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# Upper extremity

Journal of Arthroscopy, Volume 38, Issue 9

**Double-Row Repair With Platelet-Rich Plasma Optimizes Retear Rates After Small to Medium Full-Thickness Rotator Cuff Repair: A Systematic Review and Network Meta-analysis of Randomized Controlled Trials**

O. Lavoie-Gagne, M.S. Fury, et al.

DOI: https://doi.org/10.1016/j.arthro.2022.03.014

Purpose
To compare the different interventions described in the literature for the surgical treatment of small and medium complete rotator cuff tears.

Methods
A systematic review of randomized controlled trials of small-medium, full-thickness rotator cuff tears published since 2000 was performed. Clinical characteristics, re-tear rates, range of motion (ROM), and patient-reported outcomes (PRO) data were collected. Interventions were compared via arm-based Bayesian network meta-analysis in a random-effects model. Interventions were ranked for each domain (re-tear risk, pain, ROM, and PROs) via surface under the cumulative ranking curves.

Results
A total of 18 studies comprising 2046 shoulders (47% females, mean age 61 ± 3 years, mean follow-up 21 ± 5 months) were included. Interventions that ranked highest for minimizing re-tear risk included arthroscopic single-row repair (A+SR) or double-row repair (A+DR) with or without platelet-rich plasma (PRP). Open repair and A+SR repair with acromioplasty (ACP) ranked highest for pain relief. Interventions that ranked highest for ROM improvement included open repair, PT, and A+DR with or without ACP. Interventions that ranked highest for PROs included arthroscopic footprint microfracture with or without SR, open repair, and A+SR with or without ACP.

Conclusions
Based on a network meta-analysis of level 1 studies, arthroscopic rotator cuff repair with a SR or DR construct demonstrates similar retear rates, PROs, and clinical outcomes. The highest-ranking treatment for minimizing retears was arthroscopic repair with DR constructs and PRP augmentation, although open repair and arthroscopic SR remain reliable options with excellent clinical outcomes. Addition of PRP to DR constructs trended toward a 56% decreased risk of retear as compared to DR repair alone. Although no single treatment emerged superior, several interventions offered excellent clinical improvements in pain, ROM, and PROs that exceeded minimal clinically important difference thresholds.

Level of evidence
I, systematic review and meta-analysis of level I studies.

BACK

**Biceps Tenodesis Combined With Arthroscopic Posterior Labral Repair for Type VIII SLAP Lesions in Active-Duty Military Patients Yields Excellent Return to Military Duty**

C.K. Green, J.P. Scanaliato, et al.

DOI: https://doi.org/10.1016/j.arthro.2022.03.021

Purpose
To report short-term outcomes following biceps tenodesis combined with arthroscopic posterior labral repair of type VIII SLAP lesions in active-duty military patients.

Methods
All consecutive patients from January 2012 through December 2018 who underwent biceps tenodesis combined with arthroscopic posterior labral repair of type VIII SLAP tears performed by the senior surgeon with complete outcome scores and minimum 2.5 years follow-up were identified. Exclusion criteria included concomitant glenoid microfracture, rotator cuff repair, or other capsulolabral repair. Outcome measures were completed by patients within 7 days before surgery and at latest follow-up. Biceps tenodesis performed was a mini-open, through a subpectoral approach, using a double-loaded 2.9mm suture-anchor.

Results
Thirty-two patients met the inclusion criteria for the study. All patients were active-duty military at time of surgery. Average follow-up was 73.53 ± 22.37 months. Thirty-one patients achieved the minimal clinically important difference, 30 of 32 reached the substantial clinical benefit, and 31 of 32 met the patient acceptable symptomatic state, as defined for the American Shoulder and Elbow Surgeons Shoulder Score. Similarly, 30 of 32 patients reached the minimal clinically important difference, 29 of 32 achieved the substantial clinical benefit, and 32 of 32 met the patient acceptable symptomatic state for the Single Assessment Numeric Evaluation. There were no significant changes in forward flexion, external rotation, or internal rotation between pre- and postoperative measurements. Three patients reported postoperative complications and 1 patient progressed to further surgery. Thirty (93.75%) patients remained on active-duty military service and were able to return to preinjury levels of activity.

Conclusions
Active-duty military patients with type VIII SLAP tears had statistically and clinically significant increases in outcome scores, marked improvement in pain, and high rates of return to unrestricted active-duty following mini-open subpectoral biceps tenodesis combined with posterior labral repair.

Level of Evidence
IV, retrospective case series.

BACK

**Severe Obesity Is Not Associated With Worse Functional Outcomes Following Arthroscopic Rotator Cuff Repair**

A.B. Fares, J.P. Scanaliato, et al.

DOI: https://doi.org/10.1016/j.arthro.2022.02.026

Purpose
The purpose of this study is to investigate the outcomes of arthroscopic rotator cuff repair in a severely obese population (body mass index [BMI] > 0 kg/m2) compared to a healthy weight population (BMI 18.5-24.9 kg/m2).

Methods
This study is a retrospective review of prospectively collected data examining the outcomes of arthroscopic rotator cuff repair in both severely obese patients and healthy weight patients. Primary outcome measures analyzed include the American Shoulder and Elbow Surgeons (ASES) Score, the Single Assessment Numeric Evaluation (SANE), pain Visual Analog Scale (VAS), range of motion, and complications.

