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[BACK](#)

Content January

Upper Extremity

Arthroscopy

Volume 40, issue 1

- All-Arthroscopic Glenoid Bone Augmentation Using Iliac Crest Autograft Procedure for Recurrent Anterior Shoulder Instability: Button Fixation Is a Feasible and Satisfactory Alternative to Screw Fixation
- Augmentation of Massive Rotator Cuff Repairs Using Biceps Transposition Without Tenotomy Improves Clinical and Patient-Reported Outcomes: The Biological Superior Capsular Reconstruction Technique

Journal of Shoulder and Elbow Surgery (JSES)

Volume 33, issue 1

- How does dynamic arthroscopic tracking compare with radiologic glenoid track for identification of on- and off-track lesions in anterior shoulder instability?
- Bone channeling in arthroscopic rotator cuff repair: a systematic review and meta-analysis of level I studies
- Shear wave elastography correlates to degeneration and stiffness of the long head of the biceps tendon in patients undergoing tenodesis with arthroscopic shoulder surgery

Knee Surgery, Sports Traumatology, Arthroscopy (KSSTA)

Volume 32, Issue 1

- No Upper Extremity Abstracts

American Journal of Sports Medicine (AJSM)

Volume 52, Issue 1

- Effect of Patient Characteristics on the Minimal Clinically Important Difference and Patient Acceptable Symptom State Thresholds After Arthroscopic Bankart Repair
- Defining Critical Humeral Bone Loss: Inferior Craniocaudal Hill-Sachs Extension as Predictor of Recurrent Instability After Primary Arthroscopic Bankart Repair
- Outcomes of Arthroscopic Latarjet as a Revision Surgery After Failed Arthroscopic Bankart Repair
- Establishing the Minimal Clinically Important Difference, Substantial Clinical Benefit, and Patient Acceptable Symptomatic State After Arthroscopic Posterior Labral Repair for Posterior Glenohumeral Instability

Journal of Bone and Joint Surgery (JBJS)

Volume 106, Issue 1+2

- No Upper Extremity Abstracts

Clinical Orthopaedics and Related Research (CORR)

Volume 482, Issue 1

- No Upper Extremity Abstracts

Bone and Joint Journal (BJJ)

Volume 106-B, issue 1

- No Upper Extremity Abstracts

Lower Extremity

[BACK](#)

Arthroscopy

Volume 40, issue 1

- Both Labral Debridement and Labral Repair Result in >90% Total Hip Arthroplasty-free Survival at 5-Year Follow-Up: An Analysis of the German Cartilage Registry (KnorpelRegister DGO)
- Variation in Reported Learning Outcomes and Measurement Instruments in Hip Arthroscopy Simulation Training: A Systematic Review

Journal of Shoulder and Elbow Surgery (JSES)

Volume 33, issue 1

- No Lower Extremity Abstracts

Knee Surgery, Sports Traumatology, Arthroscopy (KSSTA)

Volume 32, Issue 1

- Significant improvements in clinical outcome measures and patient satisfaction after combined all-arthroscopic meniscal allograft transplantation and autologous chondrocyte implantation: A single-centre longitudinal study
- Sustainability studies in orthopaedic surgery: The carbon footprint of anterior cruciate ligament reconstruction depends on graft choice
- Weight loss enhances meniscal healing following transtibial pullout repair for medial meniscus posterior root tears
- Approximately half of pediatric or adolescent patients undergoing revision anterior cruciate ligament reconstruction return to the same level of sport or higher: A systematic review

American Journal of Sports Medicine (AJSM)

Volume 52, Issue 1

- Isolated Arthroscopic Debridement of Acetabular Labral Tears: High Rates of Failure and Conversion to Total Hip Arthroplasty at 13-Year Minimum Follow-up
- Hip Arthroscopic Surgery With Chondrolabral Refixation, Osteochondroplasty, and Routine Capsular Closure for Femoroacetabular Impingement Syndrome: Clinical Outcomes at a Minimum 10-Year Follow-up
- Functional Outcome Scores and Conversion to Total Hip Arthroplasty After Hip Arthroscopy for Femoroacetabular Impingement Syndrome in Patients With Tönnis Grade 1 Versus Grade 0 Arthritis: A Propensity-Matched Study at Minimum 10-Year Follow-up
- Intermediate-Term Outcomes of Hip Arthroscopy for Femoroacetabular Impingement Syndrome in Patients With Global Versus Isolated Lateral Acetabular Overcoverage
- Survivorship of 157 Arthroscopic Meniscal Allograft Transplants Using Bone Fixation at a Mean of 7 Years and Prognostic Factors Analysis
- Preoperative Predictors of Arthroscopic Partial Meniscectomy Outcomes: The APM Index Score

Journal of Bone and Joint Surgery (JBJS)

Volume 106, Issue 1+2

- No Lower Extremity Abstracts

Clinical Orthopaedics and Related Research (CORR)

Volume 482, Issue 1

- No Lower Extremity Abstracts

Bone and Joint Journal (BJJ)

Volume 106-B, issue 1

- No Lower Extremity Abstracts

[BACK](#)

Miscellaneous

Arthroscopy

Volume 40, issue 1

- No Miscellaneous Abstracts

Journal of Shoulder and Elbow Surgery (JSES)

Volume 33, issue 1

- No Miscellaneous Abstracts

Knee Surgery, Sports Traumatology, Arthroscopy (KSSTA)

Volume 32, Issue 1

- No Miscellaneous Abstracts

American Journal of Sports Medicine (AJSM)

Volume 52, Issue 1

- No Miscellaneous Abstracts

Journal of Bone and Joint Surgery (JBJS)

Volume 106, Issue 1+2

- No Miscellaneous Abstracts

Clinical Orthopaedics and Related Research (CORR)

Volume 482, Issue 1

- No Miscellaneous Abstracts

Bone and Joint Journal (BJJ)

Volume 106-B, issue 1

- No Miscellaneous Abstracts

Upper extremity

[Arthroscopy, Volume 40, Issue 1](#)

All-Arthroscopic Glenoid Bone Augmentation Using Iliac Crest Autograft Procedure for Recurrent Anterior Shoulder Instability: Button Fixation Is a Feasible and Satisfactory Alternative to Screw Fixation

L. Li, M. Lu

DOI: <https://doi.org/10.1016/j.arthro.2023.05.033>

Purpose: To investigate the efficacy of all-arthroscopic glenoid bone augmentation surgery using the iliac crest autograft procedure. Furthermore, we sought to compare the clinical and radiographic outcomes of using screw versus button fixation, in patients with recurrent anterior shoulder instability.

Methods: Between 2015 and 2019, 134 shoulders with persistent instability were surgically treated with an arthroscopically placed autologous iliac crest bone graft transfer procedure. Preoperative and postoperative clinical follow-up data were evaluated using the range of motion, and the Walch–Duplay, American Shoulder and Elbow Society, and Rowe scores. Radiologic assessment on 3-dimensional computed tomography scans was performed preoperatively, immediately after surgery, as well as postoperatively, at 3 months, 6 months, 1 year, and at the final follow-up stage. Graft positions, healing, and resorption were evaluated from postoperative images.

Results: This study included 102 patients who underwent arthroscopic iliac crest bone grafting procedure with 2 screws fixation (n = 37; group 1) and 2 button fixation (n = 65; group 2). The mean follow-up period was 37 months. There were no significant differences between groups in terms of clinical scores, shoulder motion range, graft healing, or graft positions on computed tomography scans ($P > .05$). In group 1, 1 patient showed mechanical irritation and persistent pain around the screw insertion site, being treated through the arthroscopic removal of the screws. The average postoperative bony resorption percentages were 20.3% and 11.2% at 6 months, and 32.4% and 19.3% at 12 months, in group 1 and group 2, respectively. A statistically significant difference was detected between the two groups ($P < .05$).

