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## **Contents**

### **February – March 2017**

#### **Upper extremity**

##### Arthroscopy

Volume 33, Issue 2, p239 – 690

- Biomechanical Performance of Medial Row Suture Placement Relative to the Musculotendinous Junction in Transosseous Equivalent Suture Bridge Double-Row Rotator Cuff Repair
- Comparison of Glenoid Version and Posterior Humeral Subluxation in Patients With and Without Posterior Shoulder Instability
- Quality of Life and Functional Results of Arthroscopic Partial Repair of Irreparable Rotator Cuff Tears
- A Prospective Comparative Study of Arthroscopic Versus Mini-Open Latarjet Procedure With a Minimum 2-Year Follow-up
- Histologic Evaluation of Biopsy Specimens Obtained After Rotator Cuff Repair Augmented With a Highly Porous Collagen Implant
- Association of Traumatic and Atraumatic Posterior Shoulder Instability With Glenoid Retroversion and Outcomes After Arthroscopic Capsulolabral Repair
- Biomechanical Comparison of Open and Arthroscopic Transosseous Repair of Triangular Fibrocartilage Complex Foveal Tears: A Cadaveric Study
- Midterm Outcomes After Arthroscopic Anteroinferior Capsular Release for the Treatment of Idiopathic Adhesive Capsulitis
- Comparison of Intra-articular Findings and Clinical Features Between Patients With Symptomatic Anterior Instability After Recurrent Shoulder Subluxation and Dislocation
- Identification of a Remodeled Neo-tendon After Arthroscopic Latarjet Procedure
- Graft Augmentation Versus Bridging for Large to Massive Rotator Cuff Tears: A Systematic Review

##### JSES

Volume 26, Issue 2, p179-552, e29- e84

- Higher critical shoulder angle increases the risk of retear after rotator cuff repair
- Rotator cuff surgery in patients older than 75 years with large and massive tears

##### KSSTA

Volume 25, Issue 2-3, February - March 2017

- No upper extremity arthroscopy abstracts available

##### AJSM

February 2017, Vol 45, Issue 2 March 2017, Volume 45, Issue 3

- A Prospective Randomized Study Comparing the Interference Screw and Suture Anchor Techniques for Biceps Tenodesis

##### JBJS

2017: Jan-Feb, volume 99, issue 1-4

- No upper extremity arthroscopy abstracts available

##### CORR

February - March 2017, Vol 475, Issue 2-3

- No upper extremity arthroscopy abstracts available

##### BJJ

February - March 2017, Vol 99-B, Issue 2-3

- No upper extremity arthroscopy abstracts available

### **Lower extremity**

#### Arthroscopy

Volume 33, Issue 2, p239 – 690

- Contribution of the Pubofemoral Ligament to Hip Stability: A Biomechanical Study
- Restricted Hip Rotation Is Correlated With an Increased Risk for Anterior Cruciate Ligament Injury
- The Distribution of Impingement Region in Cam-Type Femoroacetabular Impingement and Borderline Dysplasia of the Hip With or Without Cam Deformity: A Computer Simulation Study
- Morphologic Changes and Outcomes After Arthroscopic Acetabular Labral Repair Evaluated Using Postoperative Computed Tomography Arthrography
- A Comparison of the Outcomes for Cartilage Defects of the Knee Treated With Biologic Resurfacing Versus Focal Metallic Implants
- Long-term Survival Analysis of Meniscus Allograft Transplantation With Bone Fixation
- Inter- and Intrarater Reliability of the Femoral Tunnel Clock-Face Grading System During Anterior Cruciate Ligament Reconstruction
- Long-term Results of Arthroscopic Arthrolysis for Arthrofibrosis After Anterior Cruciate Ligament Reconstruction
- Comparative Influence of Sport Type on Outcome After Anterior Cruciate Ligament Reconstruction at Minimum 2-Year Follow-up
- High Altitude Is an Independent Risk Factor for Postoperative Symptomatic Venous Thromboembolism After Knee Arthroscopy: A Matched Case-Control Study of Medicare Patients
- Arthroscopic Quantification of Syndesmotic Instability in a Cadaveric Model
- Outcome of Patellar Tendon Versus 4-Strand Hamstring Tendon Autografts for Anterior Cruciate Ligament Reconstruction: A Systematic Review and Meta-analysis of Prospective Randomized Trials
- Hip Arthroscopy in Patients Age 40 or Older: A Systematic Review
- Femoroacetabular Impingement and Pelvic Incidence: Radiographic Comparison to an Asymptomatic Control
- Decreased Synovial Inflammation in Atraumatic Hip Microinstability Compared With Femoroacetabular Impingement
- The Effect of Capsulotomy and Capsular Repair on Hip Distraction: A Cadaveric Investigation
- Testing the Construct Validity of a Virtual Reality Hip Arthroscopy Simulator
- An Anatomic Analysis of Mid-anterior and Anterolateral Approaches for Hip Arthrocentesis: A Male Cadaveric Study
- Medial Open Wedge High Tibial Osteotomy for Varus Malunited Tibial Plateau Fractures
- Anterolateral Ligament and Iliotibial Band Control of Rotational Stability in the Anterior Cruciate Ligament-Intact Knee: Defined by Tibiofemoral Compartment Translations and Rotations

- Changes in Contact Area in Meniscus Horizontal Cleavage Tears Subjected to Repair and Resection
- Reverse Anterior Cruciate Ligament Reconstruction Fixation: A Biomechanical Comparison Study of Tibial Cross-Pin and Femoral Interference Screw Fixation
- Increased Femoral Anteversion Influence Over Surgically Treated Recurrent Patellar Instability Patients

#### JSES

Volume 26, Issue 2, p179-552, e29- e84

- No lower extremity arthroscopy abstracts available

#### KSSTA

Volume 25, Issue 2-3, February - March 2017

- Single-dose intra-articular bupivacaine plus morphine versus bupivacaine alone after arthroscopic knee surgery: a meta-analysis of randomized controlled trial

#### AJSM

February 2017, Vol 45, Issue 2 March 2017, Volume 45, Issue 3

- Hip Capsular Closure - A Biomechanical Analysis of Failure Torque
- Pediatric Anterior Cruciate Ligament Reconstruction
- Medial Patellofemoral Ligament Reconstruction Combined With Distal Realignment for Recurrent Dislocations of the Patella 5-Year Results of a Randomized Controlled Trial
- Tibial Slope Strongly Influences Knee Stability After Posterior Cruciate Ligament Reconstruction: A Prospective 5- to 15-Year Follow-up

#### JBJS

2017: Jan-Feb, volume 99, issue 1-4

- No lower extremity arthroscopy abstracts available

#### CORR

February - March 2017, Vol 475, Issue 2-3

- No lower extremity arthroscopy abstracts available

#### BJJ

February - March 2017, Vol 99-B, Issue 2-3

- The long-term clinical and radiological outcomes in patients who suffer recurrent injuries to the anterior cruciate ligament after reconstruction

### **Miscellaneous**

#### Arthroscopy

Volume 33, Issue 2, p239 - 690

- Scaffold-Free Tissue-Engineered Allogenic Adipose-Derived Stem Cells Promote Meniscus Healing
- Morphology of the Insertions of the Superficial Medial Collateral Ligament and Posterior Oblique Ligament Using 3-Dimensional Computed Tomography: A Cadaveric Study
- Integrating Social Media and Anterior Cruciate Ligament Surgery: An Analysis of Patient, Surgeon, and Hospital Use
- Knee, Shoulder, and Fundamentals of Arthroscopic Surgery Training: Validation of a Virtual Arthroscopy Simulator
- Validation of an Arthroscopic Training Device

#### JSES

Volume 26, Issue 2, p179-552, e29- e84

- Suture spanning augmentation of single-row rotator cuff repair: a biomechanical analysis

KSSTA

Volume 25, Issue 2-3, February - March 2017

- No miscellaneous arthroscopy abstracts available

AJSM

- No miscellaneous arthroscopy abstracts available

JBJS

2017: Jan-Feb, volume 99, issue 1-4

- No miscellaneous arthroscopy abstracts available

CORR

February - March 2017, Vol 475, Issue 2-3

- No miscellaneous arthroscopy abstracts available

BJJ

February - March 2017, Vol 99-B, Issue 2-3

- No miscellaneous arthroscopy abstracts available

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## Upper extremity

### Arthroscopy

Volume 33, Issue 2, p239 – 690

#### **Biomechanical Performance of Medial Row Suture Placement Relative to the Musculotendinous Junction in Transosseous Equivalent Suture Bridge Double-Row Rotator Cuff Repair**

Mandeep S. Virk, M.D., Benjamin Bruce, M.D., Kristen E. Hussey, M.S., Jacqueline M. Thomas, M.S., Tyler A. Luthringer, B.A., Elizabeth F. Shewman, M.S., Vincent M. Wang, Ph.D., Nikhil N. Verma, M.D., Anthony A. Romeo, M.D., Brian J. Cole, M.D., M.B.A.

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#### Purpose

To compare the biomechanical performance of medial row suture placement relative to the musculotendinous junction (MTJ) in a cadaveric transosseous equivalent suture bridge (TOE-SB) double-row (DR) rotator cuff repair (RCR) model.

#### Methods

A TOE-SB DR technique was used to reattach experimentally created supraspinatus tendon tears in 9 pairs of human cadaveric shoulders. The medial row sutures were passed either near the MTJ (MTJ group) or 10 mm lateral to the MTJ (rotator cuff tendon [RCT] group). After the supraspinatus repair, the specimens underwent cyclic loading and load to failure tests. The localized displacement of the markers affixed to the tendon surface was measured with an optical tracking system.

#### Results

The MTJ group showed a significantly higher ( $P = .03$ ) medial row failure (5/9; 3 during cyclic testing and 2 during load to failure testing) compared with the RCT group (0/9). The mean number of cycles completed during cyclic testing was lower in the MTJ group (77) compared with the RCT group (100;  $P = .07$ ) because 3 specimens failed in the MTJ group during cyclic loading. There were no significant differences between the 2 study groups with respect to biomechanical properties during the load to failure testing.

#### Conclusions

In a cadaveric TOE-SB DR RCR model, medial row sutures through the MTJ results in a significantly higher rate of medial row failure.

#### Clinical Relevance

In rotator cuff tears with tendon tissue loss, passage of medial row sutures through the MTJ should be avoided in a TOE-SB RCR technique because of the risk of medial row failure.

[BACK](#)

## Comparison of Glenoid Version and Posterior Humeral Subluxation in Patients With and Without Posterior Shoulder Instability

Stephen A. Parada, M.D, Stephen A. Parada, Josef K. Eichinger, M.D., Guillaume D. Dumont, M.D., Lauren E. Burton, B.A., Maggie S. Coats-Thomas, B.S., Stephen D. Daniels, B.S., Nathan J. Sinz, B.A., Matthew T. Provencher, M.D., Laurence D. Higgins, M.D., Jon J.P. Warner, M.D.

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### Purpose

To evaluate glenoid version and humeral subluxation on preoperative multiplanar imaging of patients who underwent surgery for posterior glenohumeral instability compared with a matched group of patients who had shoulder surgery for other pathology.

### Methods

All patients over a 2-year period who underwent surgery for posterior instability had preoperative magnetic resonance (MR) imaging or MR arthrogram reviewed. Patients undergoing shoulder surgery for reasons other than instability were identified as a control group and matched by sex, laterality, and age. Measurement of glenoid version and percentage of humeral subluxation was performed by 2 reviewers after completing a tutorial. Reviewers were blinded to diagnosis and to whether or not the patients were in the experimental or control group.

### Results

There were 41 patients in each group. The average glenoid version in the control group was 5.6° of retroversion (standard deviation [SD] 3.0), and the average humeral subluxation was 54% (SD 5.1%). In the experimental group, the average glenoid version was 8.1° of retroversion (SD 5.0). The average humeral subluxation in the experimental group was 56% (SD 6.8%). Student *t* test revealed a statistically significant difference in glenoid version ( $P = .009$ ) but not humeral subluxation ( $P = .25$ ). Intra- and inter-rater reliability was measured by the intraclass correlation coefficient and found to have an excellent Fleiss rating with regard to both measurements.

### Conclusions

Glenoid retroversion is significantly increased in patients with symptomatic posterior labral tears compared with a control group. However, there was no statistically significant difference between the groups with regard to posterior humeral subluxation and, therefore, is not a reliable indicator of the presence or absence of symptomatic posterior shoulder instability.

### Level of Evidence

Level III, retrospective comparative study.

[BACK](#)

## Quality of Life and Functional Results of Arthroscopic Partial Repair of Irreparable Rotator Cuff Tears

Olimpio Galasso, M.D., Daria Anna Riccelli, M.D., Marco De Gori, M.D., Massimo De Benedetto, M.D., Nicola Orlando, M.D., Giorgio Gasparini, M.D., Roberto Castricini, M.D.

Arthroscopy, February 2017, Volume 33, Issue 2, Pages 261-268

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### Purpose

To evaluate the minimum 2-year results and possible outcomes of arthroscopic partial repair in different patterns of irreparable rotator cuff tears (RCTs).

### Methods

Patients suffering from an irreparable supraspinatus and a reparable infraspinatus tendons who underwent arthroscopic partial repair with a minimum 24-month follow-up were included in this study. The Constant and Murley score (CMS) was used to assess patients' functionality pre- and postoperatively. Postoperative patient assessment included the Simple Shoulder Test (SST) and the Short Form Health Survey questionnaire (SF-36). A postoperative range of motion, CMS, and strength were compared with the contralateral side. Postoperative SF-36 was compared with age- and sex-matched norms.

### Results

Ninety patients (95 shoulders) were reviewed after a mean follow-up of 7 (range 2-12) years. The subscapularis tendon was intact in 80 shoulders and torn but completely reparable in the remaining 15 shoulders. The CMS improved from  $39.1 \pm 8.4$  (10-61) to  $76.3 \pm 9.7$  (32-93) ( $P < .001$ ). The mean postoperative SST was  $9.1 \pm 2.2$  (1-12). Although the patients had lower postoperative abduction and internal rotation, strength in abduction and CMS in comparison with the measurements from the contralateral side, the median postoperative SF-36 physical and mental component summaries were 98% and 100% of the matched norms. No significant differences were found in postoperative outcomes according to the RCT pattern. Males showed significantly higher strengths in abduction ( $B = -1.384$ , 95% confidence interval [CI]  $-2.144$  to  $-0.624$ ,  $\eta^2 = 0.123$ ,  $P < .001$ , 95% power), external rotation ( $B = -3.646$ , 95% CI  $-5.2$  to  $-2.092$ ,  $\eta^2 = 0.189$ ,  $P < .001$ , 100% power), and internal rotation ( $B = -3.867$ , 95% CI  $-5.676$  to  $-2.057$ ,  $\eta^2 = 0.162$ ,  $P < .001$ , 99% power) than females. Significantly higher ranges of abduction ( $\eta^2 = 0.431$ ,  $P = .019$ , 98% power) and external rotation ( $\eta^2 = 0.417$ ,  $P < .03$ , 97% power) were noted in younger patients. Higher strengths in abduction ( $\eta^2 = 0.495$ ,  $P = .002$ , 100% power) and internal rotation ( $\eta^2 = 0.464$ ,  $P = .006$ , 99% power) were also reported in these patients.

