance from the glenoid plane to the lateral aspect of the humeral head. Functional scores—including American Shoulder and Elbow Surgeons shoulder evaluation form, modified University of California at Los Angeles score, Constant-Murley score, and visual analog scale for pain—were used to evaluate shoulder function at a minimum follow-up of 2 years. Meanwhile, magnetic resonance imaging examinations were performed to evaluate rotator cuff integrity according to the Sugaya method and the signal/noise quotient (SNQ) of the rotator cuff tendon.

**Results:**
A total of 90 patients were included in this study: 42 patients with a single-row repair and 48 with a double-row repair. There was a significant positive correlation between CSA or AI and tendon SNQ. On the basis of CSA, the patients were divided into 2 groups: large CSA (>38°) and control (CSA ≤38°). At final follow-up, the large CSA group and the control CSA group demonstrated no significant differences in American Shoulder and Elbow Surgeons, University of California at Los Angeles, Constant, and visual analog scale scores. Postoperative magnetic resonance imaging revealed that the large CSA group had 9 cases of retear, with a significantly higher retear rate than the control group (15% vs 0%, $P = .03$). Furthermore, the tendon SNQ of the large CSA group was significantly greater than that of the control group.

**Conclusion:**
CSA did not appear to influence postoperative functional outcomes, while those in the large CSA group had poor tendon integrity after rotator cuff repair. These findings indicate that a large CSA is associated with an increased risk of rotator cuff tendon retear after repair.
Journal of Bone and Joint Surgery (JBJS), Volume 100, Issue 13 & 14

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Journal of Bone and Joint Surgery (JBJS), Volume 100, Issue 13 & 14

# Glenoid Bone Reaction to All-Soft Suture Anchors Used for Shoulder Labral Repairs

Tompane, T., MD, MPH[1,a]; Carney, J., MD[1]; Wu, W.W., MD[1]; Nguyen-Ta, K., BS[2]; Dewing, C., MD[1]; Provencher, M., MD[3]; McDonald, L., MD, MPH[1]; Gibson, M., MD[1]; LeClere, L., MD[4]

JBJS: July 18, 2018 - Volume 100 - Issue 14 - p 1223-1229

https://journals.lww.com/jbjsjournal/Abstract/2018/07180/Glenoid_Bone_Reaction_to_All_Soft_Suture_Anchors.8.aspx



**Background:**
All-soft suture anchors (ASSAs) are commonly used for shoulder labral repair and capsulorrhaphy in patients with shoulder instability. While these anchors may have some specific advantages over other types of suture anchors, little is known about the prevalence and time-dependence of bone cyst formation and tunnel expansion after implantation of ASSAs. The aim of this study was to quantify the proportions of cyst formation and tunnel expansion around ASSAs and to characterize and test for differences in abnormalities observed at different postoperative time points.

**Methods:**
Thirty patients who were treated with arthroscopic shoulder stabilization surgery with ASSAs (1.4 mm; JuggerKnot, Biomet) underwent a computed tomography (CT) scan of the operatively treated shoulder at 1 month (10 patients), 6 months (10 patients), or 12 months (10 patients) postoperatively. Demographic and operative data were collected, and CT scans were evaluated for cyst formation, tunnel expansion, and tunnel volume measured in cubic millimeters. Statistical analyses were performed to detect differences in these outcomes among the follow-up groups. All shoulders were stable at all time points of the study, and there were no incidents of recurrent instability during the study period.

**Results:**
Ninety-one suture anchors were evaluated in 30 patients. Tunnel expansion was identified in the large majority of patients in the 6-month and 12-month follow-up groups, with a significant increase in these proportions compared with the 1-month follow-up group ($p = 0.002$). Mean tunnel volumes also significantly increased over the study period ($p < 0.001$). The presence of cyst formation was negligible in all 3 follow-up cohorts.

**Conclusions:**
This study demonstrated low rates of cyst formation but a significantly increased tunnel volume 6 and 12 months after shoulder labral surgery with ASSAs. There was no association with the initial tunnel location. Additional well-controlled studies with longer follow-up are needed to identify potential associations among tunnel expansion, intraoperative technique, and clinical outcomes.

**Level of Evidence:**
Therapeutic Level IV. See Instructions for Authors for a complete description of levels of evidence

BACK

**Lower Extremity**

Arthroscopy, Volume 34, Issue 8

# Prevalence of High-Grade Cartilage Defects in Patients With Borderline Dysplasia With Femoroacetabular Impingement: A Comparative Cohort Study

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Arthroscopy, Volume 34, Issue 8, Received: June 7, 2017; Accepted: March 1, 2018; Published online: May 02, 2018

DOI: https://doi.org/10.1016/j.arthro.2018.03.012



**Purpose**
To compare the prevalence, size, and location of Outerbridge grade III and IV cartilage defects on the femoral head and acetabulum between patients with borderline acetabular dysplasia and patients with non-borderline dysplasia who underwent hip arthroscopy for femoroacetabular impingement (FAI).

**Methods**
Patients aged 18 years or older who underwent primary hip arthroscopy for correction of FAI and labral repair from November 2005 to April 2016 were included. We excluded patients with previous hip surgery, a radiographic hip joint space of 2 mm or less, and/or a lateral center-edge angle (LCEA) of less than 20° or greater than 40°. The study patients were divided into 2 groups based on the LCEA on the anteroposterior pelvic radiograph: Patients with an LCEA between 20° and 25° were included in the borderline group, and patients with an LCEA between 25° and 40° were included in the non-borderline group. The prevalence, size, and location of Outerbridge grade III and IV chondral lesions on the femoral head and acetabulum were recorded intraoperatively. Comparisons between groups were performed with the Mann-Whitney U test for nonparametric testing and the t test for data that were normally distributed. Data were analyzed to calculate odds ratios associated with the various factors.

**Results**
In total, 2,429 patients (1,114 women and 1,315 men) met the inclusion criteria. The borderline group consisted of 305 patients (150 men and 155 women), whereas the non-borderline dysplasia group comprised 2,124 patients (1,165 men and 959 women). Outerbridge grade III and IV chondral lesions were found on the femoral head in 118 patients with borderline dysplasia (39%) and 127 patients with non-borderline dysplasia (6%) and on the acetabulum in 132 patients with borderline dysplasia (43%) and 874 patients with non-borderline dysplasia (41%). Patients with borderline dysplasia were 10 times more likely (95% confidence interval, 7.3-13.4; $P < .001$) to have a grade III or IV cartilage defect on the weight-bearing surface of the femoral head ($P < .001$) than patients with non-borderline dysplasia. On the acetabular side, no difference in the prevalence of severe cartilage damage was detected between the 2 groups ($P = .588$). The size of chondral damage was significantly greater in patients with borderline dysplasia on the acetabulum ($P = .039$) compared with the non-borderline dysplasia group.

**Conclusions**
Patients with FAI and borderline dysplasia are at higher risk of having Outerbridge grade III and IV chondral damage on the femoral head than patients with non-borderline dysplastic hips.

BACK

Borderline dysplastic hips also presented with significantly larger chondral defects on the acetabular surface.

**Level of Evidence**
Level III, retrospective comparative study.

BACK

# Influence of Tönnis Grade on Outcomes of Arthroscopic Management of Symptomatic Femoroacetabular Impingement

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Arthroscopy, Volume 34, Issue 8, Received: July 28, 2017; Accepted: March 3, 2018; Published online: May 19, 2018

DOI: https://doi.org/10.1016/j.arthro.2018.03.021



**Purpose**
To define the outcomes of arthroscopic correction of femoroacetabular impingement (FAI) based on Tönnis findings within a previously reported patient population, including a comparative analysis of Tönnis grade 0 and 1 versus grade 2 changes.

**Methods**
Outcomes (modified Harris Hip Score [mHHS]) of a previously published study of arthroscopic correction of FAI were correlated with Tönnis grade. The inclusion criteria were the first 100 consecutive patients undergoing arthroscopic FAI correction with minimum 2-year follow-up. These procedures were performed between December 2003 and May 2006. Grades were determined independently by 2 experienced clinicians. Tönnis grades 0 and 1 were compared with Tönnis grade 2. Independent variables of sex and age were also evaluated.

**Results**
The average age of the entire group was 34.7 years (range, 13-76 years), with 66 male and 34 female patients. Of the patients, 17 had Tönnis grade 0, 49 had Tönnis grade 1, 29 had Tönnis grade 2, and 4 had Tönnis grade 3 (1 unknown). The average mHHS improvement for Tönnis grade 0 was 20.6 points; Tönnis grade 1, 22.2 points; Tönnis grade 2, 14.9 points; and Tönnis grade 3, 18.8 points. The improvement was statistically ($P < .01$) and clinically (>8 points) significant across all Tönnis grades. There was no difference ($P = .077$) between Tönnis grades 0 and 1 (21.8 points) versus grade 2 (14.9 points). There was no difference based on sex or age.