Results
A total of 89 patients met inclusion/exclusion criteria: 52 healthy weight patients (BMI 18.5-24.9 kg/m2) and 37 severely obese patients (BMI >40 kg/m2). Patient-reported pain and functional outcomes had significantly improved after surgery in both groups with regard to the visual analog score (VAS) scores, Single Assessment Numeric Evaluation (SANE) scores, and American Shoulder and Elbow Surgeons Shoulder (ASES) scores ($P < .0001$). When directly comparing the outcomes in the healthy weight group to the severely obese group, the latter had significantly inferior outcomes in VAS scores ($P = .0048$), SANE scores ($P = .0118$), ASES scores ($P = .0031$), and postoperative internal rotation ($P = .0132$). At large, these outcomes did not have clinically significant differences. The severely obese group also had higher total numbers of comorbid conditions and longer operative times ($P = .0041$).

Conclusions
Severely obese patients and their associated comorbid conditions pose unique challenges in rotator cuff tear management, but they still achieve overall excellent outcomes after repair and noninferior clinical differences when compared to healthy weight patients.

Level of Evidence
Level III, retrospective comparative study.

BACK

Journal of Shoulder and elbow surgery (JSES), January 2021, volume 30, issue 8, pages p1810-1822.

Journal of Shoulder and elbow surgery, January 2021, volume 30, issue 8, pages p1810-1822.

**Latissimus dorsi transfer vs. lower trapezius transfer for posterosuperior irreparable rotator cuff tears**

Baek, C.H., Lee, D.H. et al.

**DOI:** https://doi.org/10.1016/j.jse.2022.02.020

**Background**
Latissimus dorsi transfer (LDT) and lower trapezius transfer (LTT) are effective treatment options for posterosuperior irreparable rotator cuff tears (IRCTs) in relatively young patients and elderly high-demand patients without arthritic changes. However, the optimal treatment option for patients with posterosuperior IRCT remains a subject of ongoing debate. This study aimed to compare clinical and radiologic short-term outcomes between arthroscopic-assisted LDT (aLDT) and arthroscopic-assisted LTT (aLTT) in patients with posterosuperior IRCT.

**Methods**
This retrospective crossover study included patients who underwent aLDT or aLTT for posterosuperior IRCT and who had a minimum clinical follow-up time of 2 years after undergoing surgical procedures between January 2012 and June 2019. A total of 90 patients with posterosuperior IRCT were divided into 2 groups according to the surgical procedure: group D underwent aLDT (n = 48) and group T underwent aLTT (n = 42). Clinical outcomes comprised the visual analog scale score for pain, active shoulder range of motion (ROM), American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form (ASES) score, and activities of daily living that require active external rotation (ADLER) score. Radiologic outcomes included acromiohumeral distance (AHD). The progression of arthritis was evaluated using Hamada grade. Graft integrity was assessed using postoperative magnetic resonance imaging.

**Results**
Significant improvements in clinical outcomes were observed in both groups. Active shoulder external rotation ($P < .001$), postoperative ASES score ($P < .001$), and ADLER score ($P < .001$) were significantly higher in group T than in group D. AHD at 2-year follow-up was significantly higher in group T than in group D ($P < .001$). The rate of progression of arthritis was significantly higher in group D (31.3%) than in group T (7.1%) ($P = .031$).

**Conclusions**
Although both LDT and LTT improved the overall clinical outcomes of patients with posterosuperior IRCT, LTT was superior to LDT in terms of shoulder ROM, functional improvement, and progression of arthritis. Our findings indicate that LTT may be the preferred treatment option for posterosuperior IRCT in relatively active and young patients.

**Level of evidence**
Level III, Retrospective Cohort Comparison, Treatment Study

BACK

**Perianchor cyst formation in all-suture anchor after rotator cuff repair: an evaluation of anchor insertion angle**

Kim, M.S., Rhee, S.M. et al.

**DOI:** https://doi.org/10.1016/j.jse.2022.02.028

**Background**
Previous studies reported that micromotion after all-suture anchor implantation can lead to perianchor cyst formation (PCF), leading to risk of retear. Modifying anchor insertion angle (AIA) is known to be one of the various ways to increase anchor stability. However, there currently are few studies that assess the correlation between PCF, AIA, and retear.

**Purpose**
To find the correlation of PCF and the repaired rotator cuff integrity with AIA after arthroscopic double-row suture-bridge rotator cuff repair (RCR) using an all-suture anchor in the medial row.

**Methods**
A total of 218 patients who underwent arthroscopic double-row suture-bridge RCR were retrospectively reviewed. All patients underwent RCR using all-suture anchors and polyether ketone anchors in the medial and lateral rows, respectively. Magnetic resonance imaging was conducted 6 months after the surgery to evaluate PCF, AIA, and integrity of the repaired cuff. The all-suture anchor insertion angle in the medial row was measured with reference to the greater tuberosity to assess the relationship between the AIA and PCF. The correlations between PCF, AIA, and post-RCR integrity were evaluated including various demographic and radiologic factors.

