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BACK

Upper extremity

Arthroscopy, Volume 36, Issue 1

Does Bone Loss Imaging Modality, Measurement Methodology, and Interobserver Reliability Alter Treatment in Glenohumeral Instability?

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Purpose
To determine, in the context of measuring bone loss in shoulder instability, whether measurement differences between magnetic resonance imaging (MRI) and computed tomography (CT), linear-based and area-based methods, and observers altered the proposed treatment when a standardized algorithm was applied.

Methods
This was a retrospective, comparative imaging study of preoperative patients with anterior shoulder instability with both an MRI and CT scan within 1 year of one another. On parasagittal images reoriented en face to the glenoid, 2 attending orthopaedic surgeons measured glenoid width, glenoid area, glenoid defect width, and glenoid defect area. On axial images maximal Hill−Sachs width was measured. From these, linear percent glenoid bone loss (%GBL) and area %GBL were calculated, and on-versus off-track was determined. With these results, a recommended treatment was determined by applying a standardized algorithm, in which the Latarjet procedure was selected for %GBL >20%, arthroscopic labral repair and remplissage for off-track lesions with %GBL <20%, and arthroscopic labral repair on-track shoulders with %GBL <20%.

Results
In total, 53 patients with mean ± standard deviation 45 ± 83 days between scans were include with a CT linear %GBL of 23.5 ± 9.6% (range 0%-47%). CT lead to larger measurements of %GBL than MRI (linear P = .008, area P = .003), and fewer shoulders being considered on-track (33.0% vs 40.5%), which would alter treatment in 25% to 34%. Linear measurements produced larger values for %GBL (CT, P < .001; MRI, P < .001), which would alter treatment in 25%. For %GBL, inter-rater reliability was good, with intraclass correlation coefficients varying from 0.727 to 0.832 and Kappa varying from 0.57 to 0.62, but these inter-rater differences would alter treatment in 31%.

Conclusions
The significant differences in bone loss measurement between imaging modality, measurement method, and observers may lead to differences in treatment in up to 34% of cases. Linear CT measurements resulted in the most aggressive treatment recommendations.

Level of Evidence

BACK

Retrospective Comparative Study: Diagnostic, Level III.

BACK

Arthroscopic Suprapectoral and Open Subpectoral Biceps Tenodeses Produce Similar Outcomes: A Randomized Prospective Analysis

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Arthroscopy, Volume 36, Issue 1

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Purpose
To directly compare subjective and objective outcomes of arthroscopic suprapectoral biceps tenodesis (ASPBT) below the bicipital groove and open subpectoral biceps tenodesis (OSPBT) performed with interference screw fixation.

Methods
A total of 77 patients indicated for biceps tenodesis who met the inclusion and exclusion criteria were randomized into the ASPBT and OSPBT groups. All tenodesis procedures implemented PEEK (polyether ether ketone) interference screws. Patients underwent a clinical examination that included range of motion and strength assessment at 3, 6, and 12 months postoperatively. Patients completed the American Shoulder and Elbow Surgeons (ASES) shoulder score, Single Assessment Numeric Evaluation score, and Constant score preoperatively and at 6 and 12 months postoperatively.

Results
Seventy-five patients were analyzed with a mean age of 50.3 ± 10.4 years and a mean body mass index of 28.9 ± 6.3. All patients had arthroscopic evidence of biceps pathology and underwent either an ASPBT (n = 37) or OSPBT (n = 38). The surgical time was significantly greater for ASPBT than for OSPBT (16.9 ± 8.4 minutes vs 9.8 ± 3.1 minutes, $P < .001$). One patient underwent conversion from the ASPBT group to the OSPBT group because of shearing of a severely attenuated tendon preventing an ASPBT. No significant difference ($P > .05$) was found in strength or anterior shoulder pain at 3 months, 6 months, and 1 year, and no significant difference ($P > .05$) was found in clinical outcome scores (ASES, Constant subjective, and Single Assessment Numeric Evaluation) between the 2 groups at 6 months and 1 year. The improvement in the ASES score exceeded the minimal clinically important difference (12 points) in both groups.

Conclusions
No differences in patient-reported outcome measures, functional outcomes, or complication rates were found after ASPBT compared with OSPBT. However, the results of this investigation must be interpreted with caution because this study may be underpowered to detect statistical differences.

Level of Evidence
Level I, randomized controlled trial.

BACK

Progression of Erosive Changes of Glenoid Rim After Arthroscopic Bankart Repair

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Purpose
To evaluate changes of the glenoid after arthroscopic Bankart repair (ABR) in patients with different preoperative glenoid structures.

Methods
Patients who underwent ABR for traumatic anterior shoulder instability were retrospectively investigated. They were divided into 3 groups on the basis of preoperative glenoid structure by computed tomography (CT): normal glenoid (group N), glenoid erosion (group E), or glenoid defect associated with a bony Bankart lesion (group B). Shoulders in group B were also stratified according to the postoperative status of the bone fragment (union, nonunion, or resorbed). Postoperative changes of glenoid width (Δ) (increase: Δ ≥5%, stable: Δ >−5% to <5%, decrease: Δ ≤−5%) and the extent of glenoid bone loss were investigated by 3-dimensional CT.

Results
A total of 186 shoulders were divided into 3 groups: group N (n = 61), group E (n = 46), and group B (n = 79). At initial postoperative CT, the glenoid width was decreased in 41 shoulders, stable in 20 shoulders, and increased in no shoulders from group N. The respective numbers were 27, 18, and 1 in group E, and 50, 22, and 7 in group B. The glenoid width was reduced in all groups (mean percent change: −8.8%, −5.9%, and −6.1%, respectively). In group B, glenoid width decreased in most of the shoulders without bone union. The glenoid bone loss on the preoperative and postoperative final CT was, respectively, 0% and 8.6% in group N ($P < .0001$), 9.9% and 12.4% in group E ($P = .03$), and 10.4% and 7.2% in group B ($P = .01$). Final glenoid bone loss >13.5% was recognized in 18.2% of group N, 35.7% of group E, and 21.8% of group B.

Conclusions
Glenoid width often decreased after ABR because of anterior glenoid rim erosion, and this change was frequent in patients with preoperative normal glenoid, glenoid erosion, or without postoperative union of a bony Bankart lesion.

Level of Evidence
Level 3, Case-control study.

BACK

Glenoid Track Instability Management Score: Radiographic Modification of the Instability Severity Index Score

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Purpose
The purpose of this study is (1) to test the proposed treatment algorithm, the Glenoid Track Instability Management Score (GTIMS), which incorporates the glenoid track concept into the instability severity index score (ISIS), and (2) to compare treatment decision-making using either GTIMS versus ISIS in 2 cohorts of patients with operatively treated anterior instability.

Methods
A multicenter, retrospective review of two consecutive groups consisting of 72 and 189 patients treated according to ISIS and GTIMS, respectively, was conducted. Inclusion criteria for all patients were ≥2 confirmed traumatic anterior shoulder instability events and a physical examination demonstrating a positive anterior apprehension and relocation test. The GTIMS was graded for all 189 patients in the cohort, which uses 3-dimensional computed tomography as the sole radiographic parameter to assess on-track (0 points) versus off-track (4 points) Hill-Sachs lesions. This method differs from ISIS, which uses multiple plain radiographs for the 4-point imaging portion of the score. Outcomes scores were compared within the GTIMS and ISIS groups, as well as between them for overall comparisons based on the Western Ontario Shoulder Instability Index (WOSI), the Single Assessment Numerical Evaluation (SANE) score, and the mean rates of recurrent instability.

Results
A total of 261 consecutive patients from 2009 to 2014 who presented with recurrent anterior shoulder instability were treated according to either ISIS (n = 72/261, 27.6%) or GTIMS (n = 189/261, 72.4%). At a mean follow-up time of 33.2 months (range 24-49 months), the overall cohort mean ISIS of 2.9 ± 2.2 (range 0-9) was significantly higher than the mean GTIMS of 1.9 ± 1.9 (range = 0-9, $P < .001$). Of the 72 ISIS treated patients, 50 (69.4%) had an ISIS score of ≥ 4 and underwent a Latarjet, and the 22 patients (30.6%) with an ISIS score of < 4 underwent an arthroscopic Bankart repair. Based on GTIMS in the 189-patient cohort, using the same cutoff of 4 to indicate the need for a Latarjet, 162 patients were treated with arthroscopic Bankart repair (85.7%) and 27 with Latarjet (14.3%). The overall outcomes improved for patients treated with a Latarjet in both groups (GTIMS WOSI from 1099 [47.7% normal] to 395 [81.3% normal]; GTIMS SANE from 48 to 81; ISIS WOSI from 1050 [50% normal] to 345 [83.4% normal]; ISIS SANE from 50 to 84; $P < .01$). Similar positive outcomes were seen in patients treated with arthroscopic Bankart repair (GTIMS WOSI from 1062 [49.2% normal] to 402 [80.6% normal]; GTIMS SANE from 49 to 82; ISIS WOSI from 1080 [51.8% normal] to 490 [76.7% normal]; ISIS SANE from 48 to 77; $P < .01$). Of note, the patients with arthroscopically indicated ISIS had significantly worse outcomes scores than those treated arthroscopically according to GTIMS ($P < .01$). Of the 189 patients graded with GTIMS, there would have been 33 more Latarjet procedures recommended based on ISIS score. Thus the distribution of procedures based on ISIS versus GTIMS was significantly different ($\chi 2 = 45.950$; $P < .001$), indicating a higher rate of recommending Latarjets when using ISIS versus GTIMS.

Conclusions

BACK

When ISIS scoring and plain radiograph parameters only are used, this predicted a 2-fold increase in recommending a Latarjet versus GTIMS scoring criteria, which uses advanced imaging and the on- and off-track principle to more conservatively delineate anterior instability treatment with promising postoperative patient outcomes. Overall, there were minimal differences in outcomes between GTIMS and ISIS Latarjet patients; however, better outcomes were seen in patients indicated for arthroscopic Bankart repair according to GTIMS and on-off track computed tomography scanning indications.

Level of Evidence
II, Prospective Cohort Study.

BACK

Arthroscopic Rotator Cuff Repair Metrics: Establishing Face, Content, and Construct Validity in a Cadaveric Model

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Purpose
To create and determine face validity and content validity of arthroscopic rotator cuff repair (ARCR) performance metrics, to confirm construct validity of the metrics coupled with a cadaveric shoulder, and to establish a performance benchmark for the procedure on a cadaveric shoulder.

Methods
Five experienced arthroscopic shoulder surgeons created step, error, and sentinel error metrics for an ARCR. Fourteen shoulder arthroscopy faculty members from the Arthroscopy Association of North America formed the modified Delphi panel to assess face and content validity. Eight Arthroscopy Association of North America shoulder arthroscopy faculty members (experienced group) were compared with 9 postgraduate year 4 or 5 orthopaedic residents (novice group) in their ability to perform an ARCR. Instructions were given to perform a diagnostic arthroscopy and a 2-anchor, 4–simple suture repair of a 2-cm supraspinatus tear. The procedure was videotaped in its entirety and independently scored in blinded fashion by trained, paired reviewers.