**Conclusions**
These data support that statistically and clinically meaningful successful patient-reported outcomes (mHHS) at 2 years can be encountered even in the presence of Tönnis grade 2 radiographic features. Neither age nor sex was an indicator of poorer results within similar Tönnis grades.

**Level of Evidence**
Level III, case-control study.

BACK

# Perioperative Opioid Analgesics and Hip Arthroscopy: Trends, Risk Factors for Prolonged Use, and Complications

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Arthroscopy, Volume 34, Issue 8, Received: September 12, 2017; Accepted: March 2, 2018; Published online: May 02, 2018

DOI: https://doi.org/10.1016/j.arthro.2018.03.016



**Purpose**
The purpose of this article is to (1) examine trends in preoperative and prolonged postoperative opioid analgesic use in patient undergoing hip arthroscopy, (2) characterize risk factors for prolonged opioid analgesic use following hip arthroscopy, and (3) explore preoperative and prolonged postoperative opioid analgesic use as independent risk factors for complications following hip arthroscopy.

**Methods**
A private insurance database was queried for patients undergoing hip arthroscopy from 2007 to 2015 with a minimum of 6 months of follow-up. Independent risk factors for prolonged opioid analgesic use were determined. Preoperative and prolonged opioid analgesic use as risk factors for complications were examined.

**Results**
There was a significantly decreasing trend in preoperative ($P = .002$) and prolonged postoperative ($P = .009$) opioid analgesic use. The most significant risk factor for prolonged postoperative opioid analgesic use was preoperative use (odds ratio [OR], 3.61; $P < .0001$). Other preoperative prescriptions, including muscle relaxants (OR, 1.5; $P < .0001$) and anxiolytics (OR, 2.0; $P < .0001$), were also significant risk factors. Preoperative opioid analgesic use was a significant risk factor for postoperative complications, including emergency room visits (OR, 2.1; $P < .0001$) and conversion to total hip arthroplasty (THA) (OR, 1.6; $P < .0001$). Prolonged postoperative opioid analgesic use was associated with a higher risk of revision hip arthroscopy (OR, 1.4; $P = .0004$) and conversion to THA (OR, 1.8; $P < .0001$).

**Conclusions**
More than a quarter of patients undergoing hip arthroscopy continue to receive opioid analgesic prescriptions more than 3 months postoperatively. The most significant risk factor for prolonged opioid analgesic use is preoperative opioid analgesic use. Additionally, anxiolytics, substance use or abuse, morbid obesity, and back pain were among the more notable risk factors for prolonged postoperative opioid analgesic use. Preoperative and prolonged postoperative opioid analgesic use was associated with a higher likelihood of several adverse effects/complications.

**Level of Evidence**
Level III, retrospective comparative study.

BACK

# Preoperative Depression Is Negatively Associated With Function and Predicts Poorer Outcomes After Hip Arthroscopy for Femoroacetabular Impingement

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Arthroscopy, Volume 34, Issue 8, Received: October 30, 2017; Accepted: March 4, 2018; Published online: May 19, 2018

DOI: https://doi.org/10.1016/j.arthro.2018.03.020



**Purpose**
(1) To determine the prevalence of depression in patients undergoing hip arthroscopy for the treatment of femoroacetabular impingement (FAI) syndrome and (2) to determine whether depression has a statistically significant and clinically relevant effect on preoperative and postoperative patient-reported outcome scores.

**Methods**
Consecutive subjects undergoing hip arthroscopy for FAI syndrome were retrospectively reviewed. The Beck Depression Inventory-II (BDI-II), Hip Outcome Score (HOS), and 33-item International Hip Outcome Tool (iHOT-33) were administered preoperatively and postoperatively. Clinically relevant differences were defined by the minimal clinically important difference, substantial clinical benefit, and patient acceptable symptom state. Comparisons between preoperative and postoperative scores were completed. The Spearman correlation coefficient (r) was used to determine the degree of correlation between the BDI-II score, HOS, and iHOT-33 score preoperatively and postoperatively.

**Results**
We analyzed 77 patients (72.7% female patients; mean age, 35.2 ± 12.5 years). Depressive symptoms were reported as minimal (75.3%), mild (11.7%), moderate (6.5%), or severe (6.5%). Patients with minimal or mild depression had a superior HOS Activities of Daily Living (Δ17.3 preoperatively [$P < .001$] and Δ37.8 postoperatively [$P < .001$]), HOS Sport-Specific Subscore (Δ12.8 preoperatively [$P = .002$] and Δ52.1 postoperatively [$P < .0001$]), and iHOT-33 score (Δ15.4 preoperatively [$P < .0001$] and Δ51.3 postoperatively [$P < .0001$]) compared with patients with moderate or severe depression. There was a weak to moderate negative correlation between the BDI-II score and iHOT-33 score ($r = −0.4614$, $P < .0001$ preoperatively; $r = −0.327$, $P < .0001$ at 1 year), HOS Activities of Daily Living ($r = −0.531$, $P < .0001$ preoperatively), and HOS Sport-Specific Subscore ($r = −0.379$, $P < .0017$ at 1 year).

**Conclusions**
Most patients undergoing hip arthroscopy for FAI have minimal depressive symptoms with the overall prevalence higher than the general population. Patients with minimal or mild depressive symptoms have statistically and clinically better preoperative and postoperative patient-reported outcomes, are more likely to obtain substantial clinical benefit from surgery, and are more likely to reach a patient acceptable symptom state after surgery than patients with moderate to severe depressive symptoms.

**Level of Evidence**
Level III, case-control study.

BACK

# Mechanical Strength of the Proximal Femur After Arthroscopic Osteochondroplasty for Femoroacetabular Impingement: Finite Element Analysis and 3-Dimensional Image Analysis

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Arthroscopy, Volume 34, Issue 8, Received: October 23, 2017; Accepted: March 27, 2018; Published online: June 21, 2018

DOI: https://doi.org/10.1016/j.arthro.2018.03.036



**Purpose**
To examine the influence of femoral neck resection on the mechanical strength of the proximal femur in actual surgery.

**Methods**
Eighteen subjects who received arthroscopic cam resection for cam-type femoroacetabular impingement (FAI) were included. Finite element analyses (FEAs) were performed to calculate changes in simulative fracture load between pre- and postoperative femur models. The finite element femur models were constructed from computed tomographic images; thus, the models represented the shape of the original femur, including the bone resection site. Three-dimensional image analysis of the bone resection site was performed to identify morphometric factors that affect strength in the postoperative femur model. Four oblique sagittal planes running perpendicular to the femoral neck axis were used as reference planes to measure the bone resection site.

**Results**
At the transcervical reference plane, both the bone resection depth and the cross-sectional area at the resection site correlated strongly with postoperative changes in the simulated fracture load ($R2 = 0.6$, $P = .0001$). However, only resection depth was significantly correlated with the simulated fracture load at the reference plane for the head-neck junction. The resected bone volume did not correlate with the postoperative changes in the simulated fracture load.

**Conclusions**
The results of our FEA suggest that the bone resection depth measured at the head-neck junction and transcervical reference plane correlates with fracture risk after osteochondroplasty. By contrast, bone resection at more proximal areas did not have a significant effect on the postoperative femur model strength in our FEA. The total volume of resected bone was also not significantly correlated with postoperative changes in femur model strength.

**Clinical Relevance**
This biomechanical study using FEA suggest that there is a risk of femoral neck fracture after arthroscopic cam resection, particularly when the resected lesion is located distally.

BACK

**Radiographic Risk Factors and Signs of Abductor Tears in the Hip**

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Arthroscopy, Volume 34, Issue 8, Received: March 9, 2017; Accepted: March 27, 2018;

DOI: https://doi.org/10.1016/j.arthro.2018.03.039



**Purpose**
The purpose of this study is to identify radiographic risk factors (RRFs) and radiographic signs of abductor tendon tears.

**Methods**
Between April 2008 and October 2015, patients with intraoperative diagnosis of partial- or full-thickness abductor tear noted at the time of open or endoscopic treatment were included in this study. Exclusion criteria included lack of preoperative standard supine pelvic radiograph, lack of preoperative magnetic resonance imaging (MRI), or abductor tear not present at the time of operative intervention. Patients were matched by age ±5 years, gender, and body mass index ±5 with patients with no abductor pathology by clinical exam and MRI. A standardized supine anterior-posterior pelvis radiograph was performed on all patients. The radiographs were evaluated for RRF (pelvic width, body weight moment arm, abductor moment arm, abductor angle, pelvic height) and signs of abductor tendon pathology (greater trochanteric enthesophyte). Femoral version was measured on MRI when images were available. Statistical analysis was performed and included bivariate and multivariate analyses.