**Results**
Perianchor cysts were formed in 93 patients (42.7%). Mediolateral tear size (2.1 ± 1.2 cm vs. 1.7 ± 0.9 cm, P = .034) and AIA (61.9° ± 15.2° vs. 68.4° ± 13.0°, P = .001) were significantly different between patient groups with and without perianchor cysts. Multivariate logistic regression analysis showed that mediolateral tear size (odds ratio [OR] 1.318, 95% confidence interval [CI] 1.008-1.724; P = .043) and AIA (OR 0.967, 95% CI 0.947-0.988; P = .002) were independent risk factors for PCF. In addition, PCF was observed more frequently (69.6% vs. 32.1%, P < .001) and the AIA was lower (59.4° ± 13.7° vs. 67.8° ± 13.8°, P < .001) in the retear group than in the healed group.

**Conclusions**
Perianchor cysts were formed in approximately 40% of patients who underwent arthroscopic double-row suture-bridge RCR using all-suture anchors. Low AIA and large mediolateral tear size were risk factors for PCF. Moreover, perianchor cyst and AIA were correlated with post-RCR integrity. Therefore, a high AIA must be carefully considered when all-suture anchors are inserted into the medial row when performing RCR.

**Level of evidence**
Level III, Case-Control Design, Prognosis Study

BACK

**Results of arthroscopically assisted reduction and fixation of anteromedial facet coronoid fractures at short-term follow-up**

Colozza, A., Menozzi, M. et al.

**DOI:** https://doi.org/10.1016/j.jse.2022.03.026

**Background**

Varus posteromedial rotatory instability is a typical pattern of elbow injury that involves fracture of the anteromedial facet (AMF) of the coronoid, as well as injuries to the lateral ligament complex and the posterior bundle of the medial collateral ligament. Some authors support the idea that subtype II AMF coronoid fractures require fixation to restore elbow stability, but this topic is still an issue in the literature. The purpose of this study was to assess the clinical and radiologic outcomes of arthroscopically assisted reduction and internal fixation (ARIF) of AMF fractures.

**Methods**

This retrospective single-center trial evaluated consecutive patients who underwent ARIF of isolated subtype II AMF coronoid fractures between 2014 and 2020. At the final follow-up, the patients were examined for elbow range of motion, stability, and pain. Injury and post-treatment radiographs were reviewed to assess fracture healing and heterotopic ossification.

**Results**

A total of 32 patients (21 male and 11 female patients) with a median age of 47 ± 16 years were included. The average follow-up period was 28 ± 12.4 months. Coronoid process fractures were fixed by cannulated screws in 26 cases (81.25%); in 2 of these cases, additional Kirschner wires were used. Two Kirschner wires were used in 1 case (3.12%), and in the remaining 5 cases (15.62%), osteosuture was used. The lateral ulnar collateral ligament was injured in 27 cases (84.4%) and was always repaired. Other associated lesions were medial collateral ligament injury, osteochondral lesion, and radial head fracture. There were no surgical complications. At the final follow-up, the average Mayo Elbow Performance Score was 98.4 ± 2.7 and the mean Oxford Elbow Score was 47.3 ± 1.4. No cases of nonunion were detected on radiographic assessment.

**Conclusions**

Although technically demanding, ARIF has several potential advantages in comparison to open surgery: less scarring, a decreased risk of infection, and less postoperative pain.

**Level of evidence**

Level IV, Case Series, Treatment Study

BACK

American Journal of Sports Medicine (AJSM), Volume 50, Issue 11

# Arthroscopic Posterior Labral Repair in Active-Duty Military Patients: A Reliable Solution for an At-Risk Population, Regardless of Anchor Type

John P. Scanaliato MD, Benjamin R. Childs MD, John C. Dunn MD, Hunter Czajkowski BS, Nata Parnes MD

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https://doi.org/10.1177/03635465221111568



**Background:** Active-duty servicemembers are a population at risk for the development of posterior shoulder instability. While short-term outcomes after arthroscopic posterior labral repair for posterior shoulder instability are promising, there is a paucity of longer term follow-up data for this procedure.

**Purposes:** The primary purpose was to report midterm outcomes after arthroscopic posterior labral repair in active-duty military patients for posterior shoulder instability without bone loss. The secondary purpose was to determine if outcomes varied between anchor types used.

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

**Methods:** Preoperative and postoperative outcomes, with a minimum 3-year follow-up, for a visual analog scale for pain, the Single Assessment Numeric Evaluation (SANE), the American Shoulder and Elbow Surgeons (ASES) score, and the Rowe score were collected and analyzed. A separate subgroup analysis was performed comparing the outcomes of patients who underwent repair with biocomposite anchors versus those who underwent repair with all-suture anchors.

**Results:** A total of 73 patients with a mean follow-up of 82.55 ± 24.20 months met the inclusion criteria and were available for analysis. As a whole, the cohort demonstrated statistically and clinically significant improvements in outcome scores at final follow-up. Preoperative and postoperative range of motion did not vary significantly. While the difference in final outcome scores between the 2 anchor types did not reach statistical significance, a statistically significantly larger proportion of patients who underwent repair with all-suture anchors versus those who underwent repair with biocomposite anchors met the Patient Acceptable Symptom State for the SANE (97.14% vs 78.95%, respectively; P = .0180) and the ASES score (88.57% vs 68.42%, respectively; P = .0171). The proportion of patients who achieved the substantial clinical benefit or surpassed the minimal clinically important difference, however, did not vary by anchor type. Overall, 70 patients (95.89%) remained on active duty and were able to return to preinjury work and recreational activity levels. There were 3 patients (4.11%) who had recurrent posterior instability.

