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Issue 59.3, Arthroscopy, August 2019

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Upper extremity

Arthroscopy, Volume 35, Issue 8

Patient-Reported Outcomes After Use of a Bioabsorbable Collagen Implant to Treat Partial and Full-Thickness Rotator Cuff Tears

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Arthroscopy, Volume 35, Issue 8, Received: September 9, 2018; Accepted: February 2, 2019

https://doi.org/10.1016/j.arthro.2019.02.019

Purpose
To collect outcomes data on patients treated with a bioinductive collagen implant designed to induce rotator cuff healing in partial- and full-thickness cuff tears and to assess the safety and efficacy of the device.

Methods
Fifteen surgeons in 15 centers in the United States enrolled patients between April 2016 and August 2017 and collected standardized outcomes data. Patients 21 years of age and older, able to read and speak English, and with partial- or full-thickness tears of the rotator cuff documented by magnetic resonance imaging were included in the study. Patients were assessed preoperatively with visual analogue scale (VAS), single-assessment numeric evaluation (SANE), Veterans RAND 12-Item (VR-12), American Shoulder and Elbow Surgeons (ASES), and Western Ontario Rotator Cuff (WORC) outcomes measures. Postoperative assessment was made at 2, 6, and 12 weeks, 6 months, and 1 year. Patients underwent a standardized operative procedure with the implant. Patient demographics, comorbidities, tear types, and concomitant operative procedures were recorded.

Results
Patients in both groups experienced statistically significant improvement in VAS, SANE, VR-12 PCS, ASES, and WORC scores (mean values 1.1, $P < .001$; 86.0, $P < .001$; 49.7, $P < .001$; 85.6, $P < .001$; and 84.4, $P < .001$ for partial tears and 1.2, $P < .001$; 80.7, $P < .001$; 45.7, $P < .001$; 83.8, $P < .0001$; and 80.1, $P < .001$ for full-thickness tears, respectively). For the partial tear group, average times for return to driving, work, and nonoverhead athletic activity were 14.6, 37.3, and 65.6 days, and for the full-thickness group, 24.5, 50.7, and 119.2 days, respectively. In the partial-thickness group, 84% and 83% of patients reported improvement in their VAS pain and ASES scores, respectively, that met or exceeded each measure's minimal clinically important difference. In the full-thickness group, 72% and 77% of the patients met or exceeded the minimal clinically important differences for VAS pain and ASES, respectively.

Conclusion
Outcomes after repair of partial- and full-thickness rotator cuff tears using a bioinductive implant show safety and efficacy at 1-year follow-up.

Level of Evidence
Retrospective case series, level IV evidence.

BACK

Ultrasound-Guided Versus Landmark-Based Approach to the Distal Suprascapular Nerve Block: A Comparative Cadaveric Study

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Arthroscopy, Volume 35, Issue 8, Received: September 24, 2018; Accepted: February 23, 2019

https://doi.org/10.1016/j.arthro.2019.02.050

Purpose
To compare the accuracy of distal suprascapular nerve (dSSN) blockade performed with the use of ultrasound-guided regional anesthesia (USRA) versus with a landmark-based approach (LBA). A secondary aim was to describe the anatomic features of the sensory branches of the dSSN.

Methods
USRA and LBA were performed in 15 shoulders each from 15 cadavers (total of 30 shoulders). Then, 10 mL of methylene blue–infused ropivacaine 0.75% was injected into the dSSN. Simultaneously, 2.5 mL of red latex solution was injected to identify the position of the needle tip. The division and distribution of the sensory branches originating from the SSN were described.

Results
The tip of the needle was identified at 1.3 cm (range, 0-5.2 cm) and 1.5 cm (range, 0-4.5 cm) with USRA and the LBA, respectively (P = .90). Staining diffused past the origin of the most proximal sensory branch in 27 cases. The most proximal sensory branch arose 2.5 cm from the suprascapular notch. Among the 3 failures that occurred in the USRA group, the sensory branches also failed to be marked. All 30 dSSNs gave off 3 sensory branches, which innervated the posterior glenohumeral capsule, the subacromial bursa, and the coracoclavicular and acromioclavicular ligaments.

Conclusions
An LBA is as reliable and accurate as US guidance for anesthetic blockade of the dSSN. Marking of the suprascapular nerve must be proximal to the suprascapular notch to involve the 3 sensory branches in the anesthetic blockade.

Clinical Relevance
The present study demonstrates that a landmark-based approach to anesthetic blockade of the distal suprascapular nerve is accurate and can be performed by orthopaedic surgeons lacking experience in ultrasound-guided anesthetic techniques.

BACK

Perianchor Cyst Formation After Arthroscopic Rotator Cuff Repair Using All-Suture–Type, Bioabsorbable-Type, and PEEK-Type Anchors

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Arthroscopy, Volume 35, Issue 8, Received: September 28, 2018; Accepted: March 14, 2019

https://doi.org/10.1016/j.arthro.2019.03.032

Purpose
This study aimed to identify the difference in postoperative perianchor bone reactions in different groups of patients who underwent rotator cuff tear repairs with all-suture–, bioabsorbable screw–, and PEEK (polyether ether ketone)–type suture anchors. Furthermore, the rate of rotator cuff retear and its association with perianchor bone reactions based on the different anchors used were investigated. Moreover, their impact on the clinical outcome of patients was examined.

Methods
The study included 213 patients who underwent arthroscopic single-row repair and were divided into 3 groups according to the suture anchor used: all-suture (n = 137), biodegradable (n = 36), and PEEK (n = 40) anchor groups. The clinical outcomes and magnetic resonance imaging findings were evaluated at a mean follow-up of 9.6 months. The perianchor bone reaction at the anchor site was categorized according to grades. Patients were classified based on repair integrity into the healed and retear groups with Sugaya type I to III and Sugaya type IV to V, respectively.

Results
No statistically significant differences in Constant scores and retear rates were observed between the groups (P = .934 and P = .548, respectively). Magnetic resonance imaging showed that the total number of perianchor cysts formed postoperatively was 23 (10.8% [23 of 213 patients]). Moreover, the proportions of perianchor cysts were 8.8%, 16.7%, and 12.5% in the all-suture–type, bioabsorbable-, and PEEK-type anchor groups, respectively (P = .485). In the retear group, the incidence rate was significantly increased with higher grades of perianchor bone reaction (P = .001). The tear size and perianchor bone reaction were found to be independent factors that affected the incidence of retear.

Conclusions
Perianchor cyst formation was observed in 10.8% of cases after the use of suture anchors for arthroscopic rotator cuff repair. No significant differences were observed among all-suture–type, bioabsorbable-type, and PEEK-type anchors in terms of visual analog scale and Constant scores, retear rates, and perianchor bone reactions. However, the retear rate was associated with a greater perianchor cystic reaction and larger tear size.

Level of Evidence
Level III, retrospective comparative trial.

BACK

Functional Outcome and Healing With a Load-Sharing Rip-Stop Repair Compared With a Single-Row Repair for Large and Massive Rotator Cuff Tears

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Arthroscopy, Volume 35, Issue 8, Received: November 13, 2018; Accepted: March 16, 2019

https://doi.org/10.1016/j.arthro.2019.03.034

Purpose
To prospectively compare the healing rates and functional outcomes of large and massive rotator cuff tears repaired with either a load-sharing rip-stop (LSRS) technique or single-row (SR) repair.

Methods
We performed a retrospective comparison of arthroscopic rotator cuff repairs of large and massive tears performed with 2 different repair techniques. Over a 1-year period, all tears with limited tendon mobility were repaired with an LSRS technique. Over the following 1-year period, all similar tears were repaired with an SR technique. There were 17 patients in the LSRS repair group and 18 in the SR repair group. Healing was assessed with ultrasound at a minimum of 6 months postoperatively, and functional outcome was assessed at a minimum of 24 months.