Results
Delphi panel consensus for 42 steps and 66 potential errors was obtained. Overall performance assessment showed a mean inter-rater reliability of 0.93. Novice surgeons completed 17% fewer steps (32.1 vs 37.5, P = .001) and enacted 2.5 times more errors than the experienced group (6.21 vs 2.5, P = .012). Fifty percent of the experienced group members and none of the novice group members achieved the proficiency benchmark of a minimum of 37 steps completed with 3 or fewer errors.

Conclusions
Face validity and content validity for the ARCR metrics, along with construct validity for the metrics and cadaveric shoulder, were verified. A proficiency benchmark was established based on the mean performance of an experienced group of arthroscopic shoulder surgeons.

Clinical Relevance
Validated procedural metrics combined with the use of a cadaveric shoulder can be used to accurately assess the performance of an ARCR.

BACK

Comparison of Preparation Techniques for Isolating Subacromial Bursa-Derived Cells as a Potential Augment for Rotator Cuff Repair

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Purpose
To identify an effective, nonenzymatic method for maximizing the yield of subacromial bursa-derived nucleated cells for augmenting rotator cuff repair.

Methods
Subacromial bursa (minimum 0.2 g) was collected prospectively over the supraspinatus from patients (n = 7) with at least one full-thickness tendon tear undergoing arthroscopic primary rotator cuff repair. Samples were processed and analyzed prospectively using 4 different methods: (1) mechanical digestion with scissors (chopping), (2) collagenase digestion, (3) mechanical digestion with a tissue homogenizer, and (4) whole tissue with minimal manipulation. Tissue from each method were plated and cultured in a low oxygen tension, humidified incubator for 7 days. Following incubation, cellularity was assessed with nucleated cell count using a Coulter Counter. Flow cytometry was performed on the non-enzymatic method that demonstrated the greatest cell count to confirm the presence of mesenchymal stem cells (MSCs). The Kruskal–Wallis H test and post hoc Dunn's test were used for statistical analysis.

Results
Following incubation, mean nucleated cell counts (cells/mL) were (1) 102,681 ± 73,249 for chopping, (2) 76,190 ± 66,275 for collagenase, (3) 31,686 ± 29,234 for homogenization, and (4) 11,162 ± 4016 for whole tissue. There was no significant difference between chopping and collagenase (P = .45) or between homogenization and collagenase (P = .52). Both chopping (P = .003) and collagenase (P = .03) produced significantly more cells when compared with whole tissue. Flow cytometry confirmed the presence of MSC markers on samples processed by chopping.

Conclusions
Mechanical isolation of subacromial bursa-derived cells using a chopping technique demonstrated similar nucleated cell count compared with collagenase, along with the confirmed presence of MSCs.

Clinical Relevance
This study demonstrated a nonenzymatic, mechanical method for isolating subacromial bursa-derived cells to potentially augment rotator cuff repair. Further clinical studies are required to assess its possible advent in the tendon–bone healing process.

BACK

High Clinical Failure Rate After Latissimus Dorsi Transfer for Revision Massive Rotator Cuff Tears

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Purpose
To evaluate the clinical success rate, along with risk factors for failure, in patients undergoing latissimus dorsi transfer for the treatment of massive, irreparable, previously failed rotator cuff tears.

Methods
We performed a retrospective chart review of prospectively collected data from an institutional shoulder outcome registry. All patients who underwent latissimus dorsi transfer for previously failed rotator cuff repair between 2006 and 2013 with a minimum follow-up period of 1 year were included in the study. The indications for inclusion were large (≥2 tendons), retracted, chronic rotator cuff tears with fatty infiltration or atrophy for which prior surgical repair had failed. Preoperative and postoperative American Shoulder and Elbow Surgeons (ASES) and Simple Shoulder Test scores were collected, along with postoperative Single Assessment Numerical Evaluation scores. Complications and clinical failures (Δ in ASES score <17) were recorded. Patient demographic and tear characteristics were evaluated as potential risk factors for failure.

Results
A total of 22 patients (mean age, 53 ± 6 years) were included in the study, with a mean follow-up time of 3.4 ± 1.1 years. Over 63% of patients (n = 14) reported undergoing 2 or more prior failed rotator cuff repairs. Patients undergoing latissimus dorsi transfer showed significant improvements in ASES scores (from 35.2 ± 21.9 preoperatively to 55.8 ± 22.9 postoperatively, P = .001), Simple Shoulder Test scores (from 3.5 ± 3.1 preoperatively to 5.2 ± 3.4 postoperatively, P = .002), and pain scores (from 5.9 ± 2.8 preoperatively to 4.6 ± 4.3 postoperatively, P = .002) at final follow-up. The complication rate after latissimus transfer was 27%. The rate of revision to reverse total shoulder arthroplasty was 13.6% (n = 3) after a mean of 2.7 years, and the clinical failure rate was 41% (n = 9) at final follow-up. An acromiohumeral interval of less than 7 mm (P = .04) and high-grade fatty infiltration (grade 3 or greater, P = .004) were significant preoperative risk factors for clinical failure.

Conclusions
Latissimus dorsi tendon transfer resulted in a clinical failure rate of 41% and complication rate of 27%, with an acromiohumeral interval of less than 7 mm and high-grade fatty infiltration being associated with postoperative failure.

Level of Evidence
Level IV.

BACK

Magnetic Resonance Imaging Correlates With Computed Tomography for Glenoid Version Calculation Despite Lack of Visibility of Medial Scapula

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Arthroscopy, Volume 36, Issue 1

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Purpose
To assess the accuracy of measuring glenoid version on magnetic resonance imaging (MRI) in the presence of varying amounts of the medial scapula body as compared with the gold standard of glenoid version measured on computed tomography (CT) imaging, including the entire scapula in a cohort of young patients with shoulder instability and without glenohumeral arthritis.

Methods
A retrospective review was performed on instability patients with preoperative MRI and CT imaging. Measurements of available scapular width and glenoid version were performed using the Cobb angle method to measure the angle between the plane of the glenoid fossa to Friedman's line on axial images. Intra- and interrater reliability analysis was performed using intraclass correlation coefficients to assess agreement between MRI and CT measurements. Paired t tests were used to compare measurement differences between MRI and CT.

Results
Thirty-two patients with both MRI and CT scans were assessed. Intra- and inter-rater assessment revealed strong agreement for scapular width measurement. For glenoid version measurement, intra-rater agreement was excellent and inter-rater agreement was moderate on CT and good on MRI. The mean available scapular body width was 24.7 mm longer on CT as compared with MRI (95% confidence interval 17.5-31.9, $P < .0001$; 109.8 ± 8.2 mm vs 85.1 ± 16.9 mm, respectively), with MRI having an average of 78.2% (±17.6%) of the CT scapular width shown on CT. No significant difference in glenoid version was found between MRI and CT (95% confidence interval −0.87 to 1.75, $P = .499$; MRI −2.57° vs CT −2.13°).

Conclusion
MRI provided significantly shorter available scapular widths when compared with CT imaging in a cohort of patients with glenohumeral instability and without arthritis. However, this failed to produce a significant difference of ≥5° in measured glenoid version compared with CT measurements when 75% (8 cm) of the scapular width was present on MRI. Measuring glenoid version on MRI does not appear to be significantly affected when the entirety of the medial border of the scapula is not included in the imaging field.

Level of Evidence
Level III; study of diagnostic test.

BACK

Reconstruction of the Acromioclavicular Ligament Complex Using Dermal Allograft: A Biomechanical Analysis

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Purpose
To analyze the posterior translational and rotational stability of the acromioclavicular (AC) joint following reconstruction of the superior acromioclavicular ligament complex (ACLC) using dermal allograft.

Methods
Six fresh-frozen cadaveric shoulders were used (mean age of 65.3 ± 6.9 years). The resistance force against posterior translation (10 mm) and torque against posterior rotation (20°) was measured. Specimens were first tested with both the intact ACLC and coracoclavicular ligaments. The ACLC and coracoclavicular ligaments were then transected so simulate a Type III/V AC joint dislocation. Each specimen then underwent 3 testing conditions, performed in the following order: (1) ACLC patch reconstruction alone, (2) ACLC patch with an anatomic coracoclavicular reconstruction (ACCR) using semitendinosus allograft, and (3) the transected ACLC with an ACCR only. Differences in posterior translational and rotational torque across testing conditions were analyzed with a one-way repeated analysis of variance analysis.

Results
Mean resistance against posterior translation in the intact condition was 65.76 ± 23.8 N. No significant difference found between the intact condition compared with specimens with the ACLC-patch only (44.2 ± 11.3 N, P = .06). The ACCR technique, when tested alone, had significantly less posterior translational resistance compared with the intact condition (38.5 ± 8.94 N, P = .008). ACLC patch in combination with an ACCR was closest in restoring native posterior translation (57.1 ± 19.2 N, P = .75). For rotational resistance, only the addition of the ACLC patch with an ACCR (0.51 ± 0.07 N-m) demonstrated similar torque compared with the intact joint (0.89 ± 0.5 N-m, P = .06).

Conclusions
The ACLC-patch plus ACCR technique was able to closest restore the percent of normal posterior translational and rotational stability.

Clinical Relevance
Recurrent posterior instability of the AC joint is a potential complication after coracoclavicular reconstruction surgery. In the in vitro setting, this study demonstrated increased AC joint stability with the addition of an ACLC reconstruction using dermal allograft.

BACK

Arthroscopic Repair of 270- and 360-Degree Glenoid Labrum Tears: A Systematic Review

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Purpose
To review the current literature available and evaluate the efficacy of arthroscopic repair of 270° and 360° labral tears, as well as the complication rates associated with such. In addition, we intend to investigate whether consistent clinical findings can be observed in these patients.

Methods
This review is registered in the PROSPERO database. The MEDLINE, Cochrane Library, Scopus, and EMBASE databases were queried, and additional searches were performed manually. Studies that reported outcomes after arthroscopic repair of a minimum of 270° of glenoid labrum were included. Technique articles, repairs of less than 270°, studies on atraumatic multidirectional instability, and studies that lacked observable outcomes were excluded.

Results
In total, 3031 studies/documents were identified from database and manual searching. Screening, removal of duplicates, and assessment for inclusion/exclusion criteria resulted in 6 level IV studies for review. History and physical examination, as well as advanced imaging findings, were variable across studies. All studies reported satisfactory outcomes at short- to mid-term follow-up, although there was heterogeneity in type of outcomes used. Return to sport ranged from 75% to 100%. Complication rates ranged from 10% to 30%. Notably, recurrence of instability and need for secondary surgery occurred in up to 15% of patients.

Conclusions
The current literature suggests that although clinical and radiographic variability exist in the diagnosis of 270° and 360° glenoid labrum tears, successful outcomes and return to work/sport can be achieved with arthroscopic management at an average minimum follow-up of 1 year. These figures, however, are limited by heterogenous studies containing small numbers of patients. Complications occur in up to 30% of cases, including an instability recurrence rate of up to 15%.

