



Issue 58.3, Arthroscopy, June 2019

**Founder & Managing Director**

R.S. van Onkelen

**Managing Director & Webmaster**

J.A. Lafranca



**Nederlandse Vereniging  
voor Arthroscopie**

**Editor-in-Chief**

M. Huijben

**Editors**

B.S.H. Joling

4B editors

**Website** [www.4b.4abstracts.nl](http://www.4b.4abstracts.nl)

**Part of** [www.4abstracts.com](http://www.4abstracts.com)

**4B Arthroscopy founders:** D.P. ter Meulen, B. Lubberts

**Contact** [4@erasmusmc.nl](mailto:4@erasmusmc.nl)

**Manual** The titles in the contents are hyperlinks. Use these hyperlinks and the back button underneath every abstract to navigate more easily through the document. All abstracts have a hyperlink to the website of the article. Use this hyperlink to view the article in full-text. Articles can only be accessed in full-text through a personal account or the account of an institution.

---

## Content June 2019

### Upper extremity

#### Arthroscopy

Volume 35, issue 6

- Patient Satisfaction With Nonopioid Pain Management Following Arthroscopic Partial Meniscectomy and/or Chondroplasty
- Effect of Femoral Tunnel Position on Stability and Clinical Outcomes After Single-Bundle Anterior Cruciate Ligament Reconstruction Using the Outside-In Technique
- Open Meniscal Allograft Transplantation With Transosseous Suture Fixation of the Meniscal Body Significantly Decreases Meniscal Extrusion Rate Compared With Arthroscopic Technique
- Proximal, Distal, and Combined Fixation Within the Tibial Tunnel in Transtibial Posterior Cruciate Ligament Reconstruction: A Time-Zero Biomechanical Study In Vitro
- A Hamstring-Based Anatomic Posterolateral Knee Reconstruction With Autografts Improves Both Radiographic Instability and Functional Outcomes
- The Timing of Corticosteroid Injections Following Simple Knee Arthroscopy Is Associated With Infection Risk
- Re-revision Anterior Cruciate Ligament Reconstruction: An Evaluation From the Norwegian Knee Ligament Registry
- Predictive Factors for Patellofemoral Degenerative Progression After Opening-Wedge High Tibial Osteotomy
- Effect of Fibular Height and Lateral Tibial Condylar Geometry on Lateral Cortical Hinge Fracture in Open Wedge High Tibial Osteotomy
- Diagnostic Value of Stress Radiography and Arthrometer Measurement for Anterior Instability in Anterior Cruciate Ligament Injured Knees at Different Knee Flexion Position
- Comparison of Clinical and Radiologic Outcomes and Second-Look Arthroscopic Findings After Anterior Cruciate Ligament Reconstruction Using Fixed and Adjustable Loop Cortical Suspension Devices
- Hill-Sachs Lesion Classification by the Glenoid Track Paradigm in Shoulder Instability: Poor Agreement Between 3-Dimensional Computed Tomographic and Arthroscopic Methods
- Cutibacterium Acnes (Formerly Propionibacterium Acnes) Contamination of the Surgical Field During Shoulder Arthroscopy
- Biomechanical Analysis of All-Suture Suture Anchor Fixation Compared With Conventional Suture Anchors and Interference Screws for Biceps Tenodesis
- The Association of Perioperative Glycemic Control With Adverse Outcomes Within 6 Months After Arthroscopic Rotator Cuff Repair
- Patient-Reported Outcomes After Isolated and Combined Arthroscopic Subscapularis Tendon Repairs
- A Flat Anterior Glenoid Corresponds to Subcritical Glenoid Bone Loss
- The Therapeutic Benefits of Saline Solution Injection for Lateral Epicondylitis: A Meta-analysis of Randomized Controlled Trials Comparing Saline Injections With Nonsurgical Injection Therapies
- Systematic Review of the Anatomic Descriptions of the Glenohumeral Ligaments: A Call for Further Quantitative Studies
- Labral Repair Versus Biceps Tenodesis for Primary Surgical Management of Type II Superior Labrum Anterior to Posterior Tears: A Systematic Review

Journal of Shoulder and Elbow Surgery (JSES)

Volume 28, issue 6

- Patient-determined outcomes after arthroscopic rotator cuff repair with and without biceps tenodesis utilizing the PITT technique
- Do elderly patients gain as much benefit from arthroscopic rotator cuff repair as their younger peers?

Journal of Bone and Joint Surgery (JBJS)

Volume 101, Issue 12

- Factors Related to Patient Dissatisfaction Versus Objective Failure After Arthroscopic Shoulder Stabilization for Instability

**Lower extremity**

Arthroscopy

Volume 35, issue 6

- Do Your Routine Radiographs to Diagnose Cam Femoroacetabular Impingement Visualize the Region of the Femoral Head-Neck Junction You Intended?
- Patients' Expectations of Hip Preservation Surgery: A Survey Study
- Arthroscopic Surgery for Femoroacetabular Impingement in Skeletally Immature Athletes: Radiographic and Clinical Analysis
- Midterm Outcomes Following Repair of Capsulotomy Versus Nonrepair in Patients Undergoing Hip Arthroscopy for Femoroacetabular Impingement With Labral Repair
- Bilateral Hip Arthroscopy: Can Results From Initial Arthroscopy for Femoroacetabular Impingement Predict Future Contralateral Results?
- The Role of Bone Marrow Aspirate Concentrate for the Treatment of Focal Chondral Lesions of the Knee: A Systematic Review and Critical Analysis of Animal and Clinical Studies
- Return to Sport and Sports-Specific Outcomes After Osteochondral Allograft Transplantation in the Knee: A Systematic Review of Studies With at Least 2 Years' Mean Follow-Up
- Knee Flexion Angle During Graft Fixation for Medial Patellofemoral Ligament Reconstruction: A Systematic Review of Outcomes and Complications
- Hamstring Autograft Versus Hybrid Graft in Anterior Cruciate Ligament Reconstruction: A Systematic Review of Comparative Studies

Knee Surgery, Sports Traumatology, Arthroscopy (KSSTA)

Volume 27, Issue 6

- Treatment of unstable knee osteochondritis dissecans in the young adult: results and limitations of surgical strategies—The advantages of allografts to address an osteochondral challenge
- The use of allograft tendons in primary ACL reconstruction
- Allograft tendons are a safe and effective option for revision ACL reconstruction: a clinical review
- Autograft or allograft for reconstruction of anterior cruciate ligament: a health economics perspective
- The use of allograft tissue in posterior cruciate, collateral and multi-ligament knee reconstruction
- Italian consensus statement for the use of allografts in ACL reconstructive surgery

- Higher survivorship following meniscal allograft transplantation in less worn knees justifies earlier referral for symptomatic patients: experience from 240 patients
- Meniscal allograft transplantation: undersizing grafts can lead to increased rates of clinical and mechanical failure
- Meniscal allograft transplantation in the paediatric population: early referral is justified
- Meniscal allograft transplantation combined with anterior cruciate ligament reconstruction provides good mid-term clinical outcome

American Journal of Sports Medicine (AJSM)

Volume 47, Issue 7

- Survivorship and Outcome of Hip Arthroscopy for Femoroacetabular Impingement Syndrome Performed With Modern Surgical Techniques
- Is Microfracture Necessary? Acetabular Chondrolabral Debridement/Abrasion Demonstrates Similar Outcomes And Survival to Microfracture in Hip Arthroscopy: A Multicenter Analysis

---

## Upper extremity

[Arthroscopy, Volume 35, Issue 6](#)

### **Patient Satisfaction With Nonopioid Pain Management Following Arthroscopic Partial Meniscectomy and/or Chondroplasty**

Stephen D. Daniels, B.S., Kirsten D. Garvey, M.S., Jamie E. Collins, Ph.D., Elizabeth G. Matzkin, M.D.

Arthroscopy, Volume 35, Issue 6, Received: March 11, 2018; Accepted: October 29, 2018

<https://doi.org/10.1016/j.arthro.2019.03.028>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

#### **Purpose**

To evaluate the efficacy of nonopioid pain medication related to patient satisfaction with postoperative pain and identify potential risk factors for decreased patient satisfaction with nonopioid pain medications.

#### **Methods**

This was a prospective study conducted between January 2017 and April 2018 at a single institution. A power analysis was performed a priori, which determined an appropriate cohort size of 163 patients. Inclusion criteria were all patients older than age 18 who were undergoing a knee arthroscopy for a partial meniscectomy and/or chondroplasty. Patients were prescribed maximum-strength ibuprofen or acetaminophen and completed a preoperative and 2-week postoperative questionnaire to assess satisfaction with pain management.

#### **Results**

Among the 163 patients enrolled in the study, the average age was 48.7 years (range 21-73 years); 74 (45%) were male and 89 (55%) were female. Overall, 81.6% (95% confidence interval 75.7% to 87.5%,  $P < .001$ ) of patients reported satisfactory postoperative pain control without the use of opioids. Patients with a history of opioid use were found to be less likely to report adequate satisfaction with pain control than were patients who had no prior history of opioid use (relative risk 0.65, 95% confidence interval 0.38-1.12,  $P = .031$ ).

#### **Conclusions**

Based on the findings of this study, 82% of patients who undergo arthroscopic partial meniscectomy and/or chondroplasty can achieve satisfactory pain control with nonopioid pain management.

#### **Level of Evidence**

Prospective comparative study: Level II.

[BACK](#)

## **Effect of Femoral Tunnel Position on Stability and Clinical Outcomes After Single-Bundle Anterior Cruciate Ligament Reconstruction Using the Outside-In Technique**

Seung-Suk Seo, M.D.a, Chang-Wan Kim, M.D.c, Chang-Rack Lee, M.D., Yong-Uk Kwon, M.D.c, Mu-Won Kim, M.D.b, Ok-Gul Kim, M.D.b, Hyeong-Won Seo, M.D.

Arthroscopy, Volume 35, Issue 6, Received: April 25, 2018; Accepted: November 21, 2018

<https://doi.org/10.1016/j.arthro.2018.11.055>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

To evaluate the effects of the femoral tunnel location in the femoral footprint of the anterior cruciate ligament (ACL) on postoperative knee stability and clinical outcomes after ACL reconstruction (ACLR) using the outside-in technique.

### **Methods**

From December 2012 to August 2014, ACLR was performed using the outside-in technique in 137 patients. Among these patients, those who had a follow-up period of over 2 years were retrospectively reviewed. A total of 102 patients met the inclusion criteria. The relative location of the femoral tunnel in the lateral condyle was evaluated as a percentage using the standardized grid system on a 3-dimensional computed tomography image. Each patient was then classified into the anterior group, center group (anteroposterior plane,  $29.3\% \pm 3.5\%$ ), or posterior group depending on the location of the femoral tunnel. Knee laxity was evaluated using a GNRB knee arthrometer, stress radiography, and the pivot-shift test. From a clinical perspective, patient-reported outcomes (International Knee Documentation Committee subjective form and Lysholm knee score) were then evaluated.

### **Results**

Of 102 patients, 31 (30.4%) were assigned to the anterior group, 46 (45.1%) were assigned to the center group, and 25 (24.5%) were assigned to the posterior group. Postoperative side-to-side differences, which were measured using stress radiographs and the GNRB arthrometer, were significantly smaller in the posterior group ( $1.7 \pm 0.6$  mm and  $1.5 \pm 0.5$  mm, respectively) than in the center group ( $2.3 \pm 0.9$  mm and  $2.2 \pm 2.8$  mm, respectively) and anterior group ( $2.4 \pm 0.7$  mm and  $2.4 \pm 1.3$  mm, respectively) ( $P = .002$  for stress radiography and  $P = .002$  for GNRB arthrometer). No significant between-group differences were observed in the pivot-shift test results and patient-reported outcomes among the 3 groups.

### **Conclusions**

The location of the femoral tunnel in the anatomic ACL footprint did not affect postoperative stability and clinical outcomes in the case of ACLR using the outside-in technique.

### **Level of Evidence**

Level III, retrospective comparative study.

## **Open Meniscal Allograft Transplantation With Transosseous Suture Fixation of the Meniscal Body Significantly Decreases Meniscal Extrusion Rate Compared With Arthroscopic Technique**

Gergo Merkely, M.D., Takahiro Ogura, M.D., Jakob Ackermann, M.D., Alexandre Barbieri Mestriner, M.D., Tom Minas, M.D., M.S., Andreas H. Gomoll, M.D.

Arthroscopy, Volume 35, Issue 6, Received: June 20, 2018; Accepted: November 26, 2018

<https://doi.org/10.1016/j.arthro.2018.11.063>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

To assess and compare meniscal extrusion rates after lateral “bridge-in-slot” meniscal allograft transplantation (MAT) with arthroscopic versus open insertion.

### **Methods**

In this review of prospectively collected data, we analyzed data from patients who underwent arthroscopic or open lateral MAT. Patients who underwent concomitant distal femoral osteotomy, for whom 1-year postoperative magnetic resonance imaging was unavailable, or who underwent open lateral MAT without the use of transosseous sutures were excluded. Meniscal extrusion in the included patients was assessed by 2 independent examiners by measuring the absolute value and the relative percentage of extrusion on 1.5-T magnetic resonance images at 1-year follow-up. The number of MATs with radial displacement larger or smaller than 3 mm was determined.

### **Results**

A total of 20 patients met the inclusion criteria, of whom 10 underwent arthroscopic and 10 underwent open lateral MAT. No statistically significant differences were found in baseline demographic data. Absolute meniscal extrusion was similar between the groups ( $P = .091$ ). A significantly larger relative percentage of extrusion (arthroscopic MAT,  $31 \pm 27$  mm; open MAT,  $10 \pm 29$  mm; 95% confidence interval,  $-0.4$  to  $-0.02$  mm;  $P = .03$ ) and a significantly higher extrusion rate were found in patients treated with arthroscopic MAT than in those treated with open MAT ( $>3$  mm in 5 patients [50%] with arthroscopic MAT and 0 patients with open MAT,  $P = .01$ ).

### **Conclusions**

This study identified similar absolute extrusion and significantly lower postoperative lateral meniscal extrusion rates after open MAT compared with arthroscopic MAT. Transosseous fixation of the meniscal body appears protective against meniscal extrusion after MAT.

