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## Upper extremity

Arthroscopy, Volume 36, Issue 6

**The Role of Arthroscopy in Painful Shoulder Arthroplasty: Is Revision Always Necessary?**

Theodore Guild, Gabrielle Kuhn, Marie Rivers, Rebecca Cheski, Scott Trenhaile, Rolando Izquierdo

https://doi.org/10.1016/j.arthro.2020.01.045

**Purpose**
To determine whether arthroscopy is an effective means to diagnose and treat postoperative pain in anatomic total shoulder arthroplasty (TSA) and reverse TSA patients.

**Methods**
A 2-year retrospective chart review of patients with a painful shoulder arthroplasty was performed. Patients included in the study had a painful shoulder after previous shoulder arthroplasty without gross signs of infection, severely elevated laboratory markers, implant loosening, or glenoid arthrosis after hemiarthroplasty. Visual analog scale scores, physical examination findings, laboratory studies, culture results, pathology reports, operative records, and postoperative treatment data were collected.

**Results**
The study cohort included 6 male and 7 female patients. Between 2016 and 2018, 7 TSA and 6 reverse TSA patients underwent arthroscopic debridement of adhesions and synovitis with tissue biopsy for cultures and fresh-frozen sections. We arthroscopically treated adhesive capsulitis, subacromial impingement, and acromioclavicular joint arthritis in 3 patients. Three patients required extensive debridement for profound synovitis. All 6 patients had negative findings of cultures and frozen sections, and none required revision arthroplasty. Their average follow-up period was 18.6 months (range, 9-32 months), with improvement in the mean visual analog scale score from 8.2 of 10 (range, 6-10) to 2.5 of 10 (range, 2-8). Two patients had arthroscopic cultures showing Cutibacterium acnes infection. Both required revision with an antibiotic spacer. Findings of cultures and fresh-frozen sections at revision were consistent with arthroscopic findings. Arthroscopic evaluation in 5 additional patients identified mechanical implant failure or a rotator cuff tear.

**Conclusions**
Arthroscopy is a viable option to evaluate and treat painful shoulder arthroplasty. We were able to successfully treat 46% of patients (6 of 13) with arthroscopic procedures, preventing the need for revision arthroplasty. Arthroscopic frozen section and culture results had a 100% correlation with open frozen section and culture results in patients who had cultures obtained.

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

BACK

**Use of the Contralateral Glenoid for Calculation of Glenoid Bone Loss: A Cadaveric Anthropometric Study**

Stephen A. Parada, Jordan W. Paynter, Daniel W. Paré, Jessica J. Amero, Judith G. Kyrkos, Gehrig A. Broxton, Brice G. Morpeth, James W. Going, Robert J. Shelley, Matthew T. Provencher

https://doi.org/10.1016/j.arthro.2020.01.049

**Purpose**
The purpose of this study was to determine if there are significant side-to-side anthropometric differences between paired glenoids.

**Methods**
Forty-six matched-pair cadaver glenoids were harvested, and their glenoid heights (GHs) and glenoid widths (GWs) were measured with digital calipers. The glenoid surface area was calculated using the standard assumption that the inferior two-thirds of the glenoid is a perfect circle.

**Results**
There was a statistically significant difference between matched-pair GHs of 0.96 ± 3.07 mm ( P = .020) and GWs of 0.46 ± 1.64 mm ( P = .033). There was a significant difference of glenoid cavity area of 20.30 ± 81.53 mm2 ( P = .044), or a difference of ∼3%. A total of 4 of 46 pairs of glenoids (8.6%) showed a difference in width >3 mm.

**Conclusions**
This study demonstrates the fallacy of use of the contralateral glenoid in measuring glenoid bone loss. Although many paired samples exhibited similar side-to-side glenoid measurements, the number of cadaveric pairs that showed differences of >3 mm was substantial. Caution should be taken when using calculation methods that include this assumption for surgical decision making, as surface area, GW, and GH were all shown to have statistically significant side-to-side differences in their measurements.

**Clinical relevance**
Many methods exist for measuring glenoid bone loss after anterior shoulder dislocation, but some of the current methods may be inaccurate and lead to unreliable estimations.

BACK

# Biomechanical Evaluation of Knotless and Knotted All-Suture Anchor Repair Constructs in 4 Bankart Repair Configurations

Lucca Lacheta, Alex Brady, Samuel I. Rosenberg, Grant J. Dornan, Travis J. Dekker, Nicole Anderson, Burak Altintas, Joseph J. Krob, Peter J. Millett

https://doi.org/10.1016/j.arthro.2020.01.046

**Purpose**
To evaluate the biomechanical performance of Bankart repair using 1.8-mm knotless all-suture anchors in comparison to 1.8-mm knotted all-suture anchors with both simple and horizontal mattress stitch configurations.

**Methods**
Thirty fresh-frozen human cadaveric shoulders were dissected to the capsule, leaving the glenoid and humeral capsular insertions intact. A standardized anteroinferior labral tear was created and repaired using 3 anchors. A 2 × 2 factorial design was implemented, with 6 matched pairs randomized between knotless and knotted anchor repairs and 6 matched pairs randomized into simple and horizontal mattress stitch configurations. In addition, 6 unpaired shoulders were used to evaluate the native capsulolabral state. First failure load, ultimate load, and stiffness were assessed. Linear mixed-effects modeling was used to compare endpoints. Digital image correlation was used to evaluate capsular strain throughout testing. Failure modes were reported qualitatively.

**Results**
The knotless all-suture anchor repair showed similar biomechanical strength to the knotted all-suture anchors for first failure load (coefficient, 142 N; 95% confidence interval [CI], –30 to 314 N; P = .12), ultimate load (coefficient, 11.1 N; 95% CI, –104.9 to 127.2 N; P = .847), and stiffness (coefficient, 3.4 N/mm 2; 95% CI, –14.1 to 20.9 N/mm 2; P = .697) when stitch configuration was held constant. No statistically significant differences were found on comparison of simple and mattress stitch configurations for first failure load (coefficient, –31 N; 95% CI, –205 to 143 N; P = .720), ultimate load (coefficient, 112 N; 95% CI, –321 to 97 N; P = .291), and stiffness (coefficient, –9.6 N/mm 2; 95% CI, –27.3 to 8.1 N/mm 2; P = .284) when anchor type was held constant. Specimens with knotless anchors and simple stitch techniques resulted in lower stiffness compared with the native state ( P = .030). The knotless-mattress configuration resulted in significantly lower strain than the knotted-mattress ( P = .037) and knotless-simple ( P = .019) configurations and was the only configuration that did not result in a significant increase in strain compared with the intact specimens ( P = .216). Fewer instances of suture slippage (loss of loop security) were observed with knotless anchors versus knotted anchors (11% vs 30%), and less soft-tissue failure was observed with the mattress stitch configuration versus the simple stitch configuration (36% vs 47%).

**Conclusions**
Knotless and knotted all-suture anchor repairs with simple and mattress stitch configurations showed similar values of ultimate load, first failure load, and stiffness. However, the horizontal mattress stitch configuration proved to decrease capsular strain more similarly to the native state compared with the simple stitch configuration. Ultimate load and first failure load for all repairs were similar to those of the native state.

BACK

**Trans-coracoacromial Ligament Glenohumeral Injection With Arthroscopic Confirmation**

Xiexiang Shao, Jibin Chen, Lewis L. Shi, Peng Wang, Jason L. Koh, Xiaodong Chen, Jianhua Wang

https://doi.org/10.1016/j.arthro.2020.01.047

**Purpose**
To arthroscopically evaluate the trans-coracoacromial ligament glenohumeral (GH) injection technique by understanding intra-articular needle-tip placement and potential misplacement and complications.

**Methods**
The technique relies on the palpation of 3 bony landmarks: anterolateral corner of the acromion, superolateral border of the coracoid tip, and curved depression of the distal clavicle. The skin entry site lies on the line connecting the curved depression of the distal clavicle and superolateral border of the coracoid tip, two-thirds of the way from the former and one-third of the way from the latter. The direction of the needle is perpendicular to the triangle formed by the 3 bony landmarks. The technique is used to insufflate the GH joint at the start of shoulder arthroscopy procedures with patients in the beach-chair position. Saline solution is injected, and the position of the needle tip in the GH joint is evaluated arthroscopically. An injection is considered successful if saline solution can be injected and the needle tip can be visualized intra-articularly.

**Results**
This study enrolled 195 patients undergoing shoulder arthroscopy. Successful needle placement in the GH joint occurred in 179 patients (91.8%); placement occurred through the rotator interval in 122 of these, adjacent or through the long head of the biceps tendon in 41, through the upper subscapularis or anterior supraspinatus in 13, and through the anterior labrum in 3. Regarding the 16 failures (8.2%), the needle position did not allow saline solution to be injected because of high resistance in 3 patients whereas the needle tip was not visualized in 13. The needle tip was presumed to rest within the subscapularis muscle or tendon or the labrum in 10 failed injections.

**Conclusions**
The trans-coracoacromial ligament injection technique showed a high success rate (91.8%) in anesthetized patients about to undergo arthroscopy, whereas the failed injections mainly occurred because the needle was inserted into the subscapularis or labrum. This technique can be used for awake patients with different diagnoses in multiple settings.

**Level of Evidence**
Level IV, diagnostic study

BACK

**Clinical Outcomes Following Biologically Enhanced Patch Augmentation Repair as a Salvage Procedure for Revision Massive Rotator Cuff Tears**

Lukas N. Muench, Cameron Kia, Aulon Jerliu, Ariel A. Williams, Daniel P. Berthold, Mark P. Cote, Mary Beth McCarthy, Robert A. Arciero, Augustus D. Mazzocca

https://doi.org/10.1016/j.arthro.2020.02.006

**Purpose**
To evaluate the clinical outcomes of patients who underwent biologically enhanced patch augmentation repair for the treatment of revision massive rotator cuff tears.

**Methods**
Twenty-two patients who underwent arthroscopic and mini-open rotator cuff repair using a patch augmented with platelet-rich plasma and concentrated bone marrow aspirate (cBMA) for revision massive (≥2 tendons) rotator cuff tears from 2009 to 2014, with a minimum 1-year follow-up, were included in the study. In this procedure the medial side of the graft is secured to the rotator cuff tendon remaining medially. American Shoulder and Elbow Surgeons (ASES), Simple Shoulder Test, and postoperative Single Assessment Numerical Evaluation scores were evaluated. To determine the clinical relevance of ASES scores, the minimal clinically important difference, substantial clinical benefit (SCB), and the patient-acceptable symptomatic state (PASS) thresholds were used. Clinical success or failure was defined based on whether the patient reached the SCB threshold. In the laboratory, cellular counting along with the concentration of connective tissue progenitor cells were performed on patch samples from the day of surgery. Scaffolds were processed histologically at days 0, 7,14, and 21 of culture.