Level of Evidence
Systematic review of Level IV evidence.

BACK

Journal of Shoulder and Elbow Surgery (JSES), Volume 29, issue 1

Autologous chondrocyte implantation for treatment of focal articular cartilage defects of the humeral head

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Background
Autologous chondrocyte implantation (ACI) constitutes an established treatment option for cartilage defects of the knee joint. Experience in the shoulder, however, is limited, and the management of cartilage defects remains a challenge. The purpose of this study was to evaluate the results after ACI with 3-dimensional spheroids of human autologous matrix-associated chondrocytes in the shoulder.

Methods
Seven male patients (median age, 42.8 years [range, 18-55 years]) underwent ACI for symptomatic focal grade IV cartilage lesions of the humeral head by an open or arthroscopic approach. Clinical parameters (range of motion, visual analog scale score, Subjective Shoulder Value, Constant score,
and American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form score) and osteoarthritis grades were assessed. Arthroscopic re-evaluation was additionally performed in 5 patients.

Results
After a median follow-up period of 32 months (range, 22-58 months), the median Subjective Shoulder Value was 95% (range, 70%-100%) compared with 60% (range, 30%-60%) preoperatively, the visual analog scale score was 0 at rest and was a median of 0 (range, 0-2) during exercise, the median Constant score was 95 points (range, 80-100 points), and the median American Shoulder and Elbow Surgeons score was 97 points (range, 90-100 points). The median preoperative size of the cartilage lesion was 3 cm2 (range, 2.3-4.5 cm2). Arthroscopically, complete coverage of the cartilage defect was observed in 4 cases whereas a circumferential residual defect of 0.25 cm2 was found in 1 patient. Grade I osteoarthritis (Samilson and Prieto classification) was observed in 2 cases. One patient had postoperative adhesive capsulitis and required revision surgery.

Conclusion
ACI using 3-dimensional spheroids of human autologous matrix-associated chondrocytes for treatment of grade IV articular cartilage lesions of the humeral head achieves satisfactory clinical results during a short- to mid-term follow-up period and leads to successful defect coverage with only
minor radiologic degenerative changes. In this case series, ACI proved to constitute a viable treatment in the shoulder joint. However, in consideration of the 2-stage surgical design and the cost intensiveness of this procedure, the indication is restricted to young and active symptomatic patients in our practice.

Level of evidence
Level IV; Case Series; Treatment Stud

BACK

Subscapularis structural integrity and function after arthroscopic Latarjet procedure at a minimum 2-year follow-up

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Background
Subscapularis function after arthroscopic Bankart repair has been widely studied. However, data regarding subscapularis performance after arthroscopic Latarjet procedures are lacking. This study aimed to evaluate subscapularis clinical and radiologic performance after arthroscopic Latarjet procedures.

Methods
We included 40 patients who underwent arthroscopic Latarjet procedure with a minimum 2-year follow-up. Clinical evaluation included Western Ontario Shoulder Instability Index and Rowe
scores, specific subscapularis isokinetic study, and lift-off tests. Contralateral measurements were used for comparison. Computed tomographic evaluation included graft consolidation, muscle dimensions, and degree of fatty atrophy, calculated as the mean muscle attenuation (MMA).
Results: There was a decrease of 8.3% of maximum internal rotation peak torque in the operated arm (P ¼ .02). However, there was no significant difference in the agonist-antagonist ratio: 76.9% in the operated arm and 76% in the contralateral (P ¼.82). Lift-off strength test demonstrated a decrease in the first year but not at final follow-up (P ¼ .38). There was a significant decrease in lift-off distance of 23% compared to the contralateral side (P < .001). Subscapularis MMA was diminished when compared to the infraspinatus/teres minor (P < .001) at the expense of its upper part (P ¼ .03). Hyperlaxity and number of dislocation episodes were correlated to a lower MMA (P ¼ .046 and P ¼ .005).

Conclusion
Arthroscopic Latarjet procedures provide satisfactory clinical results. There seems to be a diminished subscapularis MMA depending on its superior half. Hyperlaxity and number of previous dislocations were correlated to a lower MMA. Although there was a decrease in the maximum internal rotation peak torque, we did not find any difference in the agonist-antagonist ratio or in the final lift-off
strength between sides.

Level of evidence
Level IV; Case Series; Treatment Study

BACK

Application of a new polyester patch in arthroscopic massive rotator cuff repair: a prospective cohort study

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Background
Massive rotator cuff (RC) tears still present a clinically challenging problem, with reported rerupture rates in up to 94%. The study objective was to determine the impact of synthetic patch augmentation for massive RC tears.

Methods
Between June 2012 and 2014, we performed 50 arthroscopic RC reconstructions augmented with a synthetic polyester patch. Pre- and postoperative imaging methods included arthrographic magnetic resonance imaging, arthrographic computed tomography, and ultrasound examination to determine tendon integrity or rerupture. Clinical outcome was evaluated using the Constant-Murley score and the subjective shoulder value. Mean clinical midterm and final follow-up was 22 months (9-35 months) and 52 months (25-74 months), respectively.

Result
The mean Constant-Murley score increased significantly from 36.5 (16.4 standard deviation [SD]) preoperatively to a midterm value of 81.2 (9.6 SD; P <.0001) and further improved to a mean of 83.4 (10.8 SD) at final follow-up. The mean subjective shoulder value increased from 40.3 (24.3 SD) to 89.2 (12.9 SD; P < .0001) at midterm and to 89.6 (15.2 SD) at final follow-up. We observed 7 complete reruptures (14%). However, reruptures did not correlate with revision surgery, which was performed in 8 patients. The main reason for revision was frozen shoulder or arthrofibrosis with an intact reconstruction and patch, which was performed in 6 cases.

Conclusions
The retear rate of 14% compared favorably with nonaugmented RC repairs in the literature. Therefore, we conclude that patch augmentation in massive RC tears is feasible to reduce retears and to improve clinical outcome.

Level of evidence:
Level IV; Case Series; Treatment Study

BACK

Lower Extremity

Arthroscopy, Volume 36, Issue 1

An Anatomic Study of the Damage to Capsular Hip Stabilizers During Subspine Decompression Using a Transverse Interportal Capsulotomy in Hip Arthroscopy

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Purpose
To quantify the damage to the soft tissue stabilizers of the hip after a transverse interportal capsulotomy and subspine trimming in hip arthroscopy.

Methods
Eight human cadaveric hemipelvises underwent hip arthroscopy through a transverse interportal capsulotomy. Arthroscopic subspine trimming performed on all specimens was classified according to an anatomic index. The width of the proximal capsule was measured before and after subspine trimming. The extent of damage to the iliofemoral ligament (IFL) after dissection was recorded. Potential damage to pericapsular structures was assessed by measuring the distance between the capsulotomy and rectus femoris and iliocapsularis muscle with an electronic caliper.

Results
In all specimens, ≥50% of the width of the IFL was damaged. The subspine trimming was successfully performed in 7 of 8 specimens (87.5%) according to the proposed index. The sizes of the trimmed bone area measured in the anteroposterior and proximal-distal axis were 21.2 ± 7.5 and 13.1 ± 9 mm, respectively (mean ± standard deviation). The width of the proximal capsule at the anterior and posterior corner of the capsulotomy was 19.8 ± 5.2 and 11.8 ± 1.7 mm, respectively. After subspine trimming, the mean width of the anterior and posterior proximal capsular attachments was 6.4 ± 1.4 and 7.0 ± 1.6 mm, respectively. On average, 13.4 mm of anterior capsule was damaged after anterior inferior iliac spine trimming, versus 4.7 mm of the posterior capsule. The distances from the capsulotomy to the rectus femoris direct and reflected head were 6.8 ± 4.9 and 6.3 ± 7.7 mm, respectively, and to the iliocapsularis muscle, 11.5 ± 7.8 mm.

Conclusion
High rates of damage to the IFL were observed with the interportal capsulotomy. Increased tissue damage at the anterior capsule was observed after subspine trimming. The width of the proximal capsular attachment was ≥5 mm in all specimens.

Clinical Relevance
Surgeons should be aware of the potential damage to the native capsule and pericapsular structures when using a transverse interportal capsulotomy for the arthroscopic subspine decompression.

Level of Evidence
IV: cadaveric study, case series.

BACK

Two-Year Patient-Reported Outcomes for Patients Undergoing Revision Hip Arthroscopy with Capsular Incompetency

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Arthroscopy, Volume 36, Issue 1

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Purpose
To determine clinical outcomes of patients undergoing revision hip arthroscopy for failure to improve with magnetic resonance imaging (MRI) and intraoperative evidence of a capsular incompetency as compared with (1) patients undergoing revision hip arthroscopy without evidence of a capsular incompetency and (2) patients undergoing primary surgery for femoroacetabular impingement syndrome (FAIS) at a minimum follow up of 2 years.

Methods
Data from consecutive patients undergoing revision hip arthroscopy with MRI/arthrogram-confirmed capsular incompetency between January 2012 and June 2016 were analyzed. All revision patients with capsular incompetency was matched 1:1 by age and body mass index to FAIS revision patients without capsular incompetency and primary FAIS patients. Outcomes included the Hip Outcome Score (HOS)–Activities of Daily Living (ADL), HOS-Sports Subscale (SS), Modified Harris Hip Score (mHHS), pain, and satisfaction. The minimal clinically important difference was calculated for HOS-ADL, HOS-SS, and mHHS.

Results
In total, 49 patients (54.4%) of 90 undergoing revision hip arthroscopy had MRI evidence of a capsular incompetency. Most patients were female (79.6%), with a mean age of 30 ± 10.5 years and body mass index of 25.7 ± 5.5. The difference among pre- and postoperative HOS-ADL, HOS-SS, mHHS, and visual analog scale score for pain were all statistically significant ($P < .05$). Analysis of reported outcomes among matched groups demonstrated statistically significant differences, with the group undergoing primary surgery having the greatest 2-year outcomes. Only 66.7% of patients undergoing revision surgery with capsular incompetency achieved a minimal clinically important difference; however, there was no significant difference when compared with revision patients without capsular incompetency. When compared with patients undergoing primary surgery, the difference in frequency was statistically significant (66.7% vs 91.3%; $P < .001$).

Conclusions
More than one half of patients undergoing revision hip arthroscopy had MRI and intraoperative evidence of capsular incompetency. Revision arthroscopy for capsular incompetency results in significantly improved 2-year outcomes. However, patients undergoing revision for capsular incompetency and intact capsule revision patients reported significantly lower outcomes compared with primary patients.

Level of Evidence
Level III, Retrospective Comparative Study.

BACK

Intraoperative Monitoring and Intra-abdominal Fluid Extravasation During Hip Arthroscopy

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Arthroscopy, Volume 36, Issue 1

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Objective
To evaluate the relationship between the intraoperative monitoring factors with intra-abdominal fluid extravasation (IAFE) in patients who underwent hip arthroscopy. The secondary purpose was to describe the main intraoperative variables between cases with and without IAFE.