Results
No difference in postoperative range of motion was found between the 2 groups. Likewise, no difference in the visual analog scale score for pain or functional outcomes according to the American Shoulder and Elbow Surgeons, Simple Shoulder Test, or Single Assessment Numeric Evaluation score was found between the 2 groups. Complete rotator cuff healing was observed in 53% of LSRS repairs compared with 11% of SR repairs (P = .010).

Conclusions
At short-term follow-up, there is no difference in functional outcomes after an LSRS technique versus an SR repair technique for large and massive rotator cuff tears with limited tendon mobility. However, structural healing appears to be higher with an LSRS technique.

Level of Evidence
Level III, retrospective comparative study.

BACK

Learning Curves in the Arthroscopic Latarjet Procedure: A Multicenter Analysis of the First 25 Cases of 5 International Surgeons

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Arthroscopy, Volume 35, Issue 8, Received: September 3, 2018; Accepted: March 18, 2019

https://doi.org/10.1016/j.arthro.2019.03.035

Purpose
To analyze the learning curves of 5 experienced, fellowship-trained shoulder surgeons and their respective 25 first arthroscopic Latarjet cases in regard to surgical time, graft placement, complication rates, and recurrent instability.

Methods
The first 25 arthroscopic Latarjet procedures of 5 surgeons were retrospectively analyzed in an international multicenter setting, and thus 125 patients were included in this study. The surgical time, intraoperative and postoperative events out of the ordinary, and graft positioning were examined.

Results
The 125 patients consisted of 16 women (12.8%) and 109 men (87.2%). In 81.6% (n = 102), surgery was undertaken as a first-line procedure, whereas 18.4% (n = 23) were revisions. Surgical time decreased significantly from an average of 123.8 minutes (range 70 to 210) to 92.6 minutes (range 50 to 160) from the first 5 cases to the last 5 cases of each surgeon within a period of <2 years. Overall, 22 events in 21 patients requiring additional treatment were reported (17.6%). Five (4%) were unlikely to affect final outcome and did not require revision surgery. Twelve (9.6%) required revision surgery that was not trauma related yet was prone to affect outcomes. Five events were trauma-related (4%), 4 requiring revision surgery and 1 treated conservatively. Overall, 6 patients (4.8%) had recurrent shoulder instability, 3 as a result of a traumatic event. Conventional radiology showed the bone-block in ideal positioning in 93 cases (74.4%), flush with the glenoid in a true anteroposterior view. In 3 cases (2.4%), it was considered too high, 15 too low (12%), 5 too lateral (4%), and 15 too medial (12%). Some patients had combinations of the above.

Conclusion
This analysis shows that surgical time in arthroscopic Latarjet can be significantly reduced after only 20 cases. However, complication rates did not decrease over this time. The authors believe that the arthroscopic Latarjet is a challenging yet viable technique to treat anterior shoulder instability, achieving results equal to the open technique with advantages of the arthroscopic setting.

Level of Evidence
Level IV, retrospective cohort study.

BACK

The Association of Osteoporosis and Bisphosphonate Use With Revision Shoulder Surgery After Rotator Cuff Repair

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Arthroscopy, Volume 35, Issue 8, Received: November 14, 2018; Accepted: March 16, 2019

https://doi.org/10.1016/j.arthro.2019.03.020

Purpose
To examine any association between osteoporosis and the failure of arthroscopic rotator cuff repair (ARCR) leading to revision surgery and to investigate whether the use of bisphosphonates had any influence on the observed associations.

Methods
Patients who underwent ARCR with a diagnosis of osteoporosis were identified from the PearlDiver database and stratified according to whether there was a filled prescription for a bisphosphonate in the perioperative period. Patients with osteoporosis who underwent ARCR with bisphosphonate use were compared with age- and sex-matched patients who underwent ARCR with osteoporosis without a prescription for a bisphosphonate within 1 year of surgery and patients who underwent ARCR without a diagnosis of osteoporosis and no bisphosphonate use. The primary outcome measure was ipsilateral revision rotator cuff surgery, including revision repair, debridement for a diagnosis of a rotator cuff tear, or reverse shoulder arthroplasty. A multivariable logistic regression analysis was used to control for patient demographic characteristics and comorbidities during comparisons.

Results
We identified 2,706 patients, including 451 in the bisphosphonate study group; 902 in the osteoporosis, no-bisphosphonate control group; and 1,353 in the non-osteoporosis control group. Patients with osteoporosis, including those to whom bisphosphonates were prescribed, had a significantly higher rate of revision rotator cuff surgery (6.58%) than patients without osteoporosis (4.51%) (odds ratio, 1.60; 95% confidence interval, 1.30-1.97; P = .008). No significant difference in the rate of revision surgery was found between patients with osteoporosis using bisphosphonates (6.65%) and age- and sex-matched patients with osteoporosis not using bisphosphonates (6.54%, P = .718).

Conclusions
By using an administrative database, this study was able to show a substantial difference in the revision surgery rate after ARCR in patients with osteoporosis compared with matched controls.

Level of Evidence
Level III, retrospective cohort study.

BACK

Clinical Outcomes and Factors Influencing These Outcome Measures Resulting in Success After Arthroscopic Transosseous Triangular Fibrocartilage Complex Foveal Repair.

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Arthroscopy, Volume 35, Issue 8, Received: November 21, 2018; Accepted: March 30, 2019

https://doi.org/10.1016/j.arthro.2019.03.060

Purpose
To analyze postoperative outcomes after arthroscopic transosseous triangular fibrocartilage complex (TFCC) foveal repair and identify factors affecting the clinical outcomes.

Methods
This study retrospectively enrolled patients who were treated for TFCC foveal tears by arthroscopic transosseous TFCC foveal repair. The diagnosis of TFCC foveal tear was made based on medical history, physical examination, and magnetic resonance imaging, with confirmation via arthroscopic examination. Outcome evaluation was completed at a minimum of 2 years postoperatively, and patients were classified into 2 groups according to the minimal clinically important difference of the Patient-Rated Wrist Evaluation. Various factors including age, sex, trauma history, body mass index, symptom duration, hand dominance, ulnar variance, subluxation of the distal radioulnar joint, preoperative pain score, and functional status, as well as the cross-sectional area (CSA) of the pronator quadratus (PQ) muscle, were retrospectively analyzed using both univariate and multivariate analyses.

Results
During the study period, 42 patients were treated for TFCC foveal tears. The functional status significantly improved after surgery. Overall, 27 and 15 patients showed good and poor functional outcomes, respectively, which were assessed according to the minimal clinically important difference of the Patient-Rated Wrist Evaluation. On univariate analysis, clinical outcomes were better in male patients ($P = .035$), younger patients ($P = .022$), and those with higher CSAs of the PQ muscles ($P < .001$). However, on multivariable logistic regression analysis, only a higher CSA of the PQ muscle was identified as an independent prognostic factor affecting clinical outcome after TFCC foveal repair ($P = .004$).

Conclusion
Arthroscopic transosseous TFCC complex foveal repair led to satisfactory results. However, lower PQ muscle CSA on magnetic resonance imaging was the most independent prognostic factor negatively affecting clinical outcomes.

Level of Evidence
Level III, retrospective comparative study.

BACK

Superior Capsule Reconstruction for Irreparable Rotator Cuff Tears: A Systematic Review

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Arthroscopy, Volume 35, Issue 8

https://doi.org/10.1016/j.arthro.2019.02.053

Purpose
To evaluate the preliminary clinical outcomes and complications of superior capsule reconstruction (SCR) for irreparable rotator cuff tears.