Conclusions: In the arthroscopic iliac crest bone grafting procedure for the treatment of chronic osseous anterior shoulder instability, excellent functional results were obtained after both button fixation and screw fixation techniques. In addition, less graft resorption and no hardware-related complications were detected with suture button fixation technique.

Level of evidence: Level III, retrospective comparative therapeutic trial.

Augmentation of Massive Rotator Cuff Repairs Using Biceps Transposition Without Tenotomy Improves Clinical and Patient-Reported Outcomes: The Biological Superior Capsular Reconstruction Technique

S. Gray McClatchy, D. E. Parsell

DOI: <https://doi.org/10.1016/j.arthro.2023.06.014>

Purpose: To evaluate the outcomes of a consecutive series of patients after transposition of the biceps without tenotomy (biological superior capsular reconstruction [bio-SCR] technique) to augment massive rotator cuff repairs.

Methods: Thirty massive rotator cuff tears repaired and augmented using the bio-SCR technique between June 2018 and July 2021 were identified and retrospectively reviewed. American Shoulder and Elbow Surgeons (ASES) scores, visual analog scale pain scores, supraspinatus and infraspinatus strength, and range of motion were collected preoperatively and postoperatively.

Results: The average age of patients undergoing bio-SCR augmentation was 67.0 years (range, 28.4-81.9 years), and the mean clinical follow-up period was 2.9 years (range, 1.8-4.5 years). The average ASES score improved from 33.2 preoperatively to 80.8 at 6 months postoperatively, 92.0 at 1 year, and 87.0 at 2 years ($P < .001$). The minimal clinically important difference for the ASES score was exceeded at all postoperative intervals. Active forward flexion improved from 120.6° to 156.8° ($P < .001$). The pain score improved from 7.1 to 0.9 ($P < .001$). Postoperatively, 1 complication (3.3%) occurred: a proximal biceps rupture.

Conclusions: Incorporating a transposed biceps tendon into the repair of a massive rotator cuff tear using the bio-SCR technique resulted in significant clinical improvements with a low complication rate.

Level of Evidence: Level IV, case series.

How does dynamic arthroscopic tracking compare with radiologic glenoid track for identification of on- and off-track lesions in anterior shoulder instability?

D.N. Bhatia, P. Malviya

DOI: <https://doi.org/10.1016/j.jse.2023.05.018>

Background: Current treatment paradigms for anterior shoulder instability are based on radiologic measurements of glenohumeral bone defects, and mathematical calculation of the glenoid track (GT) is used to classify lesions into on-track and off-track morphology. However, radiologic measurements have shown high variability, and GT widths under dynamic conditions have been reported to be significantly smaller than those under static radiologic conditions. The purpose of this study was to assess the reliability, reproducibility, and diagnostic validity of dynamic arthroscopic standardized tracking (DAST) in comparison to the gold-standard radiologic track measurement method for the identification of on- and off-track bony lesions in patients with anteroinferior shoulder instability.

Methods: Between January 2018 and August 2022, 114 patients with traumatic anterior shoulder instability were evaluated using 3-T magnetic resonance imaging or computed tomography scans; glenoid bone loss, Hill-Sachs interval, GT, and Hill-Sachs occupancy ratio (HSO) were measured, and defects were classified as on-track or off-track defects and peripheral-track defects (based on HSO percentage) by 2 independent researchers. During arthroscopy, a standardized method (DAST method) was used by 2 independent observers to classify defects into on-track defects (central and peripheral) and off-track defects. Interobserver reliability of the DAST and radiologic methods was calculated using the κ statistic and reported as percentage agreement. Diagnostic validity (sensitivity, specificity, positive predictive value, and negative predictive value) of the DAST method was calculated using the radiologic track (HSO percentage) as the gold standard.

Results: The radiologically measured mean glenoid bone loss percentage, Hill-Sachs interval, and HSO in off-track lesions were lower with the arthroscopic method (DAST) as compared with the radiologic method. The DAST method showed nearly perfect agreement between the 2 observers for the on-track/off-track classification ($\kappa = 0.96$, $P < .001$) and the on-track central or peripheral /off-track classification ($\kappa = 0.88$, $P < .001$). The radiologic method showed greater interobserver variability ($\kappa = 0.31$ and $\kappa = 0.24$, respectively) with only fair agreement for both classifications. Inter-method agreement varied between 71% and 79% (95% confidence interval, 62%-86%) between the 2 observers, and reliability was assessed as slight ($\kappa = 0.16$) to fair ($\kappa = 0.38$). Overall, for identification of an off-track lesion, the DAST method showed maximum specificity (81% and 78%) when radiologic peripheral-track lesions (HSO percentage of 75%-100%) were considered off-track and showed maximum sensitivity when arthroscopic peripheral-track lesions were classified as off-track.

Conclusion: Although inter-method agreement was low, a standardized arthroscopic tracking method (DAST method) showed superior interobserver agreement and reliability for lesion classification in comparison to the radiologic track method. Incorporating DAST into current algorithms may help reduce variability in surgical decision making.

Level of evidence: Level III, Diagnostic Study.

Bone channeling in arthroscopic rotator cuff repair: a systematic review and meta-analysis of level I studies

J.A. Fairley, J.W. Pollock

DOI: <https://doi.org/10.1016/j.jse.2023.08.012>

Background: There is ongoing controversy regarding the effect of bone channeling in arthroscopic rotator cuff repair. Since the most recent systematic reviews in 2019, several large high-level trials have been completed. This study assessed all available level I randomized controlled trials (RCTs) that compared arthroscopic rotator cuff repair with and without bone marrow channeling.

Methods: A systematic search of the Ovid MEDLINE, Embase, and Cochrane Library databases was conducted through mid January 2023. Two reviewers performed screening of studies meeting the eligibility criteria: English-language RCTs in patients aged ≥ 18 years comparing arthroscopic rotator cuff repair of full-thickness tears with and without bone marrow channeling (channeling group and control group, respectively). Functional scores, pain, healing rates, and reoperations were reviewed using pooled analysis where appropriate. The methodologic quality of included studies was assessed using the Cochrane risk-of-bias tool and the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach.

Results: A total of 6 randomized studies (N = 593) met the inclusion criteria. Pooled analysis of all 6 studies showed no significant mean difference in function (1.32; 95% confidence interval [CI], -0.63 to 3.26), as measured by the Constant-Murley score. Retear rates were also not statistically different between groups (risk ratio, 0.99; 95% CI, 0.57 to 1.71), with pooled retear rates of 19.6% (48 of 245) with channeling and 19.8% (51 of 257) without. The other outcomes of interest were only available for analysis in a subset of studies. There were no standardized mean differences in pain (0.09; 95% CI, -0.18 to 0.36), and there were similar reoperation rates (risk ratio, 1.19; 95% CI, 0.43 to 3.34) in the channeling and control groups. For the included studies, the overall quality of evidence by outcome was judged to be moderate (function, pain, and reoperations) or low (retear rates), mainly owing to risk of bias (all outcomes) and inconsistency (retear rates).

Conclusion: The results of this study refute the findings of prior systematic reviews that showed that channeling reduces the retear rate when combined with arthroscopic rotator cuff repair. This meta-analysis of level I evidence, including recent larger RCTs, demonstrates that bone marrow stimulation in the setting of primary arthroscopic rotator cuff repair has no significant effect on functional outcomes, healing, pain, or reoperation rates.

Level of evidence: Level I, Meta-Analysis.

Shear wave elastography correlates to degeneration and stiffness of the long head of the biceps tendon in patients undergoing tenodesis with arthroscopic shoulder surgery

H. Uehara, Y. Itoigawa

DOI: <https://doi.org/10.1016/j.jse.2023.05.014>

Background: Tendinopathy of the long head of the biceps (LHB) tendon causes degeneration and changes its stiffness. However, a reliable means of diagnosis has not been established. Shear wave elastography (SWE) provides quantitative tissue elasticity measurements. In this study, the relationship of preoperative SWE values with biomechanically measured stiffness and degeneration of the LHB tendon tissue was investigated.