Methods
We carried out a prospective observational study of 106 hip arthroscopies between June 2017 and June 2018. Within procedures, 54 cases with deep gluteal syndrome (DGS) were included. Ultrasonography was performed by a trained anesthesiologist before and after the surgery to identify the presence of fluid. The hepatorenal (Morison's pouch), splenorenal, retroaortic, suprapubic (longitudinal and transverse), and pleural spaces were examined. During the surgery, the blood pressure, heart rate, temperature, peak inspiratory pressure (PIP), pulmonary compliance, oxygen saturation, and end-tidal carbon dioxide were registered.

Results
The incidence of IAFE was 31.1% (33/106; 95% confidence interval 23.0%-40.5%). IAFE in cases with isolated FAI was 15.9% (7/44) in comparison with 52.9% (9/17) of the cases with isolated DGS. Maximum values of PIP greater than 20 mm Hg were associated with fluid extravasation (odds ratio 3.22; 95% confidence interval 1.07-9.68). No statistically significant relationship was found in blood pressure, heart rate, temperature, oxygen saturation, end-tidal carbon dioxide, and pulmonary compliance between cases with and without IAFE.

Conclusions
Asymptomatic IAFE, as measured by ultrasound, is a frequent event in patients who underwent hip arthroscopy, mainly in cases with DGS. PIP was found to be a useful intraoperative monitoring parameter for the early identification of IAFE in hip arthroscopy.

Level of Evidence
Level II, observational prospective cohort study.

BACK

Postoperative Weightbearing Protocols After Arthroscopic Surgery for Femoroacetabular Impingement Does Not Affect Patient Outcome: A Comparative Study With Minimum 2-Year Follow-up

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Arthroscopy, Volume 36, Issue 1, Received: March 28, 2019; Accepted: July 22, 2019

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Purpose
To evaluate the effects of immediate postoperative weightbearing protocols after hip arthroscopy for femoroacetabular impingement (FAI) with minimum 2-year follow-up, as measured by patient-reported outcome measures and satisfaction rates.

Methods
Between January 2011 and June 2016, patients undergoing hip arthroscopy for FAI and labral tears were reviewed. Exclusion criteria was previous hip pathology or arthroscopy, active Workers' Compensation claims, and concomitant pathologies impeding weightbearing. Patients who were operated on before September 2013 were treated with 3 weeks of postoperative non-weightbearing (NWB), with weightbearing as tolerated (WBAT) thereafter. From October 2013, patients were allowed immediate postoperative WBAT.

Results
A total of 351 hip arthroscopic surgeries were performed; 133 of these patients met the inclusion criteria. Of the 133 included patients, 69 were in the NWB group and 64 were in the WBAT group. No differences were found in terms of sex (P = .603) or age (P = .241). No differences were found in postoperative scores (the Modified Harris Hip Score was 84.5 [range 79-89] for NWB vs 86.7 [78-89] for WBAT [P = .0.523], and the Hip Outcome Score was 83.1 [78-88] vs 88.4 [80-90], respectively; P = .130). Subjective rates of improvement, satisfaction score and the will to undergo surgery again did not differ between the groups (P = .674, P = .882, P = .730). The rate of subjects who met or exceeded the MCID in the NWB and WBAT groups was 82.6% and 81.2% for the Modified Harris Hip Score (P = .838) and 79.7% and 82.8% for the Hip Outcome Score (P = .647). There were no reported complications. Limitations include the possibility of the study being underpowered.

Conclusions
After a 2-year minimum follow-up, patient-reported outcome measures and satisfactory rates with immediate weightbearing after hip arthroscopy for isolated FAI syndrome and labral tears do not differ significantly from results after strict NWB rehabilitation protocols. Revising weightbearing restrictions may allow for a more comfortable rehabilitation process after arthroscopic hip surgery for FAI and labral repair.

Level of Evidence
Level 3 – case-control study.

BACK

Does a Traumatic Etiology of Hip Pain Influence Hip Arthroscopy Outcomes?

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Arthroscopy, Volume 36, Issue 1, Received: January 14, 2019; Accepted: July 25, 2019

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Purpose
To determine whether patients who reported a discrete traumatic event precipitating the onset of femoroacetabular impingement syndrome (FAIS) reported similar patient-reported outcomes for the modified Harris Hip Score (mHHS) and the Non-Arthritic Hip Score (NAHS) following hip arthroscopy as patients with atraumatic hip pain associated with FAIS alone.

Methods
A retrospective comparative therapeutic investigation of a prospectively collected database of cases performed by a single surgeon from 2010 to 2015 identified a group of patients who developed FAIS after a discrete traumatic event. This group was compared 1:2 with a body mass index and age-matched group of primary hip arthroscopies with atraumatic hip pain attributed to FAIS. Preoperative mHHS and NAHS were obtained and compared with those at 2-year follow-up. Clinical failure at 2 years was defined as any further ipsilateral hip surgery including revision arthroscopy and conversion to arthroplasty.

Results
In the traumatic etiology group, the mean mHHS and NAHS improved from 49.6 to 82.7 ($P < .001$) and from 46.9 to 84.0 ($P < .001$), respectively. The mean mHHS and NAHS in the atraumatic group improved from 51.5 to 85.82 ($P < .001$) and from 49.3 to 85.2 ($P < .001$), respectively. Survivorship at 2 years was 81.1% for traumatic etiology and 88.3% for atraumatic etiology; adjusted proportional hazards regression analysis demonstrated a difference in survivorship that was not statistically significant between the traumatic and atraumatic cohorts (hazard ratio 1.8, 95% confidence interval 0.8-4.0).

Conclusions
The findings of this study demonstrate that patients presenting with FAIS and history of a traumatic hip injury can expect to experience similar good outcomes at 2 years following primary hip arthroscopy as compared with patients with atraumatic FAIS.

Level of Evidence
Level III (Therapeutic) retrospective comparative study.

BACK

Autologous Bone Graft Versus Silicate-Substituted Calcium Phosphate in the Treatment of Tunnel Defects in 2-Stage Revision Anterior Cruciate Ligament Reconstruction: A Prospective, Randomized Controlled Study With a Minimum Follow-up of 2 Years

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Arthroscopy, Volume 36, Issue 1, Received: March 14, 2019; Accepted: July 24, 2019

https://doi.org/10.1016/j.arthro.2019.07.035

Purpose
To compare and evaluate knee laxity and functional outcomes between autologous bone graft and silicate-substituted calcium phosphate (Si-CaP) in the treatment of tunnel defects in 2-stage revision anterior cruciate ligament reconstruction (ACLR).

Methods
This prospective, randomized controlled trial was conducted between 2012 and 2015 with a total of 40 patients who underwent 2-stage revision ACLR. The tunnels were filled with autologous iliac crest cancellous bone graft in 20 patients (control group) and with Si-CaP in the other 20 patients (intervention group). After a minimum follow-up period of 2 years, functional outcomes were assessed by KT-1000 arthrometry (side-to-side [STS] difference), the Tegner score, the Lysholm score, and the International Knee Documentation Committee score.

Results
A total of 37 patients (follow-up rate, 92.5%) with an average age of 31 years were followed up for 3.4 years (range, 2.2-5.5 years). The KT-1000 measurement did not show any STS difference between the bone graft group (0.9 ± 1.5 mm) and the Si-CaP group (0.7 ± 2.0 mm) ($P = .731$). One patient in the intervention group (5%) had an STS difference greater than 5 mm. Both groups showed significant improvements in the Tegner score, Lysholm score, and International Knee Documentation Committee score from preoperative assessment to final follow-up ($P \leq .002$), without any difference between the 2 groups ($P \geq .396$). Complications requiring revision occurred in 4 control patients (22%) and in 2 patients in the intervention group (11%) ($P = .660$). No complications in relation to Si-CaP were observed.

Conclusions
Equivalent knee laxity and clinical function outcomes were noted 3 years after surgery in both groups of patients. Si-CaP bone substitute is therefore a safe alternative to autologous bone graft for 2-stage ACLR.

Level of Evidence
Level I, prospective, randomized controlled clinical trial.

BACK

High Risk of Further Anterior Cruciate Ligament Injury in a 10-Year Follow-up Study of Anterior Cruciate Ligament-Reconstructed Soccer Players in the Swedish National Knee Ligament Registry

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Arthroscopy, Volume 36, Issue 1, Received: January 17, 2019; Accepted: May 23, 2019

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Purpose
To follow up on soccer players 10 years after a primary anterior cruciate ligament (ACL) reconstruction to find out how many players returned to play soccer, what influenced their decision, and if there are any differences in additional ACL injuries (graft failure and/or contralateral ACL injury) between those who returned to play and those who did not.

Methods
The study cohort consists of 1661 soccer players from the Swedish National Knee Ligament Registry. A questionnaire was sent to each player regarding their return to play and additional knee injuries that may have occurred 10 years after their primary ACL. The results are based on the 684 responders. Data such as age, sex, surgical procedural data, associated injuries, patient-reported outcome measures, and additional knee surgeries were collected from the registry.

Results
In this study, 51% returned to play soccer. For those who did not return to play, the primary reason was knee related (65.4% of the cases). The most common knee-related reasons for not returning were pain and/or instability (50%; n = 109), followed by fear of reinjury (32%; n = 69). Players who return to soccer have a significantly higher risk of additional ACL injury. Of the players who returned to play soccer, 28.7% (odds ratio [OR] 2.3, $P < .001$) had additional ACL injury, 9.7% (OR 2.9, $P < .001$) had a graft failure and 20.6% (OR 2.1, $P < .001$) had a contralateral ACL injury.

Conclusions
Players that return to soccer have a significantly higher risk of sustaining further ACL injury. Only half of the soccer players return to play after ACL reconstruction, and in two-thirds of those who did not return, the reason was knee related. The high risk of sustaining additional knee injury is of serious concern to the player's future knee health and should be considered when deciding on a return to play.

Level of Evidence
Level III retrospective case-control study.

BACK

Graft Choice for Anterior Cruciate Ligament Reconstruction With a Concomitant Non-surgically Treated Medial Collateral Ligament Injury Does Not Influence the Risk of Revision

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https://doi.org/10.1016/j.arthro.2019.07.015

Purpose
To compare the risk of anterior cruciate ligament (ACL) revision and the patient-reported outcome after ACL reconstruction with a concomitant non-surgically treated medial collateral ligament (MCL) injury with regard to 3 ACL graft choices; the use of semitendinosus (ST), the use of semitendinosus-gracilis (ST-G), and the use of patellar tendon (PT) autograft. It was hypothesized that the use of ST-G would be associated with a greater risk of ACL revision and poorer patient-reported knee function.

Methods
Patients older than 15 years of age registered for a primary ACL reconstruction with a concomitant non-surgically treated MCL injury in the Swedish National Knee Ligament Registry were assessed for eligibility. Three groups were created according to ACL autograft choice; the ST, the ST-G, and the PT group. The primary outcomes were ACL revision and the 1- and 2-year Knee injury and Osteoarthritis Outcome Score (KOOS), including the KOOS patient acceptable symptom state (PASS). Cox regression analysis was applied to determine the proportional hazard ratio (HR) of primary ACL reconstruction survival. The KOOS was compared using the Mann–Whitney U test and Fisher exact test.