Methods
A systematic review of PubMed, MEDLINE, EMBASE, and Cochrane databases was performed using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. Studies reporting clinical outcomes of irreparable rotator cuff tears managed by SCR were included. Clinical outcome analyses of pre- and postoperative range of motion, American Shoulder and Elbow Surgeons scores, visual analog scale pain scores, and acromiohumeral intervals (AHIs) were performed and reported as range or frequency.

Results
Five studies (285 patients, 291 shoulders) of level III-IV evidence were included, with a weighted mean (± standard deviation) follow-up of 27.7 ± 17.3 months. Forward flexion improved from 91°-130° preoperatively to 147°-160° postoperatively, external rotation from 26°-41° to 41°-45°, and internal rotation from L4-L1 to L1. American Shoulder and Elbow Surgeons scores increased from 36-52.2 to 77.5-92, and visual analog scale pain scores decreased from 4.0-6.3 to 0.4-1.7. Radiographically, AHIs with acellular dermal allograft ranged from 4.5 to 7.1 mm preoperatively, improving to 7.6-10.8 mm immediately postoperation before decreasing to 6.7-9.7 mm by final follow-up. Complication and graft failure rates were 17.2% and 11.7%, respectively.

Conclusions
Preliminary results of SCR show consistent improvement in shoulder functionality and pain reduction. However, a decrease in postoperative AHIs indicates dermal allograft elongation and persistent superior migration of the humerus, potentially contributing to later graft failure. Studies with longer follow-up will be essential to evaluate the long-term utility of SCR in the treatment of irreparable rotator cuff tears.

BACK

Lower Extremity

Arthroscopy, Volume 35, Issue 8

Labral Ossification and Sacroiliac Joint Disease: Could There Be a Link to an Autoimmune Etiology?

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Arthroscopy, Volume 35, Issue 8, Received: July 11, 2018; Accepted: March 21, 2019

https://doi.org/10.1016/j.arthro.2019.03.049

Purpose
To determine the prevalence of ipsilateral sacroiliac (SI) joint disease among patients with symptomatic femoroacetabular impingement (FAI) associated with labral ossification (LO) who underwent hip arthroscopy compared with a matched control group of patients with symptomatic FAI and no LO.

Methods
Computed tomography (CT) scans of all patients undergoing arthroscopic correction of FAI were obtained. The inclusion criterion for the study group was a diagnosis of FAI with a secondary diagnosis of LO made by plain radiography, CT, or magnetic resonance imaging or made intraoperatively. The exclusion criterion was the absence of evidence of LO. We reviewed 52 patients (56 hips) with LO to assess the SI joint and compared them with a control group matched by age, sex, and FAI type. The SI joints were graded according to the modified New York criteria.

Results
CT scans were available for evaluation of the ipsilateral SI joint in 28 patients (29 hips) with LO: 17 women and 11 men with an average age of 44.6 years (range, 26-56 years). Of the hips, 23 had combined FAI and 6 had pincer-type FAI. The control group consisted of 29 hips, exactly matched for sex and FAI type, with an average age of 44.8 years (range, 21-58 years). Grade 3 SI joint abnormalities were significantly more prevalent in the LO group (28%) than in the control group (7%, P = .037), and grade 0 or 1 changes (relatively normal SI joints) were significantly less common in patients with LO (38%) than in controls (72%, P = .008). Subanalysis showed that 35% of the LO group aged 45 years or younger had ipsilateral grade 3 SI joint abnormalities compared with none of the control patients aged 45 years or younger (P = .041). Grade 3 changes were found in 42% of male patients with LO compared with 8% of male controls (P = .155). Grade 3 changes were noted in 18% of women in the LO group compared with 6% of female controls (P = .601).

Conclusions
Patients with symptomatic FAI and LO are more likely to show associated SI joint pathology than patients with FAI not involving LO. These differences are greatest among men and among patients aged 45 years or younger.

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

BACK

Arthroscopic Outcomes as a Function of Acetabular Coverage From a Large Hip Arthroscopy Study Group

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Arthroscopy, Volume 35, Issue 8

https://doi.org/10.1016/j.arthro.2019.01.055

Purpose
To report comparative hip arthroscopic outcomes of patients with low (borderline dysplasia), normal, and high (global pincer femoroacetabular impingement [FAI]) lateral acetabular coverage.

Methods
A retrospective analysis of prospectively collected data from a multicenter registry was performed. Primary hip arthroscopy patients were assigned to 1 of 3 groups based on preoperative lateral center-edge angle: borderline dysplasia (≤25°), normal (25.1°-38.9°), and pincer (≥39°). Repeated-measures analysis of variance compared preoperative with 2-year minimum postoperative International Hip Outcome Tool (iHOT-12) scores. Subsequent analysis of variance determined the effect of acetabular coverage on magnitude of change in scores.

Results
Of 437 patients, the only statistical difference between groups was a lower prevalence of acetabuloplasty in the borderline dysplasia group ($P = .001$). A significant improvement in the preoperative to postoperative iHOT-12 scores for patients with normal acetabular coverage, acetabular undercoverage, and acetabular overcoverage was observed: $F(1, 339) = 311.06$; $P < .001$, with no statistical differences in preoperative ($P = .505$) and postoperative ($P < .488$) iHOT-12 scores when comparing the groups based on acetabular coverage. Mean iHOT-12 scores increased from 37.3 preoperatively to 68.7 postoperatively ($P < .001$) in the borderline dysplasia group, from 34.4 to 72 ($P < .001$) in the normal coverage group, and from 35.3 to 69.4 ($P < .001$) in the pincer group. These preoperative scores increased by 31.4, 37.8, and 34.1, respectively, with no effect for acetabular coverage on the magnitude of change from preoperative to postoperative iHOT-12 scores: $F(2,339) = 1.18$; $P = .310$. Ten patients (2.3%) underwent conversion arthroplasty, and 19 patients (4.4%) underwent revision arthroscopy with no significant effect of acetabular coverage on the incidence of revision or conversion surgery: $\chi 2 (6,433) = 11.535$; $P = .073$.

Conclusions
Lateral acetabular coverage did not influence outcomes from primary hip arthroscopy when performed in patients with low (borderline dysplasia), normal, and high (global pincer FAI) lateral center-edge angle. Borderline dysplasia and moderate global pincer FAI with no or minimal osteoarthritis do not compromise successful 2-year minimum outcomes or survivorship following primary hip arthroscopy when performed by experienced surgeons.

Level of Evidence
Level III, retrospective therapeutic trial.

BACK

Acetabular Subchondral and Cortical Perforation During Labral Repair With Suture Anchors: Influence of Portal Location, Curved Versus Straight Drill Guides, and Drill Starting Point

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Arthroscopy, Volume 35, Issue 8

https://doi.org/10.1016/j.arthro.2019.02.016

Purpose
To evaluate the impact of the portal used for drilling, the position of the drill guide on the acetabular rim, and the use of straight versus curved drill guides on drill perforation of the acetabular subchondral bone and the outer cortex of the acetabulum.

Methods
Sixty acetabular models were marked at the 3-, 2-, 1-, 12-, and 11-o'clock positions. Simulated anterior, anterolateral, and distal anterolateral accessory (DALA) portals were created. Twelve groups of 5 acetabula were drilled at each clock-face position using all combinations of variables.

Results
A total of 38 of 300 drillings (12.7%) perforated the subchondral bone, and 45 of 300 (15%) breached the outer cortex. Drilling from the anterior, anterolateral, and DALA portals perforated the acetabular subchondral bone on 21 of 100 attempts (21%), 17 of 100 attempts (17%), and 0 of 100 attempts (0%), respectively ($P < .001$), and perforated the outer acetabular cortex on 36 of 100 attempts (36%), 1 of 100 attempts (1%), and 8 of 100 attempts (8%), respectively ($P < .001$). The use of a curved or straight drill guide did not make a statistically significant difference. Drilling with a starting point on the acetabular rim perforated the acetabular subchondral bone on 29 of 150 attempts (19.3%) compared with 9 of 150 attempts (6%) when the starting point was 2 mm removed from the acetabular rim ($P < .001$).