### Conclusions

When there is an irreparable supraspinatus but there is still the possibility to repair the infraspinatus and subscapularis, the arthroscopic partial cuff repair should be considered as an effective surgical option. Indeed, a significant clinical improvement can be achieved and, differently from pure symptomatic surgical procedures, this technique represents a reasonable effort to restore, at least in part, the shoulder joint functionality. Successful and reliable results



can be expected at an average 7-year follow-up, regardless of the RCT pattern. Female and older patients have a greater likelihood of lower functional outcomes.

[BACK](#)

## **A Prospective Comparative Study of Arthroscopic Versus Mini-Open Latarjet Procedure With a Minimum 2-Year Follow-up**

Blandine Marion, M.D., Shahnaz Klouche, M.D., Julien Deranlot, M.D., Thomas Bauer, M.D., Geoffroy Nourissat, M.D., Ph.D. Geoffroy Nourissat, Philippe Hardy, M.D., Ph.D.

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### **Purpose**

To compare postoperative pain during the first postoperative week and the position of the coracoid bone block at the anterior aspect of the glenoid after the arthroscopic and the mini-open Latarjet procedure. The secondary purpose was to assess functional results and recurrence after at least 2 years of follow-up.

### **Methods**

This comparative prospective study included patients who underwent a Latarjet-Bristow procedure for anterior shoulder instability in 2012. The Latarjet procedure was performed by a mini-open approach (G1) in one center and by an arthroscopic approach (G2) in the other. The main evaluation criterion was average shoulder pain during the first postoperative week assessed by the patient on a standard 10-cm visual analog scale (0-10). Secondary criteria were consumption of analgesics during the first week, the position of the coracoid bone block on radiograph and computed tomography scan at the 3-month follow-up and clinical outcomes (Western Ontario Score Index and new surgery) after at least 2 years of follow-up.

### **Results**

Fifty-eight patients were included, 22 G1 and 36 G2, 13 women and 45 men, mean age  $26.9 \pm 7.7$  years. The mean follow-up was  $29.8 \pm 4.4$  months. There was significantly less pain in the arthroscopic Latarjet group than in the mini-open group during the first postoperative week ( $2.5 \pm 1.4$  vs  $1.2 \pm 1.2$ ,  $P = .002$ ) with comparable consumption of analgesics ( $P > .05$ ). The arthroscopic Latarjet procedure resulted in a more lateral coracoid bone block ( $P = .04$ ) and a better equatorial position than the mini-open technique ( $P = .02$ ). Three patients underwent revision surgery (1 recurrence [2.8%], 1 block fracture, 1 screw ablation) in the arthroscopic group, none in the mini-open group ( $P = .54$ ). At the final follow-up, the Western Ontario Score Index score was good in all patients (G1:  $78.5 \pm 7.5\%$  vs G2:  $82.3 \pm 7\%$ ,  $P = .03$ ).

### **Conclusions**

This prospective comparative study showed that the arthroscopic Latarjet procedure was significantly less painful than the mini-open procedure during the first postoperative week. The clinical outcomes were comparable after at least 2 years of follow-up.

### **Level of Evidence**

Level II, prospective comparative study.

[BACK](#)

## **Histologic Evaluation of Biopsy Specimens Obtained After Rotator Cuff Repair Augmented With a Highly Porous Collagen Implant**

Steven P. Arnoczky, D.V.M, Shariff K. Bishai, D.O., M.S., F.A.O.A.O., Brian Schofield, M.D., Scott Sigman, M.D., Brad D. Bushnell, M.D., M.B.A., Jan Pieter Hommen, M.D., Craig Van Kampen, Ph.D.

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### **Purpose**

To histologically evaluate biopsy specimens from patients who previously underwent rotator cuff repair augmented with a highly porous collagen implant.

### **Methods**

Biopsies of collagen implant/host-tissue constructs were obtained from 7 patients undergoing a second arthroscopic procedure at various time periods (5 weeks to 6 months) after arthroscopic rotator cuff repair augmented with a collagen implant overlay. The biopsy specimens were examined histologically for host-tissue ingrowth, host-tissue maturation, and host-implant biocompatibility.

### **Results**

At the earliest time period (5 weeks), the biopsy revealed the presence of host cells (fibroblasts) within the interstices of the porous collagen implant. Cells were aligned along the linear orientation of the collagen implant structure, and there was evidence of early collagen formation. The 3-month biopsies showed increased collagen formation, maturation, and organization over the surface of the implant and evidence of the collagen implant. At 6 months, the newly generated tissue had the histologic appearance of a tendon, suggesting functional loading of the new generated host tissue. There was no evidence of any remnants of the collagen implant in the 6-month biopsy. There was no evidence of any inflammatory or foreign body reaction within any of the tissue samples.

### **Conclusions**

Biopsies of collagen implants retrieved from human rotator cuff repair subjects revealed cellular incorporation, tissue formation and maturation, implant resorption, and biocompatibility.

### **Clinical Relevance**

The histologic observations from these clinical biopsies support the biocompatibility of this implant and its ability to promote new connective tissue with the histological appearance of tendon over the surface of the native cuff tendon.

[BACK](#)

## **Association of Traumatic and Atraumatic Posterior Shoulder Instability With Glenoid Retroversion and Outcomes After Arthroscopic Capsulolabral Repair**

J. Christoph Katthagen, M.D., Dimitri S. Tahal, M.Sc., Scott R. Montgomery, M.D., Marilee P. Horan, M.P.H., Peter J. Millett, M.D., M.Sc.

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### **Purpose**

To compare glenoid retroversion and functional outcomes between patients with traumatic onset of posterior shoulder instability (PSI) and patients with atraumatic onset of PSI.

### **Methods**

Patients with PSI who underwent arthroscopic posterior capsulolabral anchor repair, were active in sports, and had undergone surgery a minimum of 2 years earlier were included. Traumatic onset was defined as PSI that occurred after a trauma with the shoulder in adduction, flexion, and internal rotation in patients with no history of instability. Subjective evaluations were obtained with the American Shoulder and Elbow Surgeons (ASES); Quick Disabilities of the Arm, Shoulder and Hand; Single Assessment Numeric Evaluation (SANE); and Short Form 12 Physical Component Summary scores preoperatively and after a minimum 2-year follow-up postoperatively. Additional questions assessed return to sport and shoulder stability. Glenoid version was measured with a 2-dimensional glenoid vault method on magnetic resonance imaging.

### **Results**

A total of 41 shoulders in 38 patients were eligible for inclusion (3 female and 35 male patients; mean age, 27.6 years; age range, 13 to 66 years). Three patients refused participation, and 2 patients required subsequent surgery for failure. Postoperative outcomes were available for 32 of the remaining 36 shoulders (89%) with a mean follow-up of 4.1 years (range, 2.0 to 7.8 years; 20 atraumatic and 12 traumatic). The ASES score improved significantly in both groups ( $P < .03$ ), whereas the SANE; Quick Disabilities of the Arm, Shoulder and Hand; and Short Form 12 Physical Component Summary scores only significantly improved for patients with traumatic PSI ( $P < .02$ ). Baseline score-adjusted comparison between groups showed that the postoperative median ASES scores (atraumatic, 95.8; traumatic, 99.9) and SANE scores (atraumatic, 86.5; traumatic, 98.0) were significantly more improved in patients with traumatic PSI ( $P = .01$  and  $P = .012$ , respectively). Atraumatic PSI was associated with significantly higher glenoid retroversion ( $-21.8^\circ \pm 4.2^\circ$  vs  $-17.7^\circ \pm 5.5^\circ$ ,  $P = .032$ ). There was no significant difference regarding return to sport ( $P = .375$ ) or postoperative re-dislocations ( $P = .99$ ) between the groups.

### **Conclusions**

A traumatic onset of PSI was associated with higher degrees of glenoid retroversion and less favorable functional outcomes of arthroscopic posterior capsulolabral anchor repair than traumatic PSI.

[BACK](#)

## **Biomechanical Comparison of Open and Arthroscopic Transosseous Repair of Triangular Fibrocartilage Complex Foveal Tears: A Cadaveric Study**

Ching-Hou Ma, M.D., Ting-Sheng Lin, Ph.D., Chin-Hsien Wu, M.D, Dong-Yi Li, M.S., Shih-Chieh Yang, M.D., Yuan-Kun Tu, M.D., Ph.D.

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### **Purpose**

To biomechanically compare the stability between open repair and arthroscopic transosseous repair technique for reattachment of the foveal triangular fibrocartilage complex (TFCC). We also evaluated the feasibility of a new aiming device for the creation of 2 bone tunnels simultaneously during the arthroscopic technique.

### **Methods**

Six matched pairs of fresh-frozen forearm cadaver specimens were prepared for testing. Group I specimens were treated by open repair with suture anchor. Group II specimens were treated by arthroscopic transosseous suture with a new aiming device. Before and after disruption of the TFCC fovea and after its repair, dorsal and palmar translation of the ulna was measured in both groups in response to a load (3 kg) applied in the palmar and then in the dorsal direction. The total translation of the ulna was calculated as the sum of the mean dorsal and palmar translations.

### **Results**

The mean total ulnar translation before and after TFCC disruption, and after TFCC repair was  $5.94 \pm 2.16$  mm,  $9.08 \pm 2.64$  mm, and  $6.04 \pm 2.18$  mm, respectively. The specimens demonstrated a significant increase in the total translation of the ulna after disruption of the ulnar attachment of TFCC ( $P = .003$ ), whereas a significant decrease was observed after TFCC foveal repair ( $P = .003$ ). The median percentage of eliminated translation after TFCC repair was 64% and 172%, respectively, in groups I and II ( $P = .043$ ).

### **Conclusions**

The arthroscopic transosseous suture technique demonstrated superior repair efficacy to the open repair technique in terms of biomechanical strength. This cadaveric study also demonstrated the feasibility of a new aiming device.

### **Clinical Relevance**

When making decisions about TFCC foveal repair, arthroscopic transosseous suture technique may provide better biomechanical strength than the open repair technique.

[BACK](#)

## **Midterm Outcomes After Arthroscopic Anteroinferior Capsular Release for the Treatment of Idiopathic Adhesive Capsulitis**

Maximiliano Ranalletta, Luciano Andrés Rossi, Ezequiel Ernesto Zaidenberg, Carlos Campos, Tanoira Ignacio, Gastón Daniel Maignon, Santiago Luis Bongiovanni

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### **Purpose**

The purpose of this study is to report the early and midterm functional outcomes and complications of a consecutive series of patients with primary adhesive capsulitis who were treated with isolated anteroinferior arthroscopic capsular release after they did not respond to conservative treatment

### **Methods**

Thirty-two consecutive patients with idiopathic adhesive capsulitis who did not respond to conservative physiotherapy were included in the study. Arthroscopic anteroinferior capsular release was performed in all cases. The primary outcome was improvement in range of motion in the short- and midterm follow-up. We also evaluated pain relief with the visual analog scale, functional outcomes with the Constant–Murley score, and we registered postoperative complications.

### **Results**

The mean age was 49.6 years (range, 33-68 years) and the mean follow-up was 63 months (range, 18-84). Overall, there was significant improvement in the Constant–Murley score from 42.4 to 86 points ( $P < .001$ ). The visual analog scale decreased by approximately 6.3 points compared with the preoperative value ( $P < .001$ ). All parameters improved significantly the first 6 months and then remained stable until the end of follow-up ( $P < .001$ ). There was an additional minor improvement in both parameters between the sixth month and the final follow-up; however, this improvement was less than in the first 6 months and it was not statistically significant.

### **Conclusions**

In patients who don't respond to conservative treatment for primary adhesive capsulitis, isolated anteroinferior capsular release provides a reliable improvement in pain and range of motion that is maintained in the mid-term follow-up.

### **Level of Evidence**

Level IV, therapeutic, case series study.

[BACK](#)

## **Impact of Arthroscopic Lateral Acromioplasty on the Mechanical and Structural Integrity of the Lateral Deltoid Origin: A Cadaveric Study**

Daniel Cole Marchetti, J. Christoph Katthagen, Jacob D. Mikula, Scott R. Montgomery, Dimitri S. Tahal, Kimi D. Dahl, Travis Lee Turnbull, Peter J. Millett

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### **Purpose**

To determine whether a 5-mm and/or 10-mm arthroscopic lateral acromioplasty (ALA) would weaken the structural and mechanical integrity of the lateral deltoid.

### **Methods**

The acromion and lateral deltoid origin were harvested from 15 pairs ( $n = 30$ ) of fresh-frozen human cadaveric shoulder specimens. One side of each specimen pair (left or right) was randomly assigned to either a 5-mm ( $n = 7$ ) or 10-mm ( $n = 8$ ) ALA group, and the contralateral sides ( $n = 15$ ) were used as matched controls. Acromion thickness and width were measured pre- and postoperatively. After ALA, specimens were inspected for damage to the lateral deltoid origin. Each specimen was secured within a dynamic testing machine, and the deltoid muscle was pulled to failure. Statistical analysis was performed to determine whether ALA reduced the lateral deltoid's failure load.

### **Results**

There was no significant difference in failure load between the 5-mm ALA group ( $661 \pm 207$  N) and its matched control group ( $744 \pm 212$  N; mean difference = 83 N; 95% confidence interval [CI],  $-91$  to 258;  $P = .285$ ) nor between the 10-mm ALA group ( $544 \pm 210$  N) and its matched control group ( $598 \pm 157$  N; mean difference = 54 N; 95% CI,  $-141$  to 250;  $P = .532$ ). There was no correlation found between the amount of bone resected (measured by percent thickness and width of the acromion after ALA) and the failure load of the deltoid. Visual evaluation of the acromion after ALA revealed the lateral deltoid origin had no damage in any case.

### **Conclusions**

ALA did not weaken the structural or mechanical integrity of the lateral deltoid origin. Neither a 5-mm nor a 10-mm ALA significantly reduced the deltoid's failure load. The lateral deltoid origin was not macroscopically damaged in any case.

### **Clinical Relevance**

ALA can be performed without the potential risk of macroscopically damaging the lateral deltoid origin or reducing its failure load.

[BACK](#)

## **Comparison of Intra-articular Findings and Clinical Features Between Patients With Symptomatic Anterior Instability After Recurrent Shoulder Subluxation and Dislocation**

Sang-Jin Shin, Young-Won Ko, Yoon Sang Jeon, Juyeob Lee, Rag Gyu Kim, Hyungki Baek

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### **Purpose**

The purpose of this study was to compare the prevalence of concomitant intra-articular pathologies and clinical manifestations after arthroscopic stabilization between patients with symptomatic anterior instabilities following recurrent shoulder subluxations and dislocations.

### **Methods**

Among patients who underwent arthroscopic stabilization, 28 patients who experienced shoulder subluxations (subluxation group,  $26.7 \pm 1.8$  years) and 84 who had shoulder dislocations (dislocation group,  $25.9 \pm 2.2$  years) were included. Recurrent shoulder subluxation was defined as instability caused by repeated injuries without a history of frank dislocation or manual reduction maneuver. Common inclusion criteria were positive clinical test of anterior instability and Bankart lesion with less than 25% of glenoid bone loss. The pathoanatomies in radiologic and arthroscopic examinations and postoperative clinical outcomes were compared.