Methods: LHB tendons were obtained from 18 patients who underwent arthroscopic tenodesis. SWE values were measured preoperatively at 2 sites, proximal to and within the bicipital groove of the LHB tendon. The LHB tendons were detached immediately proximal to the fixed sites and at their superior labrum insertion. Tissue degeneration was histologically quantified using the modified Bonar score. Tendon stiffness was determined using a tensile testing machine.

Results: The SWE values of the LHB tendon were 502.1 ± 113.6 kPa proximal to the groove and 439.4 ± 123.3 kPa within the groove. The stiffness was 39.3 ± 19.2 N/mm. The SWE values displayed a moderate positive correlation with the stiffness proximal to the groove ($r = 0.80$) and within it ($r = 0.72$). The SWE value of the LHB tendon within the groove showed a moderate negative correlation with the modified Bonar score ($r = -0.74$).

Conclusions: These findings suggest that preoperative SWE values of the LHB tendon correlate moderately positively with stiffness and moderately negatively with tissue degeneration. Therefore, SWE may predict LHB tendon tissue degeneration and changes in stiffness caused by tendinopathy.

Level of evidence: Level IV, Case Series, Diagnostic Study.

Knee Surgery, Sports Traumatology, Arthroscopy (KSSTA), Volume 32, Issue 1

No Upper Extremity Abstracts

[BACK](#)

Effect of Patient Characteristics on the Minimal Clinically Important Difference and Patient Acceptable Symptom State Thresholds After Arthroscopic Bankart Repair

I. Pasqualini, I. Tanoira

DOI: <https://doi.org/10.1177/03635465231212652>

Background: There is scarce literature on clinically significant values after arthroscopic Bankart repair (ABR).

Purpose: To determine the minimal clinically important difference (MCID) and the patient acceptable symptom state (PASS) thresholds at 1 year for the Rowe and Athletic Shoulder Outcome Scoring System (ASOSS) scores after ABR and to determine the effect of patient characteristics on these metrics after ABR.

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

Methods: A retrospective review of patients undergoing ABR from a single institution between January 2017 and January 2020 was performed. Patients with at least 1 episode of instability and a minimum follow-up of 12 months were included. The exclusion criteria were as follows: bony defects of >20% on the anteroinferior portion of the glenoid based on a preoperative computed tomography scan; engaging Hill-Sachs lesions at 90° of abduction and 90° of external rotation based on an arthroscopic examination; previous surgery on the same shoulder; multidirectional instability or concomitant repair of full-thickness rotator cuff tears; superior labral anterior to posterior lesions; posterior labral tears; or humeral avulsion of the glenohumeral ligament lesions. Patient-reported outcome measures were collected both preoperatively and 1-year postoperatively. Delta was defined as the change between preoperative and 1-year postoperative scores. Distribution-based (one-half the standard deviation of the difference between pre- and postoperative outcome scores) and anchored-based approaches (response to a satisfaction question at 1 year) were used to estimate the MCID and the PASS, respectively. The optimal cutoff point, where sensitivity and specificity were maximized, and the percentage of patients achieving those thresholds were also calculated.

Results: Overall, 190 patients were included. The distribution-based MCID for the Rowe and ASOSS scores were calculated to be 8.2 and 8.7, respectively. The rate of patients who achieved MCID thresholds was 96% for the Rowe and 96% for ASOSS scores. The PASS threshold for the Rowe and ASOSS scores were ≥80 and ≥90, respectively. The rate of patients who achieved PASS scores after ABR were 86% and 83%, respectively. The MCID and PASS values showed great variability based on sex (men: 8.5 and ≥85 for Rowe / 8.9 and ≥90 for ASOSS, respectively, vs women: 6.7 and ≥73 for Rowe / 8.1 and ≥75 for ASOSS), age (≥21: 8.4 and ≥80 / 9.2 and ≥90 vs <21: 7.8 and ≥75 / 7.7 and ≥85), sports participation (sports: 8.8 and ≥85 / 9.5 and ≥90 vs no sports: 8.1 and ≥75 / 8.6 and ≥80), and type of athlete (competitive: 8.4 and ≥85 / 8.9 and ≥87 vs recreational: 7.5 and ≥73 / 8.1 and ≥68).

Conclusion: This study identified the MCID and PASS thresholds for the Rowe and ASOSS scores at 1 year after ABR. However, these values showed great variability when accounting for different patient characteristics such as sex, age, sports participation, and type of athlete, highlighting the importance of considering individual patient-specific characteristics for optimal treatment decision-making and ensuring treatment success tailored to each patient's unique needs and expectations.

Defining Critical Humeral Bone Loss: Inferior Craniocaudal Hill-Sachs Extension as Predictor of Recurrent Instability After Primary Arthroscopic Bankart Repair

T. Cong, S. Charles

DOI: <https://doi.org/10.1177/03635465231209443>

Background: The glenoid track concept for shoulder instability primarily describes the medial-lateral relationship between a Hill-Sachs lesion and the glenoid. However, the Hill-Sachs position in the craniocaudal dimension has not been thoroughly studied.

Purpose: Hill-Sachs lesions with greater inferior extension are associated with increased risk of recurrent instability after primary arthroscopic Bankart repair.

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

Methods: The authors performed a retrospective analysis of patients with on-track Hill-Sachs lesions who underwent primary arthroscopic Bankart repair (without remplissage) between 2007 and 2019 and had a minimum 2-year follow-up. Recurrent instability was defined as recurrent dislocation or subluxation after the index procedure. The craniocaudal position of the Hill-Sachs lesion was measured against the midhumeral axis on sagittal magnetic resonance imaging (MRI) using either a Hill-Sachs bisecting line through the humeral head center (sagittal midpoint angle [SMA], a measure of Hill-Sachs craniocaudal position) or a line tangent to the inferior Hill-Sachs edge (lower-edge angle [LEA], a measure of Hill-Sachs caudal extension). Univariate and multivariate regression were used to determine the predictive value of both SMA and LEA for recurrent instability.

Results: In total, 176 patients were included with a mean age of 20.6 years, mean follow-up of 5.9 years, and contact sport participation of 69.3%. Of these patients, 42 (23.9%) experienced recurrent instability (30 dislocations, 12 subluxations) at a mean time of 1.7 years after surgery. Recurrent instability was found to be significantly associated with LEA $>90^\circ$ (ie, Hill-Sachs lesions extending below the humeral head equator), with an OR of 3.29 ($P = .022$). SMA predicted recurrent instability to a lesser degree (OR, 2.22; $P = .052$). Post hoc evaluation demonstrated that LEA $>90^\circ$ predicted recurrent dislocations (subset of recurrent instability) with an OR of 4.80 ($P = .003$). LEA and SMA were found to be collinear with Hill-Sachs interval and distance to dislocation, suggesting that greater LEA and SMA proportionally reflect lesion severity in both the craniocaudal and medial-lateral dimensions.

Conclusion: Inferior extension of an otherwise on-track Hill-Sachs lesion is a highly predictive risk factor for recurrent instability after primary arthroscopic Bankart repair. Evaluation of Hill-Sachs extension below the humeral equator (inferior equatorial extension) on sagittal MRI is a clinically facile screening tool for higher-risk lesions with subcritical glenoid bone loss. This threshold for critical humeral bone loss may inform surgical stratification for procedures such as remplissage or other approaches for at-risk on-track lesions.

Outcomes of Arthroscopic Latarjet as a Revision Surgery After Failed Arthroscopic Bankart Repair

E. Calvo, L. Dzidzishvili

DOI: <https://doi.org/10.1177/03635465231209986>

Background: The role of arthroscopic Latarjet as a revision surgery after failed arthroscopic Bankart repair has yet to be established.