### **Level of Evidence**

Level III, case-control study.

## **Proximal, Distal, and Combined Fixation Within the Tibial Tunnel in Transtibial Posterior Cruciate Ligament Reconstruction: A Time-Zero Biomechanical Study In Vitro**

Xiaohui Zhang, M.M., Yuanjun Teng, M.M., Rui Li, M.M., Chongwen Ma, M.M., Xinxin Yang, M.M., Hong Wang, M.M., Hua Han, M.D., Jin Jiang, M.D., Bin Geng, M.D., Meng Wu, M.M., Yayi Xia, M.D., Ph.D

Arthroscopy, Volume 35, Issue 6, Received: August 31, 2018; Accepted: January 7, 2019

<https://doi.org/10.1016/j.arthro.2019.01.017>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

To compare the time-zero biomechanical properties of 3 graft fixation techniques (proximal, distal, and combined fixation) within the tibial tunnel in transtibial posterior cruciate ligament (PCL) reconstruction.

### **Methods**

Porcine tibias and bovine extensor tendons were used to simulate a transtibial PCL reconstruction in vitro. Load-to-failure testing was carried out in 3 groups: distal fixation alone (group I, n = 10), proximal fixation alone (group II, n = 10), and combined fixation (group III, n = 10). The load-elongation curve, tensile stiffness (in newtons per millimeter), ultimate load (in newtons), yield load (in newtons), energy absorbed to failure (in joules), and failure mode were recorded.

### **Results**

All graft-tibia complexes failed because the grafts slipped past the interference screws. The tensile stiffness, yield load, and energy absorption in group I were significantly lower than those in group II and group III (tensile stiffness,  $19.25 \pm 9.68$  N/mm in group I vs  $34.92 \pm 16.48$  N/mm in group II [ $P = .016$ ] and  $32.31 \pm 13.79$  N/mm in group III [ $P = .041$ ]; yield load,  $265.36 \pm 144.52$  N in group I vs  $398.23 \pm 57.04$  N in group II [ $P = .006$ ] and  $424.94 \pm 74.00$  N in group III [ $P = .001$ ]; and energy absorption,  $5.16 \pm 2.35$  J in group I vs  $19.95 \pm 3.48$  J in group II [ $P < .001$ ] and  $21.09 \pm 4.29$  J in group III [ $P < .001$ ]). No statistically significant differences in biomechanical properties were found between group II and group III ( $P > .05$ ).

### **Conclusions**

Compared with distal fixation in transtibial PCL reconstruction, proximal fixation and combined fixation showed superior time-zero biomechanical properties.

### **Clinical Relevance**

Proximal fixation and combined fixation produced superior biomechanical properties to distal fixation in transtibial PCL reconstruction.

## **A Hamstring-Based Anatomic Posterolateral Knee Reconstruction With Autografts Improves Both Radiographic Instability and Functional Outcomes**

Carlos Eduardo Franciozi, M.D., Ph.D., Leonardo José Bernardes Albertoni, M.D., Marcelo Seiji Kubota, M.D., Rene Jorge Abdalla, M.D., Ph.D.a,b, Marcus Vinícius Malheiros Luzo, M.D., Ph.D., Moisés Cohen, M.D., Ph.D., Robert F. LaPrade, M.D., Ph.D

Arthroscopy, Volume 35, Issue 6, Received: July 24, 2018; Accepted: January 7, 2019

<https://doi.org/10.1016/j.arthro.2019.01.016>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

To report the subjective outcomes and objective stability in a series of chronically grade III posterolateral injured knees treated with a hamstring-based anatomic posterolateral corner (PLC) reconstruction technique using autografts.

### **Methods**

An outcome study of patients with a chronic complete tear of all ligamentous structures of the PLC (>5 mm of varus gapping at 30°, ≥10° of external tibial rotation during the dial test, ≥4 mm of increased lateral compartment opening during varus stress radiographs) was performed. The patients were evaluated subjectively with Lysholm, International Knee Documentation Committee (IKDC), and Tegner scores and objectively with varus stress radiographs at 20° of knee flexion, IKDC objective scores, and recurvatum evaluation. Institutional review board approval: CEP/UNIFESP n: 1251/2016.

### **Results**

Twenty-nine of 33 patients were available for follow up at an average of 31.9 ± 12.3 months (range, 24-59 months) postoperatively. Twenty-five patients underwent multiple-ligament reconstruction without prior osteotomy. No patient had an isolated PLC knee reconstruction. The average comparative preoperative and postoperative outcomes were, respectively: Lysholm: 49.7 ± 10.3, 81.2 ± 12.8, P < .001, 89.7% met minimal detectable change; IKDC: 36.7 ± 8.3, 70.4 ± 19.8, P < .001, 82.8% met minimal clinically important difference; Tegner, 6.6 ± 1.3, 5.5 ± 1.6, P < .001; and varus stress radiograph: 7.1 ± 3.1 mm, 1.8 ± 1.8 mm, P < .001. A significant improvement, P < .001, was found between preoperative and postoperative IKDC objective scores for varus opening at 0° and 30° and external rotation measured by the dial test at 30°. Recurvatum was also improved: preoperatively, 52% had a low-grade and 48% had a high-grade recurvatum, whereas postoperatively, 100% were classified as low grade, P < .001.

### **Conclusions**

The presented anatomic PLC reconstruction, concomitant to other surgical procedures and ligament reconstructions, is a valid technique in a multiligamentous knee injury involving the PLC, improving subjective outcomes and objective stability in patients with a chronic PLC knee injury, similar to historical controls.

### **Level of Evidence**

Level IV, therapeutic case series.

## **The Timing of Corticosteroid Injections Following Simple Knee Arthroscopy Is Associated With Infection Risk**

Jourdan M. Cancienne, M.D., Michelle E. Kew, M.D., Marvin K. Smith, M.D., Eric W. Carson, M.D., Mark D. Miller, M.D., Brian C. Werner, M.D.

Arthroscopy, Volume 35, Issue 6, Received: August 11, 2018; Accepted: January 9, 2019

<https://doi.org/10.1016/j.arthro.2019.01.025>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

To examine any association between the timing of ipsilateral postoperative corticosteroid injection following simple knee arthroscopy and infection.

### **Methods**

Private payer (PP) and Medicare (MC) national insurance databases were queried for patients who underwent simple arthroscopic knee procedures. Patients undergoing concomitant open or more complex procedures with grafts were excluded. Patients who underwent ipsilateral corticosteroid injections within 2, 4, 6, and 8 weeks postoperatively were then identified. Postoperative infection within 90 days after the injection was assessed using International Classification of Diseases, 9th Revision, and Current Procedural Terminology coding and compared using a multivariate binomial logistic regression analysis.

### **Results**

A total of 5,533 patients were identified, including 725 that received an injection within 2 weeks; 1,236 patients within 4 weeks; 1,716 patients within 6 weeks; and 1,856 patients that received an injection within 8 weeks postoperatively. In both the PP and MC datasets, the rate of infection was significantly higher in the 2-week group compared with the 6- (PP: odds ratio [OR] 3.81,  $P = .012$ ; MC: OR 9.36,  $P = .001$ ) and 8-week (PP: OR 8.59,  $P = .003$ ; MC: OR 7.80,  $P = .001$ ) groups. The rate of infection was also higher in the 4-week group compared with the 6- (PP: OR 2.54,  $P = .024$ ; MC: OR 8.91,  $P = .001$ ) and 8-week (PP: OR 5.64,  $P = .009$ ; MC: OR 7.80,  $P = .001$ ) groups. There was no difference in infection rates between the 2- and 4-week groups in either dataset (PP:  $P = .278$ ; MC:  $P = .861$ ).

### **Conclusions**

There is a significant association between intra-articular knee corticosteroid injections within 4 weeks of surgery and an increased incidence of postoperative infection in both MC and PP patients after knee arthroscopy compared with patients with steroid injections more than 4 weeks postoperatively and matched controls who did not receive injections.

### **Level of Evidence**

Level III, retrospective comparative study.

## **Re-revision Anterior Cruciate Ligament Reconstruction: An Evaluation From the Norwegian Knee Ligament Registry**

Alexander R. Vap, M.D., Andreas Persson, M.D., Anne Marie Fenstad, M.S., Gilbert Moatshe, M.D., Ph.D., Robert F. LaPrade, M.D., Ph.D., Lars Engebretsen, M.D., Ph.D.

Arthroscopy, Volume 35, Issue 6, Received: August 8, 2018; Accepted: January 9, 2019

<https://doi.org/10.1016/j.arthro.2019.01.027>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

To identify the rate of re-revision anterior cruciate ligament reconstruction (ACLR) to estimate the influence of patient-related factors on the risk of re-revision ACLR. The secondary aim of the study was to report the intra-articular findings and patient-related factors at the time of revision ACLR and to compare these with the findings in a matched controlled group of primary ACLR.

### **Methods**

Patients with primary ACLR without a subsequent need of revision and patients with a revision ACLR identified in the Norwegian Knee Ligament Registry from June 2004 through September 2016 were included. Using age at operation, sex, activity at injury, and year of ACLR as covariates, a propensity score matched control group of primary ACLR patients for the revision ACLR patients was identified. For the revision ACLR patients, re-revision ACLR rates at 1, 2, 5, and 8 years were estimated with Kaplan-Meier analysis; the hazard ratio for a re-revision ACLR was estimated using a multivariable Cox regression model.

### **Results**

The cumulative estimated proportion of patients undergoing a re-revision ACLR at 1, 2, 5, and 8 years after the original revision ACLR was 0.4%, 3.0%, 6.5%, and 9.0% respectively. There was no significant difference between the control and revision ACLR groups regarding cartilage injury ( $P = .72$ ) or associated ligament injury ( $P = .17$ ). Revision ACLR patients did have fewer meniscal injuries ( $P < .001$ ). There were no intraoperative findings or surgical techniques identified as a predictor for a higher risk of re-revision ACLR.

### **Conclusions**

Based on a review of a large ligament reconstruction registry, one can expect 9% of patients to undergo a re-revision ACLR at 8 years of follow up. Revision ACLR did not have an increase in cartilage injuries or associated ligament injuries and had significantly fewer meniscal injuries compared with a primary ACLR control group.

### **Level of Evidence**

Level III, retrospective comparative study.

## **Predictive Factors for Patellofemoral Degenerative Progression After Opening-Wedge High Tibial Osteotomy**

Sung-Sahn Lee, M.D., Sang-Yeon So, M.D., Eui-Yub Jung, M.D., Hyun-Jun Kim, M.D., Byung Hoon Lee, M.D., Ph.D.c, Joon Ho Wang, M.D., Ph.D

Arthroscopy, Volume 35, Issue 6, Received: September 10, 2018; Accepted: January 21, 2019

<https://doi.org/10.1016/j.arthro.2019.01.032>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

To identify risk factors for patellofemoral degenerative progression after opening-wedge high tibial osteotomy (HTO) and to investigate the effect of patellofemoral degeneration on the patellofemoral specific patient-reported outcomes.

### **Methods**

Between March 2010 and June 2016, 94 knees (86 patients) underwent hardware removal with second-look arthroscopy at 21.4 months after opening-wedge HTO with first-look arthroscopy (mean follow-up duration, 49.8 months). Predictive factors for patellofemoral degeneration, including demographics, preoperative and postoperative mechanical axis (MA) of the lower limb (positive and negative MA indicating varus and valgus, respectively), tibial slope, and modified Blackburne-Peel ratio, were evaluated. Patients were divided into the progression and nonprogression groups according to their patellofemoral degenerative progression from first to second arthroscopy. Clinical outcomes, including the Kujala score and Knee Injury and Osteoarthritis Outcome Score, and radiographic outcomes were compared between the 2 groups.

### **Results**

Postoperative MA (adjusted odd ratio, 0.62;  $P < .001$ ) was the most significant predictive factor for progressive change in the patellofemoral joint ( $R^2 = 0.31$ ). Twenty-eight knees (30%) showed patellofemoral degenerative progression. Mean postoperative Kujala score (progression group 60.5 vs nonprogression group, 72.3;  $P = .005$ ) and Knee Injury and Osteoarthritis Outcome Score scales (except for the symptom subscale) were lower in the progression group. Postoperative MA was significantly more corrected in the progression group (progression group  $-5.1^\circ \pm 2.7^\circ$  vs nonprogression group  $-2.4^\circ \pm 2.3^\circ$ ;  $P < .001$ ).

### **Conclusions**

Postoperative MA, which might be related to overcorrection, is correlated with patellofemoral degenerative progression after opening-wedge HTO. Patients with patellofemoral degenerative progression showed inferior patient-reported outcomes.

### **Level of Evidence**

Level IV, case series with subgroup analysis.

## **Effect of Fibular Height and Lateral Tibial Condylar Geometry on Lateral Cortical Hinge Fracture in Open Wedge High Tibial Osteotomy**

Tae Woo Kim, M.D., Ph.D., Seung Hoon Lee, M.D., Joon Young Lee, M.D., Yong Seuk Lee, M.D., Ph.D

Arthroscopy, Volume 35, Issue 6, Received: August 23, 2018; Accepted: January 28, 2019

<https://doi.org/10.1016/j.arthro.2019.01.044>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

To evaluate whether the fibular position and lateral proximal tibial geometry affect the osteotomy configuration and lateral hinge fracture (LHF) during open wedge high tibial osteotomy (OWHTO).

### **Methods**

From March 2014 to January 2016, patients who underwent OWHTO for isolated medial compartment osteoarthritis of the knee were retrospectively reviewed. To identify whether the fibular position and lateral proximal tibial geometry affect the osteotomy configuration, the fibular height, fibular anteroposterior position, lateral tibial condylar width, and lateral tibial condylar slope were evaluated on plain radiograph or computed tomography (CT). Thereafter, the correlation of these parameters with the thickness of the proximal fragment around the osteotomy end and LHF was determined.