### **Results**

The number of instability events was significantly fewer in the subluxation group ( $5.0 \pm 1.3$ ) than in the dislocation group ( $12.1 \pm 2.0$ ;  $P = .01$ ). The pathologic findings in preoperative radiology demonstrated no intergroup differences, except for the prevalence of Hill-Sachs lesions. In the subluxation group, the Hill-Sachs lesions were significantly less commonly detected with computed tomography and magnetic resonance arthrography (28.6%) than in the dislocation group (63.1%, 60.7%;  $P = .001$ ,  $P = .003$ , respectively). There were no significant differences in arthroscopic findings in both groups including superior labral anterior to posterior lesion (subluxation group, 39.3%; dislocation group, 45.2%), anterior labral periosteal sleeve avulsion lesion (21.4%, 29.8%), and bony Bankart lesion (21.4%, 28.6%). Preoperative and postoperative functional outcomes also did not differ between the groups. There was no statistical difference in terms of the rate of revision or postoperative subjective instability.

### **Conclusions**

Patients who had anterior instability after recurrent shoulder subluxation demonstrated a similar rate of concomitant intra-articular pathologies requiring the same level of management as recurrent shoulder dislocation. Recurrent shoulder subluxation also displayed similar functional outcomes and failure rate after arthroscopic stabilization procedures as recurrent dislocation. Thus, the clinical importance of symptomatic recurrent subluxation should be considered comparable with that of recurrent dislocation.

### **Level of Evidence**

Level IV, case control study.

[BACK](#)



## Identification of a Remodeled Neo-tendon After Arthroscopic Latarjet Procedure

Daniel Smolen, Philip Went, Dirk Tomala, Christoph Sternberg, Laurent Lafosse, Jan Leuzinger

Arthroscopy, March 2017, Volume 33, Issue 3, Pages 534–542

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### Purpose

To macroscopically, histologically, and radiologically describe a time-dependent remodeling process of a neo-tendon or -ligament in the shoulder after the arthroscopic Latarjet procedure.

### Methods

During follow-up surgery after the arthroscopic Latarjet procedure, 17 shoulders in 16 patients were evaluated for a remodeled tendon-like structure. The mean overall follow-up period was 27.4 months. The mean time between the arthroscopic Latarjet procedure and revision was 11.6 months. All shoulders were evaluated with magnetic resonance imaging, and seven histologic specimens were obtained during revision surgery.

### Results

A distinct, oriented strand of tissue was found in 16 of 17 shoulders on revision surgery. Postoperative magnetic resonance imaging analyses showed a signal-free, longitudinal tendon-like structure originating at the tip of the acromion, traversing the space of the former subcoracoid bursa to attach in the course of the transposed conjoint tendon or the proximal short head of the biceps. Histologic analysis of seven specimens showed a characteristic timeline of remodeling.

### Conclusions

A tendon- or ligament-like structure is remodeled between the anterior bottom tip of the acromion and the transposed coracoid process in a time-dependent manner after the arthroscopic Latarjet procedure.

### Level of Evidence

Level IV, therapeutic case series.

[BACK](#)

## **Graft Augmentation Versus Bridging for Large to Massive Rotator Cuff Tears: A Systematic Review**

Yohei Ono, Diego Alejandro Dávalos Herrera, Jarret M. Woodmass, Richard S. Boorman, Gail M. Thornton, Ian K.Y. Lo

Arthroscopy, March 2017, Volume 33, Issue 3, Pages 673–680

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### **Purpose**

To systematically review the literature on the healing rates and clinical outcomes of the 2 different graft indications (i.e., augmentation vs bridging) during rotator cuff repair.

### **Methods**

A systematic literature review was performed for clinical studies of rotator cuff repair using grafts for large to massive tears. The primary outcome was tendon healing on either magnetic resonance imaging or ultrasound. The secondary outcomes included visual analog scale for pain, American Shoulder and Elbow Surgeons score, and University of California at Los Angeles score, and forward elevation. Studies were divided into augmentation and bridging groups, and outcomes were compared statistically.

### **Results**

Twelve studies with 13 study groups were included: 167 repairs in the augmentation group and 247 repairs in the bridging group. For augmentation and bridging groups, the mean age was 62.2 and 62.8 years and the mean follow-up was 28.5 and 37.7 months, respectively. The estimated healing rates were 64.0% for augmentation and 77.9% for bridging. Although both procedures had improved clinical outcomes, no statistical difference between groups was detected except lower visual analog scale in the bridging group at follow-up.

### **Conclusions**

Bridging grafts had no significant difference in healing or clinical outcomes when compared with a graft used for augmentation. Bridging grafts may be considered for this difficult patient population with large to massive rotator cuff tears.

### **Level of Evidence**

Level IV, systematic review of Level II to IV studies.

[BACK](#)

JSES

Volume 26, Issue 2, p179-552, e29- e84

## **Higher critical shoulder angle increases the risk of retear after rotator cuff repair**

JSES, February 2017 Volume 26, Issue 2, Pages 241–245

Grant H. Garcia, Joseph N. Liu, MD, Ryan M. Degen, MD, Christine C. Johnson, MD, Alexander Wong, BA, David M. Dines, MD, Lawrence V. Gulotta, MD, Joshua S. Dines, MD

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### Background

No evaluation has been done on the relationship of the critical shoulder angle (CSA) with retear after rotator cuff repair. Our purpose was to evaluate whether a higher CSA is associated with retear after rotator cuff repair.

### Methods

This was a retrospective review of 76 patients who had undergone rotator cuff repair with postoperative ultrasound examination. Ultrasound findings were graded no retear (NT), partial-thickness (PT) retear, or full-thickness (FT) retear. Preoperative radiographs were used to measure CSA, glenoid inclination, lateral acromion angle, and acromion index.

### Results

Average age was 61.9 years (45.3-74.9 years). On ultrasound examination, 57 shoulders (74.0%) had NT, 11 (14.2%) had PT retears, and 8 (10.3%) had FT retears. There was no significant difference in retear rate by age, gender, or tension of repair. Average CSA was significantly lower for the NT group at  $34.3^\circ \pm 2.9^\circ$  than for the FT group at  $38.6^\circ \pm 3.5^\circ$  ( $P < .01$ ). If CSA was  $>38^\circ$ , the odds ratio of having an FT retear was 14.8 ( $P < .01$ ). In addition, higher CSA inversely correlated with postoperative American Shoulder and Elbow Surgeons scores ( $P < .03$ ). Average glenoid inclination was significantly lower in the NT group at  $12.3^\circ \pm 2.7^\circ$  compared with  $17.3^\circ \pm 2.6^\circ$  in the FT group ( $P < .01$ ). If glenoid inclination was  $>14$ , the odds ratio of having a FT retear was 15.0 ( $P < .01$ ).

### Conclusion

At short-term follow-up, higher CSA significantly increased the risk of an FT retear after rotator cuff repair. Also, increasing CSA correlated with worse postoperative American Shoulder and Elbow Surgeons scores. This radiographic marker may help manage expectations for rotator cuff tear patients.

[BACK](#)

## **Rotator cuff surgery in patients older than 75 years with large and massive tears**

Hong Jun Jung, MD, Gyeong-Bo Sim, MD, Kun Hyung Bae, MD, Aashay L. Kekatpure, MBBS, DNB, Jae-Myeung Chun, MD, In-Ho Jeon

JSES, February 2017 Volume 26, Issue 2, Pages 265–272

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### **Background**

The purpose of this study was to evaluate whether rotator cuff repair improves subjective and functional outcomes in patients aged  $\geq 75$  years.

### **Methods**

From May 2005 to March 2013, 121 elderly patients who underwent rotator cuff repair for large and massive rotator cuff tears were evaluated retrospectively. Patients with an American Society of Anesthesiologists physical status classification system grade  $\geq 4$  were excluded. The patients were evaluated using visual analog scales, subjective satisfaction surveys, American Shoulder and Elbow Surgeons scores, and Constant scores. The Katz index of activity of daily living (ADL) and functional independence measure motor score were used to evaluate ADLs. Postoperative magnetic resonance imaging (MRI) was performed to investigate the structural integrity of repaired cuffs.

### **Results**

In total, 64 patients were enrolled in the study; 80% were satisfied with their results. Visual analog scale scores improved from 6.4 to 2.3, American Shoulder and Elbow Surgeons scores from 42 to 84, and Constant scores from 42 to 76. Katz ADL scores improved from 3.4 to 5.0. Functional independence measure motor score improved from 22 to 51. Of the 64 patients, 46 underwent MRI 1 year postoperatively. Follow-up MRI revealed retears in 26% of patients. All patients with retears had improved subjective outcomes and functional scores. No patients died or experienced complications requiring intensive care or extended hospitalization.

### **Conclusions**

Surgical treatment for large to massive rotator cuff tears in elderly patients with American Society of Anesthesiologists grade  $< 4$  provides good functional outcomes without morbidity, even in those with retears.

[BACK](#)

KSSTA

Volume 25, Issue 2-3, February - March 2017

**No upper extremity arthroscopy abstracts available**

[BACK](#)

AJSM

February 2017, Vol 45, Issue 2

March 2017, Volume 45, Issue 3

## **A Prospective Randomized Study Comparing the Interference Screw and Suture Anchor Techniques for Biceps Tenodesis**

Ji Soon Park, Sae Hoon Kim, Ho Jin Jung, Ye Hyun Lee, Joo Han Oh

The American Journal of Sports Medicine Vol 45, Issue 2; pp. 440–448

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**Background:** Several methods are used to perform biceps tenodesis in patients with superior labrum-biceps complex (SLBC) lesions accompanied by a rotator cuff tear. However, limited clinical data are available regarding the best technique in terms of clinical and anatomic outcomes.

**Purpose:** To compare the clinical and anatomic outcomes of the interference screw (IS) and suture anchor (SA) fixation techniques for biceps tenodesis performed along with arthroscopic rotator cuff repair.

**Study Design:** Randomized controlled trial; Level of evidence, 2.

**Methods:** A total of 80 patients who underwent arthroscopic rotator cuff repair with SLBC lesions were prospectively enrolled and randomly divided according to the tenodesis method: the IS and SA groups. Functional outcomes were evaluated with the visual analog scale (VAS) for pain, American Shoulder and Elbow Surgeons (ASES) score, Simple Shoulder Test (SST), Constant score, Korean Shoulder Score (KSS), and long head of the biceps (LHB) score at least 2 years after surgery. The anatomic status of tenodesis was estimated using magnetic resonance imaging or ultrasonography, and the anatomic failure of tenodesis was determined when the biceps tendon was not traced in the intertubercular groove directly from the insertion site of the IS or SA.

**Results:** Thirty-three patients in the IS group and 34 in the SA group were monitored for more than 2 years. All postoperative functional scores improved significantly compared with the preoperative scores (all  $P < .001$ ) and were not significantly different between the groups, including the LHB score (all  $P > .05$ ). Nine anatomic failures of tenodesis were observed: 7 in the IS group and 2 in the SA group ( $P = .083$ ). In a multivariate analysis using logistic regression, IS fixation ( $P = .003$ ) and a higher (ie, more physically demanding) work level ( $P = .022$ ) were factors associated with the anatomic failure of tenodesis significantly. In patients with tenodesis failure, the LHB score ( $P = .049$ ) and the degree of Popeye deformity by the patient and examiner ( $P = .004$  and  $.018$ , respectively) were statistically different compared with patients with intact tenodeses.

Conclusion: Care must be taken while performing biceps tenodesis in patients with a higher work level; IS fixation appears to pose a higher risk in terms of the anatomic failure of tenodesis than SA fixation, although functional outcomes were not different.

[BACK](#)

JBJS

2017: Jan-Feb, volume 99, issue 1-4

**No upper extremity arthroscopy abstracts available**

[BACK](#)



CORR

February - March 2017, Vol 475, Issue 2-3

**No upper extremity arthroscopy abstracts available**

[BACK](#)

BJJ

February - March 2017, Vol 99-B, Issue 2-3

**No upper extremity arthroscopy abstracts available**

[BACK](#)

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## Lower extremity

Arthroscopy

Volume 33, Issue 2, p239 – 690

### Contribution of the Pubofemoral Ligament to Hip Stability: A Biomechanical Study

Hal D. Martin, D.O., Anthony N. Khoury, M.S., Ricardo Schröder, P.T., Eric Johnson, B.S., Juan Gómez-Hoyos, M.D., Salvador Campos, M.D., Ian J. Palmer, Ph.D.

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#### Purpose

To determine the isolated function of the pubofemoral ligament of the hip capsule and its contribution to hip stability in external/internal rotational motion during flexion greater than 30° and abduction.

#### Methods

Thirteen hips from 7 fresh-frozen pelvis-to-toe cadavers were skeletonized from the lumbar spine to the distal femur with the capsular ligaments intact. Computed tomographic imaging was performed to ensure no occult pathological state existed, and assess bony anatomy. Specimens were placed on a surgical table in supine position with lower extremities resting on a custom-designed polyvinylchloride frame. Hip internal and external rotation was measured with the hip placed into a combination of the following motions: 30°, 60°, 110° hip flexion and 0°, 20°, 40° abduction. Testing positions were randomized. The pubofemoral ligament was released and measurements were repeated, followed by releasing the ligamentum teres.

#### Results

Analysis of the 2,106 measurements recorded demonstrates the pubofemoral ligament as a main controller of hip internal rotation during hip flexion beyond 30° and abduction. Hip internal rotation was increased up to 438.9% ( $P < .001$ ) when the pubofemoral ligament was released and 412.9% ( $P < .001$ ) when both the pubofemoral and teres ligament were released, compared with the native state.

#### Conclusions

The hypothesis of the pubofemoral ligament as one of the contributing factors of anterior inferior hip stability by controlling external rotation of the hip in flexion beyond 30° and abduction was disproved. The pubofemoral ligament maintains a key function in limiting internal rotation in the position of increasing hip flexion beyond 30° and abduction. This cadaveric study concludes previous attempts at understanding the anatomical and biomechanical function of the capsular ligaments and their role in hip stability.

## Clinical Relevance

The present study contributes to the understanding of hip stability and biomechanical function of the pubofemoral ligament.

[BACK](#)

## **Restricted Hip Rotation Is Correlated With an Increased Risk for Anterior Cruciate Ligament Injury**

Curtis VandenBerg, M.D., Eileen A. Crawford, M.D., Elizabeth Sibilsky Enselman, M.Ed., A.T., A.T.C., C.C.R.P., Christopher B. Robbins, Ph.D., Edward M. Wojtys, M.D., Asheesh Bedi, M.D.

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### Purpose

The primary purpose was to compare ipsilateral hip internal rotation (IR) in male and female athletes with or without an anterior cruciate ligament (ACL) tear. A secondary purpose was to compare radiographic markers of femoroacetabular impingement (FAI) in patients with or without an ACL tear.

### Methods

In this prospective case-control study, based on a power analysis, a convenience sample of 25 ACL-injured and 25 control patients matched by age and gender were examined over 14 months. The ACL injury group included preoperative patients 12-40 years old with an ACL rupture within the previous 3 months with no prior lower extremity injuries, ligamentous laxity, or arthralgias. Controls included patients presenting with an upper extremity complaint with no history of knee injury. In the outpatient clinic, hip axial rotation range of motion was measured with a goniometer on physical examination and hip radiographs were evaluated for morphologic variations consistent with FAI. Univariate analysis of variance was used to examine differences between groups.