Purpose: To compare clinical outcomes, recurrences, and complication rates of arthroscopic Latarjet as a revision procedure after failed arthroscopic Bankart repair versus arthroscopic Latarjet as a primary procedure.

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

Methods: This is a retrospective study of prospectively collected data of patients who were diagnosed with anterior shoulder instability and underwent arthroscopic Latarjet stabilization between 2009 and 2018. Patients were separated into 2 groups depending on whether Latarjet was performed after a previous instability surgery (revision) or as a primary surgery (primary). Rowe score, Western Ontario Shoulder Instability Index (WOSI), Constant-Murley Shoulder Outcome (CMSO) score, and Single Assessment Numeric Evaluation (SANE) were assessed pre- and postoperatively with a minimum 24 months of follow-up. In addition, pre- and postoperative levels of sports activity, dislocations, subluxations, and complications were assessed.

Results: A total of 97 patients (n = 62 revision; n = 35 primary), with a mean age of 31.0 ± 8.8 and 29.4 ± 7.6 years old in the revision and primary Latarjet group, respectively, met the inclusion criteria. The mean follow-up in the revision group was 32 months (24-53) and 35.5 months (27.7-42.2) in the primary Latarjet group. No significant differences between groups were observed in Rowe score (revision = 91.4, primary = 94.1; P = .223), CMSO score (revision = 90.7, primary = 94; P = .105), and SANE (revision = 85.8, primary = 87.3; P = .683) postoperatively. However, the postoperative difference in the WOSI score between the revision and primary Latarjet groups was nearly significant (510 ± 334 vs 403 ± 343 , respectively; P = .05). Four (6.4%) postoperative dislocations were reported in the revision and 1 (2.8%) in the primary Latarjet group (P = .14). Patients in the revision group had a lower return to the previous level of sports participation (P = .008) and decreased external rotation with the arm by the side compared with the primary Latarjet group (P = .000).

Conclusion: Arthroscopic Latarjet as a revision surgery is a reasonable surgical option in failed Bankart repair cases. The decision to perform arthroscopic Latarjet stabilization as a revision surgery should not be influenced by the potential risk of future complications as it provides comparable clinical outcomes to the primary Latarjet procedure with a low postoperative recurrence rate. However, a decreased level of postoperative sports participation and external rotation with the arm by the side can be expected.

Establishing the Minimal Clinically Important Difference, Substantial Clinical Benefit, and Patient Acceptable Symptomatic State After Arthroscopic Posterior Labral Repair for Posterior Glenohumeral Instability

J.P. Scanaliato, C.K. Green

DOI: <https://doi.org/10.1177/03635465231210289>

Background: Posterior glenohumeral instability is an increasingly recognized cause of shoulder pain and dysfunction among young, active populations. Outcomes after posterior stabilization procedures are commonly assessed using patient-reported outcome measures including the Single Assessment Numeric Evaluation (SANE), the Rowe instability score, the American Shoulder and Elbow Surgeons (ASES) score, and the visual analog scale (VAS) for pain. The clinical significance thresholds for these measures after arthroscopic posterior labral repair (aPLR), however, remain undefined.

Purpose: We aimed to define the minimal clinically important difference (MCID), substantial clinical benefit (SCB), and patient acceptable symptomatic state (PASS) for the SANE, Rowe score, and ASES score as well as the VAS pain after aPLR. Additionally, we sought to determine preoperative factors predictive of reaching, as well as failing to reach, clinical significance.

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

Methods: This study was a retrospective analysis of patient-reported outcome scores collected from patients who underwent aPLR between January 2011 and December 2018. To determine the clinically significant threshold that corresponded to achieving a meaningful outcome, the MCID, SCB, and PASS were calculated for the SANE, Rowe score, ASES score, and VAS pain utilizing either an anchor- or distribution-based method. Additionally, univariate and multivariate logistic regression analyses were performed to determine the factors associated with achieving, or not achieving, the MCID, SCB, and PASS.

Results: A total of 73 patients with a mean follow-up of 82.55 ± 24.20 months were available for final analysis. MCID, SCB, and PASS values for the VAS pain were 1.10, 6, and 3, respectively; for the ASES score were 7.8, 34, and 80, respectively; for the SANE were 10.15, 33, and 85, respectively; and for the Rowe score were 11.3, 60, and 90, respectively. To meet the MCID, male sex (odds ratio [OR], 1.1639; $P = .0293$) was found to be a positive predictor for the VAS pain, and a lower preoperative SANE score (OR, 0.9939; $P = .0003$) was found to be a negative predictor for the SANE. Dominant arm involvement was associated with lower odds of achieving the PASS for the ASES score (OR, 0.7834; $P = .0259$) and VAS pain (OR, 0.7887; $P = .0436$). Patients who reported a history of shoulder trauma were more likely to reach the PASS for the SANE (OR, 1.3501; $P = .0089$), Rowe score (OR, 1.3938; $P = .0052$), and VAS pain (OR, 1.3507; $P = .0104$) as well as the SCB for the ASES score (OR, 1.2642; $P = .0469$) and SANE (OR, 1.2554; $P = .0444$). A higher preoperative VAS pain score was associated with higher odds of achieving the SCB for both the VAS pain (OR, 1.1653; $P = .0110$) and Rowe score (OR, 1.1282; $P = .0175$). Lastly, concomitant biceps tenodesis was associated with greater odds of achieving the SCB for the ASES score (OR, 1.3490; $P = .0130$) and reaching the PASS for the SANE (OR, 1.3825; $P = .0038$) and Rowe score (OR, 1.4040; $P = .0035$).

Conclusion: To our knowledge, this study is the first to define the MCID, SCB, and PASS for the ASES score, Rowe score, SANE, and VAS pain in patients undergoing aPLR. Furthermore, we found that patients who reported a history of shoulder trauma and those who underwent concomitant biceps tenodesis demonstrated a greater likelihood of achieving clinical significance. Dominant arm involvement was associated with lower odds of achieving clinical significance.

Journal of Bone and Joint Surgery (JBJS), Volume 106, Issue 1+2

No Upper Extremity Abstracts

[BACK](#)

Clinical Orthopaedics and Related Research (CORR), Volume 482, Issue 1

No Upper Extremity Abstracts

[BACK](#)

Bone and Joint Journal (BJJ), Volume 106-B, issue 1

No Upper Extremity Abstracts

[BACK](#)

Lower Extremity

Arthroscopy, Volume 40, Issue 1

Both Labral Debridement and Labral Repair Result in >90% Total Hip Arthroplasty-free Survival at 5-Year Follow-Up: An Analysis of the German Cartilage Registry (KnorpelRegister DGOU)

N. Wirries, W. Zinser

DOI: <https://doi.org/10.1016/j.arthro.2023.04.014>

Purpose: To compare clinical outcome parameters between labral debridement and repair by analyzing the dataset of a multinational registry.

Methods: The data are based on the hip module of the German Cartilage Registry (KnorpelRegister DGOU). The register included patients designated for cartilage or femoroacetabular impingement surgery (up to July 1, 2021; n = 2725). The assessment consisted of the patient's characteristics, the type of labral treatment, the length of labral therapy, the pathology, the grade of cartilage damage, and the type of performed approach. The clinical outcomes were documented by the international hip outcome tool via an online platform. Separated Kaplan–Meier analyses were used for total hip arthroplasty (THA)-free survival rates.

Results: The debridement group (n = 673) showed a mean score increase of 21.9 ± 25.3 points. The repair group (n = 963) had a mean improvement of 21.3 ± 24.6 ($P > .05$). The 60-month THA-free survival rate was 90% to 93% for both groups ($P > .05$). A multivariate analysis showed that the grade of cartilage damage was the only independent statistically significant factor ($P = .002-.001$) influencing patients' outcomes and THA-free survival.