Conclusions
The use of the DALA portal and a drill starting point slightly off the acetabular rim was associated with the lowest rate of acetabular subchondral perforation and is recommended to reduce the risk of iatrogenic chondral injury.

Clinical Relevance
Iatrogenic chondral injury is a relatively common complication of hip arthroscopy. Increased awareness of factors associated with drill perforation during suture anchor placement can help surgeons mitigate this risk.

BACK

Surface Mapping of the Musculotendinous Attachments at the Pubic Symphysis in Cadaveric Specimens: Implications for the Treatment of Core Muscle Injury

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Arthroscopy, Volume 35, Issue 8

https://doi.org/10.1016/j.arthro.2019.02.043

Purpose
To characterize the 3-dimensional muscular, musculotendinous, and neurovascular anatomy about the pubic symphysis relevant to core muscle injury (CMI).

Methods
Ten cadaveric hips were dissected to characterize the musculotendinous insertion of the rectus abdominis and inguinal ligament, origins of the adductor longus and adductor brevis, and the pubic cartilage plate. A 3-dimensional coordinate measuring system and data acquisition software were used to calculate structure cross-sectional area, and the landmark anatomical relationships to 1 another and relevant neurovascular structures.

Results
All specimens were male with an average age of 62 ± 2 years. The mean footprints of the rectus abdominis, inguinal ligament, adductor longus, and adductor brevis were 8.4 ± 3.1, 1.2 ± 0.5, 3.8 ± 1.6, and 2.9 ± 1.3 cm2, respectively. The mean pectineus and gracilis footprints were 6.3 ± 2.4 and 3.4 ± 0.9 cm2, respectively. The mean cross-sectional area of the cartilage plate was 24.8 ± 5.6 cm2. The adductor longus was an average 1.5 ± 0.25 cm from the adductor brevis and 0.69 ± 0.52 cm from the rectus abdominis. The genital branch of the genitofemoral nerve was an average of 4.3 cm (range, 2.8-6.4) lateral to the insertion of the inguinal ligament. The femoral vein and artery were 3.0 cm (range, 2.5-3.6) and 3.7 cm (range, 2.5-5.9) lateral to the inguinal ligament footprint. The obturator nerve was 2.5 cm (range, 1.6-3.4) lateral to the adductor longus.

Conclusions
Familiarity with the anatomy of the pubic symphysis is essential for surgeons treating patients with CMI. We have shown that this relatively small area is the site of many muscular, musculotendinous, and neurovascular structures with various sized footprints and described the 3-dimensional anatomy of the anterior pubic symphysis. The origin of the adductor longus lies in close proximity to other structures, such as the adductor brevis, the insertion of the rectus abdominis, and the obturator nerve. These findings should be considered when operating in this region and treating patients with chronic groin pain.

Clinical Relevance
The anatomy of the pelvic region and pubic symphysis has not been well characterized. Intimate knowledge of relevant anatomy is essential to treating CMI, also known as athletic pubalgia or sports hernia.

BACK

Real-Time Assessment of Femoroacetabular Motion Using Radial Gradient Echo Magnetic Resonance Arthrography at 3 Tesla in Routine Clinical Practice: A Pilot Study

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Arthroscopy, Volume 35, Issue 8

https://doi.org/10.1016/j.arthro.2019.02.049

Purpose
To compare femoroacetabular motion in a series of consecutive symptomatic patients with hip pain throughout the range of motion of the hip using a real-time radial gradient echo (GRE) sequence in addition to the routine hip protocol sequences for magnetic resonance (MR) arthrographic assessment of patients with and without clinical femoroacetabular impingement (FAI) syndrome. In particular, we sought to assess whether the additional dynamic sequence could differentiate between patients with and without a positive physical exam maneuver for FAI syndrome.

Methods
Patients with hip pain referred for conventional hip MR arthrogram including those with and without a positive physical exam maneuver for FAI syndrome were imaged using routine hip MR arthrogram protocol and an additional real-time radial 2-dimensional GRE acquisition at 3 Tesla in an axial oblique plane with continuous scanning of a 9 mm thick slice through the center of the femoral head-neck axis. Patients who were unable to move through the range of motion were excluded (n = 3). Patients with acetabular dysplasia (defined by a lateral center-edge angle [CEA] of 20°) were also excluded, as were patients had Kellgren and Lawrence scores of > 0. The real-time cine sequence was acquired with the patient actively moving through neutral, flexion, flexion-abduction external-rotation, and flexion-adduction internal rotation (FADIR) positions aiming for 40° of abduction, then 25° of adduction at 80° to 90° flexion. Due to the placement of the coil over the hip, a true FADIR was precluded. Images were evaluated independently by 2 musculoskeletal radiologists measuring the joint space in the anterior, central, and posterior positions at each point during range of motion for femoroacetabular cortical space (FACS). Anterior FACS narrowing was calculated as the ratio of joint space in FADIR:neutral position, with lower ratios indicating greater narrowing. Static metrics including alpha angle, CEA, grade of cartilage loss according the Outerbridge classification, and patient demographics were also recorded.

Results
Twenty-two painful hips in 22 patients (11 males and 11 females) with mean age 36 years (range, 15-67) were included. Twelve patients had a positive physical exam maneuver for FAI syndrome. The time to perform the dynamic sequence was 3 to 6 minutes. Interobserver agreement was strong, with intraclass correlation 0.91 and concordance correlation 0.90. According to results from both readers, patients with impingement on clinical exam had significantly lower anterior FACS ratios compared with those without clinical impingement (reader 1: 0.39 ± 0.10 vs 0.69 ± 0.20, P = .001; reader 2: 0.36 ± 0.07 vs 0.70 ± 0.17, P < .001). Decreased anterior FACS ratio was found to be significantly correlated to increased alpha angle by both readers (reader 1: R = −0.63, P = .002; reader 2: R = −0.67, P = .001) but not significantly correlated to CEA (reader 1: R = 0.13, P = .561; reader 2: R = 0.20, P = .378) or cartilage loss (reader 1: R = 0.03, P = .885; reader 2: R = −0.06, P = .784). Both readers found patients with an anterior FACS ratio of 1/2 to have significantly higher mean alpha angle (reader 1: 62.88 vs 52.79, P = .038; reader 2: 63.50 vs 50.58, P = .006); however, there were no significant differences in cartilage loss (reader 1: P = .133; reader 2: P = .882) or CEA (reader 1: P = .340; reader 2: P = .307).

BACK

Conclusions
A dynamic radial 2-dimensional-GRE sequence can be added to standard hip MR arthrogram protocols in <6 minutes, allowing assessment of dynamic femoroacetabular motion with strong interreader agreement. Patients with impingement on clinical exam had significantly lower anterior FACS ratios between FADIR and neutral positions, compared with those without clinical impingement.

Level of Evidence
Level III, comparative diagnostic investigation.

BACK

Incidence and Risk Factors for Venous Thromboembolism Following Hip Arthroscopy: A Population-Based Study

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Arthroscopy, Volume 35, Issue 8

https://doi.org/10.1016/j.arthro.2019.03.054

Purpose
To determine the incidence of symptomatic venous thromboembolism (VTE) after hip arthroscopy (HA) using a large national database while considering several patient demographic factors.

Methods
Patients ≥20 years old who underwent HA between 2007 and 2017 were identified within the Humana administrative claims database using relevant Current Procedural Terminology and International Classification of Diseases Ninth and Tenth Revision codes. Basic demographics, including age, gender, obesity (body mass index ≥ 30 kg/m2), oral contraceptive use, smoking history, diabetes, and chronic obstructive pulmonary disease (CLD) were recorded. Postoperative incidence of deep vein thrombosis, pulmonary embolism, and VTE was identified at 30 and 90 days postoperatively. Multivariate logistic regression analysis was performed to identify independent risk factors for VTE after HA, with statistical significance set at $P < .05$.