### Results

Each group had 13 males and 12 females, average ages of  $22.8 \pm 7.2$  years (ACL group) versus  $24.5 \pm 7.9$  years (controls;  $P = .439$ ). The average sum of hip rotation (internal plus external) in patients with an ACL tear was  $60.3 \pm 12.4^\circ$  compared with  $72.6 \pm 17.2^\circ$  in controls ( $P = .006$ ). ACL-injured patients had decreased hip IR compared with controls, with respective mean measurements of  $23.4 \pm 7.6^\circ$  versus  $30.4 \pm 10.4^\circ$  ( $P = .009$ ). For every  $10^\circ$  increase in hip IR, the odds of having an ACL tear decreased by a factor of 0.419 ( $P = .015$ ).

### Conclusions

Risk of ACL injury is associated with restricted hip IR, and as hip IR increases, the odds of having an ACL tear decreases. In addition, ACL injury is associated with FAI in a generalized population of male and female athletes, although causality cannot be determined and most ACL-injured patients do not exhibit hip complaints.

Level of Evidence

Level II, prognostic, prospective cohort study.

[BACK](#)

## **The Distribution of Impingement Region in Cam-Type Femoroacetabular Impingement and Borderline Dysplasia of the Hip With or Without Cam Deformity: A Computer Simulation Study**

Naomi Kobayashi, M.D., Ph.D., Yutaka Inaba, M.D., Ph.D., So Kubota, M.D., So Nakamura, Taro Tezuka, M.D., Ph.D., Yohei Yukizawa, M.D., Ph.D., Hyonmin Choe, M.D., Ph.D., Tomoyuki Saito, M.D., Ph.D.

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### **Purpose**

To identify the distribution of the impingement region in cam-type femoroacetabular impingement (FAI) or patients with borderline developmental dysplasia of the hip (DDH) using computer simulation analysis.

### **Methods**

A total of 51 painful hip joints from 42 consecutive cases diagnosed as cam-type FAI (center edge [CE] angle  $\geq 25^\circ$ , alpha angle  $\geq 55^\circ$ ) or borderline DDH (CE angle  $\geq 20^\circ$  and  $< 25^\circ$ ) with or without a cam deformity (alpha angle  $\geq 55^\circ$  or  $< 55^\circ$ ) were enrolled. ZedHip (Lexi, Tokyo, Japan) 3-dimensional computer simulation was used to identify impingement points. Computed tomography data were used for 3-dimensional modeling and impingement simulation. The maximum flexion angle and maximum internal rotation angle at  $90^\circ$  were evaluated. The impingement point was identified at a position of maximum internal rotation and  $90^\circ$  of flexion. Six impingement regions were defined. Differences in the distribution of the impingement region were evaluated between groups.

### **Results**

There were significant differences in range of motion at maximum flexion and internal rotation among the 3 groups ( $P < .0001$ ). There was no significant difference in the distribution of the impingement point in the cam-type FAI group ( $P = .71$ ); similarly, there was no significant difference in the borderline DDH with a cam deformity group ( $P = .071$ ). On the other hand, in terms of proximal or distal sites, there was a significant difference between the borderline DDH with and without a cam deformity group ( $P < .001$ ).

### **Conclusions**

The impingement region in cases of cam-type FAI was variable. The coexistence of a cam deformity affected the distribution of the impingement region in cases of borderline DDH; the region tended to be distributed across proximal rather than distal regions. The site of cam osteochondroplasty should be based on the identified impingement point, particularly in cases of cam-type FAI and borderline DDH with a cam deformity.

Level of Evidence  
Level IV, case control study.

[BACK](#)

## **Morphologic Changes and Outcomes After Arthroscopic Acetabular Labral Repair Evaluated Using Postoperative Computed Tomography Arthrography**

Jun-Il Yoo, M.D., Yong-Chan Ha, M.D., Ph.D, Young-Kyun Lee, M.D., Ph.D., Guen-Young Lee, M.D., Ph.D., Moon-Jib Yoo, M.D., Ph.D., Kyung-Hoi Koo, M.D., Ph.D.

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### **Purpose**

To investigate smaller sized labra after acetabular labral repair comparing preoperative and postoperative computed tomography arthrography (CTA) and to assess the correlation between the anatomic changes and clinical outcomes.

### **Methods**

The design and protocol of this retrospective study were approved by the institutional review board of our hospital. The inclusion criteria included age older than 18 years and hip pain associated with mechanical symptoms. Patients with previous hip surgery, avascular necrosis, rheumatologic disorders, or advanced arthritis were excluded. All tears with femoroacetabular impingement were treated with bumpectomy or acetabuloplasty and repaired using arthroscopic suture anchors. We evaluated clinical outcomes using the modified Harris Hip Score (mHHS) and the morphologic changes and radiologic outcomes (labral retear and leakage of dye) using CTA at a minimum 2-year follow-up. The paired *t* test was performed to detect changes in labral height, labral width, and mHHS.

### **Results**

Forty labral tears in 40 patients (mean age,  $32.1 \pm 9.2$  years) underwent labral repair, with femoroplasty in 20 hips and acetabuloplasty in 17 hips, and no patients required capsular repair after capsulotomy. No leakage of contrast dye was detected during the follow-up CTA procedure. No labral retears were observed after labral refixation at the postoperative CTA evaluation. However, the mean width and height of the labrum changed from 8.1 mm and 4.9 mm, respectively, preoperatively to 6.7 mm and 4.4 mm, respectively, at the postoperative follow-up (decreasing by 19% and 11%, respectively; both  $P < .001$ ). In addition, the mean mHHS for the 36 patients in the complete repair group improved from  $61 \pm 16.0$  to  $90 \pm 9.6$  ( $P = .01$ ). Four hips showed incomplete repairs.

### **Conclusions**

Repaired labra are well maintained after capsulotomy based on follow-up CTA after arthroscopic labral repair. In addition, decreased height and width of the labra do not affect the clinical outcomes.

Level of Evidence

Level IV, therapeutic study (case series [no, or historical, control group]).

[BACK](#)

## **A Comparison of the Outcomes for Cartilage Defects of the Knee Treated With Biologic Resurfacing Versus Focal Metallic Implants**

Cecilia Pascual-Garrido, M.D., Erika Daley, M.D., Nikhil N. Verma, M.D., Brian J. Cole, M.D., M.B.A.

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### **Purpose**

To compare the results of focal metallic resurfacing with biologic procedures in patients more than 35 years of age with isolated, full thickness defects of the femoral condyle.

### **Methods**

A total of 61 patients met the selection criteria resulting in 30 patients treated with biological procedures, including debridement, microfracture, osteochondral autograft transplantation, osteochondral allograft, and autologous chondrocyte implantation (BIO group), and 32 patients treated with focal metallic resurfacing (CAP group). The BIO and CAP groups were matched according to treatment location, defect grade and size, and age profile. Outcomes included Western Ontario and McMaster Osteoarthritis Index (WOMAC), Short Form-12, and satisfaction. The primary combination endpoint was determined as a 20% improvement (minimum clinically important difference-20) on WOMAC pain and function at 2 years and no additional index lesion-related surgical intervention. Safety and effectiveness were also reported.

### **Results**

Thirty patients in the BIO group (mean age of 44.6, range 35-64) had an average follow-up of 2.6 years and 32 patients in the CAP group (mean age 47.9, range 37-68) were followed for 2.0 years. Fifty-three percent in the BIO group and 75% in the CAP group achieved success per the endpoint definition. The mean total WOMAC score improved significantly for both groups (BIO: 57-78;  $P < .001$ ) (CAP: 41-86;  $P < .001$ ). The physical component score (Short Form-12 PCS) improved significantly in the CAP group only (30-36.4;  $P < .001$ ). Good to excellent patient satisfaction was achieved by 80% in BIO and 91% in CAP. There were 4 secondary procedures on the index lesion in the BIO group and 2 in the CAP group.

### **Conclusions**

Careful patient selection can achieve high satisfaction rates with both biological and focal metal resurfacing procedures for the treatment of isolated focal chondral lesions of the femoral condyle in the knee. Focal metallic resurfacing results in similar clinical outcomes and provides excellent success rates at short-term follow-up.

Level of Evidence  
Level III comparative study.

[BACK](#)

## **Long-term Survival Analysis of Meniscus Allograft Transplantation With Bone Fixation**

Jong-Min Kim, M.D., Seong-Il Bin, M.D., Bum-Sik Lee, M.D., Nam-Ki Kim, M.D., Ju-Ho Song, M.D., Jun-Weon Choi, M.D., Chang-Rack Lee, M.D.

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### **Purpose**

To investigate the long-term clinical results and clinical survival rate of meniscus allograft transplantation (MAT) with bone fixation.

### **Methods**

The inclusion criteria of this study were previous MAT with bone fixation technique in our institution and minimum follow-up duration of 8 years. Potential subjects were identified using the medical records and database that was prospectively collected from December 1996 to December 2005. The exclusion criteria were diffuse International Cartilage Repair Society grade IV articular cartilage degeneration that was not treated with a concomitant or staged cartilage repair procedure. Surgical indication for MAT was previous total or subtotal meniscectomy followed by persistent swelling and pain in involved compartment. Recommendations to return to contact sports or strenuous activities were not made. Clinical outcomes were evaluated using the modified Lysholm score, and comparison between preoperative and final Lysholm score was done using Student *t*-test. During the follow-up period, failure was defined as (1) subtotal resection of the allograft, (2) conversion to total knee arthroplasty, or (3) a modified Lysholm score less than 65 or that of the preoperative status. Survival analysis was performed using the Kaplan-Meier method.

### **Results**

During the study period, 52 knees underwent MAT in our institution and 49 knees were eligible for this study. Three knees were excluded because they had diffuse grade IV cartilage degeneration in the respective compartment. Among the 49 knees enrolled, 34 underwent lateral and 15 underwent medial MAT. Two patients had bilateral lateral MAT. Of those 47 patients, 37 were male and 10 were female. Mean patient age at the time of the MAT was  $30.4 \pm 8.6$  years. The median follow-up period was 11.5 years (8 to 17 years). The preoperative mean modified Lysholm score was  $73.2 \pm 10.6$ , which significantly increased to  $89.4 \pm 13.2$  at the time of the final follow-up ( $P < .001$ ). There were 2 failures noted at 6 months and 11.3 years, respectively, after MAT. All of the other allografts were surviving at the time of the latest follow-up. The 10-year survival rate was 98.0% (95% confidence interval [CI], 94.1%-100%), and the 15-year survival rate was 93.3% (95% CI, 83.7%-100%) according to the Kaplan-Meier analysis.



## Conclusions

MAT using the bone fixation techniques demonstrated a high clinical survival rate according to the long-term observation.

## Level of Evidence

Level IV, therapeutic case series.

[BACK](#)

## **Inter- and Intrarater Reliability of the Femoral Tunnel Clock-Face Grading System During Anterior Cruciate Ligament Reconstruction**

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## Purpose

To determine the inter- and intrarater reliability of the clock-face grading system as used by 3 fellowship-trained sports medicine surgeons.

## Methods

Arthroscopic video was taken of the femoral tunnel placement during 20 consecutive anterior cruciate ligament (ACL) reconstructions performed by 2 surgeons. All femoral tunnels were created using a medial portal technique. The video was taken using a 30° arthroscope placed in the lateral portal and showed the femoral tunnel as well as the remainder of the femoral notch, the posterior cruciate ligament, and the menisci for orientation. Three fellowship-trained sports medicine surgeons were asked to review the videos and assign an o'clock position to the femoral tunnel from the 9 to the 3 o'clock positions in "half-hour" increments. They were also asked to review the videos again 6 months later to determine intrarater reliability. Inter-rater reliability was evaluated using the intraclass correlation coefficient (ICC) 2-way mixed effect model with absolute agreement. The Spearman rank-order correlation coefficient ( $r$ ) was applied to evaluate intrarater reliability.

## Results

The inter-rater reliability as measured by the ICC revealed poor agreement between the 3 surgeons (ICC = 0.204, 95% confidence interval = -0.015 to 0.491,  $F = 2.8$ ,  $P = .004$ ). The intrarater reliability at a 6-month interval was found to be moderate ( $r$ 's = .43,  $P = .004$ ).

## Conclusions

The inter-rater reliability of the clock-face femoral tunnel grading system was found to be poor among fellowship-trained sports medicine surgeons whereas the intrarater reliability was found to be moderate. The utility of the femoral tunnel clock-face grading system may be compromised by suboptimal inter- and intrarater reliability, making it less useful as a tool of communication between surgeons.

Level of Evidence

Level IV, case series with poor reference standard.

[BACK](#)

## **Long-term Results of Arthroscopic Arthrolysis for Arthrofibrosis After Anterior Cruciate Ligament Reconstruction**

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### **Purpose**

The current study was conducted to evaluate the long-term clinical and radiological outcomes after arthroscopic arthrolysis for arthrofibrosis after anterior cruciate ligament reconstruction (ACLR).

### **Methods**

All patients treated with arthrolysis between 1990 and 1998 were included. Indication was arthrofibrosis in at least one knee compartment or a cyclops syndrome limiting range of motion (ROM) by  $> 5^\circ$  of extension deficit and  $15^\circ$  of flexion deficit. International Knee Documentation Committee (IKDC) 2000 subjective and objective, Lysholm score, and x-ray evaluation were documented. Statistical analysis and power calculation were performed ( $P < .05$ ).

### **Results**

One hundred forty-one patients (follow-up, 71%) were examined at a mean of  $18.7 \pm 2.6$  years after arthroscopic arthrolysis. Mean IKDC 2000 score was  $79.49 \pm 14.32$ . IKDC objective was normal in 0%, nearly normal in 6%, abnormal in 56%, and severely abnormal in 38%. One hundred percent of patients showed more than grade II osteoarthritis. ROM improvement after arthrolysis did not change significantly compared with midterm results ( $t = 4.5$  years). Patients with persisting motion deficits ( $P = .02$ ) and after medial meniscus resection ( $P < .001$ ) at time of ACLR showed significantly greater progression of osteoarthritis in comparison with patients without these additional disorders. In case of arthrolysis later than 1 year after ACLR, a more severe osteoarthritis grade (4% vs 20% grade III;  $P = .038$ ) and a lower jump distance (IKDC: 61% A, 25% B vs 39% A, 41% B;  $P = .028$ ) were obvious compared with patients who underwent arthrolysis within the first year after ACLR.

### **Conclusions**

Long-term motion improvement can be achieved by arthrolysis. Persistent loss of motion resulted in a higher degree of osteoarthritis in the study population. Early intervention seems advisable as patients with arthrolysis later than 1 year after index surgery reached worse IKDC objective grading.

Level of Evidence  
Level IV, therapeutic case series.

[BACK](#)

## **Comparative Influence of Sport Type on Outcome After Anterior Cruciate Ligament Reconstruction at Minimum 2-Year Follow-up**

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### **Purpose**

To investigate differences between sport types for patient-reported outcome after anterior cruciate ligament reconstruction (ACLR).