### **Results**

A total of 123 OWHTOs including 30 LHF (24.3%) were evaluated. High fibular head and small tibial condylar width and slope were related to thin thickness of the proximal tibial fragment, particularly on the posterior side (fibular height,  $P = .005$ ; condylar width,  $P = .002$ ; condylar slope,  $P = .01$ ). The fibular height was shorter in the LHF group than in the non-LHF group on both plain radiography and CT (fibular height [plain radiography],  $18.3 \pm 1.6$  vs  $20.2 \pm 2.1$  mm;  $P < .001$ ; fibular height [CT],  $17.4 \pm 1.1$  vs  $19.6 \pm 2.0$  mm;  $P < .001$ ). The lateral tibial condylar width and slope were also smaller in the LHF group compared with the non-LHF group (tibial condylar width,  $21.2 \pm 4.9$  vs  $23.4 \pm 4.5$  mm;  $P = .023$ ; tibial condylar slope,  $37.7 \pm 6.6$  vs  $41.3 \pm 7.6$  mm;  $P = .027$ ).

### **Conclusions**

The fibular position and lateral proximal tibial geometry affect the osteotomy configuration and LHF. A highly positioned fibula was related to a small lateral tibial condyle, which induced a thin proximal fragment. This finding was related to a higher risk of LHF. Therefore, understanding the fibular height and lateral proximal tibial geometry may be helpful for the prediction of the osteotomy configuration and development of LHF.

### **Level of Evidence**

Level III, case-control study.

# Diagnostic Value of Stress Radiography and Arthrometer Measurement for Anterior Instability in Anterior Cruciate Ligament Injured Knees at Different Knee Flexion Position

Han-Jun Lee, M.D., Ph.D., Yong-Beom Park, M.D., Ph.D., Seong Hwan Kim, M.D., Ph.D.

Arthroscopy, Volume 35, Issue 6, Received: September 3, 2018; Accepted: January 28, 2019

<https://doi.org/10.1016/j.arthro.2019.01.046>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

## Purpose

To evaluate diagnostic value of stress radiography and arthrometer measurements for anterior instability at different knee flexion angle positions.

## Methods

Forty-three patients with complete anterior cruciate ligament (ACL) rupture (group 1) and 37 normal subjects (group 2) were enrolled prospectively. Arthrometer (KT-1000) measurements and stress radiography by Telos were used to evaluate side-to-side differences. Results were recorded according to the knee position (30°, 45°, 60°, and 90°). Areas under the receiver operating characteristic curves (AUCs) were used to evaluate the diagnostic accuracy of each evaluation method. The calculated cutoff values at 30° position were used to evaluate the sensitivity and specificity of combined evaluation with stress radiography and arthrometer measurements.

## Results

The side-to-side differences on stress radiography and arthrometer measurements were significantly different between groups ( $P < .05$ ), except for the values at the 90° position in arthrometer measurements ( $P = .844$ ). The amount of anterior translation decreased in both arthrometer measurements and stress radiography between 30° and 45° positions ( $P < .000$ ); however, no further decrease was observed beyond 45°. The AUC of stress radiography at the 30° position was significantly higher than other values (AUC = 0.955;  $P = .000$ ). Moreover, the clinical cutoff value of 3 mm showed 86.0% sensitivity and 89.2% specificity in stress radiography at 30°, which were higher than those in arthrometer measurements. Combined use of stress radiography and arthrometer measurements at the 30° position showed 100% sensitivity and 59.5% specificity as a screening test.

## Conclusions

Evaluation at the 30° knee position was significantly superior to that at other positions for both stress radiography and arthrometer measurements, whereas the 90° knee flexion position was not meaningful for any measurements. Evaluation needs to be performed with a 3-mm cutoff value for stress radiography at the 30° knee position; however, combined use of stress radiography and arthrometer measurements at the 30° knee flexion can have a higher diagnostic value.

## Level of Evidence

Level I, diagnostic study of established criteria.

## **Comparison of Clinical and Radiologic Outcomes and Second-Look Arthroscopic Findings After Anterior Cruciate Ligament Reconstruction Using Fixed and Adjustable Loop Cortical Suspension Devices**

Hyeon Wook Ahn, M.D., Jong Keun Seon, M.D., Ph.D, Eun Kyoo Song, M.D., Ph.D., Chan Jin Park, M.D., Hong An Lim, M.D.

Arthroscopy, Volume 35, Issue 6, Received: May 24, 2018; Accepted: January 28, 2019

<https://doi.org/10.1016/j.arthro.2019.01.051>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

To compare clinical and radiological outcomes, including tunnel widening, and to evaluate graft status by second-look arthroscopy after anterior cruciate ligament (ACL) reconstruction using 2 different femoral cortical suspension devices (fixed and adjustable loop).

### **Methods**

Seventy-nine patients were included for this study. The patients were divided into 2 groups, 41 patients of fixed loop group (EndoButton) and 38 patients of adjustable loop group (TightRope). The Tegner activity, Lysholm knee score, Lachman test, and pivot-shift test were compared between the 2 groups. Anterior stress radiographs and femoral tunnel widening on plain radiographs were also compared. Twenty-seven patients (66%) in the EndoButton group and 21 patients (55%) in the TightRope group underwent the second-look arthroscopy.

### **Results**

At the final follow-up, the mean Tegner activity, Lysholm, and International Knee Documentation Committee scores were improved in both groups and there were no statistically significant differences ( $5.1 \pm 1.6$  and  $5.5 \pm 2.1$ ,  $P = .312$ ;  $90.4 \pm 7.8$  and  $91.0 \pm 6.5$ ,  $P = .525$ ; and  $87.4 \pm 6.7$  and  $88.7 \pm 5.3$ ,  $P = .127$ , respectively). There were no statistical significances in the both groups in terms of Lachman test and pivot-shift tests ( $P = .392$ ,  $.559$ ) as well as anterior stress radiographs (mean  $3.2 \pm 1.4$  mm and  $2.9 \pm 1.1$  mm,  $P = .343$ ). Moreover, radiologic measurements comparing femoral tunnel widening at proximal and distal half also showed no significant differences ( $P = .540$  and  $.412$  on anteroposterior view;  $P = .254$  and  $.437$  on lateral view). In the second-look arthroscopy findings for graft tear and synovial coverage, there were no significant differences ( $P = .784$  and  $.897$ ).

### **Conclusions**

Both fixed loop and adjustable loop devices in ACL reconstruction provided good clinical and radiological outcomes. In patients with both devices, femoral tunnel widening at proximal and distal portion have no significant differences after ACL reconstruction. Moreover, second-look arthroscopy revealed no significant differences in terms of synovial coverage and rupture of the graft.

### **Level of Evidence**

Level II, prospective comparative study.

## **Hill-Sachs Lesion Classification by the Glenoid Track Paradigm in Shoulder Instability: Poor Agreement Between 3-Dimensional Computed Tomographic and Arthroscopic Methods**

Tadanao Funakoshi, M.D., PhD.a, Robert U. Hartzler, M.D., M.S., Eduardo Stewien, M.D., Stephen S. Burkhart, M.D.

Arthroscopy, Volume 35, Issue 6, Received: April 30, 2018; Accepted: December 3, 2018

<https://doi.org/10.1016/j.arthro.2018.12.005>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

The purpose of this study was to determine the amount of agreement between preoperative 3-dimensional computed tomographic (3D-CT) and intraoperative arthroscopic classification of Hill-Sachs lesions (HSLs) according to the glenoid track (GT) paradigm.

### **Methods**

Records for patients treated surgically for anterior shoulder instability from a single surgeon's practice from August 2013 until March 2016 were retrospectively reviewed. Inclusion criteria were presence of an HSL, < 25% glenoid bone loss, bilateral 3D-CT, and arthroscopically recorded bone loss measurements. Records for patients with chronic dislocations or prior operations were excluded. Calculations by 3D-CT and arthroscopy were performed as follows: Hill-Sachs interval (HSI) was the distance from rotator cuff insertion to medial edge of the HSL; GT was 83% of the normal glenoid width minus any glenoid defect; on-track was HSI less than GT; off-track was HSI greater than GT.

### **Results**

Sixteen shoulders with HSL status determined as on- or off-track demonstrated agreement between the 2 methods in 10 of 16 cases (63%, Cohen's  $\kappa = 0.16$ ). All 6 cases with disagreement were calculated as on-track by 3D-CT and off-track by arthroscopic measurement. The GT was larger as determined by 3D-CT measurement ( $22 \pm 1$  mm [21-24]) compared with arthroscopy ( $18 \pm 1$  mm [17-20],  $P = .002$ ).

### **Conclusions**

Preoperative 3D-CT showed slight agreement compared with intraoperative arthroscopic measurements in classifying HSL as on-track versus off-track in the GT paradigm; larger GT size by 3D-CT versus arthroscopy accounted for all discrepancies. Determination of off-track status based on preoperative 3D-CT versus determination with the arthroscopic method would result in fewer HSLs treated with remplissage if the GT treatment paradigm were followed. Surgeons using the GT paradigm to determine treatment of HSL by remplissage should recognize the potential for discordance between arthroscopic and radiographic measurements.

## **Cutibacterium Acnes (Formerly Propionibacterium Acnes) Contamination of the Surgical Field During Shoulder Arthroscopy**

Leo Pauzenberger, M.D., Viktor Heller, M.D., Roman C. Ostermann, M.D., Brenda Laky, Ph.D., M.Sc., Philipp R. Heuberer, M.D., Werner Anderl, M.D.

Arthroscopy, Volume 35, Issue 6, Received: September 8, 2018; Accepted: January 14, 2019

<https://doi.org/10.1016/j.arthro.2019.01.024>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

To evaluate the prevalence of *Cutibacterium acnes* in the shoulder region and to analyze changes in *C. acnes* contamination during shoulder arthroscopy, as well as to investigate the influence of sex and type of arthroscopic surgery on those parameters.

### **Methods**

Forty-eight consecutive patients undergoing reconstructive or non-reconstructive shoulder arthroscopy, after hair removal with a medical clipper, routine antibiotic prophylaxis, and skin preparation with an alcohol-based skin disinfectant, were prospectively enrolled in this study. The shoulder was divided into 4 regions of interest (anterior, medial, posterior, and axilla). Skin swabs were taken from each region at 3 time points (preoperatively before and after skin preparation, and at the conclusion of surgery), cultured for 21 days, and analyzed for the prevalence of *C. acnes*.

### **Results**

The rate of *C. acnes*-positive skin cultures was significantly increased at the end of surgery compared with preoperatively before (44.3% vs 27.6%,  $P < .001$ ) and after (44.3% vs 31.3%,  $P = .001$ ) skin preparation. No reduction in *C. acnes* was observed with preoperative skin preparation (27.6% vs 31.3%,  $P = .401$ ). At the end of shoulder arthroscopy, 64.6% of patients showed at least 1 culture positive for *C. acnes*. The *C. acnes* prevalence was significantly higher in male patients (48.3%) than female patients (20.1%,  $P < .001$ ), at all time points ( $P < .016$ ), and in all regions of interest ( $P < .001$ ) except the axilla. No differences in the prevalence of *C. acnes* were found between non-reconstructive and reconstructive procedures.

### **Conclusions**

Skin contamination with *C. acnes* around the shoulder increased significantly from before and after skin preparation to the conclusion of surgery in patients undergoing shoulder arthroscopy despite perioperative preventive measures.

### **Level of Evidence**

Level IV, therapeutic case series.

## **Biomechanical Analysis of All-Suture Suture Anchor Fixation Compared With Conventional Suture Anchors and Interference Screws for Biceps Tenodesis**

Rachel M. Frank, M.D., Eamon D. Bernardoni, M.D., M.S, Shreya S. Veera, B.S., Brian R. Waterman, M.D., Justin W. Griffin, M.D., Elizabeth F. Shewman, M.S., Brian J. Cole, M.D., M.B.A., Anthony A. Romeo, M.D., Nikhil N. Verma, M.D.

Arthroscopy, Volume 35, Issue 6, Received: July 26, 2018; Accepted: January 15, 2019

<https://doi.org/10.1016/j.arthro.2019.01.026>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

To compare the biomechanical properties of all-suture suture anchors (ASSAs) with conventional interference screws (CISs) and conventional suture anchors (CSAs) for long head of the biceps tendon fixation during proximal biceps tenodesis (BT).

### **Methods**

We randomized 21 fresh-frozen human cadaveric shoulders into 3 subpectoral BT treatment groups: ASSA, CSA, and CIS. Each construct was cyclically loaded from 5 to 70 N for 500 cycles (1 Hz). All specimens that survived cyclic loading were then pulled to failure (1 mm/s). Elongation, maximum load, energy, and failure mode were recorded. The humerus was stripped of tissue and then subjected to torsional displacement at a rate of 1°/s until fracture occurred. Maximum load, displacement, stiffness, and energy were recorded.

### **Results**

During tendon testing, 3 specimens (43%) in the CIS group failed early during cyclic testing by the tendon tearing at the screw-tendon interface. All other specimens in the CIS group, as well as all specimens in the ASSA and CSA groups, survived cyclic testing and failed during pull-to-failure testing. Failure occurred at the tendon-anchor or -screw interface in all specimens (100%), with no anchor or screw pullout. The CIS group had significantly decreased elongation ( $8.9 \pm 2.23$  mm) at maximum load compared with the ASSA ( $19.2 \pm 5.2$  mm) and CSA ( $18.9 \pm 2.23$  mm) groups ( $P = .001$ ). During torsional testing, the ASSA group was able to withstand significantly greater torsional displacement ( $9.22^\circ \pm 0.86^\circ$ ) before failure and had greater energy to failure ( $497.3 \pm 45$  Nmm-degrees) than the CIS group ( $6.13^\circ \pm 1.24^\circ$  and  $256.6 \pm 70.3$  Nmm-degrees, respectively;  $P = .005$ ).

### **Conclusions**

This study shows that the biomechanical properties of ASSA, CSA, and CIS constructs are similar. The interference screw group had lower tendon elongation at maximum load but had several early failures compared with the suture anchor groups. The use of suture anchors results in maximum tendon and torsional bone loads similar to interference screws for the long head of the biceps tendon. Torsional testing of the CIS resulted in spiral fractures traversing the screw tunnel in 100% of the specimens, which was not found in the suture anchor groups.