Results
Overall, 9,477 patients underwent HA procedures over the study period, of whom 5,085 (53.7%) were female. The overall incidence of VTE in all patients was 0.77% (n = 73) and 1.14% (n = 108) at 30 and 90 days, respectively. Multivariate analysis identified age ≥ 45 (odds ratio [OR] = 1.82; 95% confidence interval [CI], 1.36-2.49; P = .0001), obesity (OR = 1.54; 95% CI, 1.27-1.86; P < .0001), smoking (OR = 1.26; 95% CI, 1.04-1.53; P = .0177), diabetes (OR = 1.59; 95% CI, 1.32-1.92; P < .0001), and CLD (OR = 2.10; 95% CI, 1.63-2.68; P < .0001) as independent risk factors for higher incidence of VTE after HA. However, neither gender nor oral contraceptive use were risk factors for VTE after HA.

Conclusions
For patients undergoing HA, the incidence of symptomatic postoperative VTE is low. This study identified age ≥45, obesity, tobacco use, diabetes, and CLD as independent risk factors for VTE after HA.

Level of Evidence
Level III, retrospective cohort study.

BACK

Validation of Simendo Knee Arthroscopy Virtual Reality Simulator

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Arthroscopy, Volume 35, Issue 8, Received: August 6, 2018; Accepted: January 18, 2019

https://doi.org/10.1016/j.arthro.2019.01.031

Purpose
To determine the face and construct validity as well as educational value and user-friendliness of the Simendo knee arthroscopy virtual reality simulator.

Methods
Sixty participants were recruited and equally divided into novices (0 arthroscopic procedures), intermediates (1-59 arthroscopic procedures), and experts (60 or more arthroscopic procedures). Participants were excluded if they had previously trained with the studied simulator. Construct validity, that is, the ability to discriminate between different levels of expertise, was examined by a navigation task. All participants were asked to perform 5 navigation trials within 10 minutes. Face validity, educational value, and user-friendliness were examined by questionnaires before and after the navigation trials. Face validity is the subjective impression of how closely the simulation replicates the real environment.

Results
The novices were significantly slower than the intermediates in the first ($P < .001$) and the third ($P = .031$) trial. The novices were significantly slower than the experts in all trials ($P = .016$), except for the fifth ($P = .054$). The experts were significantly faster than the intermediates in every trial except for the fourth ($P = .069$). Median task time for the fifth trial was 63 seconds (44-80 seconds) for novices, 58 seconds (46-80 seconds) for intermediates, and 41 seconds (33-55 seconds) for experts. Ninety-two percent of all participants agreed that the simulator can be used to train for surgical inspection, and 95% indicated sufficient user-friendliness.

Conclusions
Based on the results, this knee simulator can be applied to train the basic arthroscopic hand-eye coordination skills at the start of resident education programs. Further testing is necessary to determine whether the skills are retained.

Clinical Relevance
The simulator is partly validated, which contributes to training of basic arthroscopic skills without compromising patient safety.

BACK

Effects of Preoperative Virtual Reality Magnetic Resonance Imaging on Preoperative Anxiety in Patients Undergoing Arthroscopic Knee Surgery: A Randomized Controlled Study

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Arthroscopy, Volume 35, Issue 8

https://doi.org/10.1016/j.arthro.2019.02.037

Purpose
To assess the effect of a preoperative virtual reality (VR) experience of 3-dimensional (3D) reconstructed magnetic resonance images (MRIs) on anxiety reduction in patients undergoing arthroscopic knee surgery.

Methods
Patients in the VR group watched a 3D model of their own MRI through a VR headset describing the anatomy of the knee as well as their own lesion of interest for an arthroscopic procedure. Patients in the non-VR (NR) group received standard preoperative information about their MRI. The primary outcome for analysis was the Amsterdam Preoperative Anxiety and Information Scale score to measure level of anxiety and the need for information in patients undergoing arthroscopic knee surgery. Secondary outcomes were rated with visual analog scale (VAS) scores measuring patient pain, preparedness, satisfaction, and stress.

Results
Regarding the Amsterdam Preoperative Anxiety and Information Scale score, the sum S (surgery-related anxiety) and sum C (combined anxiety component) subscales showed significantly better outcomes in the VR group (median [interquartile range] for sum S = 2.0 [2.0-4.0], median [quartile 1-quartile 3] sum C = 4.0 [4.0-8.5]) than in the NR group (median [interquartile range] for sum S = 4.9 [3.0-5.0], median [quartile 1-quartile 3] sum C = 8.0 [5.3-9.8]) (P = .014 and P = .005, respectively). Regarding VAS scores, preoperative measures showed significantly better outcomes in satisfaction among VR group patients (95 [90.0-100.0]) in comparison to NR group patients (85 [70.0-96.0]) (P = .010). For postoperative VAS measures, the VR group (satisfaction score = 95 [90.0-100.0], stress score = 15 [2.5-37.5]) showed significantly better outcomes in satisfaction and stress in comparison to the NR group (satisfaction score = 85 [70.0-97.5], stress score = 30 [30.0-50.0]).

Conclusions
Application of preoperative VR experience of 3D reconstructed knee MRIs in patients undergoing arthroscopic knee surgery reduces anxiety around surgical encounters. The VR patient group was more satisfied overall and less stressed postoperatively. However, perioperative pain and preparedness were not affected by VR exposure.

Level of Evidence
Level I, randomized controlled trial.

BACK

The Clinical Outcome of Arthroscopic Versus Open Popliteal Tendon Reconstruction Combined With Posterior Cruciate Ligament Reconstruction in Patients With Type A Posterolateral Rotational Instability

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Arthroscopy, Volume 35, Issue 8

https://doi.org/10.1016/j.arthro.2019.02.053

Purpose
To compare the objective and subjective clinical outcomes of arthroscopic versus open popliteal tendon (PT) reconstruction combined with posterior cruciate ligament reconstruction in patients with type A posterolateral corner injury.

Methods
From January 2012 to March 2016, patients were eligible for inclusion in this study if they (1) had type A posterolateral rotational instability according to Fanelli's classification, (2) underwent arthroscopic (group A) or open PT (group B) reconstruction, and (3) were followed for a minimum of 2 years with second-look arthroscopic findings. For evaluation, this study used subjective scoring systems (Lysholm, Tegner, and International Knee Documentation Committee subjective scores), knee stability examinations (side-to-side differences of tibial external rotation angle by dial test and posterior and varus stress radiographs), and second-look arthroscopic lateral gutter drive-through tests during hardware removal operations.

Results
A total of 38 patients were included in the study. The mean follow-up period was 31.0 ± 5.8 months in group A (n = 21) and 34.8 ± 12.7 months in group B (n = 17). At the final follow-up, all subjective and objective evaluation results were significantly improved compared with the preoperative condition. There were no significant intergroup differences in Lysholm score (group A, 72.7 ± 17.2; group B, 67.2 ± 14.2; P = .818), Tegner score (group A, 2; group B, 2; P = .710), or International Knee Documentation Committee subjective score (group A, 73.0 ± 13.8; group B, 69.7 ± 20.7; P = .561) at the final follow-up. In terms of objective evaluations, there was no difference in side-to-side difference of posterior stress radiography (group A, 4.0 ± 3.2 mm; group B, 5.0 ± 2.9 mm; P = .336) or lateral gutter drive-through test positive rate (group A, 1/21, 4.8%; group B, 2/17, 11.8%; P = .426).