Conclusions: Labral debridement and repair led to good and reliable results. However, these results should not be interpreted with the conclusion that the cheaper and technically easier labral debridement is the recommended treatment due to comparable results in the present study. The clinical outcome and the THA-free survival seemed to be more influenced by the grade of cartilage damage.

Level of evidence: Level III, retrospective comparative therapeutic trial.

Variation in Reported Learning Outcomes and Measurement Instruments in Hip Arthroscopy Simulation Training: A Systematic Review

A. Arevalo, R. Keller

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Purpose: To systematically review the current literature on the effectiveness of hip arthroscopy simulation training and to determine the consistency of reporting and validation of simulation used in hip arthroscopy.

Methods: Three databases (PubMed, EMBase, and CINAHL) were screened using PRISMA guidelines in January 2022 for published literature on virtual simulation in hip arthroscopy. Studies reporting on the use of hip arthroscopy simulation training in orthopedic surgical trainees were included and assessed for quality and risk of bias using MINORS criteria. The number of participants, participant education level, experience, simulator type, validation type, method of assessment, and simulation outcomes were extracted from included studies.

Results: Of the 286 articles screened, 11 met inclusion criteria for review evaluating 323 orthopedic trainees with a mean of 29.36 participants per study published between 2012 and 2021, most commonly in the United Kingdom (55%). The four most reported surgical skills evaluated were visualization and probing tasks (82%), mean time to perform the task (73%), number of cartilage and soft tissue collisions (73%), and number of hand movements (73%). The most described measurement instruments included a simulation built-in scoring system (55%), Arthroscopic Surgical Skill Evaluation Tool (ASSET) Global Rating Scale (GRS) (27%), and motion analysis system (18%). Construct validity was the most reported overall type of validity (82%), followed by face validity (36%), transfer validity (18%) and content validity (18%). Construct validity was also the most reported validity for the simulator and measurement instrument (55% and 89%, respectively).

Conclusions: There is significant variation in reported learning outcomes and measurement instruments for evaluating the effectiveness of hip arthroscopic-based education. This study highlights that simulation training may be an effective tool for evaluation of hip arthroscopy skills.

Level of evidence: Level III, systematic review of level I to III studies.

Journal of Shoulder and Elbow Surgery (JSES), Volume 33, issue 1

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Significant improvements in clinical outcome measures and patient satisfaction after combined all-arthroscopic meniscal allograft transplantation and autologous chondrocyte implantation: A single-centre longitudinal study

J. Pawelczyk, I. Fanourgiakis

DOI: <https://doi.org/10.1002/ksa.12023>

Purpose: The optimal treatment approach for the complex pathology of meniscal insufficiency and coexisting full-thickness cartilage defects remains unclear. The purpose of this study was to evaluate the viability, safety, and efficacy of this combined surgical approach at medium-term follow-up.

Methods: This is a single-centre longitudinal study with blinded outcome assessment. All consecutive patients treated with combined all-arthroscopic meniscal allograft transplantation (MAT) with bone bridge fixation and ACI using chondrospheres at our institution between 2001 and 2021 were eligible for inclusion. Twenty patients with an average follow-up of 72.6 ± 34.4 months were included in the statistical analysis. Clinical outcomes were assessed pre- and postoperatively using the IKDC Subjective Knee Form, Lysholm Score, Tegner Activity Scale, KOOS, and Visual Analog Scale (VAS) for patient satisfaction. Failure and reoperation rates were assessed, and cartilage regeneration tissue was evaluated on postoperative MRI.

Results: IKDC scores significantly improved from 52.1 ± 16.9 to 68.5 ± 16.3 ($p = 0.003$). Lysholm scores improved from 61.5 ± 21.7 to 78.5 ± 12.9 ($p = 0.004$). Tegner scores improved from 3.5 (1–4) to 4.0 (2–6) ($p = 0.014$). KOOS scores improved significantly across all subcategories, except 'symptoms', where improvements did not reach statistical significance. VAS for overall patient satisfaction showed improvements but did not reach statistical significance. The combined procedure was successful in 17 patients (85%). Eight patients had to undergo reoperation (40%), comprising mostly small, arthroscopic procedures. Seven reoperations were directly attributable to meniscal allograft transplantation (46.7%). Postoperative Magnetic Resonance Observation of Cartilage Repair Tissue scores were 68.9 ± 16.8 ($n = 14$).

Conclusion: Combined arthroscopic MAT and autologous chondrocyte implantation (ACI) is a viable, safe, and effective treatment approach for younger patients with meniscal insufficiency and coexisting full-thickness cartilage damage, where alternative treatment options are limited. The combined surgical procedure achieved significant improvements in clinical outcome measures and patient satisfaction with acceptable failure and high arthroscopic reoperation rates. MAT is the limiting part of this combined procedure, with most failures and reoperations being attributable to MAT, as opposed to ACI.

Level of Evidence: Level III.

Sustainability studies in orthopaedic surgery: The carbon footprint of anterior cruciate ligament reconstruction depends on graft choice

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DOI: <https://doi.org/10.1002/ksa.12035>

Purpose: Environmental sustainability in medicine is a growing concern. Determining the carbon footprint of medical procedures may aid in selecting a less impactful technique moving forward. The purpose of this study was to understand the environmental impact of different anterior cruciate ligament reconstruction techniques, for which there is no consensus in terms of optimal graft.

Methods: A life cycle analysis of different anterior cruciate ligament reconstruction techniques was performed. These included quadrupled semitendinosus graft, bone-patellar tendon-bone graft, iliotibial band augmented with gracilis graft, doubled semitendinosus and doubled gracilis graft, and quadriceps tendon graft. All procedures were systematically paired with a lateral extra-articular procedure. The study was conducted in a specialised centre using surgeon preference cards, with the help of a dedicated organisation for calculation according to the ISO 14044 standard. The primary outcome measure was the carbon footprint of each of the five techniques. Secondary outcomes included other environmental impact indicators, including human carcinogenic toxicity and mineral resource scarcity, among others, based on the ReCiPe 2016 midpoint guideline. The analysis had three scopes, each encompassing varying numbers of processes: graft implantation, full procedure, and entire environmental impact, from medical prescription to patient discharge. Results were reported as percentage increases compared to the graft technique with the lowest environmental impact.

Results: It was demonstrated that the surgical procedure itself accounted for <40% of the life cycle, with arthroscopy being 88% of surgery's GHG emissions, and scrubbing and draping contributing 39% to the carbon footprint. The iliotibial band augmented with gracilis tendon technique had the lowest carbon footprint (0.199 Kg Co2 eq), and the least impact in most categories at all scopes of the life cycle analysis. Using this technique as a reference, in terms of graft implantation, it was determined that extensor mechanism grafts had the highest carbon footprint (300% higher than the reference). Greater scopes showed a similar trend, with percentage differences decreasing significantly, reaching 1–3% when considering the entire environmental impact for most categories. Nevertheless, among the aforementioned factors of the ReCiPe 2016 guidelines, the semitendinosus graft paired with a lateral extra-articular procedure displayed greater difference in human carcinogenic toxicity and mineral resource scarcity (6% and 10% respectively) compared to the reference. The individual processes with the highest impact were also highlighted.

Conclusions: In the institution where the study was conducted, the studied iliotibial band graft option was found to have the lowest environmental impact. Such analyses of standardised procedures can be replicated in individual institutions in order to determine their environmental impact. Identification of procedures with comparable results and differing environmental consequences may influence the future decision-making process.

Level of Evidence: Level II, prospective cohort study.

Weight loss enhances meniscal healing following transtibial pullout repair for medial meniscus posterior root tears

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DOI: <https://doi.org/10.1002/ksa.12037>

Purpose: This study investigated the impact of weight change on the success of transtibial pullout repair for medial meniscus (MM) posterior root tears (MMPRTs).