**Conclusion:** This population of active-duty servicemembers undergoing posterior labral repair for posterior labral instability without bone loss demonstrated a statistically and clinically significant improvement in midterm outcomes, a low recurrence rate, and a rate of return to active duty of 95.89%, regardless of the anchor type used.

BACK

**Buccally Absorbed Cannabidiol Shows Significantly Superior Pain Control and Improved Satisfaction Immediately After Arthroscopic Rotator Cuff Repair: A Placebo-Controlled, Double-Blinded, Randomized Trial**

Michael J. Alaia MD, Eoghan T. Hurley MD, PhD, Kinjal Vasavada BA, Danielle H. Markus MD, Briana Britton MS, Guillem Gonzalez-Lomas MD, Andrew S. Rokito MD, Laith M. Jazrawi MD, Kevin Kaplan MD

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**Background:** Despite the widespread use and sales of cannabidiol (CBD) products in the United States, there is a paucity of literature to evaluate its effectiveness, safety, or ideal route of administration for postoperative pain.

**Purpose:** To evaluate the potential analgesic effects of buccally absorbed CBD in patients who have undergone arthroscopic rotator cuff repair (ARCR).

**Study Design:** Randomized controlled trial; Level of evidence, 1.

**Methods:** This was a US Food and Drug Administration–sanctioned, multicenter, placebo-controlled, randomized, double-blinded trial conducted in patients undergoing ARCR. Patients aged from 18 to 75 years undergoing ARCR were prospectively enrolled and randomized to the control and experimental groups. The experimental group received an oral, buccally absorbed tablet containing 25 mg of CBD 3 times a day if <80 kg, or 50 mg of CBD 3 times a day if >80 kg, for 14 days postoperatively, while the control group received an identical placebo. Patients were followed up on days 1, 2, 7, and 14, and visual analog scale (VAS) for pain scores, opioid consumption, and satisfaction with pain control were recorded. Additionally, liver function tests were conducted on days 7 and 14 to assess safety, and nausea was monitored. $P < .05$ was considered to be statistically significant.

**Results:** Overall, 100 patients were recruited, with 1 patient being excluded, for a total of 99 patients. There were no significant differences in patient demographics between the 2 groups. On day 1, the VAS pain score was significantly lower in the CBD group than in the control group (4.4 ± 3.1 vs 5.7 ± 3.2, respectively; $P = .04$), although this difference was no longer present on day 2 (4.7 ± 2.8 vs 5.3 ± 2.6, respectively; $P = .32$). On both days 1 and 2, patient satisfaction with pain control was significantly higher in the CBD group than in the control group (day 1: 7.0 ± 3.0 vs 5.6 ± 3.7, respectively [$P = .04$]; day 2: 7.3 ± 2.5 vs 6.0 ± 3.3, respectively [$P = .03$]). The quantity of opioids consumed was low in both groups, and there were no statistically significant differences in opioid consumption ($P > .05$). On days 7 and 14, there were no statistically significant differences in VAS scores, opioid consumption, or patient satisfaction with pain control between the CBD and control groups ($P > .05$ for all). There were no significant differences in liver function test results postoperatively ($P > .05$).

**Conclusion:** Buccally absorbed CBD demonstrated an acceptable safety profile and showed significant promise in the reduction of pain in the immediate perioperative period after ARCR compared with the control. Further studies are currently ongoing to confirm dosing and effectiveness in other orthopaedic conditions.

BACK

**Partial Superior Capsular Reconstruction to Augment Arthroscopic Repair of Massive Rotator Cuff Tears Using Autogenous Biceps Tendon: Effect on Retear Rate**

Paulo J. Llinás MD, David S. Bailie MD, Diego A. Sanchez MD, Julian Chica MD, Juan Francisco Londono MD, Gilberto A. Herrera MD

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https://doi.org/10.1177/03635465221112659



**Background:** Massive rotator cuff tears have a high incidence of postoperative retear that can reach 90%. It is still unclear which intervention may reduce the incidence of retear and improve the functional and clinical outcomes.

**Purpose/Hypothesis:** The purpose of this study was to investigate the clinical and structural outcomes at 2 years after repair of reparable massive rotator cuff tears with and without the use of partial superior capsular reconstruction (pSCR), using the autologous long head of the biceps tendon (LHBT) as a graft. It was hypothesized that augmentation with a pSCR would decrease retear rates.

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

**Methods:** The authors compared arthroscopic repair of massive posterosuperior rotator cuff tears with and without augmentation using the LHBT for pSCR between 2015 and 2017. After applying the selection criteria, 106 patients were included in the study and distributed into 2 groups of 50 and 56 patients. Patients in the first group (50 patients) underwent arthroscopic repair without use of the LHBT (AR group), and patients in the second group (56 patients) underwent arthroscopic repair with use of the LHBT for pSCR (AR-LHBT group). The structural outcome was evaluated by ultrasound at 2 years of follow-up. Function and pain were evaluated preoperatively and at the 2-year follow-up using the American Shoulder and Elbow Surgeons (ASES) score and visual analog scale (VAS). Pre- and postoperative active range of motion, including forward elevation, external rotation, and abduction, were also documented.