### **Clinical Relevance**

The ASSA is a viable fixation method for BT in comparison with the CSA and CIS.

## **The Association of Perioperative Glycemic Control With Adverse Outcomes Within 6 Months After Arthroscopic Rotator Cuff Repair**

Jourdan M. Cancienne, M.D., Matthew J. Deasey, M.D., Michelle E. Kew, M.D., Brian C. Werner, M.D.

Arthroscopy, Volume 35, Issue 6, Received: October 17, 2018; Accepted: January 4, 2019

<https://doi.org/10.1016/j.arthro.2019.01.035>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

To determine the association between glycemic control and adverse events after arthroscopic rotator cuff repair (RCR).

### **Methods**

Patients with a diagnosis of diabetes mellitus who underwent arthroscopic RCR and had a hemoglobin A1c (HbA1c) level determined within 3 months before or after surgery were identified in a national database and stratified by HbA1c level. The incidence of postoperative infection within 6 months was determined using Current Procedural Terminology and International Classification of Diseases, Ninth Revision codes. A receiver operating characteristic (ROC) curve analysis was performed to determine whether a threshold HbA1c level existed above which the risk of infection, revision rotator cuff surgery, and lysis of adhesions (LOA)—manipulation under anesthesia (MUA) after arthroscopic RCR was significantly increased. This threshold was then tested using a logistic regression analysis.

### **Results**

The study included 3,740 patients with an infection rate ranging from a low of 0.29% to a high of 1.14% after RCR. The inflection point of the ROC curve for infection corresponded to an HbA1c level between 7.0 and 8.0 mg/dL ( $P = .035$ ; area under the curve, 0.648; specificity, 61%; sensitivity, 59%). We then used 8.0 mg/dL as a threshold to test for adverse outcomes. We found a significant difference in infection rates for patients with levels below versus above the threshold (0.30% vs 0.84%; OR, 2.0; 95% confidence interval, 1.2-3.4;  $P = .014$ ) but no difference in revision rates ( $P = .240$ ) or LOA-MUA ( $P = .650$ ) in patients with levels above versus below the threshold.

### **Conclusions**

The risk of infection after RCR in patients with diabetes mellitus increases as the perioperative HbA1c level increases and, although statistically significant, remains low. ROC curve analysis determined that a perioperative HbA1c level above 8.0 mg/dL could serve as a threshold level; however, the area under the curve and low sensitivity reflected the poor utility of this test as an independent predictor. This study did not find an association between increased perioperative HbA1c levels and rates of revision rotator cuff surgery or LOA-MUA after RCR.

### **Level of Evidence**

Level III, retrospective cohort study.

[BACK](#)

## **Patient-Reported Outcomes After Isolated and Combined Arthroscopic Subscapularis Tendon Repairs**

Emily J. Monroe, M.D, Sergio E. Flores, B.S., Caitlin C. Chambers, M.D., Alan L. Zhang, M.D., Brian T. Feeley, M.D., Drew A. Lansdown, M.D., C. Benjamin Ma, M.D.

Arthroscopy, Volume 35, Issue 6, Received: July 26, 2018; Accepted: January 15, 2019

<https://doi.org/10.1016/j.arthro.2019.01.034>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

To analyze minimum 2-year postoperative patient-reported outcomes of a large group of patients after arthroscopic subscapularis (SSc) repair with respect to surgical findings and concurrent procedures.

### **Methods**

Patients who underwent arthroscopic SSc repair from January 2010 to April 2016 completed the Patient-Reported Outcomes Measurement Information System for Upper Extremity (PROMIS-UE) test and postoperative visual analog scale pain score. Medical records were reviewed for the preoperative visual analog scale pain score and surgical findings. SSc tears were considered partial or complete. Concomitant pathology and treatment of the supraspinatus (SS), infraspinatus (IS), and biceps tendon were recorded. We compared preoperative variables and outcomes between isolated partial SSc repair, partial SSc with SS and/or IS repair, isolated complete SSc repair, and complete SSc with SS and/or IS repair.

### **Results**

One hundred forty-five shoulders were included with an average age of  $62.0 \pm 9.8$  years and average follow-up period of  $52.2 \pm 19.5$  months. A significant reduction in the pain score occurred, from 4.8 (95% confidence interval [CI], 4.4-5.2) to 0.9 (95% CI, 0.6-1.1) ( $P < .001$ ), with a mean postoperative PROMIS-UE score of 50.7 (95% CI, 49.5-52.0). Most SSc tears were partial with SS and/or IS repair (44.1%). Isolated partial SSc tears (29.9%), complete SSc tears with SS and/or IS repair (20.1%), and isolated complete SSc tears (5.9%) were less common. A significant difference in the mean postoperative PROMIS-UE score was not found between groups ( $P = .609$ ). Biceps tendon pathology was significantly more common in complete SSc tears than partial SSc tears ( $P < .001$ ), but there was no difference in the rate of biceps intervention ( $P = .110$ ) or the PROMIS-UE score based on biceps intervention ( $P = .471$ ).

### **Conclusions**

We observed significant improvements in pain and patient-reported outcomes in line with population means for a large group of patients after SSc tendon repair. Importantly, outcomes were similar despite the size of SSc tear or concurrent SS and/or IS repairs. Biceps pathology was common, and neither its presence nor its treatment influenced postoperative patient outcomes.

### **Level of Evidence**

Level IV, retrospective case series.

[BACK](#)

## **A Flat Anterior Glenoid Corresponds to Subcritical Glenoid Bone Loss**

Drew A. Lansdown, M.D., Kevin Wang, M.D., Adam B. Yanke, M.D., Ph.D., Gregory P. Nicholson, M.D., Brian J. Cole, M.D., M.B.A., Nikhil N. Verma, M.D.

Arthroscopy, Volume 35, Issue 6, Received: August 28, 2018; Accepted: December 4, 2018

<https://doi.org/10.1016/j.arthro.2018.12.034>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

To define a quickly recognizable pattern for subcritical bone loss using the inflection point between the superior and inferior glenoid.

### **Methods**

Following institutional review board approval, 3-dimensional reconstructions of 31 shoulder computed tomography scans from cadaveric specimens were obtained. Exclusion criteria were age >65 years or evidence of fracture or arthritis of the glenoid. An en face image was obtained for each glenoid. A vertical line was defined at the most anterior point of the superior glenoid. The area of the inferior glenoid anterior to this vertical line, area of the total glenoid, chord length of the anterior portion, and a best-fit circle for the inferior glenoid were measured. These numbers were compared with determine predicted bone loss relative to this vertical line. This investigation was performed at Rush University Medical Center, Chicago, IL.

### **Results**

The mean surface area of the glenoid anterior to the vertical line was 10.2% (95% confidence interval [CI], 9.6-10.9) of the total glenoid, and 12.8% (95% CI, 12.0-13.6) of the best-fit circle of the inferior glenoid. The chord length measurement was 16.8% (95% CI, 15.7-18.3) of the total diameter of the best-fit circle. Compared with the best-fit circle, bone loss to this vertical line would represent >10% bone loss in 80.7% of patients and >13.5% bone loss in 35.5% of patients (range, 14.3%-18.1%). The negative predictive value of the vertical line was 19% for predicting 10% bone loss, 65% for predicting 13.5% bone loss, 74% for predicting 15% bone loss, and 100% for predicting 20% bone loss.

### **Conclusions**

A flat anterior glenoid may offer a consistent pattern that corresponds to  $12.8 \pm 3\%$  bone loss relative to a best-fit circle. This measurement is in line with published values of subcritical bone loss, making this a clinically useful pattern to recognize in patients with subcritical glenoid bone loss.

### **Clinical Relevance**

Our results suggest that an easily recognizable pattern of a flat anterior glenoid may correspond with more recently suggested levels of subclinical bone loss in patients with anterior shoulder instability.

### **Level of Evidence**

Level III, diagnostic study.

## **The Therapeutic Benefits of Saline Solution Injection for Lateral Epicondylitis: A Meta-analysis of Randomized Controlled Trials Comparing Saline Injections With Nonsurgical Injection Therapies**

Burke Gao, B.A., Shashank Dwivedi, M.D., Steven DeFroda, M.D., Steven Bokshan, M.D., Lauren V. Ready, M.P.H., Brian J. Cole, M.D., M.B.A., Brett D. Owens, M.D.

Arthroscopy, Volume 35, Issue 6, Received: July 25, 2018; Accepted: November 21, 2018

<https://doi.org/10.1016/j.arthro.2019.02.051>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

To quantify the effect of saline solution injections on patient-reported outcome measures (PROMs) and to determine whether this effect is clinically relevant by comparing it with minimal clinically important difference (MCID) criteria.

### **Methods**

A systematic search identified randomized controlled trials of lateral epicondylitis interventions comparing saline solution injections with nonsurgical injection therapies. Among included studies, saline solution was compared with platelet-rich plasma, autologous conditioned plasma, corticosteroid, and botulinum toxin injections. By use of data from included studies, a random-effects model was used to calculate overall mean differences (MDs) in pre- and post-injection PROMs in a pair-wise fashion. Calculated MDs were then compared with MCID criteria.

### **Results**

Of 458 identified studies, 10 met the inclusion criteria and encompassed 283 patients. At 1, 3, 6, and 12 months, statistically significant improvements in MDs in visual analog scale (VAS) scores were noted as follows: MD of 16.11 (95% confidence interval [CI], 8.29-23.93) at 1 month; MD of 22.50 (95% CI, 11.45-33.55) at 3 months; MD of 40.40 (95% CI, 27.48-53.32) at 6 months; and MD of 47.04 (95% CI, 39.43-54.66) at 12 months. At 6 months, Disabilities of the Arm, Shoulder and Hand scores showed a statistically significant improvement (MD, 23.92; 95% CI, 9.47-38.37).

### **Conclusions**

Improvements in Disabilities of the Arm, Shoulder and Hand scores at 6 months (23.92) surpassed MCID criteria for conservatively managed upper-extremity musculoskeletal pathology (10.83)—suggesting that saline solution injections have a clinically relevant effect. VAS MCID criteria are poorly established, but VAS scores at 6 and 12 months surpassed MCID criteria for conservative treatments for common orthopaedic conditions. In all but 1 study, no statistically significant difference in PROMs was found between saline solution and non-saline solution injections.

### **Level of Evidence**

Level II, meta-analysis of Level I and II randomized controlled trials.

## **Systematic Review of the Anatomic Descriptions of the Glenohumeral Ligaments: A Call for Further Quantitative Studies**

Jorge Chahla, M.D., Ph.D.a, Zachary S. Aman, B.A., Jonathan A. Godin, M.D., M.B.A., Mark E. Cinque, M.D., CAPT Matthew T. Provencher, M.D., M.C., U.S.N.R., Robert F. LaPrade, M.D., Ph.D

Arthroscopy, Volume 35, Issue 6, Received: July 25, 2018; Accepted: November 21, 2018

<https://doi.org/10.1016/j.arthro.2018.11.062>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

To perform a systematic review of the glenohumeral ligament anatomic attachments on the glenoid and humeral neck.

### **Methods**

A systematic review was performed according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines using the Cochrane Database of Systematic Reviews, the Cochrane Central Register of Controlled Trials, PubMed, MEDLINE, and Embase from 1980 to present. The inclusion criteria were as follows: cadaveric or clinical anatomic studies that qualitatively or quantitatively described the glenoid and humeral attachments of the glenohumeral ligaments in the English-language literature. Imaging and animal studies, editorial articles, and surveys were excluded from this study.

### **Results**

The 15 included studies analyzed a total of 983 shoulders. Only 5 studies reported quantitative measurements. The most common glenoid superior glenohumeral ligament attachment described was in the anterolateral region of the supraglenoid tubercle and was inserting on the humerus in close vicinity to the subscapularis tendon insertion. The superior labrum and lesser tuberosity were the most commonly reported middle glenohumeral ligament attachments. The inferior glenohumeral ligament was most commonly described to attach between the 2- and 4-o'clock positions of the glenoid and distally near the surgical neck of the humerus.

### **Conclusions**

There were limited quantitative data on the attachments of the glenohumeral ligaments. Although the literature was discordant, the most common descriptions of the attachments were as follows: The anterolateral region of the supraglenoid tubercle, the superior labrum, and the glenoid (between the 2- and 4-o'clock positions) were the medial attachments for the superior glenohumeral ligament, middle glenohumeral ligament, and inferior glenohumeral ligament, respectively. Laterally, they inserted on the humerus in close vicinity to the subscapularis tendon insertion, on the lesser tuberosity, and near the surgical neck of the humerus, respectively.

### **Clinical Relevance**

The glenohumeral ligaments are important anatomic structures contributing to the dynamic stability of the glenohumeral joint. Further detailed quantitative descriptions of their attachments are required for truly anatomically based repairs.

## **Labral Repair Versus Biceps Tenodesis for Primary Surgical Management of Type II Superior Labrum Anterior to Posterior Tears: A Systematic Review**

Darren de SA, M.D., F.R.C.S.C. Michelle E. Arakgi, M.Sc., M.D.b, Jayson Lian, B.A.a,c, Raphael J. Crum, B.S.d, Albert Lin, M.D.a, Bryson P. Lesniak, M.D.

Arthroscopy, Volume 35, Issue 6, Received: July 13, 2018; Accepted: December 9, 2018

<https://doi.org/10.1016/j.arthro.2018.12.015>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

To examine the outcomes of SLAP repair versus biceps tenodesis (BT) for the index treatment of isolated type II SLAP tears.

### **Methods**

A search of PubMed, MEDLINE, and EMBASE was performed in April 2018 for English-language studies that presented outcomes data on patients with isolated type II SLAP tears treated with either SLAP repair or BT at the primary surgical time point.

### **Results**

Twenty-three studies (i.e., 2 randomized control trials, 7 retrospective cohort, 3 prospective cohort, 4 case-control, and 7 case series) were included. Isolated type II SLAP tears were treated via SLAP repair in 781 patients with a mean age of 35 years (range, 22-58 years) and a mean postoperative follow-up of 35 months (range, 3-63 months). BT was performed in 100 patients with a mean age of 44 years (range, 18-64 years) and a mean postoperative follow-up of 32 months (range, 24-75 months). Similar postoperative scores were noted in both the SLAP repair and BT groups for American Shoulder and Elbow Surgeons, Constant, University of California, Los Angeles, and visual analog scale pain scores. The rate of return to sports was 20% to 95% for SLAP repair and 73% to 100% for BT. Reoperation rates for SLAP repair and BT were 2.9% to 40% and 0% to 15.3%, respectively.