**Results**
There were 152 patients with abductor tears identified at the time of surgery out of 2,838 eligible patients matched with 125 patients without abductor tendon pathology. The study institution was unable to perform a 1:1 match because of the advanced age of the abductor tendon group, which led to a greater age in the abductor group (n = 58) versus the control group (n = 54; P = .01. In abductor group the average age was 58, and 137 of 152 (90%) patients were female; in the control group the average age was 54, with 111 of 125 (89%) patients being female. Abductor tear patients were treated with surgical repair. The RRFs found with bivariate analysis were an increased pelvic width (14.8 cm for abductor tears vs 14.3 cm for control; P < .001), body weight moment arm (11.1 cm vs 10.9 cm; P < .001), and abductor moment arm (7.8 cm vs 7.6 cm; P < .001); decreased femoral anteversion (7.6° vs 10.6°; P = .045); and enthesophyte presence (41% vs 3%; P < .001). Multivariate regression analysis of all variables showed that teardrop distance and enthesophyte presence were the 2 variables most predictive of abductor tears, and other variables did not significantly increase or decrease the likelihood of tear when these 2 variables were considered. The presence of an enthesophyte on the greater trochanter was notable for an odds ratio of 20.7 of having an abductor tear.

**Conclusions**
Patients with abductor tears have a wider pelvis, longer abductor moment arm, and longer body weight moment arm and have greater trochanteric enthesophyte as noted on nearly half of patients with an abductor tear. Presence of an enthesophyte was noted to have an odds ratio of 20.7 and a positive predictive value of 94% for having an abductor tendon tear. The 2 variables predictive of abductor tendon tear when controlling for all variables were enthesophyte presence and teardrop distance, with no other variables significantly increasing or decreasing the likelihood of tear when these 2 variables were considered.

**Level of Evidence:**
Level III, retrospective comparative study.

BACK

# Evaluation of Anterolateral Ligament Injuries and Concomitant Lesions on Magnetic Resonance Imaging After Acute Anterior Cruciate Ligament Rupture

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Arthroscopy, Volume 34, Issue 8, Received: September 16, 2017; Accepted: February 17, 2018; Published online: May 02, 2018

DOI: https://doi.org/10.1016/j.arthro.2018.02.048



**Purpose**
To evaluate the prevalence and characteristics of anterolateral ligament (ALL) injuries with a ruptured acute anterior cruciate ligament (ACL) and to analyze the presence of concomitant bone contusions and meniscal lesions.

**Methods**
From March 2015 to March 2017, we retrospectively analyzed 378 patients who underwent primary ACL reconstructions. Using magnetic resonance imaging, we evaluated the presence of ALL injury and concomitant lesions within 3 weeks of the injury. Meniscal tears were also identified on representative arthroscopic images.

**Results**
Following the inclusion criteria, we included a total of 275 patients in this study. The mean duration from ACL rupture to magnetic resonance imaging examination was 5.0 ± 6.0 days. We visualized ALL in 98.2% of patients, of whom 64% had ALL injuries (10.9%, 4.7%, and 48.4% were complete ruptures, Segond fracture, and partial ruptures, respectively). We found that ALL injuries were most commonly found in the femoral location. The intra- and interobserver agreement on the severity of ALL injury ($\kappa$ = 0.83 and 0.81, respectively) and the location of ALL injury ($\kappa$ = 0.85 and 0.84, respectively) were excellent. The association between ALL injury and lateral meniscal lesions was significant (P = .03). In particular, the proportion of the lateral meniscal posterior horn radial tears was significantly larger in nonintact ALL than in intact ALL (P = .042). The correlation between the severity of ALL injury and the degree of bone contusion at lateral compartments was significant but weak (P < .001).

**Conclusions**
We found that more than half of acute ACL ruptures have ALL injuries. The presence of ALL injury was significantly associated with the presence of lateral meniscal lesions, especially lateral meniscal posterior horn radial tears, or lateral bone contusions. Interestingly, the severity of ALL injury significantly correlated with the degree of lateral bone contusions.

**Level of Evidence**
Level III, diagnostic cross-sectional study.

BACK

# The Relationship of Femoral Tunnel Positioning in Medial Patellofemoral Ligament Reconstruction on Clinical Outcome and Postoperative Complications

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Arthroscopy, Volume 34, Issue 8, Received: August 18, 2017; Accepted: February 16, 2018; Published online: May 19, 2018

DOI: https://doi.org/10.1016/j.arthro.2018.02.046



**Purpose**
To analyze the relation of the femoral tunnel (FT) positioning on clinical outcome.

**Methods**
Patients with recurrent patellar dislocation who underwent medial patellofemoral ligament (MPFL) reconstruction with or without tibial tubercle osteotomy between 1998 and 2012 were included in this retrospective study. Strict postoperative lateral radiographs were mandatory. Knees with previous osseous stabilization surgery, fixed lateral patellar dislocation, valgus knee (>5°), or open growth plates were excluded. The distance between the FT and the validated radiographic landmark (the “Schoettle point”) was measured. An FT with a distance greater than 10 mm was considered as malpositioned. The distance was correlated to subjective outcome measurements (patient satisfaction and Kujala score) and postoperative complications (a loss of range of motion and revision surgery).

**Results**
Sixty-three knees in 60 patients (aged 23.7 ± 7.5 years at the time of surgery, 79.4% female) were included with a mean follow-up of 5.7 ± 3.3 years. The FT showed an average distance of 13.3 mm (±6.0 mm; 95% confidence interval [CI]: 11.7-14.8) to the Schoettle point, and 45 of 63 knees (71.4%) were deemed malpositioned. The postoperative Kujala score of malpositioned FT (75.9 points; 95% CI: 71.2-80.7) was not significantly inferior to knees with an FT within 10 mm (80.5; 95% CI: 73.7-87.3, P = .315). However, all 5 knees that underwent revision surgery showed an FT outside the 10-mm area.

**Conclusions**
Malpositioning of the FT in MPFL reconstruction is associated with postoperative complications. However, a malpositioned FT in MPFL reconstruction will not necessarily lead to an unsatisfactory subjective or objective clinical outcome. Other factors, such as surgical indication or graft tensioning, might also significantly influence postoperative outcome.

**Level of Evidence**
Level IV, case-control study.

BACK

# Combined Tibial Tubercle Osteotomy and Medial Patellofemoral Ligament Reconstruction for Recurrent Lateral Patellar Instability in Patients With Multiple Anatomic Risk Factors

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Arthroscopy, Volume 34, Issue 8, Received: October 17, 2016; Accepted: February 22, 2018; Published online: May 19, 2018

DOI: https://doi.org/10.1016/j.arthro.2018.02.049



**Purpose**
To report the outcomes for combined tibial tubercle osteotomy (TTO) and medial patellofemoral ligament (MPFL) reconstruction and assess for potential risk factors for recurrent instability and/or poor outcomes.

**Methods**
The medical record at our institution was reviewed for patients treated with MPFL reconstruction and TTO for recurrent lateral patellar instability from 1998 to 2014. Preoperative imaging was assessed for trochlear dysplasia according to the Dejour classification (high grade = B, C, D) and the presence of patella alta using the Caton-Deschamps ratio (>1.2). The indication for combined MPFL reconstruction and TTO was MPFL insufficiency and a lateralized tibial tubercle. Outcomes were determined by recurrent instability, return to sport, and Kujala and International Knee Documentation Committee (IKDC) scores.

**Results**
Thirty knees in 28 patients (14 M, 14 F) with a mean age of 22.6 ± 9.1 years (range, 13-51 years) were included with a mean follow-up of 48 ± 28 months (24-123 months). Seventy-three percent (22/30) had high-grade trochlear dysplasia, and 63% (19/30) had patella alta. One patient had a postoperative dislocation and 1 had a subluxation event. The Caton-Deschamps ratio decreased by a mean of 0.2 (P = .001), leaving 30% with postoperative patella alta. The mean postoperative scores were as follows: Tegner = 5 ± 2, Kujala = 89 ± 16 (45-100), and IKDC = 85 ± 17 (44-100). Eighty-three percent (15/18) returned to their preoperative sport. Female gender was a risk factor for lower IKDC (77.3 vs. 92.6, P = .01) and Kujala (82.2 vs. 95.0, P = .03) scores. Medialization greater than 10 mm was directly correlated to lower IKDC (P = .02) and Kujala (P = .01) scores.

**Conclusions**
The combination of MPFL reconstruction and TTO in patients with trochlear dysplasia results in low recurrence of instability. Patients on average had good subjective outcomes and were able to return to sport. Female gender and tibial tubercle medialization greater than 10 mm were associated with worse outcomes.