### **Methods**

Included patients were enrolled as part of a prospective institutional ACL registry. Inclusion criteria were preoperative self-identification as a competitive athlete, maximum score on the preoperative Marx Activity Scale, and minimum 2-year follow-up. Demographic, intraoperative, and outcome data were extracted from the registry. Outcome tools administered as part of the registry included International Knee Documentation Committee (IKDC), Lysholm-Tegner Scales, Marx Activity Scale (MAS), and 12-Item Short Form Health Survey (SF-12).

### **Results**

A total of 294 patients with a mean age of 25.5 years (standard deviation 12.1) met the study inclusion criteria; mean follow-up was 3.7 years. Included sports categories were soccer (n = 92; 31.3%), skiing (n = 67; 22.8%), basketball (n = 56; 19.1%), lacrosse (n = 38; 12.9%), football (n = 29; 9.9%), and Tennis (n = 12; 4.1%). At baseline, compared with other sports, lacrosse players have higher outcome scores while skiers had lower scores. At 2-year follow-up, however, across all outcome tools, football players demonstrated significantly higher outcome scores than all other athletes (IKDC, 93.2,  $P = .001$ ; Lysholm, 93.2,  $P = .03$ ; MAS, 13.1,  $P = .03$ ; SF-12 Mental Component Summary, 57.9,  $P = .0002$ ). Conversely, at 2-year follow-up, soccer players demonstrated a significantly lower Lysholm (86.7,  $P = .02$ ) and a trend toward lower IKDC (85.6,  $P = .09$ ) scores.

### **Conclusions**

Patient-reported outcomes after ACLR among active athletes are comparable. Football players demonstrate quantitatively higher outcome scores whereas soccer players have lower scores. However, these outcome score differences may not be clinically significant and may be subject to confounding variables. Continued attention should be paid to understanding sport-specific outcome after ACLR.

Level of Evidence  
Level IV, therapeutic case series.

[BACK](#)

## **High Altitude Is an Independent Risk Factor for Postoperative Symptomatic Venous Thromboembolism After Knee Arthroscopy: A Matched Case-Control Study of Medicare Patients**

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### **Purpose**

To use a national database of Medicare patients to evaluate the association of uncomplicated knee arthroscopy performed at high altitude with the incidence of postoperative venous thromboembolism (VTE).

### **Methods**

The 100% Medicare Standard Analytical File database was queried for all patients undergoing isolated arthroscopic partial meniscectomy and/or chondroplasty from 2005-2012. Patients with more complex open or additional arthroscopic knee procedures, a personal history of VTE, or any hypercoagulable state were excluded. The result of this query was then stratified by the altitude of the hospital ZIP code in which the procedure was performed. The appropriate patients were placed into a high-altitude group ( $\geq 4,000$  ft) and matched to patients who underwent the same procedures at an altitude less than or equal to 100 ft on the basis of age, sex, and medical comorbidities. The rate of VTE was then assessed for both the high-altitude and matched low-altitude patients within 30 days and 90 days postoperatively.

### **Results**

The rate of combined VTE (deep venous thrombosis [DVT] and/or pulmonary embolism [PE]) (odds ratio [OR], 2.0;  $P = .0003$ ), the rate of PE (OR, 2.5;  $P = .0099$ ), and the rate of DVT (OR, 1.7;  $P = .0066$ ) within 30 days were all significantly higher in patients with procedures performed at high altitude compared with matched patients with the same procedures performed at low altitude. At 90 days postoperatively, similarly elevated risks of VTE, PE, and DVT were found in patients with procedures performed at high altitude.

### **Conclusions**

In this study of knee arthroscopy in Medicare patients, a procedure performed at an altitude  $\geq 4,000$  ft was a significant risk factor for the development of postoperative VTE compared with matched patients undergoing the same procedure at an altitude less than or equal to 100 ft.

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

[BACK](#)

## Arthroscopic Quantification of Syndesmotic Instability in a Cadaveric Model

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### Purpose

To investigate whether arthroscopy or stress radiography can identify instability resulting from single-ligament injury of the ankle syndesmosis and to determine whether either modality is capable of differentiating between various levels of ligament injury.

### Methods

Syndesmotic/deltoid ligament sectioning was performed in 10 cadaver legs. Arthroscopic evaluation and fluoroscopic stress testing were completed after each sectioning. In group 1 (n = 5), sectioning began with anteroinferior tibiofibular ligament (AITFL), then interosseous membrane (IOM), posteroinferior tibiofibular ligament (PITFL), and deltoid. In group 2 (n = 5), this order was reversed. Measurements were made by determining the largest-sized probe that would fit in the anterior and posterior syndesmosis. Radiographic parameters included tibiofibular overlap/clear space and medial clear space.

### Results

No radiographic measurement proved useful in distinguishing between intact and transected AITFL. Anterior probe (AP) size reached significance when distinguishing between intact and AITFL-transected specimens ( $P < .0001$ ). AP detected significant differences comparing single with 2-, 3-, and 4-ligament (AITFL, IOM, PITFL, deltoid) disruptions ( $P = .05, <.0001, \text{ and } <.0001$ , respectively). Significant differences were observed between 2- and 3/4-ligament ( $P = .02$ ) transections. Posterior probe (PP) size detected significant differences between intact and single-, double-, triple-, and complete ligament transections ( $P$  values  $.0006, <.0001, <.0001, <.001$ , respectively). PP detected significant differences between single- and double-, triple-, and complete ligament transection models ( $P = .0075, .0010, \text{ and } .0010$ , respectively). PP distinguished between 2- and 3/4-ligament ( $P = .03$ ) transections.

### Conclusions

Stress radiography did not distinguish between intact and single-ligament disruption, and was unreliable in distinguishing between sequential transection models. Arthroscopy significantly predicted isolated disruption of the AITFL or deltoid ligaments. Also, probing was able to differentiate between most patterns of ligament injury, including sequential transections.

### Clinical Relevance

These data can aid surgeons during arthroscopy of the ankle when attempting to correlate intraoperative syndesmotic evaluation findings with the extent of ligament injury.

[BACK](#)

# Outcome of Patellar Tendon Versus 4-Strand Hamstring Tendon Autografts for Anterior Cruciate Ligament Reconstruction: A Systematic Review and Meta-analysis of Prospective Randomized Trials

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## Purpose

To compare clinical outcomes of anterior cruciate ligament (ACL) reconstruction and investigate whether the clinical results of 4-strand hamstring tendon (HT) reconstruction are still inferior to that of the patellar tendon (PT).

## Methods

We performed a comprehensive systematic review and meta-analysis of the English literature on PubMed, Scopus, Web of Science, and the Cochrane register for papers that compared clinical outcomes of PT versus HT for ACL reconstruction. Outcome measures analyzed included rate of rerupture, KT-1000, International Knee Documentation Committee grade, Lachman, pivot shift, Lysholm score, Tegner Activity Scale, anterior knee pain, and discomfort on kneeling.

## Results

We included 19 studies from an initial 1,168 abstracts for the systematic review, and, eventually, 19 studies were included in the meta-analysis. The study population consisted of a total of 1784 patients. The average follow-up duration was 58.8 months. We found significant differences in favor of the HT technique in the domains of anterior knee pain, kneeling pain, and restriction in the range of active extension ("extension deficit"). We found no differences between the PT and HT technique in terms of rerupture rate. There were no clinically significant differences for the outcomes of Lysholm score and Tegner Activity Scale as well as the KT-1000 side-to-side at maximum manual force.

## Conclusions

Contemporary 4-strand HT ACL reconstruction is comparable with the PT technique in terms of clinical stability and postoperative functional status across most parameters studied. The HT technique carries lower risk of postoperative complications such as anterior knee pain, kneeling discomfort, and extension deficit. Primary ACL reconstruction using the 4-strand HT technique achieves clinical results that are comparable with the PT technique with significantly less postoperative complications.

Level of Evidence

Level I, systemic review and meta-analysis of Level I studies.

[BACK](#)

## **Hip Arthroscopy in Patients Age 40 or Older: A Systematic Review**

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### **Purpose**

To (1) report clinical outcomes, complication rates, and total hip arthroplasty (THA) conversion rates for patients age 40 or older who underwent hip arthroscopy, and (2) report any age-related predictors of outcome identified in the literature.

### **Methods**

MEDLINE, EMBASE, and PubMed were searched for relevant studies and pertinent data were abstracted from eligible studies. No meta-analysis was performed because of heterogeneity amongst studies.

### **Results**

Seventeen studies were included in this review comprising 16,327 patients, including 9,954 patients age 40 or older. All studies reported statistically significant improvements in outcomes after hip arthroscopy for femoral osteochondroplasty, labral repair, or unspecified indications. In patients 40 or older who underwent labral debridement, these improvements were not clinically significant. Obesity and osteoarthritic changes predicted poorer outcomes. Only 1 of 3 studies directly comparing the 2 groups found that patients 40 or older had a significantly less improvement in a standardized hip outcome score than patients under 40 after hip arthroscopy, but all found that patients 40 or older had significantly higher rates of THA conversion. The rate of conversion to THA was 18.1% for patients 40 or older, 23.1% for patients over 50, and 25.2% for patients over 60 with a mean of 25.0 months to THA.

### **Conclusions**

Indications for hip arthroscopy including femoral osteochondroplasty and labral repair resulted in clinically significant improvements in patients 40 or older in most research studies examined in this review, whereas labral debridement did not produce clinically significant improvements postoperatively in the same studies. In these studies, the rate of conversion to THA is higher than in patients under 40 and increases with each decade of life, with many individual studies showing a significant increase in the rate of THA conversion. Hip arthroscopy may be suitable for some patients 40 or older, but patient selection is key and patients should be informed of the higher risk of conversion to THA.

Level of Evidence

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

[BACK](#)

## **Femoroacetabular Impingement and Pelvic Incidence: Radiographic Comparison to an Asymptomatic Control**

Michael D. Hellman, Bryan D. Haughom, Nicholas M. Brown, Yale A. Fillingham, Marc J. Philippon, Shane J. Nho

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### **Purpose**

To investigate whether pelvic incidence (PI) in patients with symptomatic femoroacetabular impingement was different from that in a normal population.

### **Methods**

Retrospective analysis of 30 consecutive female and 30 consecutive male patients with computed tomography scans who underwent hip arthroscopy for FAI. PI was measured using scout lateral radiographs. The center-edge angle (CEA), acetabular version, and  $\alpha$  angle were also measured. Each patient was subcategorized as having a cam-type deformity ( $\alpha$  angle  $>55^\circ$ ), a deep socket deformity (CEA  $>39^\circ$ ), and/or a retroverted acetabulum (acetabular anteversion  $<15^\circ$ ). Our group and subgroups were compared with a historical control group from a previously published study of 300 volunteers. Each group was compared using a Student t test.

### **Results**

Our mean PI was  $49.31^\circ \pm 12.34^\circ$  (range,  $28.4^\circ$ - $79.5^\circ$ ), less than the asymptomatic historical control (n = 300) with a mean PI of  $55.0^\circ \pm 10.6^\circ$  (range,  $33^\circ$ - $82^\circ$ ) (P < .001). The subgroups for cam deformity, deep socket deformity, and acetabular retroversion have a mean PI of  $48.89^\circ \pm 11.81^\circ$ ,  $38.30^\circ \pm 7.56^\circ$ , and  $44.93^\circ \pm 11.32^\circ$ , respectively. All had a significantly lower PI than the historical control (P < .001, P < .001, P < .001, respectively).

### **Conclusions**

We conclude that patients presenting with FAI may have a lower PI than the general population. The clinical significance of a  $5.7^\circ$  difference in PI remains unknown.

Level of Evidence

Level III, retrospective comparative study.

[BACK](#)



## Decreased Synovial Inflammation in Atraumatic Hip Microinstability Compared With Femoroacetabular Impingement

Geoffrey D. Abrams, Ayala Luria, Joshua Sampson, Rachel A. Madding, William H. Robinson, Marc R. Safran, Jeremy Sokolove

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### Purpose

To compare the inflammatory profile of hip synovial tissue in those with atraumatic microinstability to patients with femoroacetabular impingement (FAI).

### Methods

Patients with cam and mixed-type FAI (FAI group) and patients with hip instability underwent sampling of the anterolateral synovium. Demographic data, intraoperative measurements, and functional outcome scores (International Hip Outcomes Tool and Short Form-12) were recorded. Cryosections were stained and examined under light microscopy as well as confocal fluorescent microscopy for anti-CD45 (common leukocyte antigen), anti-CD31 (endothelial), and anti-CD68 (macrophage) cell surface markers. A grading system was used to quantify synovitis under light microscopy whereas digital image analysis was used to quantify immunofluorescence staining area. Comparison were made with Student t test, Mann-Whitney U,  $\chi^2$ , and regression analysis.

### Results

There were 12 patients in the FAI group and 5 in the instability group. Mean age was not significantly different ( $P > .05$ ), but there was a significantly greater proportion of females in the instability group versus the FAI group ( $P < .001$ ). There was a significant correlation ( $r = 0.653$ ;  $P = .005$ ) between number of turns needed for 10 mm of distraction and increased synovitis. Synovitis scores also were increased significantly in patients with cam morphology and articular cartilage damage ( $P = .024$ ) versus those without. Immunohistochemistry did not reveal differences ( $P > .082$ ) between the instability and FAI groups, but CD68 staining was significantly greater in those with cam morphology and cartilage damage ( $P < .045$ ). CD45+/CD68– cells were noted in the perivascular area while CD45+/CD68+ cells were noted within the synovial lining in both groups.

### Conclusions

Increased synovial inflammation was associated with an increased number of turns to achieve joint distraction. Both instability and FAI groups demonstrated baseline levels of synovial inflammation. Synovitis scores also were increased in patients with cartilage damage.

### Clinical Relevance

An understanding of the molecular and cellular mechanisms behind both hip instability and FAI may lead to novel therapeutic anti-inflammatory therapy, which may serve as an adjunct to treatment of mechanical abnormalities in this conditions.

[BACK](#)

## The Effect of Capsulotomy and Capsular Repair on Hip Distraction: A Cadaveric Investigation

M. Michael Khair, Jeffrey S. Grzybowski, Benjamin D. Kuhns, Thomas H. Wuerz, Elizabeth Shewman, Shane J. Nho

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### Purpose

To quantify how increasing interportal capsulotomy size affects the force required to distract the hip and to biomechanically compare simple side-to-side suture repair to acetabular-based suture anchors as capsular repair techniques.

### Methods

Twelve fresh-frozen cadaveric hip specimens were dissected to the capsuloligamentous complex of the hip joint and fixed in a material testing system, such that a pure axial distraction of the iliofemoral ligament could be achieved. After each hip in was tested an intact state, sequential distraction was tested with 2, 4, 6, and 8 cm capsulotomies. Specimens were assigned randomly to be repaired with either 4 side-to-side suture repair ( $n = 6$ ) or 2 double-loaded all-suture anchors ( $n = 6$ ). The distraction force as well as the relative distraction force percentage normalized to the intact capsule were compared between suture repair and suture anchor repair groups.

### Results

Increasing the size of the capsulotomy resulted in less force required to distract the hip to 6 mm. The force decreased as the capsulotomy was extended with statistical significance in distraction force seen between the intact state and the 4 cm ( $P = .003$ ), 6 cm ( $P < .001$ ), and 8 cm ( $P \leq .001$ ) capsulotomy but not for the intact state compared to the 2 cm capsulotomy ( $P = .28$ ). Statistical significance in relative distraction force was seen for each of the capsulotomy conditions ( $P < .001$  for all conditions compared with the intact state). The side-to-side suture repair construct (104.3% of intact force) required greater force to distraction to 6 mm compared with the suture anchor repair (87.1% of intact force) ( $P = .008$ ).