### **Conclusions**

This study suggests that SLAP repair and BT are both acceptable as index treatment for isolated type II SLAP tears. SLAP repair remains the most commonly performed index procedure; however, BT appears equally efficacious and may represent an attractive alternative.

### **Level of Evidence**

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

**Patient-determined outcomes after arthroscopic rotator cuff repair with and without biceps tenodesis utilizing the PITT technique**

Keith M. Baumgarten, Peter S. Chang, Elaine K. Foley

DOI: <https://doi.org/10.1016/j.jse.2019.01.024>

**Hypothesis and Background**

The percutaneous intra-articular transtendon technique (PITT) is a simple, rapid, and low-cost method of performing a biceps tenodesis. Few studies exist that examine the patient-determined outcomes of this technique in general or in patients undergoing arthroscopic rotator cuff repair (RCR) with and without biceps tenodesis. We hypothesized that patients undergoing an isolated arthroscopic RCR would have equivalent outcomes to those undergoing RCRs with PITT biceps tenodesis.

**Methods**

We compared preoperative, patient-determined outcomes scores on patients undergoing primary arthroscopic RCR with and without a PITT biceps tenodesis with postoperative scores at a minimum of 2 years. These scores included the Western Ontario Rotator Cuff score (WORC), American Shoulder and Elbow Surgeons score (ASES), Single Assessment Numeric Evaluation (SANE), Simple Shoulder Test (SST), and Shoulder Activity Level (SAL). Indication for a concomitant biceps tenodesis was a partial long head biceps tendon tear or biceps instability/subluxation.

**Results**

A total of 153 patients underwent an isolated RCR and 131 patients underwent RCR with biceps tenodesis (RCRBT). Both groups had improvements in WORC, ASES, SANE, and SST ( $P < .0001$ ) and deteriorations in the SAL ( $P \leq .005$ ). There was no difference in the change in outcome scores between the groups (RCRBT vs. RCR, respectively) for WORC (46 vs. 47;  $P = .85$ ), ASES (46 vs. 47;  $P = .82$ ), SANE (53 vs. 51;  $P = .35$ ), SST (5.8 vs. 5.8;  $P = .93$ ), and SAL (-0.9 vs. -1.4;  $P = .46$ ). There was no difference between the groups in complications that required revision surgery (1.5% vs. 1.3%;  $P = .91$ ).

**Conclusions**

Arthroscopic PITT RCRBT is safe and effective with equivalent patient-determined outcomes compared with patients undergoing RCR without biceps tenodesis.

**Level of evidence:**

Level III, Retrospective Cohort Design, Treatment Study

## **Do elderly patients gain as much benefit from arthroscopic rotator cuff repair as their younger peers?**

Caroline Witney-Lagen, Georgios Mazis, Juan Bruguera, Ehud Atoun, Giuseppe Sforza, Ofer Levy

DOI: <https://doi.org/10.1016/j.jse.2018.10.010>

### **Background**

This study was conducted to ascertain whether patients aged older than 75 years achieve outcomes after arthroscopic rotator cuff repair comparable to younger patients.

### **Methods**

Arthroscopic cuff repair was performed in 60 shoulders of 59 patients aged older than 75 years. A control group of 60 younger patients, matched for sex, tear size, and American Society of Anesthesiology Functional Classification grade were included. Surgery occurred from 2006 to 2016. Prospective outcomes were the Constant score (CS), Subjective Shoulder Value, pain, satisfaction, and operative complications. Mean follow-up was 29 months.

### **Results**

The elderly group was a mean age of 78 years compared with 59 years for controls. Tear sizes were 25 massive, 20 large, 12 medium, and 3 small. The CS improved by 25.1 points in elderly patients compared with 23.7 points for controls ( $P = .742$ ). Pain improved by 7.5 of 15 in elderly patients vs. 6.2 of 15 in controls ( $P = .055$ ). Fifty-five of 59 older patients were satisfied compared with 52 of 60 controls ( $P = .378$ ). The overall complication rate did not differ between the groups ( $P = .509$ ). Both groups had 1 infection and 1 stiffness. An acromioclavicular joint cyst developed in 1 younger patient, and a traumatic retear occurred in 1 patient. Subsequent reverse total shoulder arthroplasty was performed in 4 elderly patients at a mean of 28 months after cuff repair. Massive tears had higher risk for subsequent reverse total shoulder arthroplasty ( $P = .026$ ).

### **Conclusion**

Elderly patients benefit as much from arthroscopic rotator cuff repair as their younger counterparts. Similar improvements in CS, Subjective Shoulder Value, pain, and satisfaction occurred for both elderly and control patients. Arthroscopic repair was safe and effective in both groups. Even elderly patients with massive tears showed clinically significant improvements. Arthroscopic rotator cuff repair should be considered as a valuable treatment irrespective of age.

### **Level of evidence:**

Level III, Retrospective Case Control Design, Treatment Study

## **Factors Related to Patient Dissatisfaction Versus Objective Failure After Arthroscopic Shoulder Stabilization for Instability**

Park In, MD, PhD; Kang Jun-seok, MD; Jo Yoon-geol, MD; Shin Sang-jin, MD, PhD

DOI: 10.2106/JBJS.18.01243

Copyright © 2019 The Journal of Bone and Joint Surgery, Inc., dba Striatus Orthopaedic Communications. All Rights Reserved.

**Background:** After arthroscopic stabilization procedures for recurrent anterior shoulder instability, patients are not always satisfied with their shoulder, even when the operation successfully restored stability. The aim of this study was to evaluate the factors associated with subjective patient dissatisfaction after arthroscopic stabilization procedures for recurrent anterior shoulder instability and to compare these factors with those associated with objective surgical failure.

**Methods:** A total of 195 patients who underwent an arthroscopic stabilization procedure for recurrent anterior shoulder instability were included in this study. At the 2-year postoperative visit, subjective patient dissatisfaction was assessed with a 15-point scale. Objective surgical failure was defined as postoperative dislocation or subluxation events requiring revision surgery. Several factors, including age at the first dislocation, age at the time of the operation, presence of an off-track Hill-Sachs lesion, width of the Hill-Sachs lesion, size of the glenoid bone defect, and number of instability events, were recorded. Multivariable linear regression analysis and multivariable logistic regression analysis were performed using a backward stepwise procedure as the variable selection method.

**Results:** Fifteen patients (7.7%) had recurrent instability requiring revision surgery. In the group of 180 patients without surgical failure, the width of the Hill-Sachs lesion (regression coefficient: 0.052,  $p = 0.011$ ) and number of instability events (regression coefficient: 0.103,  $p = 0.029$ ) were positively correlated with subjective patient dissatisfaction, whereas concomitant repair of a SLAP (superior labrum anterior-posterior) lesion showed negative correlation (regression coefficient:  $-0.926$ ,  $p = 0.004$ ). In the total cohort of patients, objective surgical failure was correlated with the age at the time of the operation (odds ratio [OR]: 0.851,  $p = 0.042$ ), size of the glenoid bone defect (OR: 1.172,  $p < 0.001$ ), and number of instability events (OR: 1.147,  $p = 0.048$ ). Other variables, including an off-track Hill-Sachs lesion or a concomitant remplissage procedure, were not correlated with subjective patient dissatisfaction or objective surgical failure.

**Conclusions:** Factors related to subjective patient dissatisfaction differed from those related to objective surgical failure. For a better understanding of the clinical outcomes after surgery, surgeons should assess the factors that correlate with subjective patient dissatisfaction and objective surgical failure.

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

---

## Lower Extremity

Arthroscopy, Volume 35, Issue 6

### **Do Your Routine Radiographs to Diagnose Cam Femoroacetabular Impingement Visualize the Region of the Femoral Head-Neck Junction You Intended?**

Keisuke Uemura, M.D., Ph.D., Penny R. Atkins, Ph.D. Andrew E. Anderson, Ph.D., Stephen K. Aoki, M.D.

Arthroscopy, Volume 35, Issue 6, Received: August 21, 2018; Accepted: December 4, 2018

<https://doi.org/10.1016/j.arthro.2018.12.031>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

#### **Purpose**

To use computer models and image analysis to identify the position on the head-neck junction visualized in 10 radiographic views used to quantify cam morphology.

#### **Methods**

We generated 97 surface models of the proximal femur from computed tomography scans of 59 control femurs and 38 femurs with cam morphology—a flattening or convexity at the femoral head-neck junction. Each model was transformed to a position that represents the anteroposterior, Meyer lateral, 45° Dunn, modified false-profile, Espié frog-leg, modified 45° Dunn, frog-leg lateral, cross-table, 90° Dunn, and false-profile views. The position on the head-neck junction visualized from each view was identified on the surfaces. This position was then quantified by a clock face generated on the plane of the head-neck junction, in which the 12-o'clock position indicated the superior head-neck junction and the 3-o'clock position indicated the anterior head-neck junction. The mean visualized clock-face position was calculated for all subjects. Analysis was repeated to account for variability in femoral version. A general linear model with repeated measures was used to compare each radiographic view and anteversion angle.

#### **Results**

Each radiographic view provided visualization of the mean clock-face position as follows: anteroposterior view, 12:01; Meyer lateral view, 1:08; 45° Dunn view, 1:40; modified false-profile view, 2:01; Espié frog-leg view, 2:14; modified 45° Dunn view, 2:35; frog-leg lateral view, 2:45; cross-table view, 3:00; 90° Dunn view, 3:13; and false-profile view, 3:44. Each view visualized a different position on the clock face (all  $P < .001$ ). Increasing simulated femoral anteversion by 10° changed the visualized position of the head-neck junction to a more clockwise position (range, 0:07 to 0:29; all  $P < .001$ ), whereas decreasing anteversion by 10° visualized a more counterclockwise position (range, -0:23 to -0:08; all  $P < .001$ ).

#### **Conclusions**

Ten common radiographic views used to identify cam morphology visualized different clock-face positions of the head-neck junction. Our data will help clinicians to understand the position of the head-neck junction visualized for each radiographic view and make educated decisions in the selection of radiographs acquired in the clinic.

#### **Clinical Relevance**

Our findings will aid clinicians in choosing a set of radiographs to capture cam morphology in the assessment of patients with hip pain.

[BACK](#)

## Patients' Expectations of Hip Preservation Surgery: A Survey Study

Carol A. Mancuso, M.D., Catherine H. Wentzel, B.S., Sydney M. Kersten, B.S., Bryan T. Kelly, M.D.

Arthroscopy, Volume 35, Issue 6, Received: July 6, 2018; Accepted: January 9, 2019

<https://doi.org/10.1016/j.arthro.2019.01.028>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### Purpose

To administer the Hip Preservation Surgery Expectations Survey to a large sample of patients to ascertain the prevalence of their preoperative expectations and to assess expectations in terms of demographic and clinical characteristics.

### Methods

Consecutive patients were enrolled if they were  $\geq 18$  years old/spoke English and excluded if they had prior hip surgery/degenerative changes Tönnis  $\geq 2$ . Patients completed the 21-item survey addressing the amount of improvement expected for each item (number of items and an overall score were determined) and the International Hip Outcome Tool (iHOT; hip score determined). Analyses included multivariable regression with survey score and number of expectations as dependent variables. Subanalyses considered collegiate/professional, competitive, and recreational sports level.

### Results

Three hundred two patients participated, with a mean age of 32; 270 (89%) had cam impingement, 72 (24%) had symptoms  $< 6$  months, and mean iHOT score was 41. One hundred twenty patients (40%) selected all 21 survey items, 112 (37%) selected 18 to 20, and 70 (23%) selected  $\leq 17$  items. In multivariable analysis, younger age (odds ratio [OR] = 1.3;  $P = .02$ ), symptoms  $< 6$  months (OR = 1.3;  $P = .03$ ), and worse iHOT score (OR = 2.5;  $P = .0001$ ) were associated with selecting more items. The mean survey score was 80 (range, 31-100). In multivariable analysis, younger age ( $P = .05$ ), symptoms  $< 6$  months ( $P = .01$ ), and worse iHOT score ( $P = .03$ ) were associated with greater survey scores. Collegiate/professional athletes selected more items ( $P = .01$ ) and were more likely to select improvement in sports performance (OR = 7.5;  $P = .001$ ), achievement of athletic potential (OR = 3.7;  $P = .002$ ), and maintaining options for more demanding future activities (OR = 2.7;  $P = .01$ ).

### Conclusions

Patients had multiple expectations for marked improvement in current and future physical function and psychological well-being. Younger patients, shorter symptom duration, and worse hip-specific functional status were associated with greater expectations. Understanding patients' expectations can guide preoperative education regarding realistic expectations for recovery and long-term outcome.

### Clinical Relevance

Patients' preoperative expectations vary according to demographic and clinical characteristics as measured in a survey study.

## **Arthroscopic Surgery for Femoroacetabular Impingement in Skeletally Immature Athletes: Radiographic and Clinical Analysis**

Christopher M. Larson, M.D., Rebecca Stone McGaver, M.S., A.T.C., Nicole R. Collette, B.S., M. Russell Giveans, Ph.D., James R. Ross, M.D, Asheesh Bedi, M.D., Jeffrey J. Nepple, M.D.

Arthroscopy, Volume 35, Issue 6, Received: July 19, 2018; Accepted: January 19, 2019

<https://doi.org/10.1016/j.arthro.2019.01.029>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

To evaluate radiographic and clinical outcomes after arthroscopic femoroacetabular impingement (FAI) correction in symptomatic adolescent athletes with open physes.

### **Methods**

We retrospectively reviewed radiographic and clinical outcomes in patients treated with a non-physes-sparing arthroscopic approach for symptomatic FAI with open physes and a minimum 1-year follow-up. Specific plain radiographic and computed tomography parameters were determined, and preoperative and postoperative outcomes were prospectively evaluated with modified Harris Hip Score (mHHS), 12-Item Veterans-Rand, and pain on a visual analog scale.