Results
A total of 622 patients (mean age 29.7 years, 42.4% women) were included. There was no difference in the risk of ACL revision for either the ST group (HR 1.354; 95% confidence interval [CI] 0.678-2.702 or the PT group (HR 0.837; 95% CI 0.334-2.100), compared with the ST-G group. The ST group reported a greater mean 2-year KOOS sports and recreation (68.5, standard deviation [SD] 28.5) than the ST-G group (57.4 [SD 27.6], P = .010) and the PT group (54.1 [SD 30.3], P = .006). The ST group was superior in terms of achieving PASS in sports and recreation (55.3%; 95% CI 44.1-66.1%) compared with both the ST-G (37.4%; 95% CI 29.8-45.5%; P = .014) and the PT group (33.9%; 95% CI 22.1-47.4%; P = .009).

Conclusions
The risk of ACL revision did not differ between HT and PT autografts in patients undergoing ACL reconstruction with a non-surgically treated MCL injury. However, the use of ST-G was associated with poorer 2-year patient-reported knee function compared with the ST.

Level of Evidence
Retrospective comparative trial, Level III.

BACK

Fatigue Increases Dynamic Knee Valgus in Youth Athletes: Results From a Field-Based Drop-Jump Test

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Arthroscopy, Volume 36, Issue 1

https://doi.org/10.1016/j.arthro.2019.07.018

Purpose
To determine whether fatigue increases dynamic knee valgus in adolescent athletes, as measured after a standardized exercise protocol and video-based drop-jump test. A secondary aim was to determine whether individual risk factors place certain athletes at increased risk for dynamic knee valgus.

Methods
Athletes aged 14 to 18 years were recruited for this video analysis study. Athletes were recorded performing a standard drop-jump to assess dynamic valgus. Participants then completed a standardized exercise protocol. Fatigue was quantified using a maximum vertical jump, which was compared with pre-exercise values. The drop-jump was repeated postexercise. All drop-jump recordings were randomized and scored for dynamic valgus by 11 blinded reviewers. Univariate analysis was performed to identify characteristics that predisposed athletes to increased dynamic valgus.

Results
Eighty-five (47 female, 38 male) athletes with an average age of 15.4 years were included in this study. Forty-nine percent of athletes demonstrated an increase in dynamic valgus determined by drop-jump assessment after exercise. A significantly greater percentage of athletes were graded “medium or high risk” in jumps recorded after the exercise protocol (68%) as compared with before the exercise protocol (44%; $P < .01$). Female athletes ($P < .01$) and those older than 15 years of age ($P < .01$) were the most affected by fatigue.

Conclusions
In conclusion, our study found that exercise increases dynamic knee valgus in youth athletes. Female athletes and those older than 15 years of age were most significantly affected by exercise. Greater fatigue levels were found to correlate with an increase in dynamic knee valgus, which may place athletes at greater anterior cruciate ligament injury risk. The field-based exercise drop-jump test is a low-cost and reproducible screening tool to identify at-risk athletes who could possibly benefit from anterior cruciate ligament injury-prevention strategies.

Level of Evidence
III, Comparative trial.

BACK

All-Inside Lateral Meniscal Repair via Anterolateral Portal Increases Risk of Vascular Injury: A Cadaveric Study

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Arthroscopy, Volume 36, Issue 1, Received: February 26, 2019; Accepted: July 15, 2019

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Purpose
To compare the distance from the device tip to the neurovascular structures during an all-inside medial and lateral meniscal repair using anteromedial and anterolateral portals in a fresh-frozen cadaveric study.

Methods
Ten fresh-frozen cadaveric knees were studied. The popliteal artery, popliteal vein, and tibial nerve were identified after dissection via a posterior approach. An all-inside meniscal repair device was set to a 20-mm depth limit and inserted into a fixed point in the posterior horn at the meniscocapsular junction. This was performed for medial and lateral menisci via anteromedial and anterolateral arthroscopic portals. The distances between the device tip and the neurovascular structures were measured. We performed t tests to determine statistical significance.

Results
The distance between the device and popliteal artery was significantly closer when aimed at the posterior horn of the lateral meniscus via the anterolateral portal (4.7 ± 2.3 mm) versus the anteromedial portal (13.0 ± 8.0 mm, P = .010). The distance to the popliteal vein was closer via the anterolateral portal (6.7 ± 2.9 mm) versus the anteromedial portal (13.9 ± 5.8 mm, P = .004). For medial meniscal repair, the distance to the popliteal artery was significantly closer via the anteromedial portal (12.8 ± 11.3 mm) versus the anterolateral portal (23.8 ± 7.7 mm, P = .022). The distance to the popliteal vein was closer via the anteromedial portal (16.5 ± 11.3 mm) versus the anterolateral portal (28.3 ± 8.2 mm, P = .017). No significant difference was found in the distance to the tibial nerve when aimed at either meniscus via either portal.

Conclusion
For all-inside meniscal repair, the popliteal vein is at risk and the popliteal artery is at high risk of injury when the posterior horn of the lateral meniscus is repaired via an anterolateral working portal.

Clinical Relevance
The popliteal artery and vein are at risk of injury when the posterior horn of the lateral meniscus undergoes all-inside repair via the anterolateral portal. Surgeons need to be aware of the risks when performing this repair.

BACK

Quality of Online Video Resources Concerning Patient Education for the Meniscus: A YouTube-Based Quality-Control Study

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Arthroscopy, Volume 36, Issue 1

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Purpose
To evaluate the reliability and educational content of YouTube videos concerning the menisci.

Methods
YouTube was queried using the keyword “meniscus.” The first 50 videos were evaluated. Eleven video characteristics were extracted, and videos were categorized by source and content. Video reliability was assessed using the Journal of the American Medical Association (JAMA) benchmark criteria (score range, 0-5). Video educational content was assessed using the Global Quality Score (GQS; score range, 0-4) and a meniscus-specific score (MSS; score range, 0-20).

Results
The mean video duration was 551.44 ± 1,046.04 seconds (range, 75-7,282 seconds). The mean number of views was 288,597.7 ± 735,275.9. Collectively, the 50 videos accrued 14,141,285 views. The mean JAMA score, GQS, and MSS were 1.55, 2.12, and 3.67, respectively. The video source was predominately non–physician based (24.49% of source uploaders), whereas video content was predominately concerned with disease information (37.50% of content). Significant between-group effects were observed for the JAMA score and video content ($P = .0155$), with videos concerning disease information, exercise training, and nonsurgical intervention having the highest mean JAMA scores. Significant between-group effects were also observed for the JAMA score based on video upload source ($P < .001$), with videos uploaded by physicians receiving the highest mean JAMA scores. The mean GQS and MSS were significantly greater for videos categorized as having disease-specific content ($P = .0377$ and $P = .0404$, respectively) and for physician video uploaders ($P = .0133$ and $P = .0100$, respectively). The number of video dislikes was a negative independent predictor of the JAMA score ($\beta = –0.007$, $P = .003$). Disease-specific content was a positive independent predictor of the GQS ($\beta = 1.13$, $P = .042$). There were no independent predictors of the MSS.

Conclusions
Information on the meniscus found in YouTube videos is of low quality and reliability.

Clinical Relevance
Orthopaedic health practitioners should caution patients about the inaccuracy of YouTube videos regarding the meniscus given the low quality of content. These health care providers should make efforts to provide patients with higher-quality alternatives.

BACK

How Should We Define Clinically Significant Improvement on Patient-Reported Outcomes Measurement Information System Test for Patients Undergoing Knee Meniscal Surgery?

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Arthroscopy, Volume 36, Issue 1

https://doi.org/10.1016/j.arthro.2019.07.036

Purpose
The purpose of the study was to define the minimal clinically important difference (MCID), substantial clinical benefit (SCB), and patient acceptable symptomatic state (PASS) thresholds for the Patient-Reported Outcomes Measurement Information System (PROMIS) Physical Function (PF) computerized adaptive test (CAT) instrument in patients undergoing arthroscopic meniscal surgery.

Methods
The PROMIS PF CAT was administered preoperatively and postoperatively to patients undergoing arthroscopic meniscal surgery. At 6 months postoperatively, patients graded their knee function based on a domain-specific anchor question. A satisfaction anchor question was used to indicate achievement of the PASS. Receiver operating characteristic analysis determined the relevant psychometric values. Cutoff analysis was performed to find preoperative patient-reported outcome scores predicting achievement of clinically significant outcomes (CSOs).

Results
A total of 73 patients (41.1% female patients) were included, with a mean age of 44.9 ± 12.8.0 years and average follow-up period of 24.0 ± 1.2 weeks. The MCID on the PROMIS PF CAT was calculated to be 2.09 (area under the curve [AUC], 0.75; 95% CI, 0.57-0.94). Net score improvement equivalent to achievement of SCB was found to be 6.50 (AUC, 0.77; 95% CI, 0.55-0.99). The PASS was found to be 46.1 (AUC, 0.86; 95% CI, 0.76-0.96). A preoperative score below 37.6 on the PROMIS PF CAT predicted achievement of the MCID (AUC, 0.76; 95% CI, 0.62-0.87), whereas scores above 41.9 predicted achievement of the PASS (AUC, 0.77; 95% CI, 0.65-0.90). Higher baseline functional status and the absence of pre-existing arthritis were also found to be statistically significant predictors of achieving CSOs.

Conclusions
Our study defined the MCID, SCB, and PASS for the PROMIS PF CAT. We found that a preoperative score below 37.6 was predictive of achieving a meaningful clinical change with surgery whereas a preoperative score above 41.9 was predictive of patients who would attain an acceptable postoperative health state. In addition, exercising more days per week and the absence of arthritis increased the likelihood of achieving postoperative CSOs.

Level of Evidence
Level III, retrospective cohort.

BACK

Return to Sport and Outcomes After Concomitant Lateral Meniscal Allograft Transplant and Distal Femoral Varus Osteotomy

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Arthroscopy, Volume 36, Issue 1

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Purpose
To evaluate the time and rate of return to sport (RTS), as well as outcomes, in young and active patients receiving concomitant lateral meniscal allograft transplantation (MAT) and distal femoral varus osteotomy (DFVO) for lateral meniscal deficiency and valgus malalignment.

Methods
This was a retrospective study of consecutive patients who underwent concomitant MAT and DFVO by a single surgeon. The exclusion criteria were any concomitant procedures other than cartilage restoration procedures for focal full-thickness cartilage defects of the lateral femoral condyle and less than 2 years of follow-up. At final follow-up, patients were asked to complete a subjective sports questionnaire, the Marx Activity Rating Scale, a visual analog scale (VAS), the Single Assessment Numeric Evaluation, and a satisfaction questionnaire. Changes in patient-reported outcome measures were assessed using nonparametric statistical testing.