**Results**
Patients had significant improvement in the Simple Shoulder Test (2.6 ± 3.0 pre vs 5.2 ± 4.2 post, P = .01), whereas improvement in pain scores was found to be nonsignificant (5.6 ± 2.5 pre vs 4.2 ± 3.4 post, P = .11) at final follow-up. Mean ASES improved by Δ14.6 ± 33.4 points; however, this did not reach statistical significance (40.2 ± 21.6 pre vs 53.9 ± 31.4 post, P = .10). With regards to ASES score, 45% of patients achieved the minimal clinically important difference, 41% the SCB, and 32% reached or exceeded the PASS criteria. At 21 days, there was a significantly greater cell count in scaffolds from patients who had clinical success than those who were failures ( P = .02).

**Conclusions**
Only 41% of patients undergoing biologically enhanced patch augmentation repair reached substantial clinical benefit, whereas 32% reached or exceeded the PASS criteria.

**Level of Evidence**
Case Series: Level IV.

BACK

**Incidence of Axillary Nerve Injury After Arthroscopic Shoulder Stabilization**

Hiroshige Hamada, Hiroyuki Sugaya, Norimasa Takahashi, Keisuke Matsuki, Morihito Tokai, Yusuke Ueda, Shota Hoshika, Kazuki Kuniyoshi

https://doi.org/10.1016/j.arthro.2020.02.016

**Purpose**
To investigate the incidence of axillary nerve palsy after arthroscopic shoulder stabilization and to measure the distance between the nerve and capsule in shoulders with a capsular lesion.

**Methods**
This retrospective study included 2,027 shoulders (1,909 patients; 1,433 male and 476 female patients; mean age, 32 years [age range, 13-81 years]) subjected to arthroscopic soft-tissue stabilization for recurrent shoulder instability from 2005 to 2017. The exclusion criteria were bone grafting or transfer and preoperative axillary nerve symptoms. We retrospectively reviewed patient records and investigated the incidence and clinical features of axillary nerve palsy. We measured the closest distance between the axillary nerve and capsule on preoperative magnetic resonance images.

**Results**
Postoperative axillary nerve palsy occurred in 4 shoulders (0.2% of all arthroscopic stabilizations). Capsular repair was performed in 2 shoulders (1.2% of 160 capsular repairs); humeral avulsion of the glenohumeral ligament (HAGL) repair, 1 shoulder (2% of 47 HAGL repairs); and isolated Bankart repair, 1 shoulder (0.05% of 1,941 Bankart repairs). The closest distance between the nerve and capsule was 3.4 ± 3.2 mm in shoulders with capsular or HAGL lesions and less than 1 mm in the 3 shoulders with palsy. The common symptoms in axillary nerve palsy cases were shoulder discomfort, delayed recovery of range of motion, and deltoid weakness and atrophy. A definitive diagnosis was made with electromyography in all cases. Nerve injury by a suture was confirmed during revision surgery in 3 shoulders subjected to capsular or HAGL repair during the initial operation. The palsy was transient and fully recovered in 1 shoulder with isolated Bankart repair.

**Conclusions**
The incidence of axillary nerve palsy after arthroscopic soft-tissue shoulder stabilization was low but higher in shoulders subjected to capsular or HAGL repair. We should always consider the possibility of axillary nerve palsy in shoulders that require capsular or HAGL repair.

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

BACK

**Does the Use of Knotted Versus Knotless Transosseous Equivalent Rotator Cuff Repair Technique Influence the Incidence of Retears? A Systematic Review**

Kyle N. Kunze, Luciano A. Rossi, Alexander Beletsky, Jorge Chahla

https://doi.org/10.1016/j.arthro.2020.01.052

**Purpose**
To compare knotted and knotless transosseous equivalent (TOE) rotator cuff repair (RCR) techniques and evaluate their imaging-diagnosed retear rates.

**Methods**
The Cochrane Database of Systematic Reviews, the Cochrane Central Register of Controlled Trials, PubMed (2008 to 2019), EMBASE (2008 to 2019), and Medline (2008 to 2019) were used to perform a systematic review and meta-analysis using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) criteria, with the following search terms: rotator cuff repair AND (knotless OR knotted) AND transosseous; rotator cuff repair AND (knotless OR knotted or transosseous); rotator cuff repair AND ("suture bridge" OR "suture bridging"). Data pertaining to demographic characteristics, surgical techniques, retears, and patient-reported outcomes were extracted from each study. Rates and locations of retear were reported using ranges, and risks of bias and heterogeneity for each study were assessed.

**Results**
A total of 7 studies (552 shoulders) were included. Patients had a weighted mean (± standard deviation) age of 60.5 ± 2.4 years with 27.8 ± 7.9-month follow-up. The incidence of retears ranged from 5.1% to 33.3% in patients treated with knotless TOE RCR, and the incidence for patients treated with knotted TOE RCR ranged from 7.5% to 25%. The incidence of type I retears ranged from 42.9% to 100% for patients treated with knotless TOE RCR and 20% to 100% for patients treated with knotted TOE RCR. The incidence of type II retears ranged from 0% to 57.1% in patients treated with knotless TOE RCR and 0% to 100% in patients treated with knotted TOE RCR.

**Conclusions**
The incidence and location of retears after knotless and knotted TOE RCR appear to be similar.

BACK

# Capitellar Osteochondritis Dissecans Lesions of the Elbow: A Systematic Review of Osteochondral Graft Reconstruction Options

Anthony L. Logli, Devin P. Leland, Christopher D. Bernard, Joaquin Sanchez-Sotelo, Mark E. Morrey, Shawn W. O'Driscoll, Aaron J. Krych, Zhen Wang, Christopher L. Camp

https://doi.org/10.1016/j.arthro.2020.01.037

**Purpose**
To systematically evaluate the outcomes and complications of osteochondral autograft transfer (OAT) and osteochondral allograft transplantation (OCA) for the surgical treatment of capitellar osteochondritis dissecans (OCD).

**Methods**
A literature search was conducted across 3 databases (PubMed, Cochrane, and CINAHL [Cumulative Index to Nursing and Allied Health Literature]) from database inception through December 2019 in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines. Individual study quality was assessed using the Methodological Index for Non-randomized Studies scale. Studies were published between 2005 and 2019.

**Results**
Eighteen studies consisting of 446 elbow OCD lesions treated with OAT surgery were included. There was a single OCA study eligible for inclusion. Patient ages ranged from 10 to 45 years. Of the OAT studies, 4 used autologous costal grafts whereas the remainder used autografts from the knee. Outcome measures were heterogeneously reported. A significant improvement in Timmerman-Andrews scores from preoperatively to postoperatively was reported in 9 of 10 studies. Return-to-play rates to the preinjury level of competitive play ranged from 62% to 100% across 16 studies. Significant improvement in motion, most often extension, was noted in most studies. Reported complication, reoperation, and failure rates ranged from 0% to 11%, 0% to 26%, and 0% to 20%, respectively. When used, knee autografts resulted in low donor-site morbidity (Lysholm scores, 70-100).

**Conclusions**
OAT surgery for large, unstable OCD lesions of the capitellum reliably produced good outcomes, few complications, and a high rate of return to competitive play. Complications are relatively uncommon, and donor-site morbidity is low. Less is known about the performance of OCA given the paucity of available literature.

**Level of Evidence**
Level IV, systematic review of Level II to IV studies

BACK

Journal of Shoulder and Elbow Surgery (JSES), Volume 29, issue 6

# Arthroscopic débridement has similar 30-day complications compared with open arthrotomy for the treatment of native shoulder septic arthritis: a population-based study.

Khazi, Z.M., Cates, W.T., Shamrock, A. G., et al.

DOI: https://doi.org/10.1016/j.jse.2019.11.007

**Hypothesis**
This study aimed to determine whether there are significant differences in 30-day perioperative complications between arthroscopic and open débridement (irrigation and débridement [I&D]) for septic arthritis (SA) of the shoulder using the American College of Surgeons National Surgical Quality Improvement Program database.

**Methods**
Patients undergoing arthroscopic or open I&D of the native shoulder from 2006-2016 were identified in the National Surgical Quality Improvement Program database. Those with a diagnosis of SA were included in the study. Patients with a concurrent diagnosis of osteomyelitis around shoulder (n = 25) or polyarthritis (n = 2) were excluded from the study. Patient demographics, comorbidities, and complications were compared between the groups. Poisson regression, which controlled for age and American Society of Anesthesiologists (ASA) score, was used to calculate the relative risks with 95% confidence intervals for minor adverse events, serious adverse events, total adverse events, and unplanned reoperations between the 2 treatment groups, with significance set at $P < .0125$ after Bonferroni correction.

**Results**
Overall, 147 and 57 patients underwent arthroscopic and open I&D, respectively, for SA of the shoulder. Patients in the open I&D group were more likely to be smokers ( $P = .0213$), whereas patients in the arthroscopy group had higher ASA scores ( $P = .0008$). After controlling for age and ASA score, we found no significant differences in the risk of minor adverse events ( $P = .0995$), serious adverse events ( $P = .2241$), total adverse events ( $P = .1871$), or unplanned reoperations ( $P = .3855$).

**Conclusion**
Arthroscopic débridement appears to be a safe alternative to open débridement for SA of the native shoulder. The incidence and risk of 30-day perioperative complications are similar after arthroscopic and open I&D for SA of the shoulder.

**Level of evidence**
Level III, Retrospective Cohort Design, Large Database Analysis, Treatment Study

BACK

**Surgical treatment for long head of the biceps tendinopathy: a network meta-analysis.**

Anil, U., Hurley, E.T., Kingery M.T., et al.

DOI: https://doi.org/10.1016/j.jse.2019.10.021

**Background**
Surgical options for pathology affecting the long head of the biceps tendon (LHBT) include tenotomy and tenodesis, both of which can be performed with a variety of fixation methods. This study aimed to compare surgical treatment options for LHBT lesions using a network meta-analysis of published clinical studies.

**Methods**
A systematic review of the literature was conducted in accordance with Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines. Clinical studies comparing surgical treatment options for LHBT lesions were included. Postoperative outcomes were compared between surgical treatment options using a frequentist approach to network meta-analysis.

**Results**
There were 22 studies comparing surgical treatment options for LHBT pathology including arthroscopic tenotomy, arthroscopic suprapectoral tenodesis, arthroscopic intracuff tenodesis, and open subpectoral tenodesis, consisting of 1804 patients. Compared with arthroscopic tenotomy, open subpectoral tenodesis resulted in a significantly greater American Shoulder and Elbow Surgeons score (mean difference, 4.58; P = .014). On the basis of the P-score, all 3 tenodesis techniques ranked above tenotomy with respect to the Constant score. Compared with arthroscopic tenotomy, the incidence of Popeye deformity was reduced with arthroscopic suprapectoral tenodesis (odds ratio [OR], 0.23; P < .001) and open subpectoral tenodesis (OR, 0.25; P = .022). The incidence of bicipital groove pain was increased after arthroscopic intracuff tenodesis (OR, 2.89; P = .021) compared with arthroscopic tenotomy.