### Conclusions

An interportal capsulotomy significantly affected the force required to distract the hip in a cadaveric model, with the larger the size of capsulotomy resulting in less force required to distract the hip. When we performed an interportal capsulotomy, the iliofemoral ligament strength was altered significantly but capsular repair with either side-to-side sutures or suture anchor-based repair was able to restore the capsular strength to a native intact hip. We found, however, that the side-to-side suture repair was better able to restore the distraction force compared with suture anchor repair.

### Clinical Relevance

Capsular management during hip arthroscopy remains a debated topic, with multiple techniques involving both capsulotomy and capsular closure published in the literature. This study provides insight into capsular stability against axial stress under capsulotomy and capsular repair conditions.

[BACK](#)

## Testing the Construct Validity of a Virtual Reality Hip Arthroscopy Simulator

Vikas Khanduja, John E. Lawrence, Emmanuel Audenaert

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### Purpose

To test the construct validity of the hip diagnostics module of a virtual reality hip arthroscopy simulator.

### Methods

Nineteen orthopaedic surgeons performed a simulated arthroscopic examination of a healthy hip joint using a 70° arthroscope in the supine position. Surgeons were categorized as either expert (those who had performed 250 hip arthroscopies or more) or novice (those who had performed fewer than this). Twenty-one specific targets were visualized within the central and peripheral compartments; 9 via the anterior portal, 9 via the anterolateral portal, and 3 via the posterolateral portal. This was immediately followed by a task testing basic probe examination of the joint in which a series of 8 targets were probed via the anterolateral portal. During the tasks, the surgeon's performance was evaluated by the simulator using a set of predefined metrics including task duration, number of soft tissue and bone collisions, and distance travelled by instruments. No repeat attempts at the tasks were permitted. Construct validity was then evaluated by comparing novice and expert group performance metrics over the 2 tasks using the Mann–Whitney test, with a P value of less than .05 considered significant.

### Results

On the visualization task, the expert group outperformed the novice group on time taken ( $P = .0003$ ), number of collisions with soft tissue ( $P = .001$ ), number of collisions with bone ( $P = .002$ ), and distance travelled by the arthroscope ( $P = .02$ ). On the probe examination, the 2 groups differed only in the time taken to complete the task ( $P = .025$ ) with no significant difference in other metrics.

### Conclusions

Increased experience in hip arthroscopy was reflected by significantly better performance on the virtual reality simulator across 2 tasks, supporting its construct validity.

### Clinical Relevance

This study validates a virtual reality hip arthroscopy simulator and supports its potential for developing basic arthroscopic skills.

### Level of Evidence

Level III.

[BACK](#)

## **An Anatomic Analysis of Mid-anterior and Anterolateral Approaches for Hip Arthrocentesis: A Male Cadaveric Study**

Jacob D. Mikula, Jason M. Schon, Chase S. Dean, Jorge Chahla, Renato Locks, Alex W. Brady, Robert F. LaPrade, Marc J. Philippon

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### **Purpose**

To determine the accuracy and safety of non–image-guided modified mid-anterior and anterolateral approaches to the hip joint for arthrocentesis.

### **Methods**

Six pairs (n = 12) of human cadaveric hemipelvises underwent methylene blue hip injections through either a mid-anterior or an anterolateral approach. The distance from the mid-anterior approach to the lateral femoral cutaneous nerve (LFCN) was measured. Needle orientation was defined by a combination of 2 angles, calculated by the computer software analysis of digitized points. Distal Angle was defined as the angle between the lateral axis and an intermediate needle position, in the coronal plane, toward the distal axis. Anterior Angle was defined as the angle between the intermediate needle position of Distal Angle and the final position, toward the anterior axis.

### **Results**

Methylene blue was successfully injected into the joint capsule in all specimens. The mean distances from the needle to the LFCN for both the mid-anterior and anterolateral approaches were  $19.3 \pm 7.9$  and  $80.3 \pm 28.3$  mm, respectively. For the mid-anterior approach, Distal AngleM was a mean of  $53.9^\circ \pm 14.9^\circ$  and Anterior AngleM was a mean of  $33.4^\circ \pm 15.6^\circ$ . For the anterolateral approach, Distal AngleL was a mean of  $14.5^\circ \pm 14.2^\circ$  and Anterior AngleL was a mean of  $4.5^\circ \pm 13.6^\circ$ .

### **Conclusions**

This study showed that mid-anterior and anterolateral approaches for non–image-guided hip injections or arthrocentesis can avoid the LFCN and be effectively performed in males, despite the exhibited variability in the quantitative descriptions of these techniques. The landmarks and measurements presented can be used as general guidelines for clinical studies regarding hip arthrocentesis and injections.

### **Clinical Relevance**

The high variability of the needle placement and trajectory of the mid-anterior and anterolateral approaches performed in this study showed that these techniques were not easily quantitatively defined. However, both of these approaches appeared to be safe and effective.

[BACK](#)

## Medial Open Wedge High Tibial Osteotomy for Varus Malunited Tibial Plateau Fractures

S.R. Sundararajan, H.S. Nagaraja, S. Rajasekaran

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### Purpose

To analyze radiologic and functional outcomes of varus malunited tibial plateau fractures managed with medial open wedge high tibial osteotomy (MOHTO).

### Methods

Eighteen patients with symptomatic varus malunited tibial plateau fractures with less than stage II arthritic changes managed from July 2009 to October 2013 were included. Patients with complex intra-articular step malunions and severe arthritic changes (stage III and IV) were excluded. Initially, diagnostic arthroscopy was performed followed by MOHTO stabilized with locking plate and tricortical autograft (n = 11, 61%) or a Puudu plate and allograft (n = 7, 39%). Patients were evaluated radiologically for union, medial proximal tibial angle, and tibial slope angle, and functional assessment was performed with a knee outcome survey based on activities of daily living.

### Results

The mean follow-up duration was  $41.7 \pm 12.1$  months (range 25-61); all patients achieved radiologic union by a mean duration of  $4.3 \pm 1.2$  months (range 3-8). The mean medial proximal tibial angle improved from  $75.3^\circ \pm 3.7^\circ$  (range  $70.5^\circ$ - $85.2^\circ$ ) to a postoperative angle of  $83.8^\circ \pm 3.6^\circ$  (range  $77.5^\circ$ - $90.4^\circ$ ) ( $P < .001$ ). In 12 patients, an abnormal mean anterior slope of  $-5.5^\circ \pm 3.0^\circ$  (range  $-1.1^\circ$  to  $-13^\circ$ ) was corrected to a postoperative posterior slope of  $5.8^\circ \pm 4.4^\circ$  (range  $-1.1^\circ$  to  $14.1^\circ$ ) ( $P < .001$ ). In 6 patients, a mean posterior slope of  $17.4^\circ \pm 10.5^\circ$  (range  $1.4^\circ$ - $33^\circ$ ) was corrected to a postoperative posterior slope of  $14.08^\circ \pm 5.6^\circ$  (range 7.4-21.3) ( $P = .214$ ). The mean knee outcome survey scores preoperatively were  $25\% \pm 9.68\%$  (range 8%-48%) and postoperatively were  $85\% \pm 11.18\%$  (range -52% to 98%,  $P < .001$ ).

### Conclusions

MOTHO for varus malunited tibial plateau fractures is safe and effective procedure that provides excellent functional outcomes, acceptable radiologic outcomes, and carries minimal complications.

### Level of Evidence

Level IV, therapeutic case series.

[BACK](#)

## **Anterolateral Ligament and Iliotibial Band Control of Rotational Stability in the Anterior Cruciate Ligament–Intact Knee: Defined by Tibiofemoral Compartment Translations and Rotations**

Lauren E. Huser, Frank R. Noyes, Darin Jurgensmeier, Martin S. Levy

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### **Purpose**

To determine the stabilizing effect of the anterolateral ligament (ALL) and iliotibial band (ITB) in resisting internal tibial rotation limits and anterior subluxations of the tibiofemoral compartments in anterior cruciate ligament (ACL)-intact knees during anterior drawer, internal rotation, and under 2 different 4-degree-of-freedom pivot-shift conditions.

### **Methods**

A 6-degree-of-freedom robotic simulator tested 19 fresh-frozen cadaver specimens with 3 testing conditions: intact, ALL- or ITB-sectioned (random), and both ALL and ITB sectioned. Anterior translation of the medial and lateral compartments and internal tibial rotation were measured under 100 N anterior drawer, 5 Nm internal rotation, and 2 pivot-shift conditions. Statistical equivalence was defined as  $P < .05$ .

### **Results**

Sectioning the ALL alone had no effect on lateral compartment translation or internal rotation under any loading condition (equivalent  $P < .05$ ). After ITB sectioning alone, small increases in internal rotation were found under 5 Nm internal rotation at 60° (3.0° [90% confidence interval 1.9-4.1];  $P = .99$ ) and 90° (2.2° [90% confidence interval 1.5-2.9];  $P = .84$ ) flexion. After both ALL and ITB were sectioned, increases in internal rotation of 1.7°, 4.5°, and 3.9° occurred at 25°, 60°, and 90° flexion, respectively ( $P > .05$ ). Small increases in pivot-shift internal rotation (Group 1: 2.0° [90% confidence interval 1.4-2.6];  $P = .52$ ) and lateral compartment translation occurred (Group 1: 0.9 mm [90% confidence interval 0.7-1.1];  $P < .001$ ).

### **Conclusions**

Sectioning the ALL does not lead to an increase in tibiofemoral compartment subluxations in the pivot-shift test with an intact ACL. Accordingly the ALL would not represent a primary restraint to pivot-shift subluxations. ALL sectioning alone does not lead to an increase in internal rotation motion limits, however sectioning both the ALL and ITB did produce small increases in rotation limits at higher flexion angles which would likely not be clinically detectable.

### **Clinical Relevance**

A deficiency to both the ALL and ITB during in vitro-simulated pivot-shift tests and internal rotation tests results in small, clinically undetectable changes in knee kinematics in the majority of knees assuming intact ACL function

[BACK](#)

## **Changes in Contact Area in Meniscus Horizontal Cleavage Tears Subjected to Repair and Resection**

Brandon S. Beamer, Kempland C. Walley, Stephen Okajima, Ohan S. Manoukian, Miguel Perez-Viloria, Joseph P. DeAngelis, Arun J. Ramappa, Ara Nazarian

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### **Purpose**

To assess the changes in tibiofemoral contact pressure and contact area in human knees with a horizontal cleavage tear before and after treatment.

### **Methods**

Ten human cadaveric knees were tested. Pressure sensors were placed under the medial meniscus and the knees were loaded at twice the body weight for 20 cycles at 0°, 10°, and 20° of flexion. Contact area and pressure were recorded for the intact meniscus, the meniscus with a horizontal cleavage tear, after meniscal repair, after partial meniscectomy (single leaflet), and after subtotal meniscectomy (double leaflet).

### **Results**

The presence of a horizontal cleavage tear significantly increased average peak contact pressure and reduced effective average tibiofemoral contact area at all flexion angles tested compared with the intact state ( $P < .03$ ). There was approximately a 70% increase in contact pressure after creation of the horizontal cleavage tear. Repairing the horizontal cleavage tear restored peak contact pressures and areas to within 15% of baseline, statistically similar to the intact state at all angles tested ( $P < .05$ ). Partial meniscectomy and subtotal meniscectomy significantly increased average peak contact pressure and reduced average contact area at all degrees of flexion compared with the intact state ( $P < .05$ ).

### **Conclusions**

The presence of a horizontal cleavage tear in the medial meniscus causes a significant reduction in contact area and a significant elevation in contact pressure. These changes may accelerate joint degeneration. A suture-based repair of these horizontal cleavage tears returns the contact area and contact pressure to nearly normal, whereas both partial and subtotal meniscectomy lead to significant reductions in contact area and significant elevations in contact pressure within the knee. Repairing horizontal cleavage tears may lead to improved clinical outcomes by preserving meniscal tissue and the meniscal function.

### **Clinical Relevance**

Understanding contact area and peak contact pressure resulting from differing strategies for treating horizontal cleavage tears will allow the surgeon to evaluate the best strategy for treating his or her patients who present with this meniscal pathology.

[BACK](#)

# Reverse Anterior Cruciate Ligament Reconstruction Fixation: A Biomechanical Comparison Study of Tibial Cross-Pin and Femoral Interference Screw Fixation

Richard J. Lawley, Samuel E. Klein, Steven C. Chudik

Arthroscopy, March 2017, Volume 33, Issue 3, Pages 625–632

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## Purpose

To evaluate the biomechanical performance of tibial cross-pin (TCP) fixation relative to femoral cross-pin (FCP), femoral interference screw (FIS), and tibial interference screw (TIS) fixation.

## Methods

We randomized 40 porcine specimens (20 tibias and 20 femurs) to TIS fixation (group 1, n = 10), FIS fixation (group 2, n = 10), TCP fixation (group 3, n = 10), or FCP fixation (group 4, n = 10) and performed biomechanical testing to compare ultimate load, stiffness, yield load, cyclic displacement, and load at 5-mm displacement. We performed cross-pin fixation of the looped end and interference screw fixation of the free ends of 9-mm-diameter bovine extensor digitorum communis tendon grafts. Graft fixation constructs were cyclically loaded and then loaded to failure in line with the tunnels.

## Results

Regarding yield load, FIS was superior to TIS ( $704 \pm 125$  N vs  $504 \pm 118$  N,  $P = .002$ ), TCP was superior to TIS ( $1,449 \pm 265$  N vs  $504 \pm 118$  N,  $P < .001$ ), and TCP was superior to FCP ( $1,449 \pm 265$  N vs  $792 \pm 397$  N,  $P < .001$ ). Cyclic displacement for FCP was superior to TCP. Cyclic displacement for TIS versus FIS showed no statistically significant difference ( $2.5 \pm 1.0$  mm vs  $2.2 \pm 0.6$  mm,  $P = .298$ ). Interference screw fixation consistently failed by graft slippage, whereas TCP fixation failed by tibial bone failure. FCP fixation failed by either femoral bone failure or failure elsewhere in the testing apparatus.

## Conclusions

Regarding yield load, TCP fixation performed biomechanically superior to the clinically proven FCP at time zero. Because TIS fixation shows the lowest yield strength, it represents the weak link, and combined TCP-FIS fixation theoretically would be biomechanically superior relative to combined FCP-TIS fixation with regard to yield load. Cyclic displacement showed a small difference in favor of FCP over TCP fixation and no difference between TIS and FIS.

## Clinical Relevance

Time-zero biomechanics of TCP fixation paired with FIS fixation show that this method of fixation can be considered a potential alternative to current practice and may pose clinical benefits in different clinical scenarios of anterior cruciate ligament reconstruction.