**Level of Evidence**
Level IV, therapeutic case series.

BACK

# A Prospective, Blinded, Multicenter Clinical Trial to Compare the Efficacy, Accuracy, and Safety of In-Office Diagnostic Arthroscopy With Magnetic Resonance Imaging and Surgical Diagnostic Arthroscopy

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Arthroscopy, Volume 34, Issue 8, Received: August 24, 2017; Accepted: March 2, 2018; Published online: May 24, 2018

DOI: https://doi.org/10.1016/j.arthro.2018.03.010



**Purpose**
The purpose of this study was to compare the efficacy, accuracy, and safety of in-office diagnostic arthroscopy with magnetic resonance imaging (MRI) and surgical diagnostic arthroscopy.

**Methods**
A prospective, blinded, multicenter, clinical trial was performed on 110 patients, ages 18 to 75 years, who presented with knee pain. The study period was April 2012 to April 2013. Each patient underwent a physical examination, an MRI, in-office diagnostic imaging, and a diagnostic arthroscopic examination in the operating room. The attending physician completed clinical report forms comparing the in-office arthroscopic examination and surgical diagnostic arthroscopy findings on each patient. Two blinded experts, unaffiliated with the clinical care of the study's subjects, reviewed the in-office arthroscopic images and MRI images using the surgical diagnostic arthroscopy images as the “control” group comparison. Patients were consecutive, and no patients were excluded from the study.

**Results**
In this study, the accuracy, sensitivity, and specificity of in-office arthroscopy was equivalent to surgical diagnostic arthroscopy and more accurate than MRI. When comparing in-office arthroscopy with surgical diagnostic arthroscopy, all kappa statistics were between 0.766 and 0.902. For MRI compared with surgical diagnostic arthroscopy, kappa values ranged from a low of 0.130 (considered “slight” agreement) to a high of 0.535 (considered “moderate” agreement). The comparison of MRI to in-office arthroscopy showed very similar results as the comparison of MRI with surgical diagnostic arthroscopy, ranging from a low kappa of 0.112 (slight agreement) to a high of 0.546 (moderate agreement). There were no patient-related or device-related complications related to the use of in-office arthroscopy.

**Conclusions**
Needle-based diagnostic imaging that can be used in the office setting is statistically equivalent to surgical diagnostic arthroscopy with regard to the diagnosis of intra-articular, nonligamentous knee joint pathology. In-office diagnostic imaging can provide a more detailed and accurate diagnostic assessment of intra-articular knee pathology than MRI. Based on the study results, in-office diagnostic imaging provides a safe, accurate, real-time, minimally invasive diagnostic modality to evaluate intra-articular pathology without the need for surgical diagnostic arthroscopy or high-cost imaging.

**Level of Evidence**
Level II, comparative prospective trial.

BACK

# Minimizing Graft-Tunnel Mismatch in Allograft Anterior Cruciate Ligament Reconstruction Using Blumensaat's Line: A Cadaveric Study

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Arthroscopy, Volume 34, Issue 8, Received: July 9, 2017; Accepted: March 2, 2018; Published online: May 02, 2018

DOI: https://doi.org/10.1016/j.arthro.2018.03.006



**Purpose**
To evaluate the accuracy of Blumensaat's line (BL) in predicting the tendinous graft length and tibial tunnel length (TTL) in an independent-tunnel anterior cruciate ligament reconstruction (ACLR) using a bone-patellar tendon-bone (BTB) allograft.

**Methods**
Eighteen ACLRs were performed on cadaveric specimens using an anteromedial portal technique. All knees had no previous surgeries or deformities. Lateral knee radiographs of each specimen were taken prior to the ACLR, and BL was measured. Length-specific allografts for the tendinous portion of the grafts were then ordered by adding 20 mm to the length of BL. The TTL was predicted by subtracting BL and femoral tunnel length (FTL) from the overall graft length. Graft-tunnel mismatch (GTM) was recorded for each specimen. Statistical analysis compared overall results with the gold standard (0 mm) of GTM.

**Results**
The average lateral femoral condyle width measured in line with the femoral tunnel was 33 ± 3.43 mm. The average FTL was 25 ± 0.54 mm. The average intra-articular distance (IAD) between femoral and tibial tunnel apertures was 31 ± 3.65 mm. The average TTL was 35 ± 2.21 mm. The difference between the predicted TTL and the actual TTL was not statistically significant ($P = .3$). The mean GTM was −0.9 ± 3.15 mm. There was no statistically significant difference between the BL method and the gold standard ($P = .45$). The mean percent difference between BL and the IAD was 5.2%.

**Conclusions**
The BL method can accurately predict the desired length for the tendinous portion of a BTB allograft as well as the TTL, thereby potentially minimizing GTM during arthroscopic BTB allograft ACLR. Patient-specific allografts can be ordered preoperatively based on BL.

**Clinical Relevance**
This method provides the surgeon a way to avoid GTM preoperatively by ordering patient-specific grafts prior to performing an independent-tunnel BTB allograft ACLR.

BACK

# A History of Anterior Cruciate Ligament Reconstruction at the National Football League Combine Results in Inferior Early National Football League Career Participation

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Arthroscopy, Volume 34, Issue 8, Received: September 19, 2017; Accepted: March 2, 2018; Published online: May 19, 2018

DOI: https://doi.org/10.1016/j.arthro.2018.03.018



**Purpose**
To evaluate whether players with a history of an anterior cruciate ligament reconstruction (ACLR) before the National Football League (NFL) Combine played or started fewer games and/or participated in fewer eligible snaps compared with NFL Combine participants without a history of knee injury or surgery.

**Methods**
We performed a retrospective review of all players who participated in the NFL Combine between 2009 and 2015 and who had a history of an ACLR. NFL Combine participants were included if they had a previous ACLR or combined anterior cruciate ligament (ACL) injury and nonoperatively managed medial collateral ligament injury. The number of games started, number of games played, draft number, overall draft pick, and snap percentage for each position were determined. The mean value of each outcome metric was compared between case and control players.

**Results**
We identified 110 players who had an ACL injury (n = 76) or a combined ACL and medial collateral ligament injury (n = 34). Players in the ACLR group had a significantly worse mean draft pick number (difference of 30.2, P = .002) and mean draft round (difference of 0.8, P = .019) versus controls. Compared with control players, players in the ACLR group started and played significantly fewer games in both season 1 (difference of 2.7 games started, P < .001; difference of 2.7 games played, P < .001) and season 2 (difference of 7.4 games started, P < .001; difference of 3.0 games played, P = .003) and had a significantly lower snap percentage in both season 1 (difference of 23.1%, P < .001) and season 2 (difference of 24.0%, P < .001).

**Conclusions**
Athletes at the NFL Combine who previously underwent an ACLR had significantly lower early-career NFL player metrics, including fewer games started, fewer games played, and a lower snap percentage, than uninjured controls. Defensive linemen, defensive backs, and linebackers were the 3 most affected positions. Players with a prior ACLR and combined meniscal-chondral pathology had significantly lower numbers of games started and games played in seasons 1 and 2 and a significantly lower season 2 snap percentage.

**Level of Evidence**
Level III, case-control study.

BACK

# Estimating Lengths of Semitendinosus and Gracilis Tendons by Magnetic Resonance Imaging

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Arthroscopy, Volume 34, Issue 8, Received: September 24, 2017; Accepted: March 16, 2018; Published online: May 30, 2018

DOI: https://doi.org/10.1016/j.arthro.2018.03.031



**Purpose**
To determine whether preoperative magnetic resonance imaging (MRI) can help predict the tendon-only length of the semitendinosus (ST) and the gracilis (G).

**Methods**
The distance from the tibial insertion to the distal-most aspect of the musculotendinous junction (MTJ) of the ST and G was estimated on preoperative MRI scans of patients undergoing primary anterior cruciate ligament (ACL) reconstruction with single-bundle, quadruple-stranded hamstring autograft. This MRI tendon-only length, measured by a musculoskeletal radiologist blinded to surgical findings, was compared to the actual tendon-only length measured upon harvesting each tendon.

**Results**
Among the 42 patients comprising the study population, there was very strong correlation between the estimates of tendon-only length made by MRI and surgical measurements for both the ST (Spearman coefficient = 0.83; $P < .0001$) and the G (Spearman coefficient = 0.82; $P < .0001$). The difference between MRI and surgical measurements did not exceed 3 cm for any of the 84 harvested hamstring tendons. Bland-Altman plots confirmed agreement between the 2 measurement methods. There was also strong correlation between the surgically measured tendon-only length of the ST and its G counterpart (Spearman coefficient = 0.68; $P < .0001$).

**Conclusions**
MRI estimates of tendon-only length for both the ST and G very strongly correlate with operative measurements of these lengths; the discrepancy between these 2 measurement methods was found to not exceed 3 cm when the MTJ of these tendons is visible on MRI scans.

**Level of Evidence**
Level III, comparative study.

BACK

# Dynamic 3-Dimensional Mapping of Isometric Anterior Cruciate Ligament Attachment Sites on the Tibia and Femur: Is Anatomic Also Isometric?