Methods: The study included 129 patients diagnosed with MMPRTs who had undergone transtibial pullout repair. The patients were screened between July 2018 and November 2021. Patient-reported outcomes were assessed preoperatively and at 12 months postoperatively using the Knee injury and Osteoarthritis Outcome Score (KOOS). MM extrusion (MME) and Δ MME (postoperative MME – preoperative MME) were calculated preoperatively and at 12 months postoperatively using magnetic resonance imaging.

Results: Patients were divided into weight loss (body mass index [BMI] decrease of at least 0.5 kg/m² after primary repair; n = 63) and weight gain (BMI increase of at least 0.5 kg/m²; n = 66) groups. Both groups had similar demographic variables and preoperative clinical scores; patient-reported outcomes significantly improved postoperatively. The weight loss group had significantly greater improvement in KOOS–quality of life (weight loss, 29.4 ± 23.7; weight gain, 23.9 ± 27.6; p = 0.034), lower postoperative MME (weight loss, 3.9 ± 1.7 mm; weight gain, 4.2 ± 1.2 mm; p = 0.043) and lower Δ MME (weight loss, 0.8 ± 0.8 mm; weight gain, 1.2 ± 0.9 mm; p = 0.002) than the weight gain group. Total arthroscopic healing scores (weight loss, 7.6 ± 1.0; weight gain, 7.2 ± 1.5; p = 0.048) and associated subscales, including anteroposterior bridging tissue width (weight loss, 4.0 ± 0.0; weight gain, 3.8 ± 0.7; p = 0.004) and MM posterior root stability (weight loss, 2.6 ± 0.7; weight gain, 2.4 ± 0.7; p = 0.041), significantly differed between the groups.

Conclusions: Weight loss was associated with better meniscal healing and less MME progression after MMPRT repair, highlighting the significance of weight management in individuals undergoing meniscal surgery. These findings provide valuable insights into the clinical significance of weight loss in the success of transtibial pullout repair for MMPRTs.

Level of Evidence: Level III.

Approximately half of pediatric or adolescent patients undergoing revision anterior cruciate ligament reconstruction return to the same level of sport or higher: A systematic review

B. Sun, P. Vivekanantha

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Purpose: To summarise the surgical techniques and clinical outcomes in paediatric and adolescent patients undergoing revision anterior cruciate ligament reconstruction (r-ACLR).

Methods: Three databases (MEDLINE, PubMed and EMBASE) were searched from inception to 29 July 2023. The authors adhered to the PRISMA and R-AMSTAR guidelines as well as the Cochrane Handbook for Systematic Reviews of Interventions. Data on demographics, surgical details, patient-reported outcome measures (PROMs), rates of instability, rupture and return to sport (RTS) were extracted.

Results: Eight studies comprising 706 (711 knees) patients were included (48.7% female). The mean age at r-ACLR was 17.1 years (range: 16.5–18.0). Autografts (67.5%) were more common than allografts (32.2%) in revision, with bone-patellar tendon-bone (BPTB) being the most prevalent autograft source (59.6%). Bone grafts were used in seven patients (4.8% of 146 patients). The most common femoral and tibial fixation techniques were interference screws (37.6% and 38.1%, of 244 patients, respectively). The most common tunnelling strategy was anatomic (69.1% of 236 patients), and meniscus repairs were performed in 39.7% of 256 patients. The re-rupture rate was 13.0% in 293 patients. RTS at the same level or higher was 51.6% in 219 patients. The mean (SD) Lysholm score was 88.1 (12.9) in 78 patients, the mean (SD) Tegner score was 6.0 (1.6) in 78 patients, and the mean (SD) IKDC score was 82.6 (16.0) in 126 patients.

Conclusion: R-ACLR in paediatric and adolescent patients predominantly uses BPTB autografts and interference screw femoral and tibial fixation with concomitant meniscal procedures. Rates of re-rupture and RTS at the same level or higher were 13.0% and 51.6%, respectively. Information from this review can provide orthopaedic surgeons with a comprehensive understanding of the most commonly used operative techniques and their outcomes for revision ACLR in this population.

Level of Evidence: Level IV.

Isolated Arthroscopic Debridement of Acetabular Labral Tears: High Rates of Failure and Conversion to Total Hip Arthroplasty at 13-Year Minimum Follow-up

A. Lamba, A.M. Boos

DOI: <https://doi.org/10.1177/03635465231204345>

Background: Historically, symptomatic hip labral lesions were treated with arthroscopic debridement. Hip labral repair has become the standard treatment for labral pathology; however, to date, there are limited long-term studies regarding the outcomes of isolated labral debridement.

Purpose: To (1) evaluate the long-term patient-reported outcomes of isolated labral debridement, (2) report reoperation and arthroplasty rates, and (3) identify risk factors contributing to reoperation or poor clinical outcomes.

Study Design: Case series; Level of evidence, 4

Methods: A retrospective review of a prospectively generated cohort of 59 hips in 57 patients from 1996 to 2010 who underwent hip arthroscopy with labral debridement was performed. Only patients with Tönnis grade <3 were included. Additionally, given the time period analyzed, resection of cam morphology was not performed, and the interportal capsulotomy was not repaired. The pre- and postoperative modified Harris Hip Score; Hip Outcome Score (HOS)-Activities of Daily Living and -Sports scores; and reoperation, conversion to total hip arthroplasty, and risk factors were analyzed.

Results: In total, 48 hips in 47 patients (14 men, 33 women; mean age, 48.0 ± 12.9 years) met inclusion criteria and were followed for a mean of 17 ± 3 years (range, 13-27 years). The mean preoperative Tönnis grade was 1.3 ± 0.6 (range, 0-2), the mean chondral acetabular International Cartilage Regeneration & Joint Preservation Society (ICRS) grade was 1.7 ± 1.6 (range, 0-4), the mean chondral femoral ICRS grade was 0.9 ± 1.4, and the mean acetabular labral articular cartilage grade was 2.5 ± 1.2 (range, 0-4). At the final follow-up, mean the modified Harris Hip Score, HOS-Activities of Daily Living score, and HOS-Sports score were 82.2 ± 16.6, 81.9 ± 20.5, and 82.2 ± 20.5, respectively. Nineteen hips underwent subsequent reoperation at a mean of 5.5 ± 6.2 years (range, 0.5-21.2 years) postoperatively, including 16 hips (33% overall) being converted to total hip arthroplasty. Higher acetabular ICRS chondral grades at the time of surgery were observed in patients who went on to subsequent surgery compared with those who did not (2.3 ± 1.6 vs 1.1 ± 1.5; P = .02). In reoperation-free hips, Tönnis grade demonstrated a trend of increasing over time (1.4 preoperatively vs 1.7 at radiographic follow-up; P = .08). At the final follow-up, 19 hips (40%) had undergone reoperation, and 5 additional hips (10%) were rated as “abnormal” or “severely abnormal” in function, resulting in an overall clinical failure rate of 50%.

Conclusion: Isolated labral debridement was found to result in high rates of failure and reoperation, with a third of patients being converted to arthroplasty and half of patients meeting criteria for reoperation or clinical failure. Of note, for patients remaining reoperation-free, satisfactory outcome scores were observed.

Hip Arthroscopic Surgery With Chondrolabral Refixation, Osteochondroplasty, and Routine Capsular Closure for Femoroacetabular Impingement Syndrome: Clinical Outcomes at a Minimum 10-Year Follow-up

S. Allahabadi, R.S. Chapman

DOI: <https://doi.org/10.1177/03635465231212663>

Background: Hip arthroscopic surgery for femoroacetabular impingement syndrome (FAIS) has proven to be an effective surgical intervention, with high rates of return to sport and work as well as favorable outcomes at short- and midterm follow-up. However, limited data exist on outcomes at long-term follow-up.