**Conclusion**
Lesions of the LHBT treated with open or arthroscopic tenodesis resulted in comparatively superior functional outcomes and a lower incidence of Popeye deformity, whereas arthroscopic intracuff tenodesis resulted in a higher incidence of bicipital groove pain.

**Level of evidence**
Level III, Meta-analysis

BACK

American Journal of Sports Medicine

# Predictive Modeling to Determine Functional Outcomes After Arthroscopic Rotator Cuff Repair

Salvatore Frangiamore, MD, MS, Grant J. Dornan, MS, Marilee P. Horan, MPH, Sandeep Mannava, MD, PhD, Erik M. Fritz, MD, Zaamin B. Hussain, MA, MB BChir, Gilbert Moatshe, MD,

https://doi.org/10.1177/0363546520914632

**Background**
Arthroscopic rotator cuff repair (ARCR) is one of the most commonly performed orthopaedic surgical procedures; however, patient-reported outcomes have varied greatly in the literature.

**Purpose**
To identify preoperative factors that affect outcomes and to develop prognostic tools for predicting functional outcomes in future ARCR cases.

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

**Methods**
Patients were included who underwent ARCR for repairable full-thickness rotator cuff tears with at least 2 years of follow-up. Twelve predictors were entered as candidate predictors in each model: age, sex, workers' compensation (WC) status, previous cuff repair, tear size, tear shape, multiple-tendon involvement, tendon stump length, Goutallier classification, critical shoulder angle, length of follow-up, and baseline subjective outcomes score. Postoperative American Shoulder and Elbow Surgeons (ASES), 12-Item Short Form Health Survey Physical Component Summary (SF-12 PCS), QuickDASH (short version of Disabilities of the Arm, Shoulder and Hand), and patient satisfaction were each modeled through proportional odds ordinal logistic regression. Model results were presented with marginal covariate effect plots and predictive nomograms.

**Results**
Overall, 552 shoulders fit inclusion criteria. The mean age at surgery was 60.2 years (range, 23-81 years). Twenty-five (4.5%) shoulders underwent revision cuff repair or reverse arthroplasty at a mean 1.9 years (range, 0.1-7.9 years) postoperatively. Overall, 509 shoulders were eligible for follow-up, and minimum 2-year postoperative patient-reported outcomes were obtained for 449 (88.2%) at a mean 4.8 years (range, 2-11 years). The ASES score demonstrated significant improvement from pre- to postoperative median (interquartile range): 58 (44.9-71.6) to 98.3 (89.9-100; $P < .001$). Women demonstrated significantly higher 2-year reoperation rates than men (5.8% vs 1.6%; odds ratio, 2.8 [95% CI, 0.73-9.6]; $P = .023$). Independently significant predictors for lower postoperative ASES scores included previous ARCR ($P < .001$), female sex ($P < .001$), and a WC claim ($P < .001$). Significant predictors for worse QuickDASH scores included WC claim ($P < .001$), female sex ($P < .001$), previous ARCR ($P = .007$), and ≥7 years of follow-up time. Significant predictors for lower SF-12 PCS scores included WC claim ($P < .001$), female sex ($P = .001$), and lower baseline SF-12 PCS. Last, significant independent predictors of patient satisfaction included previous ARCR ($P = .004$), WC claim ($P = .011$), female sex ($P = .041$), and age ($P = .041$).

BACK

**Conclusion**

Excellent clinical outcomes and low failure rates were obtained after ARCR by using careful patient selection and modern surgical techniques for ARCR. Female sex, WC claim, and previous ARCR were significant predictors of poorer outcomes in at least 3 patient-reported outcome models. Prognostic nomograms were developed to aid in future patient selection, clinical decision making, and patient education.

BACK

# Long-term Results of Arthroscopic Rotator Cuff Repair: A Follow-up Study Comparing Single-Row Versus Double-Row Fixation Techniques

Fabian Plachel, MD, PhD*, Paul Siegert, MD, Katja Rüttershoff, Kathi Thiele, MD, Doruk Akgün, MD, Philipp Moroder, MD, Markus Scheibel, MD, Christian Gerhardt, MD

https://doi.org/10.1177/0363546520919120

**Background:**
Arthroscopic rotator cuff repair (RCR) with suture anchor–based fixation techniques has replaced former open and mini-open approaches. Nevertheless, long-term studies are scarce, and lack of knowledge exists about whether single-row (SR) or double-row (DR) methods are superior in clinical and anatomic results.

**Purpose:**
To analyze long-term results after arthroscopic RCR in patients with symptomatic rotator cuff tears and to compare functional and radiographic outcomes between SR and DR repair techniques at least 10 years after surgery.

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

**Methods**
Between 2005 and 2006, 40 patients with a symptomatic full-thickness rotator cuff tear (supraspinatus tendon tear with or without a tear of the infraspinatus tendon) underwent arthroscopic RCR with either an SR repair with a modified Mason-Allen suture–grasping technique (n = 20) or a DR repair with a suture bridge fixation technique (n = 20). All patients were enrolled in a long-term clinical evaluation, with the Constant score (CS) as the primary outcome measure. Furthermore, an ultrasound examination was performed to assess tendon integrity and conventional radiographs to evaluate secondary glenohumeral osteoarthritis.

**Results**
A total of 27 patients, of whom 16 were treated with an SR repair and 11 with a DR repair, were followed up after a mean ± SD period of 12 ± 1 years (range, 11-14 years). Five patients underwent revision surgery on the affected shoulder during follow-up period, which led to 22 patients being included. The overall CS remained stable at final follow-up when compared with short-term follow-up (81 ± 8 vs 83 ± 19 points; P = .600). An increasing number of full-thickness retears were found: 6 of 22 (27%) at 2 years and 9 of 20 (45%) at 12 years after surgery. While repair failure negatively affected clinical results as shown by the CS (P < .05), no significant difference was found between the fixation techniques (P = .456). In general, progressive osteoarthritic changes were observed, with tendon integrity as a key determinant.

**Conclusion**
Arthroscopic RCR with either an SR or a DR fixation technique provided good clinical long-term results. Repair failure was high, with negative effects on clinical results and the progression of secondary glenohumeral osteoarthritis. While DR repair slightly enhanced tendon integrity at long-term follow-up, no clinical superiority to SR repair was found.

BACK

**Does the Dog-Ear or Bird-Beak Deformity Remodel After Rotator Cuff Repair?**

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https://doi.org/10.1177/0363546520915199

**Background:**
Dog-ear and bird-beak deformities are common after transosseous-equivalent repair (suture bridge technique). The natural course of deformities after rotator cuff (RC) repair using the suture bridge technique is unclear. The remodeling potential of these deformities has not been investigated.

**Purpose:**
To evaluate remodeling and retear rates associated with deformities after RC repair.

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

**Methods:**
Between November 2011 and February 2012, we studied 99 consecutive shoulders. All patients underwent arthroscopic RC repair via the suture bridge technique with or without additional sutures. Two groups were formed: no deformity (n= 46) and deformity (n = 53). Deformity was defined as marginal detachment and protrusion of the RC after repair, involving inappropriate compression of the suture limbs from the anchors. Tendon height was measured from the highest point of the most protruding portion of the cuff to the cortex on semi-coronal magnetic resonance imaging (MRI) scan. Change in tendon height was evaluated on MRI scan at 1 week and 6 months postoperatively. Clinical assessment at every patient visit included the American Shoulder and Elbow Surgeons (ASES) score, Constant shoulder score, and visual analog scale for pain (pVAS) score.

**Results:**
No significant differences were found in age, sex, symptom duration, tear size, and preoperative ASES, Constant, and pVAS scores ($P > .05$) between the 2 groups. The initial tendon height was 7.4 ± 1.5 mm in the no-deformity group and 9.3 ± 2.0 mm in the deformity group. Follow-up height was 6.3 ± 2.1 mm in the no-deformity group and 6.4 ± 1.6 mm in the deformity group. Mean postoperative tendon heights were 90.1% ± 23.8% of the initial height in the no-deformity group and 73.2% ± 15.1% in the deformity group. Clinical scores (ASES, Constant, and pVAS) were not significantly different between the groups at 6 months. There were 4 shoulders in each group that experienced retearing (types 4 and 5 according to the Sugaya classification) at 6 months postoperatively. There was no difference in retear rate ($P > .999$).

**Conclusion:**
Most deformities after RC repair were remodeled with no effect on retears. Clinical outcomes were not affected by deformities.

BACK

Clinical Orthopaedics and Related Research - Volume 478 - Issue 6 - p 1295-1303

# Anchorless Arthroscopic Transosseous and Anchored Arthroscopic Transosseous Equivalent Rotator Cuff Repair Show No Differences in Structural Integrity or Patient-reported Outcomes in a Matched Cohort

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doi: 10.1097/CORR.0000000000001151

**Background**
Anchored transosseous equivalent suture-bridge technique (TOE) is widely used for arthroscopic rotator cuff repair. It is unknown how patient outcomes scores, ROM, and integrity of the rotator cuff after repair using this anchored technique compare with those after repair using an anchorless transosseous technique (TO).

**Questions/purposes**
(1) What are the differences in patient-reported outcomes (American Shoulder and Elbow Surgeons [ASES] score) and shoulder ROM between TO and TOE rotator cuff repair techniques at 1 and 2 years after surgery? (2) What is the difference in repair integrity as measured by the re-tear rate, assessed ultrasonographically at 1 year, between these two techniques? (3) What is the difference in procedure duration between the two techniques when performed by a surgeon familiar with each?

**Methods**
We reviewed 331 arthroscopic rotator cuff repairs performed by one surgeon from December 2011 to July 2016 in this retrospective, matched-pair study. Of these patients, 63% (208 of 331) underwent repair with standard anchored technique (anchors placed in a double-row, TOE manner) and 37% (123 of 331) underwent anchorless TO repair, with the same indications for surgery between groups. Forty-four percent (91 of 208) of patients in the TOE group and 61% (75 of 123) of patients in the TO group met the inclusion criteria. Eighty percent (73 of 91) of patients in the TOE group and 88% (66 of 75) in the TO group had minimum 2-year follow-up. We matched each group to a cohort of 50 patients by sex, age, smoking status, and tear size (by Cofield classification: small, < 1 cm; medium, 1-3 cm; large, > 3-5 cm; or massive, > 5 cm). The resulting cohorts did not differ in mean age (TO, 62 years [range 53-65 years]; TOE, 58 years [range 53-65 years]; p = 0.79), mean BMI value (TO, 30 [range 27-33]; TOE, 29 [range 27-35]; p = 0.97), or dominant arm involvement (TO, 80%; TOE, 78%; p = 0.81). The cohorts were followed for at least 2 years (median, 3.2 years [interquartile range (IQR) 2.2-4.3] for TO and 2.9 years [IQR 2.0-3.5 years] for TOE). ASES scores and ROM were evaluated before surgery and at follow-up visits and were recorded in a longitudinally maintained institutional database. Repair integrity was assessed using ultrasonography at 1 year, as is standard in our practice. For each tear-size group, we calculated the proportion of intact tendon repairs versus the proportion of re-tears. Duration of surgery was recorded for each patient.