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Arthroscopy, Volume 34, Issue 8, Received: September 3, 2017; Accepted: March 26, 2018;

DOI: https://doi.org/10.1016/j.arthro.2018.03.033



**Purpose**
The purpose of this study was to (1) map the length changes of the medial wall of the lateral femoral condyle (MWLFC) with respect to various points about the tibial anterior cruciate ligament (ACL) footprint to determine the area that demonstrates the least amount of length change through full range of motion and (2) to identify a range of flexion that would be favorable for graft tensioning.

**Methods**
Six fresh-frozen cadaveric knees were obtained from screened individuals with no prior history of arthritis, cancer, surgery, or any ligamentous knee injury. For each knee, 3-dimensional computed tomography point-cloud models were obtained in succession from 0° to 135°. A point grid was placed on the MWLFC and the tibia. Intra-articular length was calculated for each point on the femur to the tibia at all flexion angles and grouped to represent areas for bone tunnels. Normalized length changes were compared.

**Results**
Areas anterior/distal on the MWLFC increased with increasing flexion, and areas proximal/posterior decreased with increasing flexion. The area about the intersection of the lateral intercondylar ridge and the bifurcate ridge was most isometric throughout flexion as no significant change in ligament length was found throughout flexion. The normalized length changes from the central position of the tibia showed no significant difference compared with the anterior or posterior tibial position.

**Conclusions**
No area of the MWLFC is truly isometric through flexion. Femoral tunnel placement slightly anterior to the center of the anteromedial and posterolateral bundles was most isometric. Minimal length change occurs between 10° and 40°, which reflects the range where graft tensioning was most often performed. The results of this study provide further support for an anatomic ACL reconstruction.

**Clinical Relevance**
The femoral tunnel location for ACL reconstruction with the least amount of length change through range of motion should encompass the direct fibers of the ACL.

BACK

# Risk Factors for Abnormal Anteroposterior Knee Laxity After Primary Anterior Cruciate Ligament Reconstruction

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Arthroscopy, Volume 34, Issue 8, Received: November 4, 2017; Accepted: March 14, 2018; Published online: May 08, 2018

DOI: https://doi.org/10.1016/j.arthro.2018.03.038



**Purpose**
To identify preoperative and intraoperative factors associated with abnormal anterior knee laxity after primary anterior cruciate ligament (ACL) reconstruction.

**Methods**
A total of 5,462 patients who underwent primary ACL reconstruction at our institution from January 2000 to October 2015, with no associated ligament injuries, were included. Demographic data, information regarding graft used, concomitant meniscal surgery, and instrumented laxity were reviewed. The KT-1000 arthrometer, with an anterior tibial load of 134 N, was used to evaluate knee laxity preoperatively and at 6-month follow-up. Patients were considered to have abnormal anterior knee laxity if the postoperative side-to-side difference was greater than 5 mm (International Knee Documentation Committee laxity grade C or D). A logistic regression analysis was used to evaluate whether patient age, gender, preoperative knee laxity, graft type, and presence of medial or lateral meniscus resection or suture were risk factors for abnormal knee laxity.

**Results**
The risk of having abnormal anterior knee laxity was significantly related to younger age (<30 years) (odds ratio [OR] 1.44; 95% confidence interval [CI], 1.07-1.95; P = .016), preoperative side-to-side difference greater than 5 mm (OR, 6.57; 95% CI, 4.94-8.73; P < .001), hamstring tendon graft (OR, 1.83; 95% CI, 1.08-3.11; P = .025), and medial meniscus resection (OR, 2.22; 95% CI, 1.61-3.07; P < .001). Female gender (OR, 0.96; 95% CI, 0.72-1.28; P = .80), medial meniscus suture (OR, 0.82; 95% CI 0.42-1.62; P = .58), lateral meniscus resection (OR, 0.73; 95% CI 0.49-1.10; P = .13), and lateral meniscus suture (OR, 0.99; 95% CI, 0.46-2.11; P = .98) were not associated with increased risk of abnormal knee laxity.

**Conclusions**
Age less than 30 years, preoperative side-to-side difference greater than 5 mm, hamstring tendon graft, and medial meniscus resection are associated with increased risk of having abnormal anterior knee laxity 6 months after primary ACL reconstruction.

**Level of Evidence**
Level III, retrospective comparative trial.

BACK

# The Use of Fluoroscopy Leads to Improved Identification of the Femoral Lateral Collateral Ligament Origin Site When Compared With Traditional Tactile Techniques

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Arthroscopy, Volume 34, Issue 8, Received: November 9, 2017; Accepted: March 26, 2018; Published online: May 30, 2018

DOI: https://doi.org/10.1016/j.arthro.2018.03.035



**Purpose**
To determine whether a fluoroscopic technique can be used to improve the accuracy of the determination of the femoral origin of the lateral collateral ligament (LCL).

**Methods**
A 1-cm incision was made over the lateral epicondyle in 13 fresh-frozen cadaveric knee specimens, and the LCL origin was determined first by palpation and then with a previously described fluoroscopic method. Both points for the LCL origin were marked with 2-mm Kirschner wires. The distances between the center of the anatomic LCL origin and the LCL origin points determined by palpation and fluoroscopic imaging were calculated. An independent t-test was used to compare the distances between the anatomic LCL origin center and the determined LCL origin points.

**Results**
The LCL origin points determined by fluoroscopic imaging were significantly (P = .005) closer to the anatomic center of the LCL origin point than the ones determined by palpation (3.2 mm ± 1.6 mm vs 5.0 mm ± 1.6 mm, respectively). A total of 92.7% fluoroscopically determined LCL origin points were within a 5 mm radius surrounding the anatomic LCL origin point. In contrast, only 53.8% LCL origin points determined by palpation were within a 5 mm radius surrounding the anatomic LCL origin point.

**Conclusions**
The use of palpation to identify the LCL origin may not be an accurate method for performing an isometric and anatomic LCL reconstruction. The use of fluoroscopic imaging appears to be a feasible method for identifying the LCL origin in clinical practice and may increase the accuracy of LCL origin identification. Fluoroscopic guidance improves accuracy in determining the anatomic LCL origin, which may help avoiding tunnel malplacement during LCL reconstruction.

**Clinical Relevance**
The use of a previously described radiographic method for identifying the LCL origin may be used to achieve a more anatomic LCL reconstruction.

BACK

# Arthroscopic Repair of Lateral Ankle Ligament for Chronic Lateral Ankle Instability: A Systematic Review

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Arthroscopy, Volume 34, Issue 8, Received: October 10, 2017; Accepted: February 16, 2018; Published online: May 02, 2018

DOI: https://doi.org/10.1016/j.arthro.2018.02.034



**Purpose**
The purpose of this systematic review was to evaluate the current studies on arthroscopic lateral ankle ligament repair for chronic lateral ankle instability.

**Methods**
A systematic search of MEDLINE, EMBASE, and Cochrane Library databases was performed during August 2017. Included studies were evaluated with regard to level of evidence (LOE) and quality of evidence (QOE) using the Coleman Methodology Score. Variable reporting outcome data, clinical outcomes, and percentage of patients who returned to sport at previous level were also evaluated.

**Results**
Eight studies for a total of 269 ankles were included; 87.5% of studies were LOE III or IV, and the QOE in all studies was of poor or fair quality. Preoperative American Orthopaedic Foot and Ankle Society (AOFAS) scores ranged from 41.2 to 69.9, and postoperative AOFAS scores ranged from 90.2 to 98. All studies using AOFAS score showed an increase in postoperative outcome score of 22.8 to 54.2 at a mean follow-up of 17.1 months. Five studies used Karlsson-Peterson scores with mean postoperative score of 88.5 (range, 76.2-93.6) at a mean follow-up of 21.2 months. The comparative studies showed similar clinical outcomes between arthroscopic and open procedures. The overall complication rate was 11.6% in the included studies. The overall rate of return to sport was 100%.

**Conclusions**
The current systematic review demonstrated that arthroscopic lateral ankle ligament repair yields favorable clinical outcomes in the short term. However, there is no clinical evidence to support the advantages of the arthroscopic procedure over the open procedure, and there are no long-term data currently available for the arthroscopic procedure. There was a relatively high complication rate (11.5%) associated with the arthroscopic procedures, although recent comparative studies demonstrated similar complication rates for both open and arthroscopic techniques.