### **Results**

Thirty-seven hips (28 patients; 75% male) with a mean age of 15.9 years (range, 12.8-18.3 years) had imaging studies consistent with open femoral neck and iliac crest physes. The ischial tuberosity and greater trochanteric physes were open in 95% and 54% of the hips, respectively. All patients participated in organized athletics, and 50% were in multiple sports year-round. Mean follow-up was 39.8 months post-arthroscopic FAI correction. There was a mean 27.7-point improvement in the mHHS ( $P < .001$ ), a 4.8-point decrease in the visual analog scale for pain ( $P < .001$ ), and a 15.2-point improvement in the 12-Item Veterans-Rand physical component ( $P < .001$ ). Ninety-three percent of patients returned to their preinjury level of sports participation without limitations. Thirty (81.1%) patients demonstrated improvements in mHHS greater than the minimally clinically important difference (of mHHS 8 points). Two patients could not reach minimally clinically important difference because of a preoperative mHHS of  $> 92$ . There were no postoperative physes growth arrests, growth disturbances, physes instability, or avascular necrosis.

### **Conclusions**

A non-physes-sparing arthroscopic approach for FAI in adolescents with open physes is safe and effective with no evidence of clinically relevant complication of growth arrest-related deformity or physes instability in patients with a minimum of 1 year (mean, 39.8 months) of follow-up after surgery. Young, highly athletic adolescent patients with larger FAI deformities demonstrated greater outcomes improvement after arthroscopy.

### **Level of Evidence**

Level IV, therapeutic case series.

## **Midterm Outcomes Following Repair of Capsulotomy Versus Nonrepair in Patients Undergoing Hip Arthroscopy for Femoroacetabular Impingement With Labral Repair**

Ioanna K. Bolia, M.D., Ph.D., Lorenzo Fagott, M.D., Karen K. Briggs, M.P.H., M.B.A., Marc J. Philippon, M.D.

Arthroscopy, Volume 35, Issue 6, Received: August 13, 2018; Accepted: January 18, 2019

<https://doi.org/10.1016/j.arthro.2019.01.033>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

The purpose of this study was to compare the midterm outcomes and conversion to total hip arthroplasty (THA) rate in patients who had repair of the capsulotomy versus nonrepair following arthroscopic hip labral repair and correction of femoroacetabular impingement (FAI).

### **Methods**

All patients undergoing primary arthroscopic hip labral repair and correction of FAI between 2005 and 2012 were eligible for this study. Exclusion criteria were age < 18 years, lateral center-edge angle < 25°, previous hip procedures, femoral avascular necrosis, radiographic joint space ≤ 2 mm, or microfracture at arthroscopy. Patients who did not have the capsulotomy repaired were matched 1:2 with patients who had the capsulotomy repaired. Patients were matched by age, gender, and intraoperative procedures. The primary outcome score was the Hip Outcome Score Daily Living (HOS-ADL).

### **Results**

Forty-two patients (18 female patients, 24 male patients) without repair of the capsulotomy were matched with 84 patients with repaired capsulotomy. The average age for both groups was 38 ± 15 years. Patients in the nonrepair group were 6.8 (95% confidence interval, 1.2-52) times more likely to undergo THA compared with the repair group. There was no difference in revision rate between the 2 groups. The mean follow-up time was 7.3 ± 2.7 years and 6.4 ± 2.3 years for the nonrepair and repair group, respectively (P = .107). Patients in the repair group had significantly higher HOS-ADL (P = .01) and modified Harris hip score (mHHS; P = .007). The percentage of patients who reached minimum clinically important difference was significantly higher in the repair group for HOS-ADL (P = .002) and HOS-Sport (P = .036) compared with the nonrepair group. However, there was no difference in the percentage of patients who reached minimal important change for the mHHS (P = .060). Following hip arthroscopy, the average alpha angle was 41.6° ± 6° in the nonrepair group and 40.8° ± 3° in the repair group.

### **Conclusions**

Patients who undergo arthroscopic FAI correction and hip labral repair with repair of the capsulotomy had higher HOS-ADL and mHHS scores at midterm follow-up compared with patients with nonrepair, and the percentage of patients who reached the minimum clinically important difference was significantly higher in the repair group for HOS-ADL and HOS-Sport compared with the nonrepair group. In addition, a lower rate of conversion to THA was seen in the repair group.

### **Level of Evidence**

Level III, retrospective comparative study.

[BACK](#)

## **Bilateral Hip Arthroscopy: Can Results From Initial Arthroscopy for Femoroacetabular Impingement Predict Future Contralateral Results?**

Jeffrey D. Hassebrock, M.D., Aaron J. Krych, M.D., Benjamin G. Domb, M.D., Bruce A. Levy, M.D., Matthew R. Neville, M.S., David E. Hartigan, M.D.  
Arthroscopy, Volume 35, Issue 6, Received: August 24, 2018; Accepted: December 12, 2018

<https://doi.org/10.1016/j.arthro.2018.12.033>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

To determine the degree of correlation of radiographic measurements, degree of correlation of intraoperative pathology, and difference in outcomes between sides of patients requiring staged bilateral hip arthroscopy.

### **Methods**

Two high-volume hip preservation centers retrospectively reviewed hip preservation databases for staged bilateral hip arthroscopies conducted between 2008 and 2015. Patients were separated into those who presented with bilateral hip pain and those that presented with unilateral pain and developed contralateral pain >2 years later. Patients were analyzed for radiographic correlation (alpha angle, lateral center edge angle, anterior center edge angle, magnetic resonance imaging alpha angle, Tönnis grade) and correlation of intraoperative pathology (acetabular labrum articular disruption grade, Outerbridge grade/location, Villar class ligamentum teres tears, labral tear location, symmetry of Seldes tear types, and the differences between operative procedures). Patient-reported outcomes were analyzed (modified Harris Hip Score, Non-Arthritic Hip Score, International Hip Outcome Tool-12, hip outcome score-sport specific subscale, visual analog scale, patient satisfaction). Correlative tests included Pearson and Spearman; univariate and multivariate analysis for differences included  $\chi$ -square test and Student t tests for ordinal and continuous variables respectively.

### **Results**

A total of 133 of 2,705 patients (4.6%) underwent bilateral hip arthroscopy. Radiographic alpha angle, magnetic resonance imaging alpha angle, lateral center edge angle, and anterior center edge angle demonstrated strong correlation (Pearson's coefficients 0.651, 0.648, 0.644, 0.667, respectively,  $P < .0001$ ). Tönnis grade was weakly correlated (Pearson's coefficient 0.286,  $P = .001$ ). Intraoperative pathology was moderately correlated (Pearson's coefficients for acetabular Outerbridge location, 0.300,  $P = .0170$ ; acetabular labrum articular disruption, 0.490,  $P < .0001$ ; acetabular Outerbridge; 0.530;  $P < .0001$ ; femoral head Outerbridge, 0.459,  $P < .0001$ ; Villar class, 0.393,  $P < .0001$ ; and labral tear location, 0.468,  $P < .0001$ ). Labral tear Seldes type was compared with Bowker's symmetry test and there was no significant difference between sides. There were no significant differences in surgical interventions performed between sides. Patients with bilateral hip arthroscopies significantly improved in all measured patient-reported outcomes and had a high patient satisfaction after both procedures. Final patient-reported outcomes and change in patient-reported outcomes were not different between procedures; follow up ranged from 3 months to 8 years.

### **Conclusions**

This study demonstrated an incidence of 4.6% of patients who require bilateral hip arthroscopy. These patients can expect significant improvement after surgical intervention. Patients that had 1 side done gained similar improvement when the contralateral side was performed. Preoperative radiographic, intraoperative pathology, and procedures performed were similar between hips.

### **Level of Evidence**

Level III, retrospective cohort study.

[BACK](#)

# **The Role of Bone Marrow Aspirate Concentrate for the Treatment of Focal Chondral Lesions of the Knee: A Systematic Review and Critical Analysis of Animal and Clinical Studies**

Leonardo Cavinatto, M.D., Ph.D., Betina B. Hinckel, M.D., Ph.D., Ryan E. Tomlinson, Ph.D., Sunny Gupta, M.D., Jack Farr, M.D., Arthur R. Bartolozzi, M.D.

Arthroscopy, Volume 35, Issue 6, Received: July 2, 2018; Accepted: November 21, 2018

<https://doi.org/10.1016/j.arthro.2018.11.073>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

## **Purpose**

To summarize currently available data regarding the use of bone marrow aspirate concentrate (BMAC) for the treatment of focal chondral lesions of the knee in experimental animal models and human clinical studies.

## **Methods**

A systematic review searching for the terms “(bone marrow)” AND “(aspirate OR concentrate)” AND “(cartilage OR chondral OR osteochondral)” was performed in the databases PubMed, Cochrane Central Register of Controlled Trials, and Google Scholar regarding the use of BMAC for the treatment of focal chondral lesions of the knee. The inclusion criteria were animal and clinical studies published in English that used autologous BMAC to treat focal chondral defects of the knee. We excluded studies that evaluated nonconcentrated preparations of bone marrow aspirate or preparations that were culture expanded.

## **Results**

A total of 23 studies were included: 10 studies performed in animal models and 13 human clinical studies. Animal studies showed inconsistent outcomes regarding the efficacy of BMAC for the treatment of chondral or osteochondral lesions, assessed by gross morphology, second-look arthroscopy, magnetic resonance imaging, histology, immunohistochemistry, mechanical testing, and micro-tomography. Chondral defect filling was achieved with fibrocartilage or “hyaline-like” cartilage. Cells present in BMAC did not meet the criteria to be characterized as mesenchymal stem cells according to the International Society for Cell Therapy because freshly isolated cells failed to show tri-lineage differentiation. Overall, all clinical studies, independent of the study group or level of evidence, reported improved clinical outcomes and higher macroscopic, magnetic resonance imaging, and histology scores. Comparative trials favored BMAC over microfracture and reported equivalent outcomes between BMAC and matrix-induced autologous chondrocyte implantation. However, clinical studies were scant and showed low scientific rigor, poor methodologic quality, and low levels of evidence on average.

## **Conclusions**

Although clinical success in short-term and midterm applications has been suggested for the application of BMAC for the restoration of cartilage defects in lesions of the knee, current study designs are generally of low scientific rigor. In addition, clinical applications of this technology in animal model investigations have shown inconsistent outcomes. Thus, clinicians should apply this technology cautiously.

## **Level of Evidence**

Level IV, systematic review of Level II, III, and IV evidence studies.

[BACK](#)

## **Return to Sport and Sports-Specific Outcomes After Osteochondral Allograft Transplantation in the Knee: A Systematic Review of Studies With at Least 2 Years' Mean Follow-Up**

Zachary T. Crawford, Pharm.D., Zachary T. Crawford, Adam P. Schumaier, M.D., Georgina Glogovac, M.D., Brian M. Grawe, M.D.

Arthroscopy, Volume 35, Issue 6, Received: July 2, 2018; Accepted: November 21, 2018

<https://doi.org/10.1016/j.arthro.2018.11.064>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

To report current data on return-to-sport rates and sports-specific patient-reported outcomes after osteochondral allograft (OCA) transplantation for cartilage defects of the knee.

### **Methods**

We performed a systematic review according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines that included studies from 1975 to 2018 with a minimum 2-year mean follow-up that reported return-to-sport rates or sports-specific patient-reported outcomes. Outcomes, reoperations, and complications were provided in table format, and a subjective analysis was performed.

### **Results**

This review included 13 studies with 772 patients who underwent OCA transplantation at a mean of 24 to 91 months' follow-up. The return-to-sport rate ranged from 75% to 82%. For patient-reported outcomes, the Knee Injury and Osteoarthritis Score Sport increased in 4 studies, the Tegner activity scale score increased in 3 studies but decreased in 1, and the Marx activity scale score increased in 1 study but decreased in 2. Studies reporting improvements in the Cincinnati Knee Score and Knee Injury and Osteoarthritis Score Sport reached the minimal clinically important difference. The reoperation rate was high (ranging from 34% to 53% in more than half of studies), with reoperations primarily performed for loose body removal or debridement.

### **Conclusions**

This systematic review of 13 studies suggests that OCA transplantation for cartilage defects allows most athletes to return to sport (range, 75%-82%). Most studies reported improvements in sports-specific patient-reported outcomes at follow-up and reached the minimal clinically important difference. However, the reoperation rate was high in several studies, with a large percentage of patients requiring loose body removal or debridement. The long-term survival of the allografts is largely unknown, but this study suggests OCA transplantation consistently improves function in athletes with chondral injuries.

### **Level of Evidence**

Level IV, systematic review of Level III and IV studies.

## **Knee Flexion Angle During Graft Fixation for Medial Patellofemoral Ligament Reconstruction: A Systematic Review of Outcomes and Complications**

Neel K. Patel, M.D., Darren de SA, M.D., F.R.C.S.C., Ravi Vaswani, M.D., Jeffrey Kay, M.D., Volker Musahl, M.D., Bryson P. Lesniak, M.D.

Arthroscopy, Volume 35, Issue 6, Received: May 15, 2018; Accepted: November 29, 2018

<https://doi.org/10.1016/j.arthro.2018.11.070>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

To determine the effect of knee flexion angle during graft fixation on outcomes and complications following medial patellofemoral ligament (MPFL) reconstruction.

### **Methods**

Three databases (PubMed, EMBASE, and MEDLINE) were searched from database inception to January 2018. After screening based on inclusion and exclusion criteria, patient demographics, fixation technique, graft selection, outcomes, and complications were extracted from the included studies. The studies were grouped based on flexion angle used during graft fixation: low (0°-30°) and high (45°-90°) flexion angle group. Methodological Index for Non-Randomized Studies criteria were used to assess the quality of each included study. Descriptive statistics are presented.