**Results**
At 1 year, we observed no difference in median ASES scores (90 [IQR 92-98] for TO and 88 [IQR 72-98] for TOE; p = 0.44); external rotation (50° [IQR 45°-60°) for TO and 50° [IQR: 40°-60°] for TOE; p = 0.58); forward flexion (165° [IQR 160°-170°] for both groups; p = 0.91); or abduction (100° [IQR 90°-100°] for TO and 90° [IQR 90°-100°] for TOE; p = 0.06). Fourteen percent of shoulders (seven of 50) in each treatment group had evidence of re-tear at 1 year (p > 0.99): 0 of 2 small tears in each group, 0 of 7 medium tears in each group, five of 32 large tears in each group, and two of 9 massive tears in each group (all, p > 0.99). At 2 years, we found no

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differences in median ASES scores (92 [IQR 74-98)] for TO and 90 [IQR 80-100] for TOE; p = 0.84); external rotation (60° [IQR 50°-60°] for both groups; p = 0.74); forward flexion (170° [IQR 160°-170°] for both groups; p = 0.69); or abduction (100° [IQR 90°-100°] for both groups; p = 0.95). We found no differences between groups in mean ± SD procedure time, which was 103 ± 20 minutes for TO repair and 99 ± 20 minutes for TOE repair (p = 0.45).

**Conclusions**
TO and TOE techniques for arthroscopic rotator cuff repair results in no differences in ROM, ASES scores, re-tear rates, and surgical time. Randomized control trials are needed to confirm these similarities or determine a superior method of repair. Future cost analyses may also help to determine the relative value of each technique.

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

BACK

**Lower Extremity**

Arthroscopy, Volume 36, Issue 6

## Can Radiographic Joint Space Accurately Predict Chondral Damage During Hip Arthroscopy? A Cross-Sectional Analysis

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Arthroscopy, Volume 36, Issue 6

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**Purpose**
To examine how preoperative radiographic joint space correlated with intraoperative chondral damage as diagnosed during hip arthroscopy, in patients without radiographic evidence of osteoarthritis or joint space <2 mm. Methods: Patients younger than the age of 50 years without previous hip conditions who underwent hip primary arthroscopy had their joint space and intraoperative chondral damage compared. A narrow joint space group was defined as those in the lowest decile of the average joint space. The demographics and presence of intra-articular findings of chondral damage were compared. In addition, receiver operator characteristic (ROC) curves were used to assess joint space as a predictor of intraarticular damage.

**Results**
There were 1892 in this analysis. The incidence of severe cartilage damage (Outerbridge III and IV) was not significantly different between the narrow and non-narrow groups. The ROC analysis for joint space at detecting chondral damage was poor. The ROC area under the curve for joint space detecting any chondral defect (acetabular or femoral head) was 0.536 (confidence interval 0.506-0.565), with low sensitivity (0.492), specificity (0.582), negative predictive value (0.720), and positive predictive value (0.340). Spearman correlation could not demonstrate a correlation between joint space and cartilage damage (ρ Acetabular = 0.10, ρ Femoral Head = 0.04). Interestingly, a gradual widening was observed between the medial and lateral joint spaces, with more pronounced findings in hips without damage.

**Conclusions**
The results of this study demonstrate that in patients with Tönnis 0 and 1, narrower joint space may be an anatomic variant and cannot predict actual intraoperative cartilage damage. However, if the lateral joint space has relative narrowing compared with the medial joint space, this may indicate acetabular cartilage damage.

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

BACK

**Mid-Term Results of Arthroscopic Synovectomy for Pigmented Villonodular Synovitis of the Hip**

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Arthroscopy, Volume 36, Issue

https://doi.org/10.1016/j.arthro.2020.01.059



**Purpose**
To analyze mid-term outcomes after arthroscopic synovectomy of both diffuse and nodular hip pigmented villonodular synovitis (PVNS).

**Methods**
This is a retrospective case series of patients that underwent hip arthroscopy for hip PVNS with a single senior surgeon between 2007 and 2016. Inclusion criteria were magnetic resonance imaging evidence, arthroscopic visualization, and/or histologic confirmation of PVNS; and a minimum of 3 years of follow-up. Concomitant pathology such as femoroacetabular impingement also was treated at the time of surgery. Primary outcome measures were recurrence of hip PVNS and the rate of revision hip surgery. Secondary outcomes were complications, visual analog scale pain score, pain relief, and patient satisfaction, and 6 patient-reported outcome measures were collected at latest follow-up.

**Results**
In a case series of 14 patients consisting of 6 (42.9%) male and 8 (57.1%) female patients, the mean operative age was 32.69 ± 12.73 years with a mean follow-up was 6.66 ± 1.87 years. PVNS type was determined intraoperatively: 5 (35.7%) patients had diffuse hip PVNS and 9 (64.3%) had nodular type. There was only 1 case (7.14%) of recurrence that was treated arthroscopically and no cases (0%) progressed to revision open synovectomy or arthroplasty. Mean patient-reported outcome measure scores were notable for a modified Harris Hip Score of 74.08 ± 16.84. The mean visual analog scale pain score decreased by 4.9 ± 1.7, which was significant with a $P < .001$, with a larger decrease in patients with localized type.

**Conclusions**
This study presents a large case series of hip PVNS managed arthroscopically with mid-term follow-up of slightly over 6.5 years. The survival rate was 93%, with only 1 (7%) recurrence and 0 (0%) progression to revision open synovectomy or arthroplasty with 0 (0%) complications. We conclude that arthroscopic synovectomy is a reliable and effective treatment of hip PVNS.

**Level of Evidence**
Case Series, Level IV.

BACK

# The Effect of Postoperative Opioid Prescription Refills on Achieving Meaningful Clinical Outcomes After Hip Arthroscopy for Femoroacetabular Impingement Syndrome

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Arthroscopy, Volume 36, Issue 6

https://doi.org/10.1016/j.arthro.2020.02.007



**Purpose**
To determine whether requiring postoperative opioid refills has an effect on both baseline and postoperative functional scores, as well as rates of achieving clinical success 2 years after hip arthroscopy for femoroacetabular impingement syndrome (FAIS).

**Methods**
Data from consecutive patients undergoing hip arthroscopy for FAIS from January 2012 to December 2016 were analyzed. Patients with at least 1 postoperative opioid refill were matched 1:2 by age and body mass index to patients not requiring refills. Preoperative and postoperative patient-reported outcomes including the Hip Outcome Score–Activities of Daily Living Subscale, HOS–Sports Subscale, and modified Hip Harris Score, as well as visual analog scale (VAS) pain and satisfaction surveys, were compared between the 2 groups, as well as between patients who requested 1 refill versus those requiring 2 or more refills. The minimal clinically important difference and patient acceptable symptomatic state (PASS) were calculated for the study group and compared between patient groups.

**Results**
A total of 128 patients (14.5%) requesting at least 1 postoperative opioid refill and 256 with no refills were included in the study. Analysis showed that the refill group had lower patient-reported outcomes ( $P < .05$ for all), a lower VAS satisfaction score average (73.2 ± 30.7 vs 80.1 ± 25.9, $P = .029$), and a higher VAS pain score average (27.2 ± 26.1 vs 19.9 ± 22.7, $P = .007$). Similar trends were seen when patients with 1 refill were compared with those with 2 or more refills. Analysis of meaningful clinical outcomes showed that patients in the refill group had lower rates of achieving the PASS (68.3% vs 77.2%, $P = .006$). However, there were no statistically significant differences in achieving the minimal clinically important difference between the 2 groups ( $P > .05$ for all).

**Conclusions**
Patients undergoing hip arthroscopy for FAIS who require 1 or more opioid refills postoperatively are likely to have lower baseline and postoperative functional scores, as well as to achieve the PASS at lower rates, compared with patients who do not require an additional opioid prescription to what is routinely given after surgery.

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

BACK

# Microfractures Versus a Porcine-Derived Collagen-Augmented Chondrogenesis Technique for Treating Knee Cartilage Defects: A Multicenter Randomized Controlled Trial

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Arthroscopy, Volume 36, Issue 6

https://doi.org/10.1016/j.arthro.2019.11.110



**Purpose**
The purpose of this study was to evaluate the clinical efficacy and safety of treating patients with a cartilage defect of the knee with microfractures and porcine-derived collagen-augmented chondrogenesis technique (C-ACT).

**Methods**
One hundred participants were randomly assigned to the control group (n = 48, microfracture) or the investigational group (n = 52, C-ACT). Clinical and magnetic resonance imaging (MRI) outcomes were assessed 12 and 24 months postoperatively for efficacy and adverse events. Magnetic Resonance Observation of Cartilage Repair Tissue (MOCART) assessment was used to analyze cartilage tissue repair. MRI outcomes for 50% defect filling and repaired tissue/reference cartilage (RT/RC) ratio were quantified using T2 mapping. Clinical outcomes were assessed using the visual analogue scale (VAS) for pain and 20% improvement, minimal clinically important difference (MCID), and patient acceptable symptom state for Knee Injury and Osteoarthritis Outcome Score (KOOS) and the International Knee Documentation Committee score.

**Results**
MOCART scores in the investigation group showed improved defect repair and filling ( P = .0201), integration with the border zone ( P = .0062), and effusion ( P = .0079). MRI outcomes showed that the odds ratio (OR) for ≥50% defect filling at 12 months was statistically higher in the investigation group (OR 3.984, P = .0377). Moreover, the likelihood of the RT/RC OR becoming ≥1 was significantly higher (OR 11.37, P = .0126) in the investigation group. At 24 months postoperatively, the OR for the VAS 20% improvement rate was significantly higher in the investigational group (OR 2.808, P = .047). Twenty-three patients (52.3%) in the control group and 35 (77.8%) in the investigation group demonstrated more than the MCID of KOOS pain from baseline to 1 year postoperatively, with a significant difference between groups ( P = .0116).

**Conclusion**
In this multicenter randomized trial, the addition of C-ACT resulted in better filling of cartilage defect of the knee joint.