Results
A total of 21 patients met the inclusion criteria, of whom 17 were included for analysis at an average follow-up of 7.5 years (range, 2.2-13.3 years). The average age at the time of surgery was 23.3 years (range, 16.9-36.2 years), and 76.5% of patients were female patients. The average VAS score decreased from 5.7 preoperatively to 2.6 postoperatively ($P = .02$). Of the 15 patients who participated in sports within 3 years prior to their surgical procedure, 14 (82.4%) returned to 1 or more sports at an average of 16.9 months (range, 6-36 months); however, only 46.7% were able to return to their preinjury level of participation or higher. Furthermore, 88.2% of patients reported being satisfied with their sport-related outcomes. Direct rates of sport-specific return were as follows: weightlifting, 100%; skiing, 100%; running, 66.7%; and basketball, 50%.

Conclusions
In our study population, concomitant MAT and DFVO afforded a high rate of RTS at an average of 16.9 months postoperatively, as well as a significant decrease in VAS pain scores. These findings are essential to note when counseling patients receiving these procedures who wish to resume sports and physical activities so that they may expect an extensive recovery process before they can RTS.

Level of Evidence
Level IV, case series.

BACK

Operative Versus Nonoperative Treatment of Femoroacetabular Impingement Syndrome: A Meta-analysis of Short-Term Outcomes

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Purpose
To compare the outcomes of patients with femoroacetabular impingement (FAI) syndrome treated with hip arthroscopy versus those treated with physical therapy alone.

Methods
The PubMed, Embase, and Cochrane Library databases were searched from inception to February 15, 2019. All randomized controlled trials (RCTs) that compared operative versus nonoperative treatment in the management of FAI for a minimum 6-month follow-up period were included. The primary outcome was the International Hip Outcome Tool 33. The CLEAR NPT (Checklist to Evaluate a Report of a Nonpharmacological Trial) was used to evaluate the methodologic quality of included studies.

Results
Three RCTs (Level I) were included with a total of 650 patients (323 randomized to surgery and 327 randomized to physical therapy), follow-rate of 90% (583 patients, 295 operative and 288 nonoperative), and average of 11.5 months' follow-up. Regarding participation, 222 of 350 patients (63%) in the FAIT (Femoroacetabular Impingement Trial) study, 348 of 648 (54%) in the FASHIoN (Full UK RCT of Arthroscopic Surgery for Hip Impingement Versus Best Conservative Care) study, and 80 of 104 (77%) in the study by Mansell et al. agreed to participate. The mean age was 35 years, and 51.5% of patients were male patients. All 3 RCTs represented high methodologic quality and a low risk of bias. The frequency-weighted mean follow-up period was 10 months. A meta-analysis of the 3 randomized trials showed that patients treated with operative management had improved preoperative-to-postoperative change scores on the International Hip Outcome Tool 33 compared with the nonoperative group (standardized mean difference, 3.46; 95% confidence interval, 0.07-6.86; $P < .05$). One study reported on the achievement of clinically relevant outcomes at the individual level, with 51% of the operative group and 32% of the nonoperative group achieving the minimal clinically important difference and with 48% and 19%, respectively, achieving the patient acceptable symptomatic state for the Hip Outcome Score–Activities of Daily Living.

Conclusions
The results of this meta-analysis show that patients with FAI syndrome treated with hip arthroscopy have statistically superior hip-related outcomes in the short term compared with those treated with physical therapy alone.

Level of Evidence
Level I, meta-analysis of Level I RCTs.

BACK

Oxygen–Ozone Therapy for the Treatment of Knee Osteoarthritis: A Systematic Review of Randomized Controlled Trials

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Purpose
To review the available literature on the application of oxygen–ozone therapy (OOT) in the treatment of knee osteoarthritis (KOA) to understand its therapeutic potential and to compare it with other conservative treatment options.

Methods
A systematic review of the literature was performed on the PubMed, Cochrane, Embase, ResearchGate, and PedRo Databases, with the following inclusion criteria: (1) randomized controlled trials (RCTs), (2) written in English, (3) published on indexed journals in the last 20 years (1998-2018), (4) dealing with the use of ozone intra-articular injection for the treatment of KOA. The risk of bias was assessed by the Cochrane Risk of Bias tool for RCTs.

Results
Eleven studies involving 858 patients in total (629 female and 229 male) were included. Patients in the control groups received different treatments: placebo in 1 trial; hyaluronic acid in 2 studies; hyaluronic acid and PRP in 1 trial; corticosteroids in 4; and hypertonic dextrose, radiofrequency, or celecoxib + glucosamine in the remaining 3 trials. In looking at the quality of the available literature, we found that none of the studies included reached “good quality” standard, 2 were ranked as “fair,” and the rest were considered “poor.” No major complications or serious adverse events were reported following intra-articular OOT, which provided encouraging pain relief at short term. On the basis of the available data, no clear indication emerged from the comparison of OOT with other established treatments for KOA.

Conclusions
The analysis of the available RCTs on OOT for KOA revealed poor methodologic quality, with most studies flawed by relevant bias, thus severely limiting the possibility of drawing conclusions on the efficacy of OOT compared with other treatments. On the basis of the data available, OOT has, however, proven to be a safe approach with encouraging effects in pain control and functional recovery in the short-middle term.

Level of Evidence
Systematic review of Level I and III studies.

BACK

Autologous Chondrocyte Implantation Versus Microfracture in the Knee: A Meta-analysis and Systematic Review

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Purpose
To compare clinical outcomes among patients with fractures of knee cartilage who were treated with autologous chondrocyte implantation (ACI) or microfracture (MF).

Methods
A systematic review was made of randomized controlled trials of articular cartilage lesions of the knee treated with ACI or MF that were published between January 2000 and November 2018 and catalogued in 4 major databases. The outcomes of clinical score, quality of life (QoL), pain relief score, and failure rate were assessed.

Results
A final group of 12 randomized controlled trials were included that enrolled a total of 659 patients with knee cartilage lesions: 332 patients had received ACI and 327 patients had undergone MF. Patients ranged in age from 25 to 41 years, and the majority were male. Lesion size ranged from 2.3 to 10.0 cm2. Pooled analysis found no significant difference in the improvement in International Knee Documentation Committee and Lysholm scores or overall Knee Injury and Osteoarthritis Outcome Score measures between patients in the ACI and MF groups at 1-year, 2-year, and 5-year follow-up examinations or in failure rate at 2-year, 3-year, and 5-year follow-up timepoints. However, patients treated with ACI had a significant benefit in activities of daily living at follow-up of 5 years or less compared with patients treated with MF. ACI treatment also showed better improvement in QoL and pain relief than MF at 5-year and 2-year follow-up examinations, respectively.

Conclusions
The pooled analysis found no significant difference in the improvement in International Knee Documentation Committee or Lysholm scores or overall Knee Injury and Osteoarthritis Outcome Score measures between patients in the ACI and MF groups at 1 to 5 years of follow-up. Patients treated with ACI may have a significant benefit in activities of daily living, QoL, and pain relief compared with patients treated with MF, although clinical relevance may not be achieved.

Level of Evidence
Level II, systematic review of Level I and II investigations.

BACK

Knee Surgery, Sports Traumatology, Arthroscopy (KSSTA), Volume 28, Issue 1

Redefining anterior ankle arthroscopic anatomy: medial and lateral ankle collateral ligaments are visible through dorsifexion and non‑distraction anterior ankle arthroscopy

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DOI: https://doi.org/10.1007/s00167-019-05603-2

Purpose
A thorough understanding of the arthroscopic anatomy is important to recognise pathological conditions. Although some ankle ligaments have been described as intra-articular structures, no studies have assessed the full visibility of these structures. The purpose of this study was to assess arthroscopic visibility of medial and lateral ankle collateral ligaments.

Methods
Arthroscopy was performed in 20 fresh frozen ankles. The arthroscope was introduced through the anteromedial portal and the anterior compartment was explored in ankle dorsifexion without distraction. Intra-articular structures were tagged using a suture-passer introduced percutaneously and they were listed in a table according to the surgeon's identifcation. After the arthroscopic procedure, the ankles were dissected to identify the suture-tagged structures.

Results According to the suture-tagged structures, 100% correlation was found between arthroscopy and dissection. In the anterior compartment, the superior fascicle of the anterior talofbular ligament, the distal fascicle of the anterior tibiofbular ligament and the anterior tibiotalar ligament on the medial side were observed. The deep fascicle of the posterior tibiofbular ligament and the intermalleolar ligament were tagged at the posterior compartment.

Conclusion
Ankle dorsifexion and non-distraction arthroscopic technique allows full visualisation of the medial and lateral ankle collateral ligaments: the superior fascicle of the anterior talofbular ligament, the distal fascicle of the anterior tibiofbular ligament and the anterior tibiotalar ligament. When using distraction, posterior structures as the deep fascicle of the posterior tibiofbular ligament and the intermalleolar ligament can be observed with anterior arthroscopy

BACK

Arthroscopic lift, drill, fll and fx (LDFF) is an efective treatment option for primary talar osteochondral defects

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Purpose
The purpose of this study was to describe the mid-term clinical and radiological results of a novel arthroscopic fxation technique for primary osteochondral defects (OCD) of the talus, named the lift, drill, fll and fx (LDFF) technique.

Methods
Twenty-seven ankles (25 patients) underwent an arthroscopic LDFF procedure for primary fxable talar OCDs. The mean follow-up was 27 months (SD 5). Pre- and post-operative clinical assessments were prospectively performed by measuring the Numeric Rating Scale (NRS) of pain in/at rest, walking and when running. Additionally, the Foot and Ankle Outcome Score (FAOS) and the Short Form-36 (SF-36) were used to assess clinical outcome. The patients were radiologically assessed by means of computed tomography (CT) scans pre-operatively and 1 year post-operatively.

Results
The mean NRS during running signifcantly improved from 7.8 pre-operatively to 2.9 post-operatively ($p = 0.006$), the NRS during walking from 5.7 to 2.0 ($p < 0.001$) and the NRS in rest from 2.3 to 1.2 ($p = 0.015$). The median FAOS at fnal follow-up was 86 for pain, 63 for other symptoms, 95 for activities of daily living, 70 for sport and 53 for quality of life. A pre- and post-operative score comparison was available for 16 patients, and improved signifcantly in most subscores. The SF-36 physical component scale signifcantly improved from 42.9 to 50.1. Of the CT scans at 1 year after surgery, 81% showed a fush subchondral bone plate and 92% of OCDs showed union.

Conclusion
Arthroscopic LDFF of a fxable primary talar OCD results in excellent improvement of clinical outcomes. The radiological follow-up confrms that fusion of the fragment is feasible in 92%. This technique could be regarded as the new gold standard for the orthopedic surgeon comfortable with arthroscopic procedures.

Level of evidence
Prospective case series, therapeutic level IV.

BACK

A step‑by‑step arthroscopic examination of the anterior ankle compartment

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Purpose
Despite the increased use of ankle dorsifexion without distraction, no reports have specifcally addressed the
arthroscopic anatomy of the ankle in this position. The purpose of this study was to describe the normal arthroscopic anatomy of the ankle joint, when using the ankle dorsifexion and the dynamic distraction technique, and to propose an arthroscopic examination system for the anterior ankle compartment.