Conclusion
Both arthroscopic and open PT reconstruction significantly improved the knee stability and subjective outcome of patients with type A posterolateral rotational instability. In comparison with the open procedure, the arthroscopic PT reconstruction showed similar subjective and objective clinical outcomes.

Level of Evidence
Level III, retrospective cohort study.

BACK

Influence of Medial Meniscus Bucket-Handle Repair in Setting of Anterior Cruciate Ligament Reconstruction on Tibiofemoral Contact Mechanics: A Biomechanical Study

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Arthroscopy, Volume 35, Issue 8

https://doi.org/10.1016/j.arthro.2019.03.052

Purpose
To compare the impact of an inside-out repair versus meniscectomy of a medial meniscus bucket-handle tear in restoring native contact areas and pressures across the tibial plateaus in the setting of an anterior cruciate ligament (ACL) reconstruction (ACLR).

Methods
Ten fresh-frozen cadaveric knees were tested in 6 knee conditions (1: intact; 2: ACL torn and bucket-handle tear of medial meniscus, flipped; 3: bucket-handle tear of medial meniscus, reduced; 4: bucket-handle tear of medial meniscus, repaired via inside-out vertical mattress suture technique; 5: ACLR with bone patella tendon bone autograft and bucket-handle repair; 6: ACLR and medial meniscus bucket-handle tear debridement) at 4 flexion angles (0°, 30°, 45°, and 60°), under a 1,000-N axial load. Contact area and pressure were measured with Tekscan sensors.

Results
ACLR with a concurrent medial meniscectomy for a medial meniscus bucket-handle tear resulted in significantly decreased contact area ($P < .05$) and increased mean and peak pressure in both the medial and lateral compartments across all tested flexion angles ($P < .05$). The ACLR with medial meniscectomy state also demonstrated significantly lower contact area than the bucket-handle repair state between 30° and 60° of flexion (all $P < .05$).

Conclusions
Resection of a bucket-handle medial meniscus tear concurrent with an ACLR resulted in significant increases in mean and peak contact pressures in not only the medial but also the lateral compartment. Preservation of the medial meniscus in the face of a bucket-handle tear is essential to more closely restore native tibiofemoral biomechanics.

Clinical Relevance
The increased mean and peak tibiofemoral contact pressure seen with excision of a bucket-handle medial meniscus tear would over time result in increased cartilaginous degradation and resultant osteoarthritis. Decreasing both of these factors through concomitant ACLR and inside-out bucket-handle meniscal repairs should improve patient outcomes by restoring knee biomechanics and kinematics closer to that of the native state.

BACK

Effect of Autogenous Bone Marrow Aspirate Treatment on Magnetic Resonance Imaging Integration of Osteochondral Allografts in the Knee: A Matched Comparative Imaging Analysis

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Arthroscopy, Volume 35, Issue 8

https://doi.org/10.1016/j.arthro.2019.03.033

Purpose
To accurately evaluate the effects of bone marrow aspirate (BMA) augmentation on osteochondral allograft (OCA) integration on early postoperative magnetic resonance imaging (MRI) using the comprehensive Osteochondral Allograft MRI Scoring System (OCAMRISS).

Methods
This imaging study compared patients who underwent OCA transplantation with and without BMA augmentation for the treatment of focal osteochondral defects in the knee performed by a single surgeon between July 2013 and July 2017. Patients were excluded if they underwent implantation of premade plugs, had an overlapping OCA configuration (“snowman” technique), or did not undergo MRI at 6 months postoperatively. Patients were matched by lesion location, lesion size, age, and body mass index, as well as whether they underwent previous surgical procedures. Data were analyzed using descriptive statistics, Spearman correlation, the independent t test, the Mann-Whitney U test, and the $\chi 2$ test.

Results
A total of 58 patients (29 per group) were included in this study, with an average age of 36.4 ± 10.1 years and mean body mass index of 28.6 ± 5.1. The mean size of the analyzed OCA plugs was 3.3 ± 1 cm2. At an average imaging follow-up of 5.6 ± 1 months, 86.2% of the grafts had achieved osseous integration at the graft-host junction and 75.9% did not show any cystic changes in the subchondral bone. No difference in any OCAMRISS subscale was seen comparing OCAs with and without BMA augmentation ($P > .05$). Specifically, osseous integration and subchondral cyst formation were comparable between groups ($P = .128$ and $P = .539$, respectively).

Conclusions
OCAs showed excellent osseous integration at the graft-host junction on 6-month postoperative MRI. The treatment of OCAs with autogenous BMA did not result in superior imaging outcomes when analyzed using the OCAMRISS.

Level of Evidence
Level III, case-control study.

BACK

Meniscal Allograft Transplantation Is an Effective Treatment in Patients Older Than 50 Years but Yields Inferior Results Compared With Younger Patients: A Case-Control Study

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Arthroscopy, Volume 35, Issue 8

https://doi.org/10.1016/j.arthro.2019.03.048

Purpose
To evaluate the influence of age on midterm clinical outcomes and failures of meniscal allograft transplantation (MAT), aiming at investigating the efficacy of MAT in patients older than 50 years.

Methods
In this case-control study, data on patients older than 50 years (older MAT [O-MAT] group) with at least 5 years of follow-up and a matched-pair group of patients younger than 30 years of age (younger MAT [Y-MAT] group) were extracted from a database of MAT procedures, performed with arthroscopic implantation of fresh-frozen meniscal allograft without bone plugs.

Results
A matched-pair comparative analysis of midterm results and survival between 26 O-MAT patients and 26 Y-MAT patients was performed at a mean follow-up of 7.3 ± 2.2 years. All the clinical scores significantly improved from the baseline values in both the O-MAT and Y-MAT groups although with significantly lower scores in the O-MAT group. Two-thirds of O-MAT patients were able to return to a recreational level of sports activity. Only 2 patients in the O-MAT group underwent knee replacement, but the overall failure rate, also considering a clinical criterion, was 31% in the O-MAT group and 15% in the Y-MAT group (P = .3244). The mean survival time free from replacement or graft removal was 11.6 years in the O-MAT group and 12.3 years in the Y-MAT group (P = .691).

Conclusions
MAT is able to provide symptom relief and functional improvement at midterm follow-up in patients older than 50 years although with inferior results and a higher failure rate compared with those younger than 30 years. MAT can be considered a viable option to treat patients older than 50 years.

Level of Evidence
Level III, case-control study.

BACK

A Meta-analysis of Surgical Versus Nonsurgical Treatment of Primary Patella Dislocation

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Arthroscopy, Volume 35, Issue 8

https://doi.org/10.1016/j.arthro.2019.03.047

Purpose
To compare outcomes after surgery versus nonsurgical treatment in the management of primary lateral patellar dislocation (LPD) through a meta-analysis of randomized controlled trials (RCTs) in terms of redislocation rate and clinical outcome, investigating both short-term (<6 years) functional recovery and overall benefit over time (>6 years).

Methods
A systematic search of the literature was performed in November 2018. Risk of bias and quality of evidence were evaluated according to the Cochrane guidelines. RCTs investigating differences between surgery and nonsurgical treatment in primary LPD were included. The outcomes evaluated were redislocation rate, reinterventions, and Kujala score at short-, mid-, and long-term follow-up, with subanalyses for the pediatric population.

Results
We included 510 patients from 10 RCTs in the meta-analysis. Redislocation rate was 0.40 (0.25 to 0.66; P < .001) and 0.58 (0.29 to 1.15; P = .12) at the short- and mid-term follow-ups, respectively, and the risk ratio for the need for further operations at 6 to 9 months' follow-up was 0.14 (0.02 to 1.03; P = .05), all favoring surgery. Concerning the Kujala score, an advantage of the surgical approach of 10.2 points (1.6 to 18.7; P = .02) at short-term follow-up was seen, whereas long-term follow-up results were similar between the groups. The subanalysis of the pediatric population at heterogeneous follow-up confirmed a lower risk of recurrence in surgery, with a risk ratio of 0.60 (0.26 to 1.37; P = .22), although not significant.