**Level of Evidence**
Level I, Multicenter Randomized Controlled Trial

BACK

# All-Inside Quadrupled Semitendinosus Autograft Shows Stability Equivalent to Patellar Tendon Autograft Anterior Cruciate Ligament Reconstruction: Randomized Controlled Trial in Athletes 24 Years or Younger

Patrick A. Smith, Corey S. Cook, Jordan A. Bley

Arthroscopy, Volume 36, Issue 6

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**Purpose**
To compare clinical outcomes of knee anterior cruciate ligament (ACL) autograft reconstruction using all-inside quadrupled semitendinosus (AIST) versus bone–patellar tendon–bone (BPTB) in a high-risk athletic population 24 years or younger.

**Methods**
Skeletally mature candidates younger than 24 years old with an ACL tear were randomized into either the AIST (n = 32) or BPTB (n = 32) group and were followed for 2 years. Magnetic resonance imaging scans were obtained at 1-year follow-up, and radiographs were obtained at 2-year follow-up. All surgeries were performed by a single surgeon using an anteromedial portal to establish the femoral tunnel. The primary outcome measure was KT-1000 stability testing. Secondary outcome measures included International Knee Documentation Committee (IKDC) Knee Evaluation Form, IKDC Subjective Form, Knee Injury and Osteoarthritis Outcome Score, Marx Activity Scale, visual analog pain scale, and SF-12 (Mental and Physical). Results: At 2-year follow-up, no statistical difference existed with KT-1000-measured side-to-side laxity between AIST (0.3 ± 0.7 mm, 95% confidence interval 0.0-1.0 mm) and BPTB (0.0 ± 0.8 mm, confidence interval CI -0.3 to 1.1 mm) ( P = .197). In addition, no statistical differences between the groups were found for IKDC Subjective Form, Knee Injury and Osteoarthritis Outcome Score, Marx, SF-12 Mental, SF-12 Physical, or with regards to imaging findings. Patients with BPTB reported significantly greater postoperative pain scores at days 2 ( P = .049), 3 ( P = .004), and 7 ( P = .015) and had significantly greater kneeling pain at 2 years ( P < .019). A return to sport questionnaire at 2 years revealed no significant difference between the groups for returning to preoperative level of sport activity (83% AIST, 74% BPTB; P = .415). Two graft retears (7%; P = .222) occurred in the AIST group. Three patients in the BPTB group experienced ACL tears in the contralateral knee (9%; P = .239).

**Conclusions**
ACL reconstruction with an all-inside quadrupled semitendinosus autograft construct is equivalent to patellar BPTB autograft based on KT-1000 stability testing in athletes 24 years or younger.

**Level of Evidence**
Randomized controlled trial with 92% 2-year follow-up, Level I.

BACK

# Clinical Characteristics and Outcomes After Anatomic Reconstruction of the Proximal Tibiofibular Joint

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Arthroscopy, Volume 36, Issue 6

https://doi.org/10.1016/j.arthro.2020.01.056



**Purpose**
To assess the most common presenting symptoms, clinical outcomes, and satisfaction after anatomic reconstruction of the proximal tibiofibular joint (PTFJ) with a free semitendinosus autograft.

**Methods**
Consecutive patients with minimum 2-year follow-up after isolated anatomic PTFJ reconstruction were retrospectively reviewed. Patients were evaluated with the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score and Lysholm Knee Survey score along with a simple numeric patient satisfaction score (0-10, with 10 rated as perfect). Statistical analysis was performed with paired t tests, with $P < .05$ considered significant.

**Results**
The study included 16 PTFJ reconstruction surgical procedures in 15 patients with isolated proximal tibiofibular instability verified by an examination under anesthesia (4 reconstructions in male patients vs 12 in female patients); the average age was 37.9 ± 14.6 years, with an average follow-up period of 43.2 months (range, 22-72 months). Of the 13 patients with complete follow-up, 11 (84.6%) were able to return to full desired activities and previous level of sport. Fourteen patients presented with concomitant common peroneal nerve pathology. Two patients had a subsequent complication. No patients needed an additional procedure. Significant ( $P < .05$) improvement occurred across all WOMAC domains and in the WOMAC total score, from 31.4 (±14.9) preoperatively to 15.2 (±15.5) postoperatively. Lysholm Knee Survey scores significantly ( $P < .05$) improved from 51.2 (±17.2) to 75.0 (±18.0). Patients' overall satisfaction was rated 7.6 (± 2.7) of 10.

**Conclusions**
At an average follow-up of 43.2 months, anatomic PTFJ reconstruction for isolated PTFJ instability provided improvement in clinical outcomes, a return to activities, and a low risk of complications or need for additional procedures.

**Clinical Relevance**
PTFJ reconstruction with hamstring tendon graft is a promising surgical treatment that improves patient satisfaction when conservative treatment of PTFJ instability fails.

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

BACK

**Arthroscopy-Assisted Reduction in the Management of Isolated Medial Malleolar Fracture**

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Arthroscopy, Volume 36, Issue 6

https://doi.org/10.1016/j.arthro.2020.01.053



**Purpose**
To evaluate the feasibility of arthroscopic reduction percutaneous fixation (ARPF) in the treatment of isolated medial malleolar fracture and compare the results with those of conventional open reduction internal fixation (ORIF).

**Methods**
This prospective study enrolled 77 patients with isolated medial malleolar fracture between November 2011 and February 2016. The patients were assigned to the ARPF (n = 34) and ORIF (n = 43) groups. The Olerud-Molander ankle score (OMAS), ankle range of motion (ROM), visual analog scale, and radiographic evaluation were determined at the scheduled follow-up.

**Results**
In the ARPF group, 11 of 34 patients (32.4%) had chondral lesions. Tears of the deltoid ligament and anterior inferior tibiofibular ligament were noted in 3 (8.8%) and 15 (44.1%) patients, respectively. The mean follow-up was 5 years. The mean OMAS was higher in the ARPF group than in the ORIF group. The differences were statistically significant at 6 months (mean ± standard deviation, 80.2 ± 4.0 for ARPF vs 77.2 ± 4.1 for ORIF, P = .005) and 1 year (92.9 ± 4.9 vs 88.1 ± 4.6, P < .001), but not at the latest follow-up ( P = .081). Ankle ROM was markedly improved in the ARPF group, unlike in the ORIF group at 6 months (dorsiflexion, P = .025; plantarflexion, P < .001) and 1 year (dorsiflexion and plantarflexion, P < .001). The improvement remained at the latest follow-up in plantarflexion ( P = .001) but not in dorsiflexion ( P = .354).

**Conclusions**
Arthroscopy-assisted reduction is a feasible alternative modality with superior short-term outcomes for treating isolated medial malleolar fracture, but its superiority may be attenuated in the intermediate term.

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

BACK

# Platelet-Rich Plasma Augmentation in Meniscal Repair Surgery: A Systematic Review of Comparative Studies

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Arthroscopy, Volume 36, Issue 6

https://doi.org/10.1016/j.arthro.2020.01.038



**Purpose**
To systematically review the literature on meniscal repair surgery and assess functional and radiographic outcomes of platelet-rich plasma (PRP)–augmented repair compared with standard repair techniques.

**Methods**
A systematic review of the literature was completed according to Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines using the PubMed, MEDLINE, Embase, and Cochrane databases. The inclusion criteria included all human studies testing PRP augmentation of meniscal repair written in the English language. All cadaveric, animal, and basic science studies were excluded from review. The quality of the included publications was assessed prior to data extraction through the Jadad score. Risk of bias was further determined by Methodological Index for Non-randomized Studies (MINORS) and Cochrane risk-of-bias assessments. Heterogeneity in outcomes reported across studies was evaluated using I 2 statistic calculations.

**Results**
A total of 5 studies (1 with Level I evidence; 1, Level II; and 3, Level III) met the inclusion criteria for this review, all comparing PRP augmentation of meniscal repair surgery versus meniscal repair with no augmentation. Overall quality and risk of bias in the included studies varied substantially (Jadad score, 1-5; Methodological Index for Non-randomized Studies score, 7-18). Three comparative studies found no significant difference in outcome or failure, whereas the other two showed a significant improvement in PRP-augmented repairs at final follow-up. Two studies assessed healing with postoperative magnetic resonance imaging or second-look arthroscopy, with both showing significantly improved outcomes in the PRP-treated groups ( $P < .01$ and $P = .048$). PRP preparation techniques and composition differed among all studies and were inconsistently reported.

**Conclusions**
In early and limited investigations, there is insufficient evidence to support PRP augmentation of meniscal repair surgery improving functional and radiographic outcomes and resulting in lower failure rates compared with standard repair techniques. There is considerable heterogeneity in the reporting and preparation of PRP used for augmentation.

**Level of Evidence**
Level III, systematic review of Level I to III studies.

BACK

Knee Surgery, Sports Traumatology, Arthroscopy (KSSTA), Volume 28, Issue 6

# Micro-fragmented stromal-vascular fraction plus microfractures provides better clinical results than microfractures alone in symptomatic focal chondral lesions of the knee.

Bisicchia, S., Bernardi, G., Pagnotta, S.M., Tudisco, C.

DOI: https://doi-org.eur.idm.oclc.org/10.1007/s00167-019-05621-0

**Purpose**
To evaluate clinical outcomes over a 1-year period in patients affected by symptomatic focal chondral lesions of the knee treated with micro-fragmented stromal-vascular fraction plus microfractures compared to microfractures alone.

**Methods**
Two groups of 20 patients were arthroscopically treated with microfractures for a symptomatic focal chondral defect of the knee. At the end of surgery, in the experimental group, micro-fragmented stromal-vascular fraction was injected into the joint. Primary end point was WOMAC score at 12 months. Secondary end points were any adverse events, Oxford Knee Score, EQ-5D score, VAS for pain, analgesic and anti-inflammatory consumption.

**Results**
All the patients were evaluated at 12-month follow-up. No adverse reactions were noted. Analgesic and anti-inflammatory consumption was similar in both groups. At 1-month follow-up, no differences were noted between groups when compared to pre-operative scores. At 3-month follow-up, patients in both groups improved from the baseline in all variables. Significantly lower VAS scores were found in the experimental group ($4.2 \pm 3.2$ vs. $5.9 \pm 1.7$, $p = 0.04$). At 6- and 12-month follow-ups, patients in the experimental group scored better in all outcomes with a moderate effect size; in particular, better WOMAC scores were obtained at 12 months, achieving the primary end-point of the study ($17.7 \pm 11.1$ vs. $25.5 \pm 12.7$; $p = 0.03$).

**Conclusions**
Injection of micro-fragmented stromal-vascular fraction is safe and, when associated with microfractures, is more effective in clinical terms than microfractures alone in patients affected by symptomatic focal chondral lesions of the knee. Results of the current study provide information that could help physicians to improve their counseling for patients concerning ADMSCs.