**Level of Evidence**
Level IV, systematic review of Level I, III, and IV studies.

BACK

**The Role of Blood Flow Restriction Therapy Following Knee Surgery: Expert Opinion**

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Arthroscopy, Volume 34, Issue 8, Received: April 12, 2018; Accepted: May 22, 2018;

DOI: https://doi.org/10.1016/j.arthro.2018.05.038



Abstract
Blood flow restriction (BFR) therapy is becoming increasingly popular in musculoskeletal injury rehabilitation. In particular, this form of therapy is being utilized more often in the postoperative setting following knee surgery, including anterior cruciate ligament reconstruction. BFR therapy provides patients and clinicians an alternative treatment option to standard muscle strengthening and hypertrophy guidelines in the setting of postoperative pain, weakness, and postoperative activity restrictions that contribute to muscle atrophy. The ability to complete exercise in a low load environment and achieve similar physiological adaptations as high-intensity strength training makes this modality appealing. With poor patient-related outcomes associated with continued muscle atrophy, pain, and muscle weakness, some researchers have investigated BFR training postoperatively following arthroscopic knee surgery with promising results. However, owing to the current paucity of research studies, inconsistency among reported protocols, and mixed results, it may be some time before a mass adoption of BFR therapy is made into the world of orthopaedic rehabilitation. Although the current data is inconclusive, we choose to utilize BFR in postoperative knee patients, regardless of weight-bearing status, for whom maintenance of existing muscle mass or improvement of decreased postoperative strength levels is important. Therefore, the purpose of this expert opinion is to review the background of BFR, describe the clinical evidence of BFR following knee surgery, and report the authors' current recommendations for application of BFR postoperatively.

BACK

Knee Surgery, Sports Traumatology, Arthroscopy (KSSTA), Volume 26, Issue 8

# Meniscal repair results in inferior short-term outcomes compared with meniscal resection: a cohort study of 6398 patients with primary anterior cruciate ligament reconstruction

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KSSTA, August 2018, Volume 26, Issue 8, pp 2251–2258

https://doi.org/10.1007/s00167-017-4793-2



**Purpose**
To compare patient reported outcome measures (PROMs) during the first postoperative year between isolated anterior cruciate ligament (ACL) reconstruction and ACL reconstruction with concomitant meniscal intervention.

**Methods**
Patients who underwent primary ACL reconstruction at Capio Artro Clinic, Stockholm, Sweden, between 1st Jan 2001 and 31st Dec 2014 without concomitant injuries others than meniscal and/or cartilage lesions were included. Five groups of meniscal treatment simultaneously to ACL reconstruction were established; medial meniscal (MM) resection, MM repair, lateral meniscal (LM) resection, LM repair, and MM + LM resection. Patients treated with isolated ACL reconstruction formed a separate group. Preoperative, 6-month and 1-year Knee Injury and Osteoarthritis Outcome Score (KOOS), and Lysholm knee score and Tegner Activity scale were collected. Differences in the change over time were analyzed with an ANOVA for repeated measurements with age at surgery, gender, and cartilage injury as covariates. A univariate ANOVA was applied to analyze PROMs between groups at the final follow-up.

**Results**
A total of 6398 patients were included (56.8% males, mean age 28.5 ± 10.2 years). The KOOS improved across all subscales for all treatment groups. The mean change over time differed significantly between groups for the subscales symptoms ($p = 0.017$) and activities in daily living (ADL) ($p < 0.001$). Symptoms was least improved in the MM repair group, while the MM + LM resection group showed the largest improvement. For the ADL subscale, the isolated ACL reconstruction group showed the least improvement and the MM + LM resection group showed the major improvement. At 1-year follow-up, a significant difference between the groups was found for the subscale symptoms ($p = 0.019$), where the MM repair group reported the lowest score [mean 78.4 (95% CI 76.3–80.5)]. No significant differences were found between groups in change of the Lysholm score over time; however, at 6 months, the difference between groups was significant ($p = 0.006$) with the meniscal repair groups reporting the lowest scores.

**Conclusion**
Patients with concomitant meniscal resection are able to reach the same subjective knee function as isolated ACL reconstructions as early as 6 months postoperatively. However, patients with meniscal repair may have slightly worse subjective knee function at both 6- and 12-month follow-up. These findings could help clinicians to set realistic short-term expectations for patients undergoing ACL reconstruction with simultaneous meniscal intervention.

**Level of evidence**
3.

BACK

# Similar clinical outcomes following collagen or polyurethane meniscal scaffold implantation: a systematic review

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KSSTA, August 2018, Volume 26, Issue 8, pp 2259–2269

https://doi.org/10.1007/s00167-018-4838-1



**Purpose**
The purpose of this systematic review is to evaluate the current literature in an effort to assess specific clinical outcomes following meniscal scaffold implantation using the two available scaffolds: Collagen Meniscal Implant (CMI) and the Actifit polyurethane meniscal scaffold.

**Methods**
A systematic review was performed by searching PubMed, Embase, and Cochrane Library to find studies evaluating clinical outcomes of patients undergoing meniscal scaffold implantation. Search terms used were “meniscus”, “meniscal”, “scaffold”, and “implant”. Studies were evaluated based on scaffold type, treatment failure rates, patient-reported outcome scores, concomitant procedures, and radiological findings. Radiological findings were recorded using the Genovese scale to assess morphology and signal intensity and the Yulish score to assess articular cartilage.

**Results**
Nineteen studies (1 level I, 1 level II, 17 level IV evidence) were identified that met inclusion criteria, including a total of 658 patients (347 Actifit, 311 CMI). The overall average follow-up was 45 months. Treatment failure occurred in 9.9% of patients receiving the Actifit scaffold at a mean follow-up of 40 months and 6.7% of patients receiving CMI at a mean follow-up of 44 months (n.s.). However, the rate of failure ranged from 0 to 31.8% amongst the included studies with a variable definition of failure. Additionally, overlapping patients and presence of concomitant surgeries such as anterior cruciate ligament reconstruction (ACLR) and high tibial osteotomy (HTO) may have a significant influence on these results. Outcomes for the Visual Analog Scale (VAS) for pain, Lysholm knee score, and Tegner activity score improved from preoperatively to latest follow-up in both groups, while the Knee Injury and Osteoarthritis Outcome Score and International Knee Documentation Committee scores improved from preoperatively to latest follow-up for Actifit scaffold patients. Overall, patients receiving CMI scaffolds had higher grades for Genovese morphology and signal intensity when compared to Actifit scaffold patients.

**Conclusion**
Patients undergoing meniscal scaffold implantation with either CMI or Actifit scaffold can both be expected to experience improvement in clinical outcomes when used in association with concomitant procedures such as ACLR and HTO.

**Level of evidence**
IV, systematic review.

BACK

**Meniscus repair with simultaneous ACL reconstruction demonstrated similar clinical outcomes as isolated ACL repair: a result not seen with meniscus resection**

Mark Phillips, Erik Rönnblad, Love Lopez-Rengstig, Eleonor Svantesson, Anders Stålman, Kalle Eriksson, Olufemi R. Ayeni, Kristian Samuelsson

KSSTA, August 2018, Volume 26, Issue 8, pp 2270–2277

https://doi.org/10.1007/s00167-018-4862-1



**Purpose**
To compare Knee Injury and Osteoarthritis Outcome Score (KOOS) and EuroQol-5D (EQ-5D) subscale scores at 2-year follow-up for patients with primary isolated ACL reconstruction with patients undergoing ACL reconstruction and simultaneous meniscal treatment in terms of either resection or repair in the Swedish National Knee Ligament Register (SNKLR).

**Methods**
All ACL reconstruction patients within the SNKLR at 2-year follow-up were reviewed. The KOOS and EQ-5D subscales were assessed in four distinct patient groups: isolated ACL reconstruction, ACL reconstruction + medial meniscus resection, ACL reconstruction + lateral meniscus resection, ACL reconstruction + medial meniscus repair, and ACL reconstruction + lateral meniscus repair. The primary analysis was conducted using linear regression with isolated ACL reconstruction designated as the reference group, and was adjusted for patient age, gender, and time from injury to surgery.

**Results**
The included patients consisted of 10,001 (65.0%) individuals with an isolated ACL injury, 588 (3.8%) with ACL injury plus treated with medial meniscus repair, 2307 (15.0%) with ACL injury plus treated with medial meniscus resection, 323 (2.1%) with ACL injury plus treated with lateral meniscus repair, and 2173 (14.1%) with ACL injury plus treated with lateral meniscus resection. Meniscus resection demonstrated significantly worse results with respect to the KOOS Symptoms subscale for both the medial and lateral meniscus resection groups. Medial meniscus resection also demonstrated worse results for the KOOS quality of life (QoL) subscale, while lateral meniscus resection only approached significance. Outcomes were not different between the isolated ACL reconstruction group and the meniscus repair groups.

**Conclusion**
Meniscus resection in addition to ACL reconstruction resulted in worse clinical outcomes than isolated ACL reconstruction patients; a result not seen within the meniscus repair group. This suggests that, when possible, meniscus repair may provide greater clinical outcomes over resection when treating a reparable meniscal tear that presents along with an ACL tear. Clinicians should consider and implement these findings for the management of future meniscus tear patients within their clinical practice.