[BACK](#)



## Increased Femoral Anteversion Influence Over Surgically Treated Recurrent Patellar Instability Patients

Carlos Eduardo Franciozi, Luiz Felipe Ambra, Leonardo José Bernardes Albertoni, Pedro Debieux, Fernando Cury Rezende, Mauricio Ayres de Oliveira, Marcio de Castro Ferreira, Marcus Vinícius Malheiros Luzo

Arthroscopy, March 2017, Volume 33, Issue 3, Pages 633–640

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### Purpose

To verify the influence that increased femoral anteversion (FA) has on patients with recurrent patellar instability (RPI) treated by anteromedialization tibial tubercle osteotomy (TTO) combined with medial patellofemoral ligament reconstruction (MPFLR) and to present the midterm outcomes of these patients.

### Methods

From January 2008 to August 2013, skeletally mature patients with RPI and tibial tubercle (TT)–trochlear groove (TG)  $\geq 17$  mm who underwent anteromedialization TTO combined with MPFLR were evaluated for J sign, patellar glide, apprehension test, increased FA, Caton index, trochlea dysplasia, TT-TG, Kujala, International Knee Documentation Committee subjective knee evaluation form, and Tegner. Increased FA was determined clinically by a difference of more than  $30^\circ$  between hip internal and external rotation,  $70^\circ$  or more of hip internal rotation, and  $30^\circ$  or more of femoral neck anteversion. A subgroup analysis involving increased FA was made.

### Results

Forty-eight patients composed the study group. Mean follow-up was  $41.5 \pm 11.05$  months. The J-sign was present in 86% before surgery and none postoperatively ( $P < .001$ ). All patients had a positive apprehension test or a patellar luxation at the patellar glide test rated as grade 4 before surgery. After surgery, the mean glide was  $1.29 \pm 0.45$  with no apprehension ( $P < .001$ ). Increased FA was present in 18.7%. Caton index before surgery was  $1.11 \pm 0.21$  and  $0.99 \pm 0.11$  postoperatively ( $P = .004$ ). Trochlea dysplasia was present in all patients. TT-TG preoperatively was  $20.77 \pm 2.12$  mm and  $11.33 \pm 1.24$  mm postoperatively ( $P < .001$ ). Functional scores improved preoperatively to postoperatively ( $P < .001$ ) with Kujala and International Knee Documentation Committee means: 59.08 to 84.37; 52.6 to 85.5, respectively. Tegner preinjury score was 5.4 and postoperatively was 5.2 ( $P = .01$ ). Increased FA group had worse Kujala compared with the normal FA group and worse Kujala improvement: 77.7 and 85.89 ( $P = .012$ ), and 21.7 and 26.1, respectively ( $P < .001$ ).

### Conclusions

Increased FA in patients with RPI had a negative effect on the outcome of anteromedialization TTO combined with MPFLR. Combined anteromedialization TTO and MPFLR had good functional midterm outcomes in treating patients with RPI and TT-TG  $\geq 17$  mm.

### Level of Evidence

Level III, comparative study.

[BACK](#)

JSES

Volume 26, Issue 2, p179-552, e29- e84

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[BACK](#)

KSSTA

Volume 25, Issue 2-3, February - March 2017

**Single-dose intra-articular bupivacaine plus morphine versus bupivacaine alone after arthroscopic knee surgery: a meta-analysis of randomized controlled trial**

Ye Yang, Chao Zeng, Jie Wei, Hui li, Tuo Yang, Zhen-han Deng, Yu-sheng Li, Tu-bao Yang, Guang-hua Lei

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DOI: 10.1007/s00167-015-3748-8

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**Purpose**

The purpose of this meta-analysis was to compare the efficacy and safety of single-dose intra-articular bupivacaine plus morphine versus bupivacaine alone for pain management following arthroscopic knee surgery.

**Method**

A comprehensive literature search was conducted to identify randomized controlled trials that used single-dose intra-articular bupivacaine plus morphine and bupivacaine alone for post-operative pain, using MEDLINE (1966–2014), Cochrane Library and EMBASE databases. The weighted mean difference (WMD), relative risk (RR) and their corresponding 95 % confidence intervals (CIs) were calculated using RevMan statistical software.

**Result**

A total of twenty-nine trials ( $n = 1167$ ) were included. The post-operative visual analog scale (VAS) pain score of the bupivacaine plus morphine group compared with the bupivacaine alone group was significantly lower (WMD  $-1.15$ , 95 % CI  $-1.67$  to  $-0.63$ ,  $p < 0.0001$ ). As far as safety, there was no significant difference in side effects between the two groups (RR 1.10, 95 % CI 0.59–2.04, n.s.). Sensitivity analyses suggested that the results of these two primary outcomes were stable and reliable. However, the current evidence did not suggest a superior effect with respect to the time to first analgesic request (WMD 51.33, 95 % CI  $-110.99$  to 213.65, n.s.) and the number of patients requiring supplementary analgesia (RR 1.13, 95 % CI 0.92–1.39, n.s.).

**Conclusions**

On the basis of the currently available literature, this study is the first to suggest that single-dose intra-articular bupivacaine plus morphine was shown to be significantly better than bupivacaine alone at relieving post-operative pain after arthroscopic knee surgery without increasing the short-term side effects. Routine use of single-dose intra-articular bupivacaine plus morphine is an effective way for pain management after arthroscopic knee surgery.

[BACK](#)

AJSM

February 2017, Vol 45, Issue 2

March 2017, Volume 45, Issue 3

## **Hip Capsular Closure - A Biomechanical Analysis of Failure Torque**

Jorge Chahla, Jacob D. Mikula, Jason M. Schon, Chase S. Dean, Kimi D. Dahl, Travis J. Menge, Eduardo Soares, Travis Lee Turnbull, Robert F. LaPrade, Marc J. Philippon

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**Background:** Hip capsulotomy is routinely performed during arthroscopic surgery to achieve adequate exposure of the joint. Iatrogenic instability can result after hip arthroscopic surgery because of capsular insufficiency, which can be avoided with effective closure of the hip capsule. There is currently no consensus in the literature regarding the optimal quantity of sutures upon capsular closure to achieve maximal stability postoperatively.

**Purpose/Hypothesis:** The purpose of this study was to determine the failure torques of 1-, 2-, and 3-suture constructs for hip capsular closure to resist external rotation and extension after standard anterosuperior interportal capsulotomy (12 to 3 o'clock). Additionally, the degree of external rotation at which the suture constructs failed was recorded. The null hypothesis of this study was that no significant differences with respect to the failure torque would be found between the 3 repair constructs.

**Study Design:** Controlled laboratory study.

**Methods:** Nine pairs (n = 18) of fresh-frozen human cadaveric hemipelvises underwent anterosuperior interportal capsulotomy, which were repaired with 1, 2, or 3 side-to-side sutures. Each hip was secured in a dynamic biaxial testing machine and underwent a cyclic external rotation preconditioning protocol, followed by external rotation to failure.

**Results:** The failure torque of the 1-suture hip capsular closure construct was significantly less than that of the 3-suture construct. The median failure torque for the 1-suture construct was 67.4 N·m (range, 47.4-73.6 N·m). The median failure torque was 85.7 N·m (range, 56.9-99.1 N·m) for the 2-suture construct and 91.7 N·m (range, 74.7-99.0 N·m) for the 3-suture construct. All 3 repair constructs exhibited a median 36° (range, 22°-64°) of external rotation at the failure torque.

**Conclusion:** The most important finding of this study was that the 2- and 3-suture constructs resulted in comparable biomechanical failure torques when external rotation forces were applied to conventional hip capsulotomy in a cadaveric model. The 3-suture construct was significantly stronger than the 1-suture construct; however, there was not a significant difference between the 2- and 3-suture constructs. Additionally, all constructs failed at approximately 36° of external rotation.

Clinical Relevance: Re-establishing the native anatomy of the hip capsule after hip arthroscopic surgery has been reported to result in improved outcomes and reduce the risk of iatrogenic instability. Therefore, adequate capsular closure is important to restore proper hip biomechanics, and postoperative precautions limiting external rotation should be utilized to protect the repair.

[BACK](#)

## **Pediatric Anterior Cruciate Ligament Reconstruction**

A Systematic Review of Transphyseal Versus Physeal-Sparing Techniques

Todd P. Pierce\*, Kimona Issa\*, Anthony Festa\*, Anthony J. Scillia\*†, Vincent K. McInerney\*

The American Journal of Sports Medicine Vol 45, Issue 2; pp. 488–494

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**Background:** Anterior cruciate ligament reconstruction is becoming more common in skeletally immature individuals, and it may be performed with transphyseal or physeal-sparing techniques. A number of studies have assessed the outcomes of these techniques, but there is a need to systematically evaluate the pooled data from these studies.

**Purpose:** To compare the differences in demographics and outcomes of transphyseal and physeal-sparing techniques by assessing (1) demographics, (2) incidence of growth disturbances, and (3) graft survivorship in the pediatric population.

**Study Design:** Systematic review.

**Methods:** A thorough review of 3 databases was performed to identify all studies that evaluated outcomes after pediatric reconstruction based on transphyseal or physeal-sparing techniques. After completing our search and cross-referencing for additional sources, 43 reports were identified for this review. Reports were analyzed for differences in demographics as well as incidence of leg-length discrepancies, angular deformities, and graft survivorship. After review of manuscripts, 27 studies were included for review (21 transphyseal and 6 physeal-sparing studies).

**Results:** Those who had transphyseal reconstruction were more likely to be female (39% vs 20%;  $P = .0001$ ), while those with the physeal-sparing surgery were younger (12 vs 13.5 years of age;  $P = .0001$ ). The transphyseal and physeal-sparing cohorts demonstrated similar incidence rates of leg-length discrepancies (0.81% vs 1.2%, respectively;  $P = .64$ ) and angular deformities (0.61% vs 0%, respectively;  $P = .36$ ). The transphyseal and physeal-sparing cohorts also showed similar rates of rerupture (6.2% vs 3.1%, respectively;  $P = .11$ ).

**Conclusion:** Although the study groups were not well matched with regard to age and sex, our results show that these surgical techniques have no differences in incidence of growth disturbances or graft survivorship. Younger males tend to undergo physeal-sparing reconstruction. Future research should focus on long-term outcome metrics with the physeal-sparing techniques, as there remains a paucity of studies regarding them.

[BACK](#)

## **Medial Patellofemoral Ligament Reconstruction Combined With Distal Realignment for Recurrent Dislocations of the Patella 5-Year Results of a Randomized Controlled Trial**

Iswadi Damasena, Murray Blythe, David Wysocki, David Kelly, Peter Annear

The American Journal of Sports Medicine Vol 45, Issue 2; pp. 369–376

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**Background:** Tibial tubercle transfer (TTT) and medial patellofemoral ligament (MPFL) reconstruction have both shown, either in isolation or in combination, to provide improved patellofemoral joint (PFJ) stability. There are few studies that provide evidence that this remains true in the long term.

**Purpose:** To compare the long-term results of patellar instability after TTT with and without MPFL reconstruction in 2 randomized groups.

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

**Methods:** A total of 34 patients (36 knees) were randomized to 2 groups. The first group underwent lateral release (LR) and TTT for confirmed maltracking of the patella (control group). The second group underwent MPFL reconstruction in addition to TTT and LR (reconstruction group). Patients were followed up with validated questionnaires (Kujala score, Tegner activity score), a visual analog scale (VAS) assessing their insecurity, and a clinical assessment at a minimum of 5 years postoperatively. Participants also underwent quantitative computed tomography (CT) at 1 year for comparison. Two patients in the control group and 1 patient in the reconstruction group were lost to follow-up at 5 years.

**Results:** There were no significant differences in the Kujala ( $P = .75$ ), Tegner ( $P = .36$ ), or VAS ( $P = .75$ ) scores at any time period. One patient in the control group sustained a patellar redislocation at 3 years. Five patients in the control group and 2 in the reconstruction group had functional failures and required reoperations; however, this was not statistically significant ( $P = .30$ ). There were no significant differences between groups in the time to return to school or work ( $P = .65$ ) or sports ( $P = .38$ ) after surgery. Overall patient satisfaction was higher in the reconstruction group compared with the control group ( $P = .04$ ), and quantitative CT scans showed that the reconstruction group had a statistically significant improvement in the mean patellar tilt ( $6^\circ$  vs  $-8^\circ$ , respectively;  $P = .03$ ) and mean congruence angle ( $13^\circ$  vs  $-11^\circ$ , respectively;  $P = .03$ ) in the quadriceps-contracted state compared with the control group.

**Conclusion:** Reconstruction of the MPFL in addition to TTT and LR resulted in improved alignment parameters (congruence angle, patellar tilt angle) as well as patient satisfaction. The Kujala and Tegner scores were no different between the 2 groups at any time period. There was insufficient evidence to conclude that the addition of MPFL reconstruction to TTT results in fewer redislocations or reoperations. This study concludes that MPFL reconstruction improves PFJ alignment and patient satisfaction; however, further studies with larger patient numbers are required to satisfy its significance with respect to redislocation rates and functional scores in the long term.

## **Tibial Slope Strongly Influences Knee Stability After Posterior Cruciate Ligament Reconstruction: A Prospective 5- to 15-Year Follow-up**

Clemens Gwinner, Andreas Weiler, Manoussos Roider, Frederik M. Schaefer, Tobias M. Jung

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**Background:** The reported failure rate after posterior cruciate ligament (PCL) reconstruction remains high. Previous studies have shown that the tibial slope (TS) influences sagittal plane laxity. Consequently, alterations of TS might have an effect on postoperative knee stability after PCL reconstruction.

**Hypothesis:** We hypothesized that flattening of TS is associated with increased posterior laxity after PCL reconstruction.

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

**Methods:** This study consisted of 48 patients who underwent PCL reconstruction in a single-surgeon series. Eight patients underwent an isolated PCL reconstruction, 27 patients underwent an additional posterolateral corner reconstruction, and 13 patients underwent a combined reconstruction of the PCL, anterior cruciate ligament, and posterolateral corner. Three blinded observers measured TS and the side-to-side difference (SSD) of posterior tibial translation (PTT) before and after PCL reconstruction using standardized stress radiographs. The minimum follow-up was 5 years.

**Results:** At a mean follow-up of 103 months (range, 65-187), the mean SSD of PTT was significantly reduced ( $10.9 \pm 2.9$  vs  $4.9 \pm 4.3$  mm;  $P < .0001$ ). The mean TS was  $8.0^\circ \pm 3.7^\circ$  (range,  $1^\circ$ - $14.3^\circ$ ) for the operated knee and  $7.9^\circ \pm 3.2^\circ$  (range,  $2^\circ$ - $15.3^\circ$ ) for the contralateral knee. There was a statistically significant correlation between TS and PTT ( $r = -0.77$  and  $R^2 = 0.59$ ;  $P < .0001$ ). In addition, there was a significant correlation between TS and the postoperative reduction of PTT ( $r = 0.74$  and  $R^2 = 0.55$ ;  $P < .0001$ ). Subgrouping according to the number of operated ligaments showed no significant differences regarding TS or the mean reduction of PTT.

**Conclusion:** Flattening of TS is associated with a significantly higher remaining PTT as well as a lower reduction of PTT. Notably, these results are irrespective of sex and number of ligaments addressed. Thus, isolated soft tissue procedures in PCL deficiency may only incompletely address posterior knee instability in patients with flattening of the posterior slope.