**Level of evidence**
Level I - therapeutic study

BACK

**Inclination of Blumensaat's line influences on the accuracy of the quadrant method in evaluation for anterior cruciate ligament reconstruction.**

Iwasaki, K., Inoue, M., Kasahara, Y., et al.

DOI: https://doi-org.eur.idm.oclc.org/10.1007/s00167-019-05619-8

**Purpose**
The quadrant method is used to evaluate the bone tunnel position with the grid based on the Blumensaat's line in anterior cruciate ligament (ACL) reconstruction. This study aimed to clarify the influence of variation in the Blumensaat's line on the accuracy of the quadrant method measurements.

**Methods**
A retrospective review of the radiological records of patients aged 18–30 years who underwent computed tomography (CT) scanning of the knee joint was conducted. The Blumensaat's line inclination angle (BIA), along with the most posterior point of the posterior condyle (point P) position using the quadrant method and morphology of the Blumensaat's line were measured on true lateral transparent three-dimensional CT images of the distal femoral condyle in 147 patients. Statistical analysis was conducted to determine associations among these measurements.

**Results**
BIA was 37.5° (standard deviation 4.2°; range 27°–48°). The point P position was significantly correlated with BIA in the high/low ($R2 = 0.590$, $P < 0.0001$) and deep/shallow ($R2 = 0.461$, $P < 0.0001$) directions. The morphology of the Blumensaat's line was straight in 35 knees (23.8%); whereas, the remaining 112 knees (76.2%) were not straight but had some hill on the Blumensaat's line. No significant difference among the morphological variation of the Blumensaat's line was observed in BIA and the point P position.

**Conclusion**
There was a strong correlation between BIA and the point P measured using the quadrant method, suggesting the influence of the Blumensaat's line on the accuracy of the quadrant method measurements in ACL reconstruction. As for the clinical relevance, surgeons should be careful in application of the quadrant method for ACL reconstruction, because the variation of the Blumensaat's line inclination influences the accuracy of this method.

**Level of evidence**
Level III – retrospective review

BACK

**Femoral nerve block at time of ACL reconstruction causes lasting quadriceps strength deficits and may increase short-term risk of re-injury.**

Everhart, J.E., Hughes, L., Abouljoud, M.M., et al..

DOI: https://doi-org.eur.idm.oclc.org/10.1007/s00167-019-05628-7

**Purpose**
To determine whether femoral nerve blockade (FNB) at the time of primary ACL reconstruction is associated with meeting isokinetic extension strength return to sport criteria near completion of physical therapy and whether FNB affects 1-year or 2-year risk of ipsilateral ACL graft rupture or contralateral native ACL injury.

**Methods**
Three-hundred and sixty patients (n = 244 with FNB, n = 116 no FNB) underwent primary ACL reconstruction. All patients completed rehabilitation and underwent functional strength testing towards the end of knee rehabilitation (mean 5.6 months post-surgery). Association between FNB and isokinetic extension strength limb symmetry index (LSI) (goal LSI ≥ 90% for return to sport) as well as risk of recurrent ACL injury within first or second year after surgery was evaluated.

**Results**
Ipsilateral or contralateral ACL injury within 2 years occurred in 11.2% of patients with FNB and 5.7% without FNB (p = 0.01). Patients with FNB had higher incidence of ipsilateral graft rupture within the first year after surgery but no difference in graft rupture during the second. Two-year risk of contralateral ACL injury was similar in both groups. At the time of initial testing, patients who received FNB had lower fast isokinetic extension LSI versus patients without FNB and were less likely achieve a goal ≥ 90% LSI; slow extension LSI was unaffected.

**Conclusion**
Use of FNB at the time of primary ACL reconstruction can negatively affect achievement of isokinetic extension strength return to sport criteria. FNB increases risk of graft rupture within the first year after surgery but does not affect re-injury risk during the second. FNB may not be appropriate for use in patients already at high risk of ACL re-injury.

**Level of evidence**
III.

BACK

**Re-revision anterior cruciate ligament reconstruction showed more laxity than revision anterior cruciate ligament reconstruction at a minimum 2-year follow-up.**

Yoon, K.H., Kim, J.H., Kwon, Y.B., et al.

DOI: https://doi-org.eur.idm.oclc.org/10.1007/s00167-019-05653-6

**Purpose**
This study aimed to compare patient demographics, associated lesions (concurrent meniscal and chondral injuries), and clinical outcomes between revision and re-revision anterior cruciate ligament reconstructions.

**Methods**
Patients who underwent revision or re-revision anterior cruciate ligament reconstruction between 2008 and 2016 with a minimum 2-year follow-up were retrospectively evaluated. Detailed patient demographic data, radiographic preoperative tunnel diameters, posterior tibia slope, and concurrent meniscal and chondral lesion were reviewed. Clinical scores and laxity tests' results were compared between the groups at the last follow-up.

**Results**
Eighty-two patients (mean age, 33.8 ± 9.9 years; revision group, $n = 62$; re-revision group, $n = 20$) were included. The re-revision group showed a higher grade for preoperative arthritis ($P < 0.001$); more severe preoperative bone defects of the femoral (13.8 ± 2.6 vs 11.7 ± 2.7 mm, $P = 0.004$) and tibial tunnels (14.6 ± 2.4 vs 13.0 ± 2.3 mm, $P = 0.010$); and a higher prevalence of subtotal medial meniscectomy ($P = 0.008$) and chondral defects of the medial ($P = 0.006$) and lateral femoral condyles ($P < 0.001$), patella ($P = 0.040$), and trochlea ($P = 0.036$). At the final follow-up, the clinical scores did not differ significantly between the groups. However, the re-revision group showed more instability in the anterior drawer ($P = 0.001$), Lachman ($P < 0.001$), and pivot-shift ($P < 0.001$) tests, while a side-to-side difference was observed on the Telos stress radiographs (7.1 ± 4.7 vs 4.9 ± 3.7 mm, $P = 0.038$).

**Conclusion**
These findings showed that the patients who underwent re-revision had poor prognostic factors as compared with those who underwent revision anterior cruciate ligament reconstruction. Although the clinical scores did not differ significantly between the groups, the re-revision group showed more laxity at the 2-year follow-up.

**Level of evidence**
IV - Cohort study.

BACK

**Comparable clinical and functional outcomes after anterior cruciate ligament reconstruction over and under 40 years of age.**

Corona, K., Ronga, M., Morris, B.J., et al.

DOI: https://doi-org.eur.idm.oclc.org/10.1007/s00167-019-05680-3

**Purpose**
The aim of the present meta-analysis was to update the literature on the outcomes and complications of ACL reconstruction in patients aged 40 years and older. It has been hypothesized that patients older than 40 years of age may have comparable clinical outcomes to those of younger patients.

**Methods**
A systematic review of articles from 1996 to 2018 was completed using Pubmed, Medline, Cochrane Reviews, and Google Scholar databases using the keyword terms “anterior cruciate ligament reconstruction” and “middle-aged OR elderly OR over 40 OR age factors.” Functional and clinical outcomes (International Knee Documentation Committee, Lysholm and Tegner score and KT-1000 arthrometer), complication and graft failure rate were evaluated.

**Results**
Eleven articles met inclusion criteria. In total, 306 middle-aged patients and 566 younger patients were included in this study. The mean age of patients > 40 was 49 ± 7 (range 40–75) years with a mean follow-up of 25 ± 9 months (range 12–68). The mean age of younger patients was 26 ± 2.7 (range 15–39) years with a mean post-operative follow-up of 26.7 ± 11.5 months (range 3–64). The results were slightly higher (but no significantly different) towards the younger group in terms of objective IKDC (*P* = n.s.), Lysholm (*P* = n.s.) and Tegner (*P* = n.s.) scores and knee laxity assessment (*P* = n.s.). Complication rate (*P* = n.s.) and graft failure (*P* = n.s.) were low even in this cohort.

**Conclusions**
The present meta-analysis shows that patients older than 40 years achieve comparable clinical outcomes to those of younger patients following primary ACL reconstruction. This evidence may push the surgeons toward a more aggressive approach in this specific cohort of patients.

**Level of evidence**
III.

BACK

**Arthroscopic primary repair of proximal anterior cruciate ligament tears seems safe but higher level of evidence is needed: a systematic review and meta-analysis of recent literature.**

van der List, J.P., Vermeijden, H.D., Sierevelt, I.N., et al.

DOI: https://doi-org.eur.idm.oclc.org/10.1007/s00167-019-05697-8

**Purpose**
To assess the outcomes of the various techniques of primary repair of proximal anterior cruciate ligament (ACL) tears in the recent literature using a systematic review with meta-analysis.

**Methods**
PRISMA guidelines were followed. All studies reporting outcomes of arthroscopic primary repair of proximal ACL tears using primary repair, repair with static (suture) augmentation and dynamic augmentation between January 2014 and July 2019 in PubMed, Embase and Cochrane were identified and included. Primary outcomes were failure rates and reoperation rates, and secondary outcomes were patient-reported outcome scores.

**Results**
A total of 13 studies and 1,101 patients (mean age 31 years, mean follow-up 2.1 years, 60% male) were included. Nearly all studies were retrospective studies without a control group and only one randomized study was identified. Grade of recommendation for primary repair was weak. There were 9 out of 74 failures following primary repair (10%), 6 out of 69 following repair with static augmentation (7%) and 106 out of 958 following dynamic augmentation (11%). Repair with dynamic augmentation had more reoperations (99; 10%), and more hardware removal (255; 29%) compared to the other procedures. All functional outcome scores were > 85% of maximum scores.

**Conclusions**
This systematic review with meta-analysis found that the different techniques of primary repair are safe with failure rates of 7–11%, no complications and functional outcome scores of > 85% of maximum scores. There was a high risk of bias and follow-up was short with 2.1 years. Prospective studies comparing the outcomes to ACL reconstruction with sufficient follow-up are needed prior to widespread implementation.

**Level of evidence**
IV.

BACK

**Flexible reamers create comparable anterior cruciate ligament reconstruction femoral tunnels without the hyperflexion required with rigid reamers: 3D-CT analysis of tunnel morphology in a randomised clinical trial.**

**Kosy, J.D., Walmsley, K., Anaspure, R., et al.**

DOI: https://doi-org.eur.idm.oclc.org/10.1007/s00167-019-05709-7

**Purpose**
The hyperflexion required for femoral tunnel drilling in anterior cruciate ligament reconstruction can be challenging in patients with increased body habitus or musculature. Whilst allowing femoral tunnel creation without hyperflexion, additional benefits of flexible reamers have been proposed in terms of tunnel dimensions. The purpose of this study was to examine whether these theoretical benefits are seen in a clinical study.