**Level of evidence**
Level III.

BACK

**Regeneration of lateral discoid meniscus after arthroscopic partial meniscectomy in an adult patient**

Seung-Beom Han, Chand Pasha Babu, Jae-Hyuk Choi, Dong-Won Suh, Ki-Mo Jang

KSSTA, August 2018, Volume 26, Issue 8, pp 2278–2281

https://doi.org/10.1007/s00167-018-4884-8



Arthroscopic partial resection is indicated for patients who have symptomatic discoid meniscus with overall satisfactory clinical outcomes. Reports regarding regeneration of discoid meniscus after arthroscopic surgery are limited. There are only two reports for children in the literature. To the authors' knowledge, the present study is the first report in the literature to report regeneration of discoid lateral meniscus after arthroscopic partial meniscectomy in an adult patient. The diagnosis was confirmed by both magnetic resonance imaging and arthroscopy. Surgeons should be aware that regeneration of discoid meniscus can occur in adult as well as pediatric patients.

*Level of evidence* V.

BACK

**Successful anterior cruciate ligament reconstruction and meniscal repair in osteogenesis imperfecta**

Jae-Young Park, Tae-Joon Cho, Myung Chul Lee, Hyuk-Soo Han

KSSTA, August 2018, Volume 26, Issue 8, pp 2297–2301

https://doi.org/10.1007/s00167-018-4901-y



A case of anterior cruciate ligament (ACL) reconstruction with meniscal repair in an osteogenesis imperfecta patient is reported. A 24-year-old female with osteogenesis imperfecta type 1a suffered from a valgus extension injury resulting in tear of ACL and medial meniscus. She underwent an arthroscopic-assisted ACL reconstruction and medial meniscus repair. Meniscal tear at the menisco-capsular junction of the posterior horn of medial meniscus was repaired with three absorbable sutures via inside-out technique. ACL reconstruction was then performed with a bone-patellar tendon-bone allograft. The patient was followed up for 1 year with intact ACL grafts and healed medial meniscus. This case report showed that successful ACL reconstruction and meniscal repair is possible in an osteogenesis imperfecta patient.

*Level of evidence* V.

BACK

# Discoid lateral meniscus can be overlooked by magnetic resonance imaging in patients with meniscal tears

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KSSTA, August 2018, Volume 26, Issue 8, pp 2317–2323

https://doi.org/10.1007/s00167-017-4704-6



**Purpose**
MRI evaluation of torn lateral meniscus was compared with arthroscopy. This study calculates the sensitivity, specificity, and accuracy of MRI in determining the presence or absence of discoid lateral meniscus (DLM) for different tear types.

**Methods**
MR imaging of 156 knees with arthroscopically confirmed lateral meniscus tears was analysed. There were 78 knees (70 patients) in non-DLM group and 78 knees (74 patients) in DLM group on arthroscopy as the reference standard. The presence of DLM on MRI was determined by an orthopaedic surgeon and a radiologist, who were blinded to the arthroscopic findings. The presence of discoid meniscus on MRI was determined by coronal and sagittal measurements, considering the tear pattern of lateral meniscus. The tear pattern was categorized into six types based on arthroscopic findings: horizontal, longitudinal, radial, combined radial, degenerative, and complex tear. The sensitivity, specificity, and accuracy of MRI were calculated for each type of lateral meniscus tear. In addition, we analysed the reason for non-detection of discoid meniscus on preoperative MRI.

**Result**
The sensitivity for determining the presence of discoid meniscus was 58% for radial tear, 57% for combined radial tear, and 65% for longitudinal tear, whereas the specificity was 100% for all tear groups. In the presence of radial or longitudinal tear, the accuracy of MRI was significantly lower than having no radial and longitudinal tear ($p < 0.001$). The presence of discoid meniscus was not recognized on MRI because of large radial tear (12 knees), deformed bucket-handle tear (6 knees), and inverted flap tear (3 knees).

**Conclusions**
MRI was not successful in determining the presence or absence of DLM in radial tear, combined radial tear, and longitudinal tear. When there are large radial tear, deformed bucket-handle tear, and inverted flap tear in lateral meniscus, it is recommended to consider the possibility of DLM. This information can help to make accurate diagnosis of DLM, which allows appropriate surgical planning and facilitates patient's information on poor prognosis of DLM.

**Level of evidence**
Level I.

BACK

# Preservation of remnant with poor synovial coverage has no beneficial effect over remnant sacrifice in anterior cruciate ligament reconstruction

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KSSTA, August 2018, Volume 26, Issue 8, pp 2345–2352

https://doi.org/10.1007/s00167-017-4683-7



**Purpose**
The purpose of the study was to evaluate the influence of synovial coverage of the remnant on clinical outcomes and graft healing in anterior cruciate ligament (ACL) reconstruction.

**Methods**
Seventy-five patients who underwent second-look arthroscopy after a single-bundle ACL reconstruction using autologous quadriceps tendon graft were included. The patients were divided into two groups according to whether the remnant was preserved (group P, n = 42) or sacrificed (group S, n = 33). Group P was further classified according to the degree of synovial coverage of the remnant on initial arthroscopic findings: group A (remnant fully covered with synovium, n = 15), group B (synovial coverage >50%, n = 15), and group C (coverage <50%, n = 12). Clinical outcomes including manual laxity tests, KT-2000 side-to-side difference, modified Lysholm score, Tegner activity score, and International Knee Documentation Committee score were evaluated pre-operatively and prior to the second-look arthroscopy. Graft tension, degrees of synovialization, and gross integrity were evaluated on second-look arthroscopic examination.

**Results**
There were no statistical differences in manual laxity tests, KT-2000 side-to-side difference, and clinical scores between groups P and S. In second-look arthroscopic examination, graft tension showed no difference between the two groups, but gross integrity and synovialization were significantly higher in group P (P = 0.032 and P = 0.008, respectively). In subgroup analysis, only group A showed higher grade regarding gross integrity and synovialization in comparison with group S (P = 0.007 and P < 0.001, respectively).

**Conclusions**
Preservation of remnant in ACL reconstruction showed no superiority concerning knee stability and clinical outcomes over remnant sacrificing at post-operative 1-year second-look arthroscopy. Preservation of remnant with good synovial coverage had a positive effect on graft synovialization and maintenance of graft integrity, but this effect was not observed in cases of a remnant with poor synovial coverage. When deciding whether to preserve the remnant or not, the degree of synovial coverage should be considered.

**Level of evidence**
III.

BACK

**Similar views on rehabilitation following hip arthroscopy among physiotherapists and surgeons in Scandinavia: a specialized care survey**

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KSSTA, August 2018, Volume 26, Issue 8, pp 2519–2526

https://doi.org/10.1007/s00167-017-4676-6



**Purpose**
The rising number of hip arthroscopies (HA) is leading to increasing numbers of patients requiring post-surgical rehabilitation; however, evidence regarding post-operative rehabilitation is currently limited. The purpose of the study was to describe and compare current rehabilitation strategies and views among surgeons and physiotherapists in Scandinavia.

**Methods**
Scandinavian surgeons and physiotherapists experienced with HA and post-surgical rehabilitation were asked to complete an online survey. Ninety clinicians (28 surgeons, 62 physiotherapists) responded.

**Results**
Both professions mostly rated physiotherapy as very or extremely important in the rehabilitation process. The majority advocated criteria-based or combined criteria- and time-based progression. Expected rehabilitation timelines were reported with large intra-professional variation but general inter-professional agreement. However, compared with physiotherapists surgeons expected fewer weeks on crutches and faster return to competitive sport. Surgeons more often reported use of evidence-based self-reported outcomes while physiotherapists more often evaluated readiness for return to play.

**Conclusions**
Among surgeons and physiotherapists, physiotherapy is considered very important following HA. Generally, very similar views were held between professions. Surgeons expected reduced time on crutches and to return to competitive sports than physiotherapists. Surgeons also used evidence-based self-reported outcomes to a higher degree than physiotherapists. Being the first study to provide an overview on currently applied rehabilitation strategies following HA, results of this study may guide much needed, future research on the rehabilitation process following HA.

**Level of evidence**
IV.

BACK

**Hip arthroscopy enables classification and treatment of precollapse subchondral insufficiency fracture of the femoral head associated intra-articular pathology**

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KSSTA, August 2018, Volume 26, Issue 8, pp 2527–2535

https://doi.org/10.1007/s00167-017-4722-4



**Purpose**
The purposes of this study were to investigate (1) the clinical, radiographic and arthroscopic presentation of patients with subchondral insufficiency fracture of the femoral head (SIFFH) and (2) the outcomes following arthroscopic treatment with internal fixation using hydroxyapatite poly-lactate acid (HA/PLLA) threaded pins and concomitant arthroscopic treatment of associated findings.