**Results:** No significant differences were found between groups regarding the baseline characteristics. After 24 months, both groups showed significant improvement from preoperative ASES scores, VAS score, and active range of motion ($P < .01$ for all). Patients in the AR-LHBT group showed significant improvements in postoperative functional and pain scores compared with the AR group in all measurements at the 2-year follow-up (ASES score: 77.23 ± 7.45 vs 71.04 ± 9.28, $P < .01$; VAS score: 1.64 ± 1.03 vs 2.12 ± 1.06, $P < .01$). Final range of motion was significantly increased for the AR-LHBT group for forward elevation (155 [interquartile range {IQR}, 150-160] vs 150 [IQR, 140-170]; $P < .01$) and abduction (150 [IQR, 140-157.5] vs 120 [IQR, 100-140]; $P < .01$), but external rotation was significantly greater for the AR group (54.43 ± 10.55 vs 59.5 ± 10.55; $P < .01$). Postoperative ultrasonography at the 2-year follow-up revealed a higher retear rate in the AR group than in the AR-LHBT group (46% vs 14%; $P < .01$).

**Conclusion**: Use of the LHBT for pSCR to augment massive rotator cuff tears resulted in markedly lower retear rates and modestly improved pain and function outcomes compared with repair alone.

BACK

Journal of Bone and Joint Surgery (JBJS), Volume 104, Issue 17 & 18

# Patients Who Undergo Rotator Cuff Repair Can Safely Return to Driving at 2 Weeks Postoperatively

Ariel E. Badger, Linsen T. Samuel, Allison N. Tegge, Mariette Metrey, Miguel A. Perez, John R. Tuttle, Peter J. Apel

DOI: 10.2106/JBJS.21.01436


Background: Evidence-based guidelines are lacking for return to driving following rotator cuff repair (RCR). As a result, surgeons are often overly conservative in their recommendations, placing potential undue burden on patients and their families. Therefore, the primary objective of this study was to formulate evidence-based return-to-driving guidelines.

Methods: Thirty-two subjects planning to undergo primary RCR were enrolled. Driving fitness was assessed in a naturalistic setting with an instrumented vehicle on public streets with a safety monitor onboard. Driving kinematic measures and behavioral data were obtained from vehicle data and camera capture. Several driving tasks and maneuvers were evaluated, including parking, left and right turns, straightaways, yielding, highway merges, and U-turns. The total course length was 15 miles (24 km) and the course took 45 to 55 minutes to complete. The subjects' baseline drive was performed prior to RCR and postoperative drives occurred at 2, 4, 6, and 12 weeks after RCR. All drives consisted of identical routes, tasks, and maneuvers. Driving metrics were analyzed for differences between baseline and postoperative drives, including differences in gravitational force equivalents (g).

Results: Twenty-seven subjects (mean age, 58.6 years [range, 43 to 68 years]) completed all 5 drives. Of the 13 analyzed kinematic metrics measured from 14 of 17 driving events, all exhibited noninferiority across all postoperative drives (2 to 12 weeks) after RCR compared with baseline. Beginning at postoperative week 2, subjects generally braked less aggressively, steered more smoothly, and drove more stably. Kinematic metrics during the performance of specific maneuver types also showed noninferiority when compared with baseline. Of note, subjects drove more smoothly on highway merges starting at postoperative week 2 (minimum longitudinal acceleration, −0.35 g [95% confidence interval (CI), −0.050 to −0.019 g]; standard deviation of longitudinal acceleration, 0.008 g [95% CI, 0.003 to 0.013 g]), but exhibited more aggressive driving and acceleration on highway merges at postoperative week 12 (maximum absolute yaw, −0.8°/sec [95% CI, −1.2°/sec to −0.4°/sec]).

Conclusions: Patients showed no clinically important negative impact on driving fitness as early as 2 weeks after RCR. Adaptive behaviors were present both preoperatively and postoperatively.

Level of Evidence: Prognostic Level II. See Instructions for Authors for a complete description of levels of evidence

BACK

## Lower Extremity

Journal of Arthroscopy, Volume 38 Issue 9

**Athletes Undergoing Concomitant Hip Arthroscopy and Periacetabular Osteotomy Demonstrate Greater Than 80% Return-to-Sport Rate at 2-Year Minimum Follow-Up**

A. E. Jimenez, M.S. Lee, et al.

DOI: https://doi.org/10.1016/j.arthro.2022.02.017

Purpose
To report minimum 2-year follow-up patient-reported outcomes and return-to-sport (RTS) rates in athletes undergoing concomitant hip arthroscopy and periacetabular osteotomy (PAO) to treat acetabular dysplasia and intra-articular pathologies such as cam deformity and labral tears.

Methods
We reviewed the data of consecutive athletes undergoing concomitant primary hip arthroscopy and PAO for acetabular dysplasia and cam deformity from November 2010 to December 2018. Patients were included in the study if they had the following preoperative and minimum 2-year postoperative scores: modified Harris Hip Score (mHHS), Nonarthritic Hip Score (NAHS), and Hip Outcome Score–Sport-Specific Subscale (HOS-SSS). The percentage of patients who achieved the minimal clinically important difference was recorded, in addition to RTS status.