### **Results**

Seventeen studies (of 3,399) were included and were either cohort (n = 1) or case series (n = 17) study designs. A total of 556 patients with a mean age of 23.6 years (range, 10-60 years) underwent MPFL reconstructions, with 458 patients in the 0° to 30° fixation group and 98 in the 45° to 90° fixation group. The mean Kujala score improved from 45 to 72.9 (365 patients) preoperatively to 83 to 94.5 (460 patients) postoperatively for the 0° to 30° fixation group and from 53.3 to 72 preoperatively to 92.2 to 95.2 postoperatively for the 45° to 90° fixation group (98 patients).

### **Conclusions**

The knee flexion angle during MPFL graft fixation ranges from 20° to 90°. Graft fixation at low and high knee flexion angles during MPFL reconstruction showed excellent patient-reported outcomes and low patellar redislocation rates overall, with no clear differences between the 2 groups based on the currently available data.

### **Level of Evidence**

Level IV, systematic review of Level III-IV studies.

## **Hamstring Autograft Versus Hybrid Graft in Anterior Cruciate Ligament Reconstruction: A Systematic Review of Comparative Studies**

Kyle R. Sochacki, M.D., Patrick C. McCulloch, M.D., David M. Lintner, M.D., Joshua D. Harris, M.D.

Arthroscopy, Volume 35, Issue 6, Received: August 3, 2018; Accepted: November 28, 2018

<https://doi.org/10.1016/j.arthro.2018.11.070>

© 2019 by the Arthroscopy Association of North America. Published by Elsevier. All rights reserved.

### **Purpose**

To compare (1) patient-reported outcomes, (2) objective knee measures of stability, (3) failures, and (4) reoperations after primary anterior cruciate ligament (ACL) reconstruction with semitendinosus-gracilis autograft versus autograft-allograft hybrid grafts.

### **Methods**

We performed a systematic review using Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Multiple databases were searched for studies that compared outcomes of ACL reconstruction with semitendinosus-gracilis autograft versus autograft-allograft hybrid grafts in adult human patients with minimum 2-year follow-up. Knee-specific patient-reported outcome scores, objective knee measures of stability, failures, and reoperations were reported for each study and compared between semitendinosus-gracilis autografts and hybrid grafts. Study heterogeneity and levels of evidence precluded meta-analysis.

### **Results**

We analyzed 6 articles (544 patients; 54.5% male patients; mean age,  $30.9 \pm 3.9$  years; mean follow-up period,  $43.6 \pm 15.5$  months). Of 6 studies, 4 showed no significant differences in International Knee Documentation Committee and Lysholm scores between the semitendinosus-gracilis autograft and hybrid groups. Five of six studies showed no significant differences in KT-1000 measurements between groups. The risk of ACL failure ranged from 3.2% to 8.4% for semitendinosus-gracilis autografts and from 2.4% to 14.3% for hybrid grafts, with no study reporting a significant difference in failure rates between groups. The reoperation rate in the subjects undergoing ACL reconstruction with semitendinosus-gracilis autografts and hybrid grafts ranged from 2.8% to 10.3% and from 2.4% to 48.3%, respectively. In 5 of 6 studies, no significant differences in reoperation rates were found between groups.

### **Conclusions**

Most studies reported no significant differences in patient-reported outcome scores, objective knee measures of stability, and reoperation rates between semitendinosus-gracilis autografts and hybrid grafts. No significant difference in ACL failure rates was found between groups in any study.

### **Level of Evidence**

Level III, systematic review of Level II and III studies.

**Treatment of unstable knee osteochondritis dissecans in the young adult: results and limitations of surgical strategies—The advantages of allografts to address an osteochondral challenge**

Giuseppe Filardo, Luca Andriolo, Francesco Soler, Massimo Berruto, Paolo Ferrua, Peter Verdonk, Frederic Rongieras, Dennis C. Crawford

DOI: <https://doi.org/10.1007/s00167-018-5316-5>

**Abstract**

Joint surface incongruence resulting from osteochondritis dissecans (OCD) alters the articular physiologic congruence, increasing the contact stress on adjacent joint surfaces and accelerating wear and the cascade of joint degeneration. Accordingly, the restoration of articular surface integrity is of major importance, especially in young adults where, in lesions left untreated or following simple fragment excision, early osteoarthritis can be anticipated. Therefore, the treatment algorithm in unstable knee OCD of the young adult foresees surgical options to restore the articular surface. Several procedures have been proposed, including refixation of the detached fragment, bone marrow stimulation, osteochondral autograft implantation, fresh osteochondral allograft transplantation, and cell-based or cell-free regenerative techniques. The aim of this review was to summarize the evidence for these surgical strategies, reporting their results and limitations. The overall evidence documents positive results for each of the assorted surgical procedures applied to treat unstable OCD, thus indicating support for their selected use to treat osteochondral defects paying particular attention to their specific indications for the lesion characteristics. The fixation of a good quality fragment should be pursued as a first option, while unfixable small lesions may benefit from autografts. For large lesions, available cell-based or cell-free osteochondral scaffold are a feasible solution but with limitation in terms of regenerated tissue quality. In this light, fresh allografts may offer articular surface restoration with viable physiologic osteochondral tissue providing a predictably successful outcome, and therefore they may currently represent the most suitable option to treat unstable irreparable OCD lesion in young adults.

**Level of evidence**

V.

**Keywords**

Osteochondritis dissecans Young adult Surgical treatment Knee Osteochondral Cartilage Scaffold Allograft

## **The use of allograft tendons in primary ACL reconstruction**

Christophe Hulet, Bertrand Sonnery-Cottet, Ciara Stevenson, Kristian Samuelsson, Lior Laver, Urszula Zdanowicz, Sjoerd Stufkens, Jonathan Curado, Peter Verdonk, Tim Spalding

DOI: <https://doi.org/10.1007/s00167-019-05440-3>

### **Purpose**

Graft choice in primary anterior cruciate ligament (ACL) reconstruction remains controversial. The use of allograft has risen exponentially in recent years with the attraction of absent donor site morbidity, reduced surgical time and reliable graft size. However, the published evidence examining their clinical effectiveness over autograft tendons has been unclear. The aim of this paper is to provide a current review of the clinical evidence available to help guide surgeons through the decision-making process for the use of allografts in primary ACL reconstruction.

### **Methods**

The literature in relation to allograft healing, storage, sterilisation, differences in surgical technique and rehabilitation have been reviewed in addition to recent comparative studies and all clinical systematic reviews and meta-analyses.

### **Results**

Early reviews have indicated a higher risk of failure with allografts due to association with irradiation for sterilisation and where rehabilitation programs and post-operative loading may ignore the slower incorporation of allografts. More recent analysis indicates a similar low failure rate for allograft and autograft methods of reconstruction when using non-irradiated allografts that have not undergone chemically processing and where rehabilitation has been slower. However, inferior outcomes with allografts have been reported in young (< 25 years) highly active patients, and also when irradiated or chemically processed grafts are used.

### **Conclusion**

When considering use of allografts in primary ACL reconstruction, use of irradiation, chemical processing and rehabilitation programs suited to autograft are important negative factors. Allografts, when used for primary ACL reconstruction, should be fresh frozen and non-irradiated. Quantification of the risk of use of allograft in the young requires further evaluation.

### **Levels of evidence**

III.

### **Keywords**

Anterior cruciate ligament reconstruction, Allografts ACL, Graft choice, Decision making, Autografts

## **Allograft tendons are a safe and effective option for revision ACL reconstruction: a clinical review**

V. Condello, U. Zdanowicz, Berardo Di Matteo, T. Spalding, P. E. Gelber, P. Adravanti, P. Heuberer, S. Dimmen, B. Sonnery-Cottet, C. Hulet, M. Bonomo, E. Kon

DOI: <https://doi.org/10.1007/s00167-018-5147-4>

Revision anterior cruciate ligament reconstruction remains a challenge, especially optimising outcome for patients with a compromised knee where previous autogenous tissue has been used for reconstruction. Allograft tissue has become a recognized choice of graft for revision surgery but questions remain over the risks and benefits of such an option. Allograft tendons are a safe and effective option for revision ACL reconstruction with no higher risk of infection and equivalent failure rates compared to autografts provided that the tissue is not irradiated, or any irradiation is minimal. Best scenarios for use of allografts include revision surgery where further use of autografts could lead to high donor site morbidity, complex instability situations where additional structures may need reconstruction, and in those with clinical and radiologic signs of autologous tendon degeneration. A surgeon needs to be able to select the best option for the challenging knee facing revision ACL reconstruction, and in the light of current data, allograft tissue can be considered a suitable option to this purpose.

### **Level of evidence**

IV.

### **Keywords**

ACL Revision Allograft Multi-ligament Arthroscopy Return to sport Anterior cruciate ligament

## **Autograft or allograft for reconstruction of anterior cruciate ligament: a health economics perspective**

Hema Mistry, Andrew Metcalfe, Jill Colquitt, Emma Loveman, Nick A. Smith, Pamela Royle, Norman Waugh

DOI: <https://doi.org/10.1007/s00167-019-05436-z>

### **Purpose**

To assess the clinical and cost-effectiveness of allografts versus autografts in the reconstruction of anterior cruciate ligaments.

### **Methods**

Systematic review of comparative clinical effectiveness and cost-effectiveness analysis.

### **Results**

Both autograft and allograft reconstruction are highly effective. Recent studies show little difference in failure rates between autografts and allografts (about 6% and 7%, respectively). In cost-effectiveness analysis, the price differential is the main factor, making autografts the first choice. However, there will be situations, particularly in revision ACL reconstruction, where an allograft may be preferred, or may be the only reasonable option available.

### **Conclusion**

In ACL reconstruction, clinical results with autografts are as good as or slightly better than with allografts. Allografts cost more, indicating that autografts are more cost-effective and should usually be first choice.

### **Level of evidence**

II.

## **The use of allograft tissue in posterior cruciate, collateral and multi-ligament knee reconstruction**

Marc Jacob Strauss, Ricardo Varatojo, Tarek Boutefnouchet, Vincenzo Condello, Kristian Samuelsson, Pablo E. Gelber, Paolo Adravanti, Lior Laver, Sigbjorn Dimmen, Karl Eriksson, Peter Verdonk, Tim Spalding

DOI: <https://doi.org/10.1007/s00167-019-05426-1>

### **Purpose**

Currently both autograft and allograft tissues are available for reconstruction of posterior cruciate, collateral and multi-ligament knee injuries. Decision-making is based on a complex interplay between anatomical structures, functional bundles and varying biomechanical requirements. Despite theoretically better biological healing and reduced risk of disease transmission autografts are associated with donor site morbidity as well as being limited by size and quantity. The use of allografts eliminates donor-site morbidity but raises cost and issues of clinical effectiveness. The purpose of this paper is to review current concepts and evidence for the use of allografts in primary posterior cruciate, collateral and multi-ligament reconstructions.

### **Methods**

A narrative review of the relevant literature was conducted for PCL, collateral ligament and multi-ligament knee reconstruction. Studies were identified using a targeted and systematic search with focus on recent comparative studies and all clinical systematic reviews and meta-analyses. The rationale and principles of management underpinning the role of allograft tissue were identified and the clinical and functional outcomes were analysed. Finally, the position of postoperative physiotherapy and rehabilitation was identified.

### **Results**

The review demonstrated paucity in high quality and up-to-date results addressing the issue especially on collaterals and multi-ligament reconstructions. There was no significant evidence of superiority of a graft type over another for PCL reconstruction. Contemporary principles in the management of posterolateral corner, MCL and multi-ligament injuries support the use of allograft tissue.

### **Conclusion**

The present review demonstrates equivalent clinical results with the use of autografts or allografts. It remains, however, difficult to generate a conclusive evidence-based approach due to the paucity of high-level research. When confronted by the need for combined reconstructions with multiple grafts, preservation of synergistic muscles, and adapted postoperative rehabilitation; the current evidence does offer support for the use of allograft tissue.

### **Level of evidence**

IV.

## **Italian consensus statement for the use of allografts in ACL reconstructive surgery**

Corrado Bait, Pietro Randelli, Riccardo Compagnoni, Paolo Ferrua, Rocco Papalia, Filippo Familiari, Andrea Tecame, Paolo Adravanti, Ezio Adriani, Enrico Arnaldi, Franco Benazzo, Massimo Berruto

DOI: <https://doi.org/10.1007/s00167-018-5003-6>

### **Purpose**

Graft choice for primary anterior cruciate ligament reconstruction (ACL-R) is debated, with considerable controversy and variability among surgeons. Autograft tendons are actually the most used grafts for primary surgery; however, allografts have been used in greater frequency for both primary and revision ACL surgery over the past decade. Given the great debate on the use of allografts in ACL-R, the “Allografts for Anterior Cruciate Ligament Reconstruction” consensus statement was developed among orthopedic surgeons and members of SIGASCOT (Società Italiana del Ginocchio, Artroscopia, Sport, Cartilagine, Tecnologie Ortopediche), with extensive experience in ACL-R, to investigate their habits in the use of allograft in different clinical situations. The results of this consensus statement will serve as benchmark information for future research and will help surgeons to facilitate the clinical decision making.

### **Methods**

In March 2017, a formal consensus process was developed using a modified Delphi technique method, involving a steering group (9 participants), a rating group (28 participants) and a peer-review group (31 participants). Nine statements were generated and then debated during a SIGASCOT consensus meeting. A manuscript has been then developed to report methodology and results of the consensus process and finally approved by all steering group members.

### **Results**

A different level of consensus has been reached among the topics selected. Strong agreement has been reported in considering harvesting, treatment and conservation methods relevant for clinical results, and in considering biological integration longer in allograft compared to autograft. Relative agreement has been reported in using allograft as the first-line graft for revision ACL-R, in considering biological integration a crucial aspect for rehabilitation protocol set-up, and in recommending a delayed return to sport when using allograft. Relative disagreement has been reported in using allograft as the first-line graft for primary ACL-R in patients over 50, and in not considering clinical results of allograft superior to autograft. Strong disagreement has been reported in using allograft as the first-line graft for primary ACL-R and for skeletally immature patients.

### **Conclusions**

Results of this consensus do not represent a guideline for surgeons, but could be used as starting point for an international discussion on use of allografts in ACL-R.