Conclusion
The literature documents a low number of high-level trials. The meta-analysis of RCTs underlined that the redislocation rate is higher with the nonsurgical approach compared with the surgical one. Moreover, when looking at the clinical outcome, more favorable findings were found with the surgical approach up to 6 years, whereas results seems to be similar at a longer follow-up after either surgical or nonsurgical treatment of primary LPD.

Level of evidence
II, meta-analysis of level I and level II randomized clinical trials.

BACK

Fixed- Versus Adjustable-Loop Devices for Femoral Fixation in Anterior Cruciate Ligament Reconstruction: A Systematic Review

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Arthroscopy, Volume 35, Issue 8, Received: October 30, 2018; Accepted: February 17, 2019

https://doi.org/10.1016/j.arthro.2019.02.029

Purpose
To compare biomechanical and clinical outcomes between adjustable-loop devices (ALDs) and fixed-loop devices (FLDs) in the femoral fixation component of anterior cruciate ligament reconstruction (ACLR) using a hamstring autograft or allograft.

Methods
A multi-database search was performed on July 18, 2018, according to Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines. All articles directly comparing ALDs and FLDs in ACLR using hamstring grafts were included. Non–English-language articles were excluded.

Results
We included 13 biomechanical, 2 prospective, and 6 retrospective studies in this review. Retensioning of ALDs was performed in 4 of 13 biomechanical studies and in all clinical studies. Biomechanically, 11 studies showed a statistically significantly larger maximum irreversible displacement of the graft in the ALD group. Two studies showed no statistically significant difference with retensioning of the TightRope ALD, whereas all 3 studies that examined knotting of ALDs showed no statistically significant difference between the FLD and ALD groups. Five studies reported statistically significantly higher graft stiffness for FLDs than ALDs. Retensioning or knotting did not produce any significant change in construct stiffness. Nine studies reported a statistically significantly higher ultimate load to failure for FLDs. With knotting of ALDs, this difference was no longer statistically significant in only 1 study. Clinical studies showed no statistically significant differences in clinical, functional, radiologic, and complication outcomes between both groups.

Conclusions
Despite the superior biomechanical properties of FLDs, ALDs and FLDs yielded similar clinical outcome scores and graft rerupture rates. Biomechanical outcomes were improved with retensioning of ALDs after tibial fixation, as per manufacturer recommendations.

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

BACK

“Postage Stamp” Fractures: A Systematic Review of Patient and Suture Anchor Profiles Causing Anterior Glenoid Rim Fractures After Bankart Repair

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Arthroscopy, Volume 35, Issue 8

https://doi.org/10.1016/j.arthro.2019.02.047

Purpose
To systematically review patient and technical risk factors for anterior glenoid rim fractures through suture anchor points (i.e. “postage stamp”) after arthroscopic Bankart repair.

Methods
An independent, duplicate search of Embase, Medline, and Web of Science databases, in addition to the past 5-year annual meeting abstracts of several prominent shoulder meetings, was conducted according to R-AMSTAR and Preferred Reporting Items for Systematic Reviews and Meta-analyses guidelines to identify English-language studies reporting this complication.

Results
A screen of 2,833 studies yielded 6 for inclusion herein. Data across 43 patients, aged 14 to 61 years (mean 24.4), 5% female, and who were followed for 4 to 108 months postoperatively, were reviewed. Only 1 of 6 studies (n = 2) reported postage stamp fracture in female patients. Median time from initial surgery to fracture ranged from 12 to 24 months. Five of 6 studies (n = 32) reported a median age at initial surgery of 25 years or younger (range 17-35). Four of 6 studies (n = 30) reported fracture mostly after sport involvement. All studies (n = 35) reported initial fixation with a median of 3 anchors or more, 3 of 5 studies (n = 26) reported fracture entirely after conventional knot-tying anchors, and 5 of 6 studies (n = 24) reported more fractures after absorbable suture anchor use. Fractures occurred entirely through anchor holes in 5 of 6 studies (n = 29) and mostly after osteolysis in 3 of 4 studies (n = 19). Management strategies after fracture included revision arthroscopic Bankart repair or open Bristow/Latarjet procedures.

Conclusion
Postage stamp fractures were reported frequently in patients who were male, age 25 years or younger, and participants in sporting activities and in fractures initially stabilized with 3 or more anchors or conventional knot-tying anchors or that experienced osteolysis around anchor sites.

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

BACK

Does Internal Fixation for Unstable Osteochondritis Dissecans of the Skeletally Mature Knee Work? A Systematic Review

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Arthroscopy, Volume 35, Issue 8

https://doi.org/10.1016/j.arthro.2019.03.020

Purpose
To report the rate of radiographic union, patient-reported outcomes, complications, and reoperations after internal fixation of unstable osteochondritis dissecans (OCD) in the skeletally mature knee.

Methods
A literature search was conducted according to Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines. Patients were included if they were skeletally mature and underwent internal fixation of an unstable OCD lesion of the knee. Risk of bias assessment was performed using the Methodological Index for Non-randomized Studies scoring system. Surgical technique, rate of union, patient-reported outcomes, complications, and reoperations were collected.

Results
Thirteen studies resulted in 148 patients (150 knees) for inclusion. Patient age ranged from 14 to 45 years. Numerous fixation procedures were used, including biodegradable devices (rods, pins, nails, and screws), metal screws, Kirschner wire, and autologous bone sticks. Overall, reported outcome measures were heterogeneous in nature. The rate of radiographic healing ranged from 67% to 100% across 6 studies. Improved subjective results and Hughston criteria on final follow-up ranged from 83% to 100% across 4 studies each. Mean postoperative Lysholm scores ranged from 42 to 98 in studies that reported them. Both complication and reoperation rates ranged from 0% to 44%. The most commonly performed reoperations were loose body excision and cartilage resurfacing procedures.

Conclusions
A variety of surgical techniques are available for treatment of unstable OCD lesions in the skeletally mature knee. In this systematic review, internal fixation of the native fragment showed acceptable rates of radiographic union and improved patient-reported outcomes relative to other techniques.

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

BACK

Knee Surgery, Sports Traumatology, Arthroscopy (KSSTA), Volume 27, Issue 8

Relationship between bone plug position and morphological changes of tunnel aperture in anatomic rectangular tunnel ACL reconstruction

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DOI: https://doi.org/10.1007/s00167-018-5224-8

Purpose
In animal studies after ACL reconstruction (ACL-R) using the bone-patellar tendon-bone (BTB), the graft-healing pattern was found to depend on the relationship between bone plug and the tunnel wall. This difference of graft-healing pattern could influence the postoperative morphological changes of the tunnel. However, no study has assessed the relationship between bone plug position and the change of tunnel morphology. Therefore, the main purpose of this study was to investigate the relationship between the bone plug position within femoral or tibial tunnel and morphological changes of each tunnel aperture in ACL-R using computed tomography.

Methods
Subjects were 30 consecutive patients (six females and 24 males; mean age, 20.4 ± 5.4 years) who underwent primary ACL-R using BTB. The distance from the tunnel aperture to the tendon-bone junction (TBJ) at 2 weeks postoperatively, and tunnel aperture enlargement and tunnel wall migration from 2 weeks to 6 months postoperatively, were evaluated.

Results
The distance from the femoral tunnel aperture to the TBJ in most cases was less than 2 mm, whereas the TBJ was located within the tibial tunnel. Femoral tunnel aperture was significantly enlarged (17.0 ± 11.7%) distally, and the tibial tunnel aperture was significantly enlarged (19.6 ± 12.5%) posterolaterally. Only the position at distal portion of femoral bone plug was correlated with femoral tunnel aperture enlargement ($r = 0.454$, $p = 0.0015$).