**Methods**
Fifty adult patients (with isolated anterior cruciate ligament rupture) were randomised to reconstruction with either flexible or rigid femoral reamers. Femoral tunnel drilling was performed at 100° flexion (flexible system) or maximal hyperflexion (rigid system). Otherwise, the procedure was standardised. Femoral tunnel measurements were performed by a consultant musculoskeletal radiologist who was blinded to the method of femoral drilling. Tunnel position, length and angles (axial and coronal) were measured alongside aperture shape and exit point using three-dimensional computed tomography 3–6 months post-operatively.

**Results**
With no difference in tunnel position, tunnel length was found to increase with the use of the flexible system ($37.8 \pm 3.7$ vs $35.0 \pm 4.4$ mm; $p = 0.024$). In addition, the exit point and fixation device were more anterior on the lateral femur using the flexible reamers ($p = 0.016$). No difference was seen in either tunnel angles or aperture shape. One case of incomplete posterior blow-out was seen in each of the study groups.

**Conclusions**
This comparative study shows that flexible reamers can reproduce a desired femoral tunnel position with only small improvements of no clinical relevance. As this can be achieved without hyperflexing the knee, these systems can be used for all patients (even when hyperflexion is a challenge).

**Level of evidence**
I.

BACK

**Joint laxity and graft compliance increase during the first year following ACL reconstruction with short hamstring tendon grafts.**

Pouderoux, T., Muller, B., Robert, H.

DOI: https://doi-org.eur.idm.oclc.org/10.1007/s00167-019-05711-z

**Purpose**
Evaluating joint laxity and graft compliance after ACL surgery may be used to quantify biomechanical graft properties during the ligamentization process. This study aimed to analyse the evolvement of joint laxity and graft compliance of short hamstring tendon grafts after ACL reconstruction (ACLR).

**Methods**
Forty-seven patients that underwent ACLR were retrospectively enrolled. Joint laxity was quantified with a GNRB® arthrometer before surgery, then at 15 days, at 1/3/6/9 months (M1–M9), at 1 year postoperatively and then again at the last mean follow-up (FU) of 14.7 ± 3.0 months. The side-to-side laxity difference (Δ*L* in mm) was measured at 30 and 60 N at every FU, additionally at 90 N from M3 on and at 134 N from M6 on. The side-to-side compliance difference (Δ*C* in µm/N) was calculated for each graft.

**Results**
Mean Δ*L* and Δ*C* decreased significantly between preoperative and M1 for all applied forces (at 30 N, Δ*L*: 0.8 mm, $p < 0.0001$; Δ*C*: 25.9 µm/N, $p < 0.001$). Between M1 and M9, Δ*L* increased significantly at 30 N ($p = 0.02$) and 60 N ($p < 0.001$), while Δ*C* increased by 15.2 µm/N at 30 N ($p = 0.003$) and 14.9 µm/N at 60 N ($p = 0.001$). Between M9 and the last FU, there were no significant differences for Δ*L* and Δ*C*.

**Conclusion**
Joint laxity and graft compliance evolve during the first postoperative year with a phase between the first and ninth postoperative month of relative weakness. According to the established evolvement profile, return to pivoting or contact sports should be considered only after stabilization of joint laxity and graft compliance.

**Level of evidence**
Retrospective cohort study, Level III

BACK

American Journal of Sports Medicine (AJSM), Volume 48, Issue 7

# A Multicenter Study of Radiographic Measures Predicting Failure of Arthroscopy in Borderline Hip Dysplasia: Beware of the Tönnis Angle

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**Background:** Hip arthroscopy has been previously demonstrated to be an effective treatment for adult mild hip dysplasia. There are many radiographic parameters used to classify hip dysplasia, but to date few studies have demonstrated which parameters are of most importance for predicting surgical outcomes.

**Purpose:** To identify preoperative radiographic parameters that are associated with poor outcomes in the arthroscopic treatment of adult mild hip dysplasia.

**Study Design:** Case-control study; Level of evidence, 3.

**Methods:** Radiographic analysis was performed in patients with mild hip dysplasia who underwent arthroscopic surgery between 2009 and 2015. Preoperative radiographic measurements included lateral center edge angle, Tönnis angle, neck shaft angle, anterior center edge angle, alpha angle, femoral head extrusion index, and acetabular depth-to-width ratio. Failure was defined as failure to achieve the minimal clinically important difference (MCID) utilizing the modified Harris Hip Score or as the need for secondary operation. The equal variance t test was used to analyze radiographic parameters. Statistical significance was determined using a P value of .05.

**Results:** A total of 373 hips underwent analysis with an average follow-up of 41 months (range, 24-102 months). Of these, 46 hips (12%) required secondary operation, and 95 (25%) failed to meet the MCID. The overall failure rate was 32.4%. There was no single measurement or combination thereof associated with failure to reach the MCID. Higher preoperative Tönnis angles were associated with secondary operation, with a mean of 6.7° (95% CI, 5.3°-8.1°) in the secondary operation group versus 4.8° (95% CI, 4.4°-5.3°) in the nonsecondary operation group (P = .006). The odds ratio was 1.12 (95% CI, 1.0-1.2; P = .05) per degree increase in Tönnis angle for secondary operation. In patients with a Tönnis angle >10°, 84% required secondary operation.

**Conclusion:** Higher Tönnis angles portend a higher risk for revision surgery. The probability of secondary operation was increased by a magnitude of 1.12 with each degree increase in the Tönnis angle. In patients with a Tönnis angle >10°, 84% required a secondary operation.

BACK

**Patients With Borderline Hip Dysplasia Achieve Clinically Significant Improvement After Arthroscopic Femoroacetabular Impingement Surgery: A Case-Control Study With a Minimum 5-Year Follow-up**

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First Published March 30, 2020; pp. 1439–1449

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**Background:** Hip arthroscopy for the treatment of femoroacetabular impingement syndrome (FAIS) in patients with borderline hip dysplasia (BHD) is becoming a more common practice. However, the literature on achieving meaningful outcomes at midterm follow-up, as well as predictors of these outcomes, is limited.

**Purpose:** To (1) compare the rates of achieving meaningful clinical outcomes between patients with and without BHD and (2) identify the predictors for achieving clinical success among patients with BHD 5 years after undergoing hip arthroscopic surgery for FAIS.

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

**Methods:** Data from consecutive patients who underwent primary hip arthroscopic surgery with routine capsular closure for the treatment of FAIS between January 2012 and August 2014 were collected and retrospectively analyzed. Patients with BHD (lateral center-edge angle [LCEA] 20°-25°) were matched 1:2 by age (±1 year) and body mass index (BMI; ±5 kg/m2) to control patients with normal acetabular coverage (LCEA 25°-40°). Data collected included baseline and 5-year postoperative patient-reported outcomes. The minimal clinically important difference (MCID) and patient acceptable symptom state (PASS) were calculated for each patient-reported outcome measure and compared between the 2 groups. A binary logistic regression analysis was used to identify significant predictors of achieving the MCID and PASS in the BHD group.

**Results:** The MCID in the BHD group was defined as 9.6, 14.1, and 9.5 for the Hip Outcome Score–Activities of Daily Living, Hip Outcome Score–Sports Subscale, and modified Harris Hip Score, respectively. Threshold scores for achieving the PASS in both groups were 90.9, 76.6, and 81.9, respectively. A total of 88 patients were identified with having BHD and were matched to 176 controls. No statistical differences were identified for age, BMI, or sex. Both the BHD and the non-BHD groups had statistically significant increases in patient-reported outcome scores over the 5-year period, but the difference in both groups was not statistically significant ($P > .05$ for all). There was no statistical difference in the frequency of patients in the BHD and non-BHD groups achieving the MCID (86.6% vs 85.2%, respectively; $P = .804$) or PASS (76.0% vs 73.7%, respectively; $P = .675$) on at least 1 outcome measure. The logistic regression model demonstrated that being physically active (odds ratio [OR], 27.59; $P = .005$) and being female (OR, 14.64; $P = .025$) were independent predictors of achieving the MCID, while running (OR, 11.1; $P = .002$), being female (OR, 7.6; $P = .011$), and a larger preoperative LCEA (OR, 2.3; $P = .001$) were independent preoperative predictors of achieving the PASS.

**Conclusion:** The rates of achieving clinical success 5 years after undergoing arthroscopic treatment with capsular closure for FAIS were not significantly different between patients with BHD and those with normal acetabular coverage. Being physically active, running for exercise,

BACK

female sex, and a larger LCEA were preoperative predictors of achieving clinical success at 5 years in patients with BHD.

BACK

**Achieving Successful Outcomes of Hip Arthroscopy in the Setting of Generalized Ligamentous Laxity With Labral Preservation and Appropriate Capsular Management: A Propensity Matched Controlled Study**

David R. Maldonado, MD, Jeffery W. Chen, BA, Mitchell J. Yelton, BS, Philip J. Rosinsky, MD, Jacob Shapira, MD, Ciaran Brayboy, Ajay C. Lall, MD, MS, Benjamin G. Domb, MD

https://doi.org/10.1177/0363546520914604

**Background:** Association among generalized ligamentous laxity (GLL), hip microinstability, and patient-reported outcomes (PROs) after hip arthroscopy has yet to be completely established.

**Purposes:** (1) To report minimum 2-year PROs in patients with GLL who underwent hip arthroscopy in the setting of symptomatic labral tears and femoroacetabular impingement syndrome and (2) to compare clinical results with a matched-pair control group without GLL.

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

**Methods:** Data from a prospectively collected database were retrospectively reviewed between August 2014 and December 2016. Patients were considered eligible if they received primary arthroscopic treatment for symptomatic labral tears and femoroacetabular impingement. Inclusion criteria included preoperative and minimum 2-year follow-up scores for the following PROs: modified Harris Hip Score (mHHS), Non-arthritic Hip Score (NAHS), and visual analog scale for pain (VAS). From the sample population, 2 groups were created: the GLL group (Beighton score ≥4) and the control group (Beighton score <4). Patients were matched in a 1:2 ratio via propensity score matching according to age, sex, body mass index, Tönnis grade, and preoperative lateral center-edge angle. Patient acceptable symptomatic state (PASS) and minimal clinically important difference (MCID) for mHHS, Hip Outcome Score–Sports Specific Scale (HOS-SSS), and International Hip Outcome Tool–12 (iHOT-12) were calculated.

**Results:** A total of 57 patients with GLL were matched to 88 control patients. Age, sex, body mass index, and follow-up times were not different between groups ($P > .05$). Preoperative radiographic measurements demonstrated no difference between groups. Intraoperative findings and procedures between groups were similar except for capsular treatment, with the GLL group receiving a greater percentage of capsular plications ($P = .04$). At minimum 2-year follow-up, both groups showed significant improvement in PROs and VAS ($P < .001$). Furthermore, the postoperative PROs at minimum 2-year follow-up and the magnitude of improvement (delta value) were similar between groups for mHHS, NAHS, HOS-SSS, and VAS ($P > .05$). Moreover, groups reached comparable rates of MCID and PASS for mHHS, HOS-SSS, and iHOT-12.