Methods
Ankle arthroscopy was performed in 20 fresh frozen specimens. Arthroscopic examination was performed with
the arthroscope introduced through the anteromedial portal. The anterior compartment was examined in ankle dorsifexion without distraction. The compartment was examined in four steps: (1) lateral area including the lateral gutter; (2) the central area of the anterior tibial rim; (3) the medial area including the medial gutter; (4) the talar neck. Next, distraction was applied to visualise the anterior compartment again and to examine the central and posterior ankle compartments.

Results
Anatomic intra-articular structures were visualised in all specimens. Four intra-articular fat pads, one anteromedial, two syndesmotic and another posteromedial, were constantly observed. A description of the normal arthroscopic anatomy of the ankle using the ankle dorsifexion and the dynamic distraction technique is detailed for the anterior, central and posterior compartments.

Conclusion
The ankle arthroscopic procedure without distraction allows constant visualisation of the ATFL's superior fascicle on the foor of the lateral gutter, the ATiFL's distal fascicle laterally and the most anterior margin of the deltoid ligament in the medial gutter (anterior tibiotalar ligament). However, ankle distraction is required to observe the central and posterior compartments, but it does not provide optimal visualisation of the anterior ankle compartment structures.

Level of evidence
V.

BACK

The arthroscopic all-inside ankle lateral collateral ligament repair is a safe and reproducible technique

Matteo Guelf, Jordi Vega, Francesc Malagelada, Miki Dalmau-Pastor

DOI: https://doi.org/10.1007/s00167-019-05427-0

Purpose
Neurovascular structures around the ankle are at risk of injury during arthroscopic all-inside lateral collateral
ligament repair for the treatment of chronic ankle instability. This study aimed to evaluate the risk of damage to anatomical structures and reproducibility of the technique amongst surgeons with diferent levels of expertise in the arthroscopic allinside ligament repair.

Methods
Twelve fresh-frozen ankle specimens were used for the study. Two foot and ankle surgeons with diferent level of experience in the technique performed the procedure on 6 specimens each. The repair was performed following a standardized procedure as originally described. Then, an experienced anatomist dissected all the specimens to evaluate the outcome of the ligament repair, any injuries to anatomical structures and the distance between arthroscopic portals and the superficial peroneal nerve (SPN) and sural nerve.

Results
Dissections revealed no injury to the nerves assessed. Mean distance from the anterolateral portal and the SPN was of 4.8 (range 0.0–10.4) mm. The mean distance from the accessory anterolateral portal to the SPN and sural nerve was of 14.2 (range 7.1–32.9) mm and 28.1 (range 2.8–39.6) mm, respectively. The diference between the 2 surgeons' groups was non-statistically signifcant for any measurement (mm). In all specimens both fascicles of the anterior talofbular ligament were reattached onto its original fbular footprint. The calcaneofbular ligament was not penetrated in any specimen.

Conclusions
The all-inside arthroscopic lateral collateral ligament repair is a safe and reproducible technique. The clinical
relevance of this study is that this technique provides a safe and anatomic reattachment of the anterior talofbular ligament, with minimal risk of injury to surrounding anatomical structures regardless of the level of experience with the technique.

BACK

Arthroscopic all-inside ATiFL's distal fascicle transfer for ATFL's superior fascicle reconstruction or biological augmentation of lateral ligament repair

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DOI: https://doi.org/10.1007/s00167-019-05460-z

Purpose
Tendon grafts are often utilized for reconstruction of the lateral ligaments unamenable to primary repair. However, tendon and ligaments have diferent biological roles. The anterior tibiofbular ligament's (ATiFL) distal fascicle may be resected without compromising the stability of the ankle joint. The aim of this study is to describe an all-arthroscopic and intra-articular surgical technique of ATiFL's distal fascicle transfer for the treatment of chronic ankle instability.

Methods
Five unpaired cadaver ankles underwent arthroscopic ATiFL's distal fascicle transfer using a non-absorbable
suture and a knotless anchor. Injured or absent ATiFL's distal fascicle were excluded from the study. Following arthroscopy, the ankles were dissected and evaluated for entrapment of nearby adjacent anatomical structures. The ligament transfer was also assessed. The distance between the anterolateral (AL) portals and the superfcial peroneal nerve (SPN) was measured and the shortest distance was reported.

Results
All specimens revealed successful transfer of the tibial origin of the ATiFL's distal fascicle onto the talar insertion of anterior talofbular ligament's (ATFL) superior fascicle. The fbular origin of the ATiFL's distal fascicle remained intact. There were no specimens with SPN or extensor tendon entrapment. The median distance between the proximal AL portal and SPN was 3.8 mm. The median distance between the distal AL portal and SPN was 3.9 mm.

Conclusion
An all-arthroscopic approach to an ATiFL's distal fascicle transfer is a reliable method to reconstruct the ATFL's superior fascicle. Transfer of ATiFL's distal fascicle avoids the need for tendon harvest or allograft. The lack of injury to nearby adjacent structures suggests that it is a safe procedure. The clinical relevance of the study is that ATiFL's distal fascicle can be arthroscopically transferred to be used as a biological reinforcement of the ATFL repair, or as an ATFL reconstruction.

BACK

Endoscopic anatomic ligament reconstruction is a reliable option to treat chronic lateral ankle instability

Guillaume Cordier, Jordan Ovigue, Miki Dalmau-Pastor, Frederick Michels

DOI: https://doi.org/10.1007/s00167-019-05793-9

Purpose
Anatomic reconstruction of the anterior talofbular ligament and calcaneofbular ligament is a valid treatment of
chronic hindfoot instability. The purpose of this study was to investigate the outcomes of this procedure performed by an all-inside endoscopic technique.

Methods
This study is a retrospective evaluation of a prospective database. Subjects were all patients who underwent an
endoscopic lateral ligament reconstruction between 2013 and 2016. All patients had symptoms of ankle instability with positive manual stress testing and failed nonoperative treatment during at least 6 months. At fnal follow-up the outcomewas assessed using the visual analogue score (VAS), American Orthopaedic Foot and Ankle Society (AOFAS) score and Karlsson–Peterson scores.

Results
After an average follow-up of 31.5±6.9 months, all patients reported signifcant improvement compared to their
preoperative status. The preoperative AOFAS score improved from 76.4±15 to 94.7±11.7 postoperatively (p=0.0001). The preoperative Karlsson–Peterson score increased from 73.0±16.0 to 93.7±10.6 postoperatively (p=0.0001). The VAS score improved from 1.9±2.5 to 0.8±1.7 (p<0.001). Two patients had complaints of recurrent instability.

Conclusion
Endoscopic ligament reconstruction for chronic lateral ankle instability is a safe procedure and produces good
clinical results with minimal complications. In addition, the endoscopic approach allows an assessment of the ankle joint and treatment of associated intra-articular lesions.

Level of evidence II

BACK

Arthroscopic all-inside anterior talo-fbular ligament repair with suture augmentation gives excellent results in case of poor ligament tissue remnant quality

Jordi Vega, Erik Montesinos, Francesc Malagelada, Albert Baduell, Matteo Guelf, Miki Dalmau-Pastor

DOI: https://doi.org/10.1007/s00167-018-5117-x

Purpose
An increasing role of arthroscopy as the defnitive treatment for ankle instability has been reported, and assisted
or all-arthroscopic techniques have been developed. However, treatment of chronic ankle instability with poor remnant ligament-tissue quality is still challenging. The aim of this study was to describe the technique and report the results of the arthroscopic ATFL all-inside repair with suture augmentation to treat patients with poor remnant ligament-tissue quality.

Methods
Fifteen patients [9 men and 6 women, median age 30 (19–47) years] with chronic ankle instability and poor remnant ligament-tissue quality were treated by arthroscopic means after failing non-operative management. Median follow-up was 18 (12–23) months. Through an arthroscopic all-inside technique, and using a suture passer and two knotless anchors, the ligament was repaired. Then, the anchor's residual suture limbs were not cut, but were recycled and used for augmentation of the ligament repair.

Results
Arthroscopic examination demonstrated an isolated anterior talofbular ligament (ATFL) injury with poor remnant ligament tissue in the 15 patients. All patients reported subjective improvement in their ankle instability after the arthroscopic all-inside ligaments repair and suture augmentation. The median AOFAS score increased from 66 (44–87) preoperatively to 100 (85–100) at the fnal follow-up.

Conclusion
Chronic ankle instability with poor remnant ligament-tissue quality can be successfully treated by an arthroscopic all-inside repair and suture augmentation of the ligament. The clinical relevance of the study is the description of the frst arthroscopic all-inside anatomic ATFL repair with suture augmentation that ofers the beneft of maintaining the native ligament while reinforcing the repair, especially in patients with poor remnant ligament-tissue quality.

Level of evidence IV, retrospective case series

BACK

Arthroscopic ankle lateral ligament repair with biological augmentation gives excellent results in case of chronic ankle instability

Guillaume Cordier, Johan Lebecque, Jordi Vega, Miki Dalmau-Pastor

DOI: https://doi.org/10.1007/s00167-019-05650-9

Purpose
The open “Broström-Gould” procedure has become the gold standard technique for the treatment of chronic ankle instability. Although arthroscopic techniques treating ankle instability have signifcantly evolved in the last years, no all arthroscopic Broström-Gould has been described. The aim of the study was to describe the all-arthroscopic Broström-Gould technique [anterior talofbular ligament (ATFL) repair with biological augmentation using the inferior extensor retinaculum (IER)], and to evaluate the clinical results in a group of patients.

Methods
Fifty-fve patients with isolated lateral ankle instability were arthroscopically treated. Arthroscopic ATFL repair
with biological augmentation was performed through a two-step procedure. First, the ligament is reattached through an arthroscopic procedure. Next, the ligament is augmented with the IER that is endoscopically grasped. Both the ligament repair and its augmentation with IER were performed with the help of an automatic suture passer and two soft anchors. Characteristics of the patients, and pre- and postoperatively AOFAS and Karlsson scores were recorded.

Results
The median preoperative AOFAS score increased from 74 (range 48–84) to 90 (range 63–100). According to the Karlsson score, the median preoperative average increased from 65 (range 42–82) to 95 (range 65–100). No major complications were reported. Only one case (1.8%) required a revision surgery at 23 months of follow-up.

Conclusion
The arthroscopic all-inside ATFL repair with biological augmentation using the IER is a reproducible technique.
Excellent clinical results were obtained. The technique has the advantage of its minimally invasive approach and the potential to treat concomitant ankle intra-articular pathology.

Level of evidence
Retrospective case series, Level IV.

BACK

Arthroscopic all‑inside ATFL and CFL repair is feasible and provides excellent results in patients with chronic ankle instability

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Purpose
Chronic ankle instability has been described as presenting with complete tears of both the anterior talofbular ligament (ATFL) and calcaneofbular ligament (CFL) in 20% of cases. Arthroscopic techniques to treat chronic ankle instability are increasingly being reported and in some instances they can be technically demanding. The aim of this study was to describe an arthroscopic all-inside repair of both the ATFL and CFL, and to report the outcomes of a group of patients with chronic ankle instability that underwent the technique.