Results
A total of 29 athletes (29 hips) were included, with a mean follow-up time of 34.1 ± 7.9 months, mean age of 26.0 ± 8.7 years, and mean body mass index of 23.7 ± 3.4. These athletes showed significant improvements in the mHHS, NAHS, and HOS-SSS from baseline to latest follow-up ($P < .001$). The minimal clinically important difference was achieved at high rates for the mHHS (82.8%), NAHS (86.2%), and HOS-SSS (79.3%). Athletes who attempted to RTS successfully returned at a rate of 81.8%.

Conclusions
Athletes undergoing concomitant hip arthroscopy and PAO showed significant improvements in patient-reported outcomes at minimum 2-year follow-up and had an RTS rate of 81.8%.

Level of Evidence
Level IV, retrospective case series.

BACK

**Labral Degeneration Predicts Inferior Mid-Term Outcomes in Hip Labral Repair: A Multicenter Comparative Analysis**

D.S. Carreira, D.B. Shaw, et al.

DOI: https://doi.org/10.1016/j.arthro.2022.02.019

Purpose

To analyze and compare the mid-term outcomes of hip arthroscopy for patients with and without labral degeneration from multiple orthopaedic centers. The purpose of this research is to develop an understanding of the impacts of labral degeneration on patient outcomes following arthroscopic treatment of labral tears.

Methods

A prospective multicenter hip arthroscopy registry was queried for primary surgeries from January 2014 to October 2017 with completed 2-year International Hip Outcome Tool-12 (iHOT-12) reports. Patients were placed into cohorts based on the presence or absence of labral degeneration noted intraoperatively during hip arthroscopy. Degeneration was defined as yellowing, ossification, or calcification present in at least 50% of the labrum. Differences in baseline variation between groups were assessed with a Wilcoxon rank-sum test or $\chi 2$ test. Two-year outcomes were assessed with iHOT-12. Multivariate logistic regression models were fitted while controlling for age, body mass index, sex, and preoperative iHOT-12 scores to identify significant predictors of achieving the clinically significant thresholds of minimal clinically important difference, substantial clinical benefit, and patient-acceptable symptom scale.

Results

In total, 735 patients met inclusion criteria, of whom 613 had complete outcomes information. Relative to the control group, the labral degeneration group was significantly older (mean age 44 ± 11 years vs 33 ± 12 years; $P < .01$). Both groups experienced statistically significant improvement in iHOT-12 scores from baseline to final follow-up ($P < .001$); however, patients with labral degeneration reported inferior 2-year iHOT-12 scores when compared with patients without degeneration ($P < .001$). In the logistic regression models, labral degeneration was a significant negative predictor of achieving iHOT-12 minimal clinically important difference (odds ratio [OR] 0.47; 95% confidence interval [95% CI] 0.28-0.79), patient acceptable symptom state (OR 0.50; 95 CI 0.32-0.77), and substantial clinical benefit (OR 0.58; 95% CI 0.37-0.89).

Conclusions

The results of our study conclude that patients with nondegenerative labral tissue at the time of repair have superior patient-reported outcomes at mid-term follow-up. The presence of labral degeneration was a negative predictor of achieving clinically significant thresholds after controlling for patient age, body mass index, sex, and baseline iHOT-12 scores.

Level of Evidence

III, retrospective comparative prognostic trial.

BACK

**Favorable Patient-Reported Outcomes and High Return to Sport Rates Following Hip Arthroscopy in Adolescent Athletes: A Systematic Review**

E. Arciero, R. Kakazy, et al.

DOI: https://doi.org/10.1016/j.arthro.2022.02.022

Purpose

The purpose of this systematic review is to synthesize the existing literature surrounding hip arthroscopy in the adolescent athlete population to determine patient-reported outcomes, return to sport rates, complications, and reoperations associated with this intervention.

Methods

A systematic literature review was performed using PubMed (MEDLINE), Cochrane Library, and Embase according to PRISMA guidelines. Studies were included if they were published in English with greater than 2 participants, contained patients aged 10-19 years old or classified as “high school athletes” or “middle school athletes,” and reported postoperative patient-reported outcomes and return to sport. Patient-reported outcomes (PROs) and their associated P values were recorded. Finally, return-to-sport outcomes and sports played were also extracted from the included studies. Weighted kappa was used to assess inter-reviewer agreement.

Results

Eleven studies included in the final analysis, resulting in 344 patients and 408 hips were analyzed by this review. Patient-reported outcomes (PROs) were reported in all studies. The modified Harris Hip Score (mHHS) was used in all but 1 study. Six of the 11 studies reported a 100% return-to-sport rate, for a total of 98/98 athletes returning to sport. Fabricant et al. did note that a majority of athletes who returned to sport were able to do so at a subjective “nearly normal” level. Only 4 of the studies reported complications, with the majority being transient neuropraxias.

Conclusions

Adolescent athletes who undergo hip arthroscopy demonstrate favorable postoperative patient-reported outcome scores, high rates of return to sport, and an overall low complication rate. The heterogeneity in both surgical methodology and outcome measures used for evaluation and treatment leads to continued ambiguity with regard to the optimal method for managing adolescent athletes with hip pathology.