**Methods**
Nine patients (median age 49.0 years, range 43–65, five female and four male patients) with SIFFH who underwent arthroscopic treatment with labral repair, capsular closure and internal fixation of SIFFH using HA/PLLA pins were retrospectively reviewed. Inclusion criteria were adult patients with precollapse SIFFH with minimum 1-year follow-up (median follow-up 30.0 months, range 12–56).

**Results**
Acetabular labral tears were observed in all patients. The median BMI was 24.3 kg/m$^2$ (range 20.1–31.8). Clinical presentations and radiographic measurements demonstrated mixed type FAI in six patients, borderline developmental dysplasia in two patients and pincer type FAI in one patient. The median MHHS significantly improved from preoperatively (67.1, range 36.3–78.0) to post-operatively (96.8, range 82.5–100; $p = 0.001$). The median NAHS significantly improved from preoperatively (34.0, range 17–63) to post-operatively (78.0 range 61–80; $p = 0.001$).

**Conclusion**
SIFFH is associated with bony deformities and labral tears. Precollapse SIFFH can be treated with bioabsorbable pin stabilization of unstable lesions and treatment of associated intra-capsular pathology in those with stable lesions as determined by a new arthroscopic classification system with promising early outcomes.

**Level of Evidence**
IV.

BACK

# Fascia iliaca blockade with the addition of liposomal bupivacaine vs. plain bupivacaine for perioperative pain management following hip arthroscopy

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KSSTA, August 2018, Volume 26, Issue 8, pp 2536–2541

https://doi.org/10.1007/s00167-018-4874-x



**Purpose**
A newer formulation of bupivacaine, encapsulated within carrier molecules, has garnered attention for its role in providing extended post-operative analgesia. The purpose was to evaluate the addition of liposomal bupivacaine to fascia iliaca blockade during hip arthroscopy.

**Methods**
Retrospective cohort study of patients undergoing hip arthroscopy with a pre-operative fascia iliaca blockade with either liposomal bupivacaine (Group 1; 266mg + 20 cc 0.5% plain bupivacaine) or bupivacaine (Group 2; 40 cc 0.25% plain bupivacaine). All patients received standardized pre-operative oral pain medications. The primary outcome was the defense veteran pain rating scale (DVPRS). Secondary outcomes included duration of hospital admission, PACU opioid use, PACU pain scores, and duration of nerve blockade.

**Results**
Thirty-eight males and 30 females, mean age of 33 years (range 14–56). There was no difference in pre-operative DVPRS between the groups (n.s.). There was no difference in post-operative DVPRS pain scores at POD0 (3.7 vs. 3.9, n.s.), POD1 (4.2 vs. 3.8, n.s.), POD2 (4.2 vs. 3.7, n.s.), POD3 (3.9 vs. 3.7, n.s.) or POD14 (2.2 vs. 2.4, n.s.). Group 1 trended towards longer mean total hospital admission time (872 vs. 822 min, n.s.), and greater mean morphine equivalents administered in the PACU (33 vs. 29 mg, n.s.). 68% of patients in group 1 reported continued anterior thigh numbness at POD3, compared to 34% in group 2 ($p = 0.008$).

**Conclusions**
Despite the advertised benefits of prolonged post-operative analgesia using liposomal bupivacaine, there were no significant differences in post-operative pain scores or PACU opioid consumption. Our results support that acceptable pain scores are successfully achieved at all time periods with the use of multimodal analgesia including fascia iliaca blockade despite the type of pain medication administered.

**Level of evidence**
III.

BACK

American Journal of Sports Medicine (AJSM), Volume 46, Issue 7

# Return-to-Play and Performance Outcomes of Professional Athletes in North America After Hip Arthroscopy From 1999 to 2016

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First Published May 16, 2018; pp. 1959–1969

http://journals.sagepub.com/doi/full/10.1177/0363546518773080



**Background:**
The effect of hip arthroscopy on athletic performance compared with preinjury levels for professional athletes in different sports remains unknown. In addition, while return rates have been reported for professional baseball, football, and hockey players, return rates have not been reported for professional basketball players.

**Hypothesis:**
Professional athletes in 4 major North American sports would be able to return to their sport and preoperative level of performance at a high rate after arthroscopic hip surgery.

**Study Design:**
Descriptive epidemiology study.

**Methods:**
Major League Baseball (MLB), National Basketball Association (NBA), National Football League (NFL), and National Hockey League (NHL) athletes who underwent hip arthroscopy were identified through a previously reported protocol based on public sources. Successful return to play (RTP) was defined as returning for at least 1 professional regular season game after surgery. Performance scores were calculated by use of previously established scoring systems. Each player served as his own control, with the season prior to surgery defined as baseline. To make comparisons across sports, the authors adjusted for expected season and career length differences between sports and calculated percentage changes in performance.

**Results:**
The authors identified 227 procedures performed on 180 professional athletes between 1999 and 2016. Successful RTP was achieved in 84.6% (192/227) of the procedures. Compared with all other athletes, NBA athletes returned at a similar rate (85.7%, $P \geq .999$). NFL offensive linemen returned at a significantly lower rate than all other athletes (61.1%, $P = .010$). NHL athletes returned at a significantly higher rate than all other athletes (91.8%, $P = .048$) and demonstrated significantly decreased performance during postoperative season 1 compared with baseline (–35.1%, $P = .002$). Lead leg surgery for MLB athletes (batting stance for hitters, pitching stance for pitchers) resulted in a 12.7% reduction in hitter performance score ($P = .041$), a 1.3% reduction in pitcher fastball velocity ($P = .004$), and a 60.7% reduction in pitch count ($P = .007$) one season after surgery compared with baseline. Players in nearly every sport demonstrated significant reductions in game participation after surgery.
**Conclusion:**
This study supports the hypothesis that hip arthroscopy in professional athletes is associated with excellent rates of return at the professional level. However, postoperative performance outcomes varied based on sport and position.

BACK

Journal of Bone and Joint Surgery (JBJS), Volume 100, Issue 13 & 14

# Gait Mechanics After ACL Reconstruction Differ According to Medial Meniscal Treatment

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JBJS: July 18, 2018 - Volume 100 - Issue 14 - p 1209-1216

https://journals.lww.com/jbjsjournal/Abstract/2018/07180/Gait_Mechanics_After_ACL_Reconstruction_Differ.6.aspx



**Background:** Knee osteoarthritis risk is high after anterior cruciate ligament reconstruction (ACLR) and arthroscopic meniscal surgery, and higher among individuals who undergo both. Although osteoarthritis development is multifactorial, altered walking mechanics may influence osteoarthritis progression. The purpose of this study was to compare gait mechanics after ACLR among participants who had undergone no medial meniscal surgery, partial medial meniscectomy, or medial meniscal repair.

**Methods:** This was a secondary analysis of data collected prospectively as part of a clinical trial. Sixty-one athletes (mean age of 21.4 ± 8.2 years) who had undergone primary ACLR participated in the study when they achieved impairment resolution (5.3 ± 1.7 months postoperatively), including minimal to no effusion, full knee range of motion, and ≥80% quadriceps-strength symmetry. Participants were classified by concomitant medial meniscal treatment: no involvement or nonsurgical management of a small, stable tear; partial meniscectomy; or meniscal repair. Participants underwent comprehensive walking analyses. Joint contact forces were estimated using a previously validated, electromyography-driven musculoskeletal model. Variables were analyzed using a mixed-model analysis of variance with group and limb comparisons ($\alpha = 0.05$); group comparisons of interlimb differences in measurements (surgical minus contralateral limb) were performed to determine significant interactions.

**Results:** The participants in the partial meniscectomy group walked with a higher peak knee adduction moment (pKAM) in the surgical versus the contralateral limb as compared with those in the meniscal repair group and those with no medial meniscal surgery (group difference for partial versus repair: 0.10 N-m/kg-m, $p = 0.020$; and for partial versus none: 0.06 N-m/kg-m, $p = 0.037$). Participants in the repair group walked with a smaller percentage of medial to total tibiofemoral loading in the surgical limb compared with both of the other groups (group difference for repair versus partial: −12%, $p = 0.001$; and for repair versus none: −7%, $p = 0.011$). The participants in the repair group loaded the medial compartment of the surgical versus the contralateral limb 0.5 times body weight less than did the participants in the partial meniscectomy group.
**Conclusions:** Participants in the partial meniscectomy group walked with higher pKAM and shifted loading toward the medial compartment of the surgical limb, while participants in the repair group did the opposite, walking with lower pKAM and unloading the surgical limb relative to the contralateral limb. These findings may partially explain the conflicting evidence regarding pKAM after ACLR and the elevated risk for osteoarthritis (whether from overloading or underloading) after ACLR with concomitant medial meniscectomy or repair.

**Level of Evidence:** Therapeutic Level III. See Instructions for Authors for a complete description of levels of evidence.

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