[BACK](#)



JBJS

2017: Jan-Feb, volume 99, issue 1-4

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CORR

February - March 2017, Vol 475, Issue 2-3

**No lower extremity arthroscopy abstracts available**

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BJJ

February - March 2017, Vol 99-B, Issue 2-3

## **The long-term clinical and radiological outcomes in patients who suffer recurrent injuries to the anterior cruciate ligament after reconstruction**

I. Ahmed, L. Salmon, J. Roe, L. Pinczewski

Bone Joint J 2017;99-B:337–43.

<http://www.bjj.boneandjoint.org.uk/content/99-B/3/337>

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**Aims** The aim of this study was to investigate the long-term clinical and radiological outcome of patients who suffer recurrent injuries to the anterior cruciate ligament (ACL) after reconstruction and require revision surgery.

**Patients and Methods** From a consecutive series of 200 patients who underwent primary reconstruction following rupture of the ACL, we identified 36 who sustained a further rupture, 29 of whom underwent revision surgery. Patients were reviewed prospectively at one, two, seven, 15 and about 20 years after their original surgery. Primary outcome measures were the number of further ruptures, the posterior tibial slope (PTS), and functional and radiological outcomes. These were compared with a gender and age matched cohort of patients who underwent primary ACL reconstruction only.

**Results** At a mean follow-up of 18.3 years (14.3 to 20.2), 29 patients had undergone revision surgery and within this revision group 11 had sustained more than three ruptures of the ACL (3 to 6). The mean age at the time of revision reconstruction was 26.4 years (14 to 54). The mean PTS was significantly higher in those patients who suffered a further injury to the ACL (11°) compared with the control group (9°) ( $p < 0.001$ ). The mean PTS in those patients who sustained more than three ruptures was 12°.

**Conclusion** Patients who suffer recurrent injuries to the ACL after reconstruction have poorer functional and radiological outcomes than those who suffer a single injury. The causes of further injury are likely to be multifactorial but an increased PTS appears to have a significant association with recurrent ACL injuries.

[BACK](#)

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## Miscellaneous

### Arthroscopy

Volume 33, Issue 2, p239 - 690

#### **Scaffold-Free Tissue-Engineered Allogenic Adipose-Derived Stem Cells Promote Meniscus Healing**

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#### Purpose

To determine whether meniscal tissue could be healed histologically by the implantation of allogenic three-dimensional formed adipose-derived stem cells (ADSCs) in a rabbit model of partial meniscectomy.

#### Methods

Forty Japanese white rabbits (aged 15-17 weeks) were assigned to 2 groups. Defects 1.5 mm in diameter were created in the anterior horn of the medial menisci. The defects were left empty in the control group and were filled with cylindrical plugs of allogenic ADSCs extracted from adipose tissue in the experimental group. Macroscopic scoring (range, 0-3), histological scoring (range, 0-12), and immunohistological stainability of type I collagen were evaluated at 2, 4, 8, and 12 weeks postoperatively (n = 5 rabbits for each week).

#### Results

Macroscopically, the height of the healing tissue in the experimental group was significantly greater than that of the control group at 2 weeks (3 vs 0,  $P = .01$ ), 4 weeks (3 vs 1,  $P = .01$ ), and 8 weeks (3 vs 2,  $P = .02$ ). Histologically, safranin-O staining was noted at 2 weeks and increased gradually over time in the experimental group. In contrast, the intensity of staining was lower in controls at all weeks. Tissue quality scores were significantly higher in the experimental group than in the controls at all weeks (3 vs 0 at 2 weeks [ $P = .00009$ ], 4.5 vs 2 at 4 weeks [ $P = .00023$ ], 9 vs 5 at 8 weeks [ $P = .0047$ ], 10.5 vs 6 at 12 weeks [ $P = .00026$ ]). The implanted tissue was positive for type I collagen, and stainability was increased gradually over time.

#### Conclusions

Three-dimensional scaffold-free allogenic ADSCs implanted into a 1.5-mm avascular meniscal defect survived, adhered to the defect, and promoted histological meniscus healing in a rabbit model.

#### Clinical Relevance

ADSC implantation designed to promote meniscal healing may play an important role as a tool for meniscus healing.

[BACK](#)

## **Morphology of the Insertions of the Superficial Medial Collateral Ligament and Posterior Oblique Ligament Using 3-Dimensional Computed Tomography: A Cadaveric Study**

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### **Purpose**

To describe the insertions of the superficial medial collateral ligament (sMCL) and posterior oblique ligament (POL) and their related osseous landmarks.

### **Methods**

Insertions of the sMCL and POL were identified and marked in 22 unpaired human cadaveric knees. The surface area, location, positional relations, and morphology of the sMCL and POL insertions and related osseous structures were analyzed on 3-dimensional images.

### **Results**

The femoral insertion of the POL was located 18.3 mm distal to the apex of the adductor tubercle (AT). The femoral insertion of the sMCL was located 21.1 mm distal to the AT and 9.2 mm anterior to the POL. The angle between the femoral axis and femoral insertion of the sMCL was 18.6°, and that between the femoral axis and the POL insertion was 5.1°. The anterior portions of the distal fibers of the POL were attached to the fascia cruris and semimembranosus tendon, whereas the posterior fibers were attached to the posteromedial side of the tibia directly. The tibial insertion of the POL was located just proximal and medial to the superior edge of the semimembranosus groove. The tibial insertion of the sMCL was attached firmly and widely to the tibial crest. The mean linear distances between the tibial insertion of the POL or sMCL and joint line were 5.8 and 49.6 mm, respectively.

### **Conclusions**

This study used 3-dimensional images to assess the insertions of the sMCL and POL and their related osseous landmarks. The AT was identified clearly as an osseous landmark of the femoral insertions of the sMCL and POL. The tibial crest and semimembranosus groove served as osseous landmarks of the tibial insertions of the sMCL and POL.

### **Clinical Relevance**

By showing further details of the anatomy of the knee, the described findings can assist surgeons in anatomic reconstruction of the sMCL and POL.

[BACK](#)

## **Integrating Social Media and Anterior Cruciate Ligament Surgery: An Analysis of Patient, Surgeon, and Hospital Use**

Prem N. Ramkumar, Ton La Jr., Evan Fisch, Peter D. Fabricant, Alexander E. White, Kristofer J. Jones, Samuel A. Taylor

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### **Purpose**

The purpose of this observational study of social media in sports medicine was to investigate and analyze the presence and shared content of anterior cruciate ligament (ACL) patients, sports surgeons, and top orthopaedic hospitals on popular social media streams.

### **Methods**

A search of 2 public domains (Instagram and Twitter) was performed over a 6-month period. ACL surgery (“#aclsurgery”) was selected for the Instagram-based patient analysis after exclusion of veterinary ACL operations. A binary scoring system was used for media format, time (preoperatively or postoperatively), perioperative period (within 1 week of surgery), tone (positive or negative), return-to-work reference, return-to-play reference, rehabilitation reference, surgical-site reference, satisfaction reference, and dissatisfaction reference; perspective of the media was noted as well. A sample of 97 National Football League team surgeons was used for analysis of physician use in social media outlets and quantified by the number of posts. Hospital analysis categorized a sample of the top 50 orthopaedic hospitals by average number of posts and monthly posting rates with regard to orthopaedics, research, education, and personnel focus.

### **Results**

In the patient analysis, 3,145 public posts of human subjects were shared on Instagram. Of these, 92% were personal recovery stories, with an emphasis on postoperative photographs (93%) with a positive tone (88%) more than 1 week after surgery (73%). Posts focused on surgical site (25%), return to play (30%), and postoperative rehabilitation (37%). Of the physicians, 16% had Twitter accounts, with an average of 94 posts per surgeon; none had Instagram accounts. Of the hospitals, 96% had Twitter accounts and 32% had Instagram accounts. Most of the hospital-based Instagram content in the sample was centered on patients or celebrities.

**Conclusions** Orthopaedic surgery has a large social media presence. Patients emphasize wound appearance, the rehabilitation process, and return to play. Ninety-six percent of hospitals are represented in social media outlets, whereas physicians are relatively under-represented.

### **Clinical Relevance**

Social media offers a unique window into what truly matters to patients after surgery and may help us better manage expectations, enhance health care delivery, and improve marketing strategies.

[BACK](#)

## **Knee, Shoulder, and Fundamentals of Arthroscopic Surgery Training: Validation of a Virtual Arthroscopy Simulator**

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### **Purpose**

To validate the knee, shoulder, and virtual Fundamentals of Arthroscopic Training (FAST) modules on a virtual arthroscopy simulator via correlations with arthroscopy case experience and postgraduate year.

### **Methods**

Orthopaedic residents and faculty from one institution performed a standardized sequence of knee, shoulder, and FAST modules to evaluate baseline arthroscopy skills. Total operation time, camera path length, and composite total score (metric derived from multiple simulator measurements) were compared with case experience and postgraduate level. Values reported are Pearson  $r$ ;  $\alpha = 0.05$ .

### **Results**

35 orthopaedic residents (6 per postgraduate year), 2 fellows, and 3 faculty members (2 sports, 1 foot and ankle), including 30 male and 5 female residents, were voluntarily enrolled March to June 2015. Knee: training year correlated significantly with year-averaged knee composite score,  $r = 0.92$ ,  $P = .004$ , 95% confidence interval (CI) = 0.84, 0.96; operation time,  $r = -0.92$ ,  $P = .004$ , 95% CI =  $-0.96$ ,  $-0.84$ ; and camera path length,  $r = -0.97$ ,  $P = .0004$ , 95% CI =  $-0.98$ ,  $-0.93$ . Knee arthroscopy case experience correlated significantly with composite score,  $r = 0.58$ ,  $P = .0008$ , 95% CI = 0.27, 0.77; operation time,  $r = -0.54$ ,  $P = .002$ , 95% CI =  $-0.75$ ,  $-0.22$ ; and camera path length,  $r = -0.62$ ,  $P = .0003$ , 95% CI =  $-0.8$ ,  $-0.33$ . Shoulder: training year correlated strongly with average shoulder composite score,  $r = 0.90$ ,  $P = .006$ , 95% CI = 0.81, 0.95; operation time,  $r = -0.94$ ,  $P = .001$ , 95% CI =  $-0.97$ ,  $-0.89$ ; and camera path length,  $r = -0.89$ ,  $P = .007$ , 95% CI =  $-0.95$ ,  $-0.80$ . Shoulder arthroscopy case experience correlated significantly with average composite score,  $r = 0.52$ ,  $P = .003$ , 95% CI = 0.2, 0.74; strongly with operation time,  $r = -0.62$ ,  $P = .0002$ , 95% CI =  $-0.8$ ,  $-0.33$ ; and camera path length,  $r = -0.37$ ,  $P = .044$ , 95% CI =  $-0.64$ ,  $-0.01$ , by training year. FAST: training year correlated significantly with 3 combined FAST activity average composite scores,  $r = 0.81$ ,  $P = .0279$ , 95% CI = 0.65, 0.90; operation times,  $r = -0.86$ ,  $P = .012$ , 95% CI =  $-0.93$ ,  $-0.74$ ; and camera path lengths,  $r = -0.85$ ,  $P = .015$ , 95% CI =  $-0.92$ ,  $-0.72$ . Total arthroscopy cases performed did not correlate significantly with overall FAST performance.

### **Conclusions**

We found significant correlations between both training year and knee and shoulder arthroscopy experience when compared with performance as measured by composite score, camera path length, and operation time during a simulated diagnostic knee and shoulder arthroscopy, respectively. Three FAST activities demonstrated significant correlations with training year but not

arthroscopy case experience as measured by composite score, camera path length, and operation time.

#### Clinical Relevance

We attempt to validate an arthroscopy simulator that could be used to supplement arthroscopy skills training for orthopaedic residents.

[BACK](#)

## Validation of an Arthroscopic Training Device

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#### Purpose

To investigate the usefulness and conduct validation of a simulated arthroscopy training device to train basic arthroscopy skills.

#### Methods

Forty-six participants including 12 novices, 12 intermediates, and 22 experts completed a questionnaire regarding demographics, previous arthroscopic experience, training potential, and statements about the device. Furthermore, participants performed a single task on the arthroscopic training device using the 0° camera and a probe. The task consisted of an attempt to carry a rubber ring across a helix inside a box as fast as possible. Construct validity was evaluated by comparing total task time and portal replacements of the camera and probe between all groups (median values [interquartile range]; Kruskal-Wallis test).

#### Results

The median age was 35 (29-44) years. There were 4 female and 42 male participants. A total of 89% of the participants graded the overall training capacity  $\geq 5$  (35% graded it as 5, 39% as 6, and 15% as 7), and 83% believed that it is useful to improve any kind of arthroscopy. Ninety-three percent of the participants would recommend the arthroscopic training device to their colleagues. Sixty-one percent of the participants stated that there are certain disadvantages. The median time to complete the task was 108 (58-236) seconds. Novices (259 [123-435] seconds) performed tasks significantly slower than intermediates (169 [67-257] seconds) and experts (75 [49-132] seconds) ( $P = .005$ ). Furthermore, portal changes were significantly more common in novices and intermediates than experts ( $P = .019$ ).

#### Conclusions

High scores in training potential were achieved with this arthroscopy simulator box, and most study participants believed that practice with the arthroscopic training device is useful for any kind of arthroscopy. Construct validity was established since novices, intermediates, and experts in real arthroscopy were discriminated with the arthroscopic training device in terms of time to successful completion of a task. However, 61% of the participants stated that there were certain disadvantages.



### Clinical Relevance

In every training tool using simulation, it is crucial to pass the first steps in the validation cascade. This study provides this step for further evaluation of this arthroscopic training device.

[BACK](#)

JSES

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## **Suture spanning augmentation of single-row rotator cuff repair: a biomechanical analysis**

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### **Background**

This in vitro study evaluated the biomechanical benefit of adding spanning sutures to single-row rotator cuff repair.

### **Methods**

Mechanical testing was performed to evaluate 9 pairs of cadaveric shoulders with complete rotator cuff repairs, with a single-row technique used on one side and the suture spanning technique on the other. The spanning technique included sutures from 2 lateral anchors securing tendon near the musculotendinous junction, spanning the same anchor placement from single-row repair. The supraspinatus muscle was loaded to 100 N at 0.25 Hz for 100 cycles, followed by a ramp to failure. Markers and a video tracking system measured anterior and posterior gap formation across the repair at 25-cycle intervals. The force at which the stiffness decreased by 50% and 75% was determined. Data were compared using paired t-tests.

### **Results**

One single-row repair failed at <25 cycles. Both anterior and posterior gap distances tended to be 1 to 2 mm larger for the single-row repairs than for the suture spanning technique. The difference was statistically significant at all cycles for the posterior gap formation ( $P \leq .02$ ). The trends were not significant for the anterior gap ( $P \geq .13$ ). The loads at which the stiffness decreased by 50% and 75% did not differ significantly between the 2 types of repair ( $P \geq .10$ ).

### **Conclusions**

The suture spanning technique primarily improved posterior gap formation. Decreased posterior gap formation could reduce failure rates for rotator cuff repair.

[BACK](#)

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Volume 25, Issue 2-3, February - March 2017

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[BACK](#)

AJSM

February 2017, Vol 45, Issue 2

March 2017, Volume 45, Issue 3

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2017: Jan-Feb, volume 99, issue 1-4

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February - March 2017, Vol 475, Issue 2-3

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