Level of Evidence

V, systematic review of Level II-V studies

BACK

**Improved Accuracy of Coronal Alignment Can Be Attained Using 3D-Printed Patient-Specific Instrumentation for Knee Osteotomies: A Systematic Review of Level III and IV Studies**

Z.S. Zaman, N.N. DePhillipo, et al.

DOI: https://doi.org/10.1016/j.arthro.2022.02.023

To evaluate the accuracy and precision of postoperative coronal plane alignment using 3D-printed patient-specific instrumentation (PSI) in the setting of proximal tibial or distal femoral osteotomies.

Methods

A systematic review evaluating the accuracy of 3D-printed PSI for coronal plane alignment correcting knee osteotomies was performed. The primary outcomes were accuracy of coronal plane limb alignment correction and number of correction outliers. Secondary variables were duration of surgery, number of intraoperative fluoroscopic images, complications, cost, and clinical outcomes (as applicable).

Results

Ninety-three studies were identified, and 14 were included in the final analysis. Overall, mean postoperative deviation from target correction ranged from 0.3° to 1° for all studies using hip-knee angle measurements and 2.3% to 4.9% for all studies using weight-bearing line measurements. The incidence of correction outliers was assessed in 8 total studies and ranged from 0 to 25% (total n = 10 knees) of patients corrected with 3D-printed PSI. Osteotomies performed with 3D-printed cutting guides or wedges demonstrated significantly shorter operative times ($P < .05$) and fewer intraoperative fluoroscopic images ($P < .05$) than control groups in four case control studies.

Conclusion

Patients undergoing distal femoral osteotomy or proximal tibial osteotomy procedures with 3D-printed patient-specific cutting guides and wedges had highly accurate coronal plane alignment with a low rate of outliers. Patients treated with 3D printed PSI also demonstrated significantly shorter operative times and decreased intraoperative fluoroscopy when compared to conventional techniques.

Level of Evidence

Level IV, systematic review of Level III-IV studies

BACK

American Journal of Sports Medicine (AJSM), Volume 50, Issue 11

# Outcomes of Staged Bilateral Hip Arthroscopic Surgery in the Context of Femoroacetabular Impingement Syndrome: A Nested Matched-Pair Control Study Focusing on the Effect of Time Between Procedures

Hari K. Ankem MD, Samantha C. Diulus BS, Cynthia Kyin BA, Andrew E. Jimenez MD, Benjamin R. Saks MD, Payam W. Sabetian MD, David R. Maldonado MD, Ajay C. Lall MD, MS, Benjamin G. Domb MD

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**Background:** Bilateral hip symptoms from femoroacetabular impingement syndrome (FAIS) are a common finding in patients regardless of athletic involvement. Oftentimes, patients and surgeons choose to stage bilateral hip arthroscopic surgery.

**Purpose/Hypothesis:** The purpose of this study was (1) to compare minimum 2-year outcomes between patients who underwent staged bilateral hip arthroscopic surgery for FAIS to a propensity score–matched control group that underwent unilateral hip arthroscopic surgery and (2) to investigate the effect of time between bilateral procedures on patient-reported outcomes (PROs). We hypothesized that, after bilateral hip arthroscopic surgery, the improvement in outcomes would be similar to that after unilateral hip arthroscopic surgery and the time duration between bilateral procedures would not affect the final outcome.

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

**Methods:** Data were retrospectively reviewed on a consecutive series of patients who underwent primary hip arthroscopic surgery at our institution between June 2008 and November 2017. Patients who underwent bilateral hip arthroscopic surgery with minimum 2-year PROs for the modified Harris Hip Score (mHHS), the Nonarthritic Hip Score (NAHS), the Hip Outcome Score–Sports Specific Subscale (HOS-SSS), patient satisfaction, and a visual analog scale (VAS) for pain were included. The study group was matched 1:1 based on age, sex, and body mass index to a control group that only required unilateral hip arthroscopic surgery. Additionally, a subanalysis was performed on the study group to determine the effect of time between arthroscopic procedures. Rates of achieving the minimal clinically important difference (MCID) and Patient Acceptable Symptom State (PASS) for the mHHS and HOS-SSS were determined. The P value was set at <.05.

**Results:** A total of 205 patients (410 hips) were included. The mean age and body mass index of the study group were 32.3 ± 13.2 years and 25.0 ± 5.1, respectively. All 410 hips that met the inclusion criteria were matched. There were no significant differences in patient, radiographic, or procedural data. A significant and comparable improvement was reported for all PRO measures and the VAS (P < .0001) in both groups. Similarly, rates of achieving the MCID and PASS were comparable. After dividing the study group based on whether the contralateral procedure was performed <3 months or >3 months after the first procedure, it was determined that patients had a significant improvement and favorable outcomes regardless of time between bilateral procedures.

**Conclusion:** Patients who underwent unilateral and bilateral hip arthroscopic surgery for FAIS had a significant and comparable improvement in PROs at a minimum 2-year follow-up. A time interval of <3 months or >3 months between bilateral procedures did not affect PROs.