Methods
Twenty-four patients [22 male and 2 female, median age 41 (range 22–56) years] with chronic ankle instability and torn ATFL and CFL were treated arthroscopically after failing non-operative management. Median follow-up was 35 (mean 34.7, and range 18–55) months. Through an arthroscopic all-inside technique, and using a suture passer and two knotless anchors, both fascicles of the ATFL and the CFL were repaired.

Results
Arthroscopic examination demonstrated ATFL and CFL injuries in all patients. Subjective improvement in their ankle instability was observed postoperatively. The anterior drawer and the talar tilt tests were negative at follow-up. The median AOFAS score increased from 65 (mean 65, range 52–85) preoperatively to 97 (mean 97, range 85–100) at fnal follow-up.

Conclusion
Chronic ankle instability with concomitant injury of both the ATFL and CFL, can be successfully treated by an arthroscopic all-inside repair. The clinical relevance of the study is the description of the frst arthroscopic all-inside ATFL and CFL anatomic repair technique, which ofers excellent clinical results and the inherent benefts from minimally invasive surgery.

Level of evidence
IV, retrospective case series.

BACK

Combined arthroscopic all-inside repair of lateral and medial ankle ligaments is an efective treatment for rotational ankle instability

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Purpose
When the anterior fascicle of the deltoid ligament is injured in patients with chronic ankle instability, the diagnosis of rotational ankle instability is supported. The aim of this study was to report the results of an all-arthroscopic technique to concomitantly repair the lateral collateral and deltoid ligaments to treat patients with rotational ankle instability.

Methods
Thirteen patients [12 men and 1 woman, median age 32 (15–54) years] with rotational ankle instability were
treated by arthroscopic means after failing non-operative management. Median follow-up was 35 (18–42) months. Using a suture passer and knotless anchors, the ligaments were repaired with an arthroscopic all-inside technique.

Results
During diagnostic arthroscopy, 12 patients showed an isolated anterior talofbular ligament (ATFL) injury, and.
in one patient, both the ATFL and calcaneofbular ligament were afected. Arthroscopic examination of the deltoid ligament demonstrated a tear afecting the anterior area of the ligament in all cases. The tear was described as an "open book" tear, because the ligament was separated from the medial malleolus when applying passive internal rotation of the tibio-talar joint. This gap was closed when the tibiotalar joint was in neutral rotation or externally rotated. All patients reported subjective improvement in their ankle instability after the arthroscopic all-inside ligaments repair. The median AOFAS score increased from 70 (44–77) preoperatively to 100 (77–100) at fnal follow-up.

Conclusion
Rotational ankle instability can be successfully treated by an arthroscopic all-inside repair of the lateral and
medial ligaments of the ankle.

Level of evidence
Level IV, retrospective case series

BACK

Arthroscopic lift, drill, fll and fx (LDFF) is an efective treatment option for primary talar osteochondral defects

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Purpose
The purpose of this study was to describe the mid-term clinical and radiological results of a novel arthroscopic
fxation technique for primary osteochondral defects (OCD) of the talus, named the lift, drill, fll and fx (LDFF) technique.

Methods
Twenty-seven ankles (25 patients) underwent an arthroscopic LDFF procedure for primary fxable talar OCDs.
The mean follow-up was 27 months (SD 5). Pre- and post-operative clinical assessments were prospectively performed by measuring the Numeric Rating Scale (NRS) of pain in/at rest, walking and when running. Additionally, the Foot and Ankle Outcome Score (FAOS) and the Short Form-36 (SF-36) were used to assess clinical outcome. The patients were radiologically assessed by means of computed tomography (CT) scans pre-operatively and 1 year post-operatively.

Results
The mean NRS during running signifcantly improved from 7.8 pre-operatively to 2.9 post-operatively ($p = 0.006$), the NRS during walking from 5.7 to 2.0 ($p < 0.001$) and the NRS in rest from 2.3 to 1.2 ($p = 0.015$). The median FAOS at fnal follow-up was 86 for pain, 63 for other symptoms, 95 for activities of daily living, 70 for sport and 53 for quality of life. A pre- and post-operative score comparison was available for 16 patients, and improved signifcantly in most subscores. The SF-36 physical component scale signifcantly improved from 42.9 to 50.1. Of the CT scans at 1 year after surgery, 81% showed a fush subchondral bone plate and 92% of OCDs showed union.

Conclusion
Arthroscopic LDFF of a fxable primary talar OCD results in excellent improvement of clinical outcomes. The
radiological follow-up confrms that fusion of the fragment is feasible in 92%. This technique could be regarded as the new gold standard for the orthopedic surgeon comfortable with arthroscopic procedures.

Level of evidence
Prospective case series, therapeutic level IV

BACK

The arthroscopic syndesmotic assessment tool can differentiate between stable and unstable ankle syndesmoses

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Purpose
Patients with stable isolated injuries of the ankle syndesmosis can be treated conservatively, while unstable injuries require surgical stabilisation. Although evaluating syndesmotic injuries using ankle arthroscopy is becoming more popular, diferentiating between stable and unstable syndesmoses remains a topic of on-going debate in the current literature. The purpose of this study was to quantify the degree of displacement of the ankle syndesmosis using arthroscopic measurements. The hypothesis was that ankle arthroscopy by measuring multiplanar fbular motion can determine syndesmotic instability.

Methods
Arthroscopic assessment of the ankle syndesmosis was performed on 22 fresh above knee cadaveric specimens, frst with all syndesmotic and ankle ligaments intact and subsequently with sequential sectioning of the anterior inferior tibiofbular ligament, the interosseous ligament, the posterior inferior tibiofbular ligament, and deltoid ligaments. In all scenarios, four loading conditions were considered under 100N of direct force: (1) unstressed, (2) a lateral hook test, (3) anterior to posterior (AP) translation test, and (4) posterior to anterior (PA) translation test. Anterior and posterior coronal plane tibiofbular translation, as well as AP and PA sagittal plane translation, were arthroscopically measured.

Results
As additional ligaments of the syndesmosis were transected, all arthroscopic multiplanar translation measurements increased (p values ranging from $p<0.001$ to $p=0.007$). The following equation of multiplanar fbular motion relative to the tibia measured in millimeters: 0.76*AP sagittal translation+0.82*PA sagittal translation+1.17*anterior third coronal plane translation—0.20*posterior third coronal plane translation, referred to as the Arthroscopic Syndesmotic Assessment tool, was generated from our data. According to our results, an Arthroscopic Syndesmotic Assessment value equal or greater than 3.1 mm indicated an unstable syndesmosis.

Conclusions
This tool provides a more reliable opportunity in determining the presence of syndesmotic instability and can
help providers decide whether syndesmosis injuries should be treated conservatively or operatively stabilized. The longterm usefulness of the tool will rest on whether an unstable syndesmosis correlates with acute or chronic clinical symptoms.

BACK

Anterior talofbular ligament (ATFL) repair using two suture anchors produced better functional outcomes than using one suture anchor for the treatment of chronic lateral ankle instability

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Purpose
To compare the function and activity level after one-anchor repair versus two-anchor repair of the anterior talofbular ligament (ATFL) in patients with chronic lateral ankle instability.

Methods
All patients who underwent arthroscopic surgical ATFL repair using suture anchors were included in this study.
The American Orthopedic Foot and Ankle Society (AOFAS) score, Karlsson Ankle Functional Score (Karlsson score) and Tegner activity score were used to evaluate ankle function at a follow-up of a minimum of 2 years. A magnetic resonance imaging (MRI) scan was performed to evaluate the repaired ATFL.

Results
A total of 51 patients with chronic ankle instability were included in this study. Among them, 20 patients accepted a one-anchor repair procedure (one-anchor group), and the other 31 patients accepted a two-anchor repair procedure (twoanchor group). At the fnal follow-up, there was no signifcant diference in the AOFAS score between the one-anchor group and the two-anchor group (90±9 vs 91±10; ns). However, the mean Karlsson score of the two-anchor group (88±12) was signifcantly higher than that of the one-anchor group (80±14) (p=0.04). There was a signifcant diference in activity level as measured by the Tegner activity score (5±1 vs 4±1; p<0.001) between the two-anchor group and the one-anchor group
after surgery. Patients in the two-anchor group (68%) had a signifcantly higher percentage of sport participation compared to those in the one-anchor group (30%) (p=0.01).

Conclusion
Compared with a one-anchor repair, a two-anchor repair of the lateral ankle ligament produced better functional
outcomes. Arthroscopic ATFL repair with two anchors provided a minimally invasive technique with a higher rate of return to sports than repair with one anchor. The present study showed its clinical relevance by maintaining the advantage of ATFL repair using two anchors regarding the clinical function.

Level of evidence III.

BACK

Arthroscopic suture‑tape internal bracing is safe as arthroscopic modifed Broström repair in the treatment of chronic ankle instability

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Purpose
The aim of the study was to compare the intermediate-term clinical outcomes between lateral ligaments augmentation using suture-tape and modifed Broström repair in a selected cohort of patients. The hypothesis of the presented study is that suture-tape augmentation technique has comparable clinical and radiological outcomes with arthroscopic Broström repair technique.

Methods
Sixty-one consecutive patients with chronic ankle instability were operated between 2012 and 2016 randomized to 2 groups. First group was composed of 31 patients whom were operated using an arthroscopic Broström repair technique (ABR) and second group was composed of 30 Patients whom were operated using arthroscopic lateral ligaments augmentation using suture-tape internal bracing (AST). At the end of total follow-up time, all patients were evaluated clinically using the Foot and Ankle Outcome Score (FAOS) and Foot and Ankle Ability Measure (FAAM). Radiological evaluation was performed using anterior drawer and varus stress radiographs with standard Telos device in 150 N. Talar tilt angles and anterior talar translation were measured both preoperatively, 1 year postoperatively and at the fnal follow-up.

Results
Preoperative total FAOS scores for ABR and AST groups were 66.2±12 and 67.1±11, respectively. Postoperative Total FAOS scores for ABR and AST groups were 90.6±5.2 and 91.5±7.7, respectively. There was no statistical diference in between 2 groups both pre- and postoperatively (n.s). According to FAAM, sports activity scores of ABR and AST groups were 84.9±14 and 90.4±12 at the fnal follow-up, which showed that AST group was signifcantly superior (p=0.02). There were no signifcant diferences in preoperative and postoperative stress radiographs between the two groups. Mean operation time for AST and ABR groups were 35.2 min and 48.6 min, respectively, which shows statistically signifcantly diference ($p<0.05$). There was no signifcant diference in recurrence rate of instability between to operation techniques (n.s).

Conclusions
Arthroscopic lateral ligament augmentation using suture tape shows comparable clinical outcomes to arthroscopic Broström repair in the treatment of chronic ankle instability at intermediate-term follow-up time. Arthroscopic lateral ligament augmentation using suture tape has a signifcant superiority in the terms of less operation time and no need for cast or brace immediate after surgery which allows early rehabilitation. It also has a signifcant superiority in the terms of FAAM scores at sports activity. However, there was no diference during daily life.

Level of evidence II.

BACK