**Conclusion:** Patients with GLL after hip arthroscopy for symptomatic femoroacetabular impingement and labral tears may expect favorable outcomes with appropriate labral and capsular management at minimum 2-year follow-up. When compared with a pair-matched control group without GLL, results were comparable for mHHS, NAHS, HOS-SSS, and VAS and reached PASS and/or MCID for mHHS, HOS-SSS, and iHOT-12.

BACK

# Hips With Acetabular Retroversion Can Be Safely Treated With Advanced Arthroscopic Techniques Without Anteverting Periacetabular Osteotomy: Midterm Outcomes With Propensity-Matched Control Group

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**Background:** Different options, from reverse (anteverting) periacetabular osteotomy to hip arthroscopy, have been proposed for surgical treatment of femoroacetabular impingement syndrome (FAIS) in the setting of acetabular retroversion.

**Purpose:** (1) To report and analyze midterm patient-reported outcome scores (PROs) in patients with FAIS and labral tears in the setting of acetabular retroversion after isolated hip arthroscopy and (2) to compare these PROs with those of a propensity-matched control group without acetabular retroversion.

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

**Methods:** Prospectively collected data were retrospectively reviewed for patients who underwent hip arthroscopy for FAIS and labral tear treatment between June 2008 and March 2014. Inclusion criteria were as follows: acetabular retroversion, pre- and postoperative PROs for modified Harris Hip Score (mHHS), Non-arthritic Hip Score, Hip Outcome Score–Sports Specific Scale (HOS-SSS), and visual analog scale (VAS). Propensity score matching was utilized to identify a control group without acetabular retroversion matched 1:1 with similar age, sex, body mass index, acetabular and femoral head Outerbridge grade, preoperative lateral center-edge angle, and labral treatment. Patient acceptable symptomatic state (PASS) and/or minimal clinically important difference (MCID) for the mHHS, HOS-SSS, International Hip Outcome Tool–12, and VAS was calculated.

**Results:** A total of 205 hips with acetabular retroversion were matched to a control group. The groups showed no difference in demographic variables. The retroversion group was composed of 139 female and 66 male hips, with a mean ± SD age of 23.81 ± 7.28 years and follow-up time of 65.24 ± 20.31 months. Intraoperative diagnostic data and procedures performed were similar between groups, except more femoroplasties were performed in the retroversion group. Significant improvements for the mHHS, Non-arthritic Hip Score, HOS-SSS, and VAS were seen for both groups at a mean 5-year follow-up. The proportion of patients who reached the PASS and MCID were similar.

**Conclusion:** In the setting of FAIS and labral tears, patients with acetabular retroversion can be safely treated with advanced hip arthroscopic techniques without reverse (anteverting) periacetabular osteotomy in a high-volume surgeon's hands. Patients with acetabular retroversion demonstrated favorable PROs at midterm follow-up. Furthermore, the proportion of patients reaching the MCID and PASS for several PROs were comparable with those of a propensity-matched control group without acetabular retroversion.

BACK

**Outcomes After Arthroscopic Hip Labral Reconstruction: A Systematic Review and Meta-analysis**

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https://doi.org/10.1177/0363546519878147



**Background:** The acetabular labrum is critical to maintenance of hip stability and has been found to play a key role in preservation of the hip fluid seal. For irreparable labral damage, arthroscopic labral reconstruction is an evolving technique that has been shown to decrease hip pain and restore function.

**Purpose:** To provide a comprehensive review of current literature for arthroscopic hip labral reconstruction, with a focus on determining if outcomes differ between autograft or allograft tissue.

**Study Design:** Systematic review and meta-analysis.

**Methods:** PubMed and Scopus online databases were searched with the key terms "hip,""labrum,""reconstruction," and "graft" in varying combinations. Procedures performed, complications, failures, and functional outcome measures were included in this analysis. The inverse variance method was used to calculate pooled estimates and 95% CIs.

**Results:** Eight studies with 537 hips were included. Mean age was 37.4 years (95% CI, 34.5-40.4 years), and mean follow-up time was 29 months (95% CI, 26-33 months). Survivorship after autograft reconstruction ranged from 75.7% to 100%, as compared with 86.3% to 90.0% in the allograft cohort. In the autograft cohort, failures included 0% to 13.2% conversion to total hip arthroplasty and 0% to 11.0% revision hip arthroscopy. Failures in the allograft cohort included 0% to 12.9% total hip arthroplasty conversion, 0% to 10.0% revision arthroscopy, and 0% to 0.8% open revision surgery. Based on 6 studies, the modified Harris Hip Score improved by a mean 29.0 points after labral reconstruction ($P < .0001$).

**Conclusion:** Arthroscopic hip labral reconstruction results in clinically significant improvements in patient-reported outcomes. Our analysis indicates that there are no significant differences in outcomes based on graft type alone. A number of factors may determine graft choice, including patient preference, surgeon experience, operative time, morbidity, and cost. Proper patient selection based on age and severity of degenerative joint disease will also optimize outcomes after labral reconstruction.

BACK

# Outcomes of Hip Arthroscopic Surgery in Adolescents With a Subanalysis on Return to Sport: A Systematic Review

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**Background:** There is a plethora of literature on outcomes after hip arthroscopic surgery in the adult population; however, outcomes in the adolescent population have not been as widely reported. Additionally, as adolescents represent a very active population, it is imperative to understand their athletic activity and return to sport after hip arthroscopic surgery.

**Purpose:** To analyze patient-reported outcomes (PROs) after hip arthroscopic surgery in adolescents (aged 10-19 years) and present a return-to-sport analysis in the athletic adolescent subgroup.

**Study Design:** Systematic review; Level of evidence, 4.

**Methods:** The PubMed, Embase, and Cochrane databases were searched according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to identify articles that reported PROs after hip arthroscopic surgery in adolescents. The standardized mean difference was calculated to compare the effect size of hip arthroscopic surgery on various PROs. For the athletic subgroup, a return-to-sport summary was also provided.

**Results:** Ten studies, with 618 adolescent hips and a collective study period of December 2004 to February 2015, were included in this systematic review. Across all studies, the mean age was 15.8 years (range, 11.0-19.9 years), and female patients composed approximately 56.7% of the entire cohort. The mean follow-up was 34.5 months (range, 12-120 months). The modified Harris Hip Score (mHHS) was reported in 9 studies, and at latest follow-up, scores were excellent in 4 studies (range, 90-95) and good in the remaining 5 studies (range, 82.1-89.6). All adolescents also showed significant improvement on the Non-Arthritic Hip Score (NAHS), the Hip Outcome Score–Activities of Daily Living (HOS-ADL), the HOS–Sport-Specific Subscale (HOS-SSS), the physical component of the 12-Item Short Form Health Survey (SF-12P), a visual analog scale for pain (VAS), and both versions of the International Hip Outcome Tool (iHOT-12 and iHOT-33) at latest follow-up ($P < .05$). Further, mean improvements reported in all studies surpassed reported values of the minimal clinically important difference and patient acceptable symptomatic state for the mHHS, HOS-ADL, HOS-SSS, and iHOT-33. Finally, the collective return-to-sport rate among athletic adolescents was 84.9%.

**Conclusion:** In the setting of labral tears and femoroacetabular impingement, hip arthroscopic surgery can safely be performed in adolescents and leads to significant functional improvement. Furthermore,

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# Is Primary Arthroscopic Repair Using the Pulley Technique an Effective Treatment for Partial Proximal ACL Tears?

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**Background**
Attention has recently been paid to primary arthroscopic repair to treat ACL tears because of the disadvantages associated with reconstruction. However, there remain many unanswered questions and concerns about its application in the treatment of ACL tears.

**Questions/purposes**
(1) Does primary arthroscopic repair using the pulley technique result in satisfactory ROM (a functional ROM with a flexion contracture of 30° or less), knee stability, and functional scores in patients with partial proximal ACL tears? (2) What complications are associated with primary arthroscopic repair using the pulley technique in patients with partial proximal ACL tears?

**Methods**
Between January 2014 and March 2016, we treated 23 patients surgically who had partial proximal ACL tears and excellent tissue quality (defined as a remnant with mild interstitial tearing and the ability to hold sutures). All patients meeting those two criteria were treated using primary arthroscopic repair using the pulley technique. During that period, this represented 13% (23 of 183) of the patients we treated surgically for an ACL tear. Patients were excluded if they had other ACL tear types, insufficient tissue quality (defined as a severely torn remnant that was not strong enough to hold sutures), multi-ligamentous injuries, or substantial arthrosis (chondromalacia greater than Outerbridge grade 3, most of which underwent conversion to ACL reconstruction). Clinical outcomes were assessed using ROM, the anterior drawer test, the Lachman test, Lysholm score, Tegner activity score, IKDC subjective score, and radiographs. Twenty-one patients were observed for a mean (range) period of 36 months (25-49), and two were lost to follow-up.

**Results**
At the most-recent follow-up examination, all patients achieved full extension and only one patient lacked full flexion, with a flexion contracture of 10°. Twenty patients had no instability on the anterior drawer test and Lachman test findings, and one patient had a 1 + anterior drawer test. The mean Lysholm score improved from a mean ± SD of 71 ± 9 before surgery to 94 ± 6 (mean difference 23 points [95% CI 20 to 25]; $p < 0.001$) at latest follow-up. The IKDC subjective score improved from 64 ± 10 to 86 ± 11 points (mean difference 22 points; $p < 0.001$). We found no difference in the Tegner score from before surgery to latest follow-up (6.3 ± 1.2 versus 6.1 ± 1.2; mean difference 0.2; $p = 0.056$). One patient re-ruptured his ACL 2 months after surgery in military training during an obstacle race. No complications such as infection, thrombosis, stiffness, patellofemoral pain, or implant failure were observed.

**Conclusions**

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Primary arthroscopic repair using the pulley technique can achieve short-term clinical success in a carefully selected (the selection process includes first identifying the ACL injury pattern preoperatively with MRI, then confirming the diagnosis under arthroscopy, and deciding whether to perform a repair intraoperatively) subset of patients with partial proximal ACL tears and excellent tissue quality (defined as a remnant with mild interstitial tearing and the ability to hold sutures). Despite the promising clinical outcomes of our study, this technique should not be widely adopted unless it has been compared directly with ACL reconstruction, so future studies should be conducted to compare the clinical outcomes between this technique and ACL reconstruction, and longer-term follow-up is necessary to identify whether there is deterioration in the clinical outcomes over time.

**Level of Evidence**
Level IV, therapeutic study.

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