Purpose: To evaluate patient-reported outcomes (PROs) at a minimum 10-year follow-up after primary hip arthroscopic surgery including labral repair, femoral osteochondroplasty, acetabular osteochondroplasty, and capsular closure for FAIS.

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

Methods: Patients who underwent primary hip arthroscopic surgery for FAIS between June 2012 and January 2013 were identified. PROs were collected preoperatively and at a minimum of 10 years postoperatively, including the Hip Outcome Score–Activities of Daily Living (HOS-ADL), Hip Outcome Score–Sports Subscale (HOS-SS), modified Harris Hip Score (mHHS), International Hip Outcome Tool–12 (iHOT-12), and visual analog scale (VAS) for pain and satisfaction. Unique minimal clinically important difference (MCID) and patient acceptable symptom state (PASS) thresholds were calculated, and their rates of achievement were analyzed. An alpha level of $<.05$ was used to determine statistical significance.

Results: A total of 94 patients (55 female; mean age, 34.3 ± 12.4 years) were analyzed with a mean follow-up of 10.1 ± 0.3 years (range, 10.0-10.7 years). Patients demonstrated significant 10-year improvement across all PRO measures ($P < .001$). MCID and PASS thresholds were calculated as follows: HOS-ADL (10.4 and 85.3, respectively), HOS-SS (14.6 and 60.2, respectively), mHHS (8.8 and 76.0, respectively), VAS pain (14.6 and 27.5, respectively), and iHOT-12 (PASS: 71.4). The majority of patients achieved the MCID and PASS for each PRO measure: HOS-ADL (73.4% and 70.9%, respectively), HOS-SS (78.5% and 77.2%, respectively), mHHS (81.0% and 70.9%, respectively), VAS pain (88.6% and 70.9%, respectively), and iHOT-12 (PASS: 73.4%). Overall, 9 patients (9.6%) underwent subsequent revision hip arthroscopic surgery at a mean 4.9 ± 3.7 years (range, 1.1-10.1 years) postoperatively, and 6 patients (6.4%) underwent conversion to total hip arthroplasty at a mean 4.1 ± 3.1 years (range, 0.9-9.3 years) postoperatively.

Conclusion: Patients who underwent primary hip arthroscopic surgery for FAIS utilizing contemporary methods of labral repair, acetabular and/or femoral osteochondroplasty, and capsular closure commonly experienced sustained clinical improvement and reported high levels of satisfaction at a minimum 10-year follow-up with low rates of reoperation.

Functional Outcome Scores and Conversion to Total Hip Arthroplasty After Hip Arthroscopy for Femoroacetabular Impingement Syndrome in Patients With Tönnis Grade 1 Versus Grade 0 Arthritis: A Propensity-Matched Study at Minimum 10-Year Follow-up

T.W. Fenn, D.J. Kaplan

DOI: <https://doi.org/10.1177/03635465231210958>

Background: Hip arthroscopy has become the mainstay surgical intervention for the treatment of femoroacetabular impingement syndrome (FAIS). However, postoperative outcomes and rates of secondary surgery are mixed in patients with differing levels of preoperative osteoarthritis (OA). Furthermore, there is a paucity of literature comparing patients with and without OA at long-term follow-up.

Purpose: To compare outcomes and rates of secondary surgery at minimum 10-year follow-up, including revision hip arthroscopy and conversion to total hip arthroplasty (THA), in patients with Tönnis grade 1 undergoing hip arthroscopy for FAIS compared with a propensity-matched control group of patients with Tönnis grade 0.

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

Methods: Patients who underwent primary hip arthroscopy for FAIS between January 2012 and February 2013 were identified. Patients with Tönnis grade 1 were propensity matched in a 1:2 ratio by age, sex, and body mass index (BMI) to patients with Tönnis grade 0. Patient-reported outcomes (PROs) were collected at varying timepoints including preoperatively and 1, 2, 5, and 10 years postoperatively and compared between the 2 cohorts. Rates of minimal clinically important difference (MCID) and Patient Acceptable Symptom State (PASS) achievement at 10 years were evaluated and compared between groups. Rates of secondary surgery including revision hip arthroscopy and conversion to total hip arthroplasty (THA) were evaluated. Gross survivorship between cohorts was evaluated using a Kaplan-Meier gross survivorship curve. A subanalysis was performed comparing patients with Tönnis grade 1 who converted to THA and those who did not.

Results: A total of 31 patients with Tönnis grade 1 (age, 42.6 ± 9.0 years; BMI, 28.0 ± 6.3) were successfully matched to 62 patients with Tönnis grade 0 (age, 42.1 ± 8.5 , $P = .805$; BMI, 26.1 ± 3.9 , $P = .117$). Both the Tönnis grade 1 and Tönnis grade 0 groups demonstrated significant improvements regarding all PROs at minimum 10 years ($P < .05$ for all), except for the Hip Outcome Score Activities of Daily Living subscale (HOS-ADL) ($P = .066$) in the Tönnis grade 1 cohort. No significant difference ($P > .05$ for all) was noted between cohorts regarding any 10-year PRO. When the authors evaluated comparisons between preoperative and 1-, 2-, 5-, and 10-year PRO measures, significant differences were noted between cohorts regarding 2-year HOS-ADL ($P = .021$), Hip Outcome Score Sports-Specific subscale ($P = .016$), and modified Harris Hip Score ($P = .026$); otherwise, differences did not reach significance. High rates of 10-year MCID and PASS achievement were seen, with no significant differences between groups. Patients with Tönnis grade 1 had significantly higher rates of conversion to THA compared with patients who had Tönnis grade 0 (25.8% vs 4.8%; $P = .006$). Patients with Tönnis grade 1 had significantly lower gross survivorship compared with those who had Tönnis grade 0 (71.0% vs 85.5%, respectively; $P = .04$).

Conclusion: Hip arthroscopy confers comparable postoperative clinical improvements to patients who have FAIS with and without mild OA; however, the benefits among patients with mild OA may be less durable. Patients with Tönnis grade 1 had significantly higher conversion to THA and reduced gross survivorship compared with patients with no evidence of preoperative OA, suggesting that patients with evidence of OA may need to be cautioned on the higher rate of conversion surgery.

Intermediate-Term Outcomes of Hip Arthroscopy for Femoroacetabular Impingement Syndrome in Patients With Global Versus Isolated Lateral Acetabular Overcoverage

M.T. Kingery, B. Akpinar

DOI: <https://doi.org/10.1177/03635465231213236>

Background: Previous studies evaluating the outcomes of hip arthroscopy for patients with global acetabular overcoverage and focal superolateral acetabular overcoverage suffer from short-term follow-up and inconsistent radiographic criteria when defining these subpopulations of patients with femoroacetabular impingement syndrome (FAIS).

Purpose: To evaluate the intermediate-term postoperative outcomes for patients with FAIS in the setting of global acetabular overcoverage, lateral acetabular overcoverage, and normal acetabular coverage.

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

Methods: Patients undergoing hip arthroscopy for FAIS were enrolled in a prospective cohort study, and those with a minimum follow-up of 5 years were included in this analysis. Patients were grouped based on type of acetabular coverage: global overcoverage (lateral center-edge angle [LCEA] $\geq 40^\circ$, with coxa profunda), lateral overcoverage (LCEA $\geq 40^\circ$, without coxa profunda), and no overcoverage (LCEA $< 40^\circ$). Functional outcomes (modified Harris Hip Score and Nonarthritic Hip Score) and failure of primary hip arthroscopy were compared between groups.