BACK

**Determining Clinically Meaningful Thresholds for the Hip Outcome Score Sport-Specific Subscale in Athletes Undergoing Hip Arthroscopy for Femoroacetabular Impingement Syndrome**

Jade S. Owens BS, Andrew E. Jimenez MD, Michael S. Lee BA, Tom George MD, David R. Maldonado MD, Benjamin G. Domb MD

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**Background:** The minimal clinically important difference (MCID), Patient Acceptable Symptom State (PASS), substantial clinical benefit (SCB), and maximum outcome improvement (MOI) satisfaction threshold for the Hip Outcome Score Sport-Specific Subscale (HOS-SSS) have not been established in athletes undergoing hip arthroscopy for femoroacetabular impingement syndrome (FAIS).

**Purpose:** To determine threshold MCID, PASS, SCB, and MOI satisfaction threshold values for the HOS-SSS in athletes undergoing hip arthroscopy for FAIS at minimum 2–year follow–up.

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

**Methods:** Anchor questions were administered to recreational, organized amateur, high school, college, and professional athletes who underwent primary hip arthroscopy for FAIS between May 2015 and March 2019. Patients were included if they were younger than 50 years, answered the anchor questions, and had preoperative and minimum 2–year follow–up for the HOS-SSS, modified Harris Hip Score (mHHS), Non-Arthritic Hip Score (NAHS), and visual analog scale (VAS) for pain. Exclusion criteria were Tönnis grade >1, hip dysplasia (lateral center–edge angle <18°), and previous ipsilateral hip surgery or conditions. Receiver operating characteristic (ROC) analysis was used to determine PASS, SCB, and MOI satisfaction for the HOS-SSS. Two distribution methods were used to calculate MCID for HOS-SSS.

**Results:** A total of 225 athletes who underwent primary hip arthroscopy met the inclusion criteria. Of those athletes, 200 (88.9%) who had minimum 2–year follow–up and information regarding return to sport (RTS) were included. The cohort included 124 (62.0%) women and 76 (38.0%) men with a mean ± standard deviation age of 29.4 ± 10.4 years, body mass index of 25.6 ± 5.4, and follow–up of 29.5 ± 5.1 months. Athletes experienced significant improvements in HOS-SSS, mHHS, NAHS, and VAS from preoperative to latest postoperative follow–up ($P < .001$), and mean satisfaction was 8.2. The RTS rate was 83.7%. ROC analysis determined that the PASS, MOI satisfaction threshold, SCB absolute score, SCB change score, and MCID (baseline/change score methods) for the HOS-SSS were 77.0, 44.6%, 92.7, 30.6, and 10.6, respectively, with athletes achieving thresholds at high rates (80.0%, 80.5%, 45.0%, 54.0%, and 79.5%, respectively).

**Conclusion:** This study identified values for the HOS-SSS that can be used to define clinically meaningful outcomes in athletes after primary hip arthroscopy for FAIS. The PASS, MOI satisfaction threshold, SCB absolute score, SCB change score, and MCID for the HOS-SSS at minimum 2–year follow–up in athletes after primary hip arthroscopy were 77.0, 44.6%, 92.7, 30.6, and 10.6, respectively.

BACK

# Miscellaneous

Arthroscopy, Volume 38, Issue 9

**Many Radiographic and Magnetic Resonance Imaging Assessments for Surgical Decision Making in Pediatric Patellofemoral Instability Patients Demonstrate Poor Interrater Reliability**

P.D. Fabricant, M.R. Heath, et al.

DOI: https://doi.org/10.1016/j.arthro.2022.03.033

Purpose
To evaluate the interrater reliability of several common radiologic parameters used for patellofemoral instability and to attempt to improve reliability for measurements demonstrating unacceptable interrater reliability through consensus training.

Methods
Fifty patients with patellar instability between the ages of 10 and 19 years were selected from a prospectively enrolled cohort. For measurements demonstrating unacceptable interrater reliability (intraclass correlation coefficient [ICC]: <0.6), raters discussed consensus methods to improve reliability and re-examined a subset of 20 images from the previous set of images. If reliability was still low after the second round of assessment, the measure was considered unreliable.

Results
Of the 50 included subjects, 22 (44%) were male and the mean age at the time of imaging was 14 ± 2 years. With 1 or fewer consensus training sessions, the interrater reliability of the following radiograph indices were found to be reliable: trochlea crossing sign (ICC: 0.625), congruence angle (ICC: 0.768), Caton-Deshamps index (ICC: 0.644), lateral patellofemoral angle (ICC: 0.768), and mechanical axis deviation on hip-to-ankle alignment radiographs (ICC: 0.665-0.777). Reliable magnetic resonance imaging (MRI) indices were trochlear depth (ICC: 0.743), trochlear bump (ICC: 0.861), sulcus angle (ICC: 0.684), patellar tilt (ICC: 0.841), tibial tubercle to trochlear groove distance (ICC: 0.706), effusion (ICC: 0.866), and bone marrow edema (ICC: 0.961).

Conclusions
With 1 or fewer consensus training sessions, the interrater reliability of the following patellofemoral indices were found to be reliable for trochlear morphology: trochlea crossing sign and congruence angle on radiograph and trochlear depth, trochlear bump, and sulcus angle on MRI. Reliable patellar position measurements included: Caton-Deshamps index and lateral patellofemoral angle on radiograph and patellar tilt and tibial tubercle to trochlear groove distance on MRI. Additional global measurements (e.g., mechanical axis deviation on standing radiographs) and MRI assessments demonstrated acceptable reliability.

Level of Evidence
II, prospective diagnostic study.

BACK