### **Level of evidence**

IV, consensus of experts

## **Higher survivorship following meniscal allograft transplantation in less worn knees justifies earlier referral for symptomatic patients: experience from 240 patients**

Benjamin Bloch, Laura Asplin, Nick Smith, Peter Thompson, Tim Spalding

DOI: <https://doi.org/10.1007/s00167-019-05459-6>

### **Purpose**

To analyse the clinical outcome and survivorship of meniscal allograft transplantation (MAT), performed in a single unit, specifically to assess the impact of concomitant operations and the influence of articular cartilage lesions on outcome.

### **Method**

A prospective case series analysis of 240 patients undergoing MAT with follow-up greater than 12 months (range 1–10 years) was performed. Group A represented patients with good chondral surfaces (ICRS 0–3A); Group B had good chondral surfaces with concomitant realignment osteotomy. Group C had good chondral surfaces with ACL reconstruction performed at the same time. Groups D and E had bare bone on one or both surfaces respectively. Kaplan–Meier survivorship and PROMS including Lysholm, KOOS, Tegner, and IKDC subjective scores were analysed.

### **Results**

Overall survivorship was 96.7% at 1 year, 87% at 5 years and 82.2% at 7 years. Groups A–C (knees without significant chondral damage) had significantly improved survivorship (95% at 5 years) compared to Groups D, E (full-thickness chondral wear) with 77% survivorship at 5 years. Survivorship and PROMS were equivalent between Groups A–C. Groups D and E had similar PROMS to Group A, but did have a higher failure rate. Overall 27% required further operative intervention.

### **Conclusions**

Meniscal transplantation is clinically effective in treating patients with symptomatic meniscal deficiency. Where indicated, the addition of osteotomy or ACL reconstruction achieves results similar to patients undergoing simple meniscal transplantation in stable and normally aligned knees. Survivorship is lower in patients with full-thickness chondral loss and future treatments should, therefore, be directed at improving success in this at-risk group. The results support encouragement for earlier referral of symptomatic patients to a specialist meniscal reconstruction centre before a significant chondral damage is sustained.

### **Level of evidence**

III.

## **Meniscal allograft transplantation: undersizing grafts can lead to increased rates of clinical and mechanical failure**

Ciara Stevenson, Ahmed Mahmoud, Francois Tudor, Peter Myers

DOI: <https://doi.org/10.1007/s00167-019-05398-2>

### **Purpose**

To assess mid-term survivorship of meniscal allograft transplantation (MAT) and determine the effect that pre-operative meniscal sizing has upon functional outcome and mechanical survivorship.

### **Methods**

A prospectively collected database of patients receiving MAT from 2001 to 2017 was analysed. Data include demographics; sizing measurements, complications, further surgery, and patient-reported outcome measures (PROMs). Allografts were fresh frozen, non-irradiated, and sized using the Pollard technique.

### **Results**

Seventy-three MATs were performed in 67 patients; mean age at MAT was 34 years (range 14–52 years). 56% were male and 62% were medial. The mean follow-up was 75 months (6.25 years). Mechanical survival at 5 and 10 years was 96% and 89.4%, respectively. There were statistically significant improvements in all PROMs; mean Lysholm score improved by 17.5 points [95% confidence interval (CI) 22.2–12.9,  $p < 0.001$ ]; mean IKDC score improved significantly by 13.3 points (CI 19.3–7.4,  $p < 0.001$ ); mean OKS improved by 5.6 points (CI 9.2–2.2,  $p < 0.002$ ); and the median Tegner improved by 1 point. Forty-one MATs (56%) were undersized for width (range 1–11 mm). Seven MATs (10%) were undersized for length (range 1–4 mm). There was no statistically significant difference in mechanical survivorship or clinical outcomes between undersized, matched, or oversized grafts overall; however, sub-group analysis demonstrated increased failure when allografts were undersized by more than 5 mm in width.

### **Conclusions**

MAT is an effective treatment to improve function and alleviate pain with excellent survivorship in this series. Accepting an allograft that is more than 5 mm smaller in width than pre-operative templating increases the likelihood of clinical and mechanical failure. We, therefore, urge surgeons to be familiar with the measuring process used by their individual tissue bank provider to avoid graft–host mismatch that could affect outcome.

## **Meniscal allograft transplantation in the paediatric population: early referral is justified**

S. Middleton, L. Asplin, C. Stevenson, P. Thompson, T. Spalding

DOI: <https://doi.org/10.1007/s00167-019-05437-y>

### **Purpose**

The need for meniscal allograft transplantation (MAT) in children is rare, and as a result, there is a paucity of evidence detailing survivorship and clinical outcome. MAT has been shown to significantly reduce pain and improve function in the adult population. The aim of this study was to document the outcomes of a single surgeon case series of MAT in the paediatric population.

### **Methods**

Analysis of a prospective meniscal allograft transplantation (MAT) group database of 280 patients was performed. Twenty-three patients met the inclusion criteria—undergoing MAT aged 18 years or younger.

### **Results**

Fourteen were female and nine were male with median age of 17 (range 8–18). Thirteen (57%) were right knee and nineteen (83%) were lateral. Additional procedures included high tibial osteotomy, anterior cruciate ligament reconstruction, and microfracture procedures. The median follow-up was 3.8 years (range of 0.2 to 7.8 years). There have been no cases of graft failure. All patients demonstrated improvement in all the modalities of the KOOS outcome scores. At 5 years, the Lysholm score had improved from 57.9 to 87.6 (SD 12.1), Tegner activity score had improved from 2 to 5 (range 4–7) and IKDC score had improved from 40.6 to 78.6 (SD 15.8). Four patients required secondary surgical intervention. No patients developed a superficial or deep infection.

### **Conclusion**

Meniscal allograft transplantation in children is founded on the successful results of MAT in the adult population. We have demonstrated in this series that MAT can improve function and reduce pain in the paediatric population, and is, therefore, a viable treatment option for the management of the symptomatic paediatric meniscal-deficient knee. Early referral should be considered in the patients with post-menisectomy syndrome, pain on weight bearing with a history of previous menisectomy.

### **Level of evidence**

IV.

## **Meniscal allograft transplantation combined with anterior cruciate ligament reconstruction provides good mid-term clinical outcome**

Stefano Zaffagnini, Alberto Grassi, Iacopo Romandini, Maurilio Marcacci, Giuseppe Filardo

DOI: <https://doi.org/10.1007/s00167-018-5078-0>

### **Purpose**

Aim of this study is to document if combined meniscal allograft transplantation (MAT) and ACL reconstruction can improve knee function, reduce pain and allow patients with meniscal defect and ACL lesion to resume sport activities.

### **Methods**

Fifty MAT, arthroscopically performed without bone plugs and combined with one-stage primary or revision ACL reconstruction, with or without high tibial osteotomy (HTO), were included. Patients (aged  $38.2 \pm 10.6$  years, 87% males) were evaluated at a mean follow-up of 5 years with Lysholm, Tegner and VAS scores. Patient satisfaction was also recorded, together with complications and failures.

### **Results**

VAS and Lysholm scores improved significantly (from 63.7 to 24.5 and from 60.6 to 82.7, respectively,  $p < 0.001$ ), while the Tegner score did not reach pre-injury values ( $p < 0.001$ ), but it improved significantly compared to pre-surgery values (from 2.8 to 4.6,  $p < 0.001$ ). Medial MAT reported significantly better results compared to lateral MAT. Patients undergoing concomitant HTO reported a significantly higher decrease of VAS. Younger patients with higher pre-operative pain and lower activity level presented higher satisfaction. Eight patients needed a reoperation. Three patients were considered surgical failures while four were considered clinical failures, for a total of 15% failures.

### **Conclusions**

Meniscal allograft transplantation combined with ACL reconstruction represents a safe and suitable treatment, which should be considered as a suitable option in the clinical practice. All evaluated patient profiles, ACL injury in a patient with post-menisectomy syndrome, failed ACL reconstruction in patients with a meniscus defect, and ACL reconstruction in patients with malalignment due to meniscal defect, benefited from the combined MAT procedure at medium-term follow-up.

### **Level of evidence**

IV.

## **Survivorship and Outcome of Hip Arthroscopy for Femoroacetabular Impingement Syndrome Performed With Modern Surgical Techniques**

Shane J. Nho, MD, MS, Edward C. Beck, MD, MPH, Benedict U. Nwachukwu, MD, Gregory L. Cvetanovich, MD, William H. Neal, BS, Joshua D. Harris, MD, Alexander E. Weber, MD, Richard C. Mather, MD, MBA

First Published May 30, 2019; pp. 1662–1669

<https://doi.org/10.1177/0363546519843936>

Copyright © 2019 SAGE Publications in association with American Orthopedic Society for Sports Medicine. All Rights Reserved.

**Background** Hip arthroscopy for femoroacetabular impingement syndrome (FAIS) is a rapidly growing field in sports surgery; however, factors associated with poor outcomes and identification of predictor models of inferior clinical outcomes is unclear.

**Purpose** To analyze predictors of clinical failure and inferior clinical outcomes among patients undergoing hip arthroscopy for treatment of FAIS.

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

**Methods** Data were collected and analyzed from consecutive patients who underwent primary hip arthroscopy with routine capsular closure for the treatment of FAIS from a single fellowship-trained surgeon between January 2012 and November 2015. Baseline data, postoperative patient-reported outcomes, and rates of clinical failure and inferior clinical outcomes were recorded at 2 years postoperatively. Clinical failure was defined by revision hip arthroscopy or conversion to total hip arthroplasty. Inferior clinical outcome was defined as not reaching the minimal clinically important difference (MCID) or patient acceptable symptomatic state for Hip Outcome Score–Activities of Daily Living. A multivariate logistic regression analysis was used to identify significant predictors of clinical failure and inferior clinical outcome.

**Results** Out of 1161 eligible patients, 935 (80.5%) completed 2-year postoperative patient-reported outcomes. The mean  $\pm$  SD age and body mass index were  $33.3 \pm 12.3$  years and  $25.4 \pm 8.2$  kg/m<sup>2</sup>, respectively. The overall clinical failure rate was 3.6% ( $n = 34$ ), including 23 cases (2.5%) of revision hip arthroscopy and 11 cases (1.2%) of conversion to total hip arthroplasty. Predictors of clinical failure were lower preoperative International Hip Outcome Tool score ( $P = .016$ ), chronic preoperative pain ( $P = .001$ ), and chondromalacia in the affected hip ( $P = .04$ ). The inferior clinical outcome group, consisting of those who failed to reach the MCID for Hip Outcome Score–Activities of Daily Living, included 256 patients (27.4%). Predictors of inferior clinical outcomes were Tönnis grade  $>1$  ( $P = .01$ ), workers' compensation ( $P < .001$ ), and increased body mass index ( $P = .02$ ).

**Conclusion** This study demonstrates that 73% of all patients treated for symptomatic FAIS with primary hip arthroscopy and routine capsular closure achieved the MCID. Clinical failure is predicted by a number of modifiable and nonmodifiable factors, including chronic preoperative pain and presence of chondromalacia. The current study updates the midterm failure rates and outcomes achievable with hip arthroscopy for FAIS.

## **Is Microfracture Necessary? Acetabular Chondrolabral Debridement/Abrasion Demonstrates Similar Outcomes and Survival to Microfracture in Hip Arthroscopy: A Multicenter Analysis**

Mario Hevesi, MD, Christopher Bernard, BS, David E. Hartigan, MD, Bruce A. Levy, MD, Benjamin G. Domb, MD, Aaron J. Krych, MD

First Published May 15, 2019; pp. 1670–1678

<https://doi.org/10.1177/0363546519845346>

Copyright © 2019 SAGE Publications in association with American Orthopedic Society for Sports Medicine. All Rights Reserved.

**Background** Hip arthroscopy is becoming more advanced and commonly performed. However, significant controversy exists regarding whether high-grade acetabular cartilage lesions should be treated with debridement/abrasion or microfracture. In addition, patients treated with microfracture are subject to extended protected weightbearing rehabilitation to mitigate risk of subchondral plate fracture and to protect fibrocartilage tissue formation.

**Purpose** To determine the midterm patient-reported outcomes and failure rate of patients with grade 3 and 4 acetabular labrum articular disruption (ALAD) lesions managed with debridement/abrasion or microfracture.

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

**Methods** Primary arthroscopic labral repair cases at 2 centers from November 2008 to April 2016 were reviewed for patients aged <55 years with unipolar ALAD grade 3 and 4 chondrolabral acetabular delamination. Patients undergoing microfracture and debridement/abrasion were compared using the visual analog pain scale (VAS), modified Harris Hip Score (mHHS), and Hip Outcome Score–Sports-Specific Subscale (HOS-SSS) to determine predictors of outcomes and failure.

**Results** A total of 113 hips in 110 patients (66 males, 44 females; mean age,  $34.5 \pm 1.1$  years) undergoing debridement/abrasion ( $n = 82$ ) or microfracture ( $n = 31$ ) were followed for a mean of 4.9 years (range, 2.0–8.5 years). Lesion size was not statistically different between the debridement/abrasion ( $1.3 \pm 1.0$  cm<sup>2</sup>) and microfracture cohorts ( $1.4 \pm 1.0$  cm<sup>2</sup>) ( $P = .47$ ). Patients undergoing debridement/abrasion achieved 3.6-point mean improvements in VAS ( $P < .01$ ), 21.2-point improvements in mHHS ( $P < .01$ ), and 25.4-point improvements in HOS-SSS ( $P < .01$ ), which were not significantly different from those observed in microfracture patients ( $P \geq .20$ ). The 5-year rate of survival free of revision surgery was 84.0% in the debridement/abrasion group and 85.6% in the microfracture group ( $P = .78$ ). The cartilage treatment technique was found not to be predictive of revision risk during both univariate (hazard ratio [HR], 1.01;  $P = .98$ ) and multivariate (HR, 0.93;  $P = .90$ ) analysis accounting for patient age, lesion grade, and acetabular coverage.

### **Conclusion**

Patients undergoing debridement/abrasion of high-grade unipolar acetabular cartilage lesions demonstrate similar outcome scores and revision rates compared with those of patients undergoing microfracture. These outcomes support the consideration of preferential debridement/abrasion at the discretion of the treating surgeon to optimize recovery while maintaining established positive outcomes after hip arthroscopy.

[BACK](#)