Results: In total, 94 patients (mean age, 41.9 ± 14.2 years) were included with a mean follow-up duration of 6.1 ± 0.9 years. Of these patients, 40.4% had no acetabular overcoverage, 36.2% had lateral overcoverage, and 23.4% had global overcoverage. There was no difference between groups with respect to percentage of patients who underwent reoperation for either revision arthroscopy or conversion to total hip arthroplasty (28.9% for the normal acetabular coverage group, 29.4% for the lateral overcoverage group, and 31.8% for the global overcoverage group; $P = .971$). Among patients for whom primary hip arthroscopy did not fail, there was no difference in 5-year functional outcomes between groups. Postoperative LCEA $> 40^\circ$ ($\beta = -13.3$; 95% CI, -24.1 to -2.6 ; $P = .016$), female sex ($\beta = -14.5$; 95% CI, -22.7 to -6.2 ; $P = .001$), and higher body mass index ($\beta = -1.9$; 95% CI, -2.8 to -1.0 ; $P < .001$) were associated with worse intermediate-term hip function in terms of modified Harris Hip Score.

Conclusion: There was no difference in functional outcomes or rate of reoperation at a minimum of 5 years postoperatively between those with global acetabular overcoverage, those with regional lateral overcoverage, and those with normal acetabular coverage. Provided that an appropriate acetabuloplasty is performed, there is no evidence to suggest that global acetabular overcoverage portends a worse prognosis than other FAIS subtypes.

Survivorship of 157 Arthroscopic Meniscal Allograft Transplants Using Bone Fixation at a Mean of 7 Years and Prognostic Factors Analysis

M. Husen, K. Poudel

DOI: <https://doi.org/10.1177/03635465231212667>

Background: Meniscal allograft transplantation (MAT) is an accepted and effective treatment option in the context of unsalvageable menisci, particularly in young and active patients. It has been shown to reduce pain and improve knee function in previously symptomatic patients. However, there is still limited knowledge about the long-term survival rates of allografts, the durability of clinical results, and the influence of patient-specific parameters, such as leg alignment, tibial slope, and preoperative International Cartilage Regeneration & Joint Preservation Society (ICRS) grade.

Purpose: To determine (1) the long-term clinical success rate after MAT with bony fixation in a large, single-center cohort of consecutive patients, and (2) if patient-specific and procedural variables influence the clinical, anatomic, and subjective outcomes and risk of failure.

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

Methods: Data on 185 consecutive knees undergoing MAT in a single institution were prospectively collected and screened for inclusion in this study. The minimum follow-up time was 2 years. Radiographic variables (ICRS grade and Kellgren-Lawrence grade) were assessed preoperatively and at follow-up. Subjective patient-reported outcome measures (PROMs) (Lysholm score, Knee injury and Osteoarthritis Outcome Score [KOOS] including subscores, International Knee Documentation Committee [IKDC] score, and visual analog scale [VAS] score) were collected preoperatively and at follow-up. Clinical failure was defined as revision surgery due to graft failure or conversion to total knee arthroplasty. Anatomic failure was considered a tear covering >20% of the allograft, any peripheral tear, and unstable peripheral fixation leading to dislocation of the graft. Subjective failure was defined as Lysholm score ≤ 65 . Preoperative tibial slope and leg alignment were assessed. Survival analyses were performed using the Kaplan-Meier estimate. Univariate and multivariate analyses were performed to determine risk factors for clinical and anatomic failure.

Results: A total of 157 knees met inclusion criteria. After a mean follow-up time of 7 ± 3.5 years, 127 (80.9%) knees were free of clinical, anatomic, and subjective failure. Fourteen (8.9%) knees experienced clinical failure, 26 (16.6%) knees were identified as having experienced anatomic failure, and 13 (8.3%) patients experienced subjective failure with a reported Lysholm score of ≤ 65 at a mean follow-up of 7 years. Concurrent osteochondral allograft transplantation was identified as a predictor of both clinical (hazard ratio [HR], 4.55; 95% CI, 1.46-14.17; $P = .009$) and anatomic (HR, 3.05; 95% CI, 1.34-6.92; $P = .008$) failure. Cartilage damage of ICRS grade 3 or 4 of the index compartment conveyed an increased risk for clinical (HR, 3.41; 95% CI, 1.05-11.01; $P = .04$) and anatomic (HR, 3.04; 95% CI, 1.31-7.11; $P = .01$) failure. High-grade cartilage damage preoperatively (HR, 10.67; 95% CI, 1.037-109.768; $P = .046$), patient age >25 years (HR, 5.44; 95% CI, 0.120-246.070; $P = .384$), and a body mass index >30 (HR, 2.24; 95% CI, 0.748-6.705; $P = .149$) were associated with subjective failure. PROMs including KOOS and IKDC were significantly improved at final follow-up compared with preoperative scores across all measurements ($P < .005$).

Conclusion: MAT showed good to excellent clinical results at a mean follow-up of 7 years. Low ICRS lesion grade was associated with a higher clinical and anatomic survival rate. Patients with concurrent OCA transplantation are at a higher risk of clinical and anatomic failure, but still report significantly improved PROMs. These results suggest that MAT has a lasting beneficial effect both in isolation and in complex cases with ≥ 1 concurrent procedures.

Preoperative Predictors of Arthroscopic Partial Meniscectomy Outcomes: The APM Index Score

N.A. Lowenstein, Y. Chang

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Background: Preoperative risk factors contributing to poor outcomes after arthroscopic partial meniscectomy (APM) have not yet been consolidated and codified into an index scoring system used to predict APM success.

Purpose: To create an index score using available preoperative factors to predict the likelihood of favorable postoperative outcomes after APM.

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

Methods: A consecutive cohort of patients undergoing primary APM were enrolled in this study. Patients completed pre- and postoperative patient-reported outcome measure (PROM) questionnaires that included the Knee injury and Osteoarthritis Outcome Score (KOOS), visual analog scale (VAS) for pain, Veterans RAND 12-Item Health Survey (VR-12 Physical and Mental), and Marx Activity Rating Scale (MARS). Multivariable logistic regression models were performed to evaluate independent predictors of KOOS Pain, Symptoms, and Activities of Daily Living scores and achievement of the minimal clinically important difference (MCID) and substantial clinical benefit (SCB). The authors assigned points to each variable proportional to its odds ratio, rounded to the nearest integer, to generate the index score.

Results: In total, 468 patients (mean age, 49 years [SD, 10.4 years; range, 19-81 years]) were included in this study. In the univariate analysis, shorter symptom duration, lower Kellgren-Lawrence (KL) grade, lower preoperative KOOS Pain value, and lower VR-12 Physical score were associated with a higher likelihood of clinical improvement at 1 year. In the multivariable model for clinical improvement with MCID, symptom duration (<3 months: OR, 3.00 [95% CI, 1.45-6.19]; 3-6 months: OR, 2.03 [95% CI, 1.10-3.72], compared with >6 months), KL grade (grade 0: OR, 3.54 [95% CI, 1.66-7.54]; grade 1: OR, 3.04 [95% CI, 1.48-6.26]; grade 2: OR, 2.31 [95% CI, 1.02-5.27], compared with grade 3), and preoperative KOOS Pain value (score <45: OR, 3.00 [95% CI, 1.57-5.76]; score of 45-60: OR, 2.80 [95% CI, 1.47-5.35], compared with score >60) were independent significant predictors for clinical improvement. The scoring algorithm demonstrated that a higher total score predicted a higher likelihood of achieving the MCID: 0 = 40%, 1 = 68%, 2 = 80%, 3 = 89%, and 4 = 96%.

Conclusion: Using this model, the authors developed an index score that, using preoperative factors, can help identify which patients will achieve clinical improvement after APM. Longer symptom duration and higher KL grade were associated with a decreased likelihood of clinical improvement as measured by KOOS Pain at 1 year postoperatively.

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[BACK](#)

Miscellaneous

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No Miscellaneous Abstracts

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No Miscellaneous Abstracts

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[BACK](#)

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No Miscellaneous Abstracts

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