Conclusion
Both femoral and tibial tunnel aperture were significantly enlarged distally and posterolaterally 6 months postoperatively. Only correlation between the position at distal portion of femoral bone plug and femoral tunnel enlargement were found, suggesting the deep plug position in the tunnel is a risk factor for femoral tunnel enlargement, highlighting the importance of accurately locating the TBJ just at the femoral tunnel aperture. Another option is to deviate the harvest site in the patellar tendon to match the shape of the TBJ and the tunnel aperture.

Level of evidence
4 (case series).

BACK

Meniscal tear morphology independently affects pain relief following arthroscopic partial meniscectomy in middle-aged patients

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DOI: https://doi.org/10.1007/s00167-018-5238-2

Purpose
To analyze the influence of meniscal tear pattern on clinical outcomes following arthroscopic partial meniscectomy in middle-aged patients with medial meniscal tears.

Methods
A total of 123 patients (130 knees) aged ≥ 50 years who underwent arthroscopic partial meniscectomy for medial meniscal tears were evaluated. Inclusion criteria were none to moderate medial knee osteoarthritis [Kellgren–Lawrence (KL) grade ≤ 3] and a minimum of 2-year follow-up (median 4.6 years; range 2.1–8.0 years). Meniscal tears observed during arthroscopic examination were classified into six types: radial tear of the middle segment, posterior root tear, horizontal tear of the posterior segment, flap tear, minor tear, and complex tear. Postoperative outcomes were classified into effective (group 1) and non-effective (group 2) according to the pain relief administered 1 month postoperatively and at the final follow-up. Demographic variables, KL grade, type of meniscal tear, and postoperative follow-up period were evaluated.

Results
Forty knees (38%) were classified into group 1. Of the six types of tears, radial tear of the middle segment [odds ratio (OR) 4.1, 95% confidence interval (CI) 1.1–20.9] and flap tear (OR 12.9, 95% CI 1.8–140.7) were significant predictors of good outcome on multivariate logistic regression analysis.

Conclusions
In middle-aged patients with medial meniscal tears, radial tear of the middle segment was independently associated with less pain following arthroscopic meniscectomy. Arthroscopic partial meniscectomy may be indicated in patients with radial tear if conservative treatment fails.

Level of evidence
Case–control study, Level III.

BACK

Increased risk of ACL revision with non-surgical treatment of a concomitant medial collateral ligament injury: a study on 19,457 patients from the Swedish National Knee Ligament Registry

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DOI: https://doi.org/10.1007/s00167-018-5237-3

Purpose
To determine how concomitant medial collateral ligament (MCL) and lateral collateral ligament (LCL) injuries affect outcome after anterior cruciate ligament (ACL) reconstruction.

Methods
Patients aged > 15 years who were registered in the Swedish National Knee Ligament Registry for primary ACL reconstruction between 2005 and 2016 were eligible for inclusion. Patients with a concomitant MCL or LCL injury were stratified according to collateral ligament treatment (non-surgical, repair or reconstruction), and one isolated ACL reconstruction group was created. The outcomes were ACL revision and the 2-year Knee Injury and Osteoarthritis Outcome Score (KOOS), which were analyzed using univariable and multivariable Cox regression and an analysis of covariance, respectively.

Results
A total of 19,457 patients (mean age 27.9 years, 59.4% males) met the inclusion criteria. An isolated ACL reconstruction implied a lower risk of ACL revision compared with presence of a non-surgically treated MCL injury (HR = 0.61 [95% CI 0.41–0.89], p = 0.0097) but not compared with MCL repair or reconstruction. A concomitant LCL injury did not impact the risk of ACL revision. Patients with a concomitant MCL or LCL injury reported inferior 2-year KOOS compared with isolated ACL reconstruction. The largest difference was found in the sports and recreation subscale across all groups, with MCL reconstruction resulting in the maximum difference (14.1 points [95% CI 4.3–23.9], p = 0.005).

Conclusion
Non-surgical treatment of a concomitant MCL injury in the setting of an ACL reconstruction may increase the risk of ACL revision. However, surgical treatment of the MCL injury was associated with a worse two-year patient-reported knee function. A concomitant LCL injury does not impact the risk of ACL revision compared with an isolated ACL reconstruction.

Level of evidence
Cohort study, Level III.

BACK

Superior graft maturation after anatomical double-bundle anterior cruciate ligament reconstruction using the transtibial drilling technique compared to the transportal technique

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DOI: https://doi.org/10.1007/s00167-018-5240-8

Purpose
To evaluate and compare the femoral tunnel aperture position, graft bending angle and the magnetic resonance imaging (MRI) graft signal intensity after anatomical double-bundle anterior cruciate ligament (ACL) reconstruction between transtibial and transportal drilling techniques of the femoral tunnel.

Methods
Eighty-seven patients who underwent anatomic double-bundle ACL reconstruction with hamstring tendon autograft between January 2012 and December 2014 were included in this retrospective study. Forty-one patients underwent reconstruction using a transportal technique (TP group) and 46 patients underwent reconstruction using a transtibial technique (TT group). The anteromedial (AM) femoral aperture position and the graft bending angle were assessed using transparent three-dimensional CT 2 weeks postoperatively. MRI assessment was performed with proton density-weighted images in an oblique coronal plane 6 and 12 months postoperatively. Signal/noise quotient was calculated for two specific graft sites (femoral tunnel site and mid-substance site). Femoral aperture position, the graft bending angle and signal/noise quotient were compared between the TP and TT groups.

Results
There was no significant difference in the aperture position between the two groups. The graft bending angle of the AM tunnel in the axial plane was significantly greater in the TP group ($p < 0.001$). On the other hand, the TP group had a significantly more acute angle in the coronal plane ($p < 0.001$). There was no significant difference at either site in the signal/noise quotient of the graft between the two groups at 6 months. However, the TT group had a lower signal/noise quotient at 12 months at both sites (femoral aperture: $p = 0.04$, mid-substance: $p = 0.004$).

Conclusion
There was a significant difference in signal/noise quotient between the two drilling techniques 12 months postoperatively. There was no significant difference in femoral tunnel aperture position between the two groups. However, graft bending angle at the femoral tunnel aperture was significantly different between the two groups, indicating the possibility that graft bending angle is a factor that influences graft maturation. This indicates that the TT technique has an advantage over the TP technique in terms of graft maturation.

BACK

The 6-m timed hop test is a prognostic factor for outcomes in patients with meniscal tears treated with exercise therapy or arthroscopic partial meniscectomy: a secondary, exploratory analysis of the Odense–Oslo meniscectomy versus exercise (OMEX) trial

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DOI: https://doi.org/10.1007/s00167-018-5241-7

Purpose
To identify the prognostic factors for 2-year patient-reported outcomes in middle-aged patients with degenerative meniscal tears treated with exercise therapy (ET) or arthroscopic partial meniscectomy (APM).

Methods
One hundred and seven patients, with mean age 49.6 (SD 6.2) years and BMI 25.7 (SD 3.7), were included in this analysis of data from the OMEX trial (http://www.clinicaltrials.gov NCT01002794). Linear and Poisson regression models were built to explore the associations between potential prognostic factors (patient characteristics, knee function-related and disease-related factors) and 2-year patient-reported outcomes: the Knee Injury and Osteoarthritis Outcome Score (KOOS) subscales Pain, Symptoms, ADL, Sport/Rec, QoL and 5-point Global Rating of Change scales for knee pain (GRC Pain) and function (GRC Function). Analyses were performed for the whole cohort and for the two treatment groups (n = 55 and 52) with adjustments for age, sex, BMI and baseline KOOS.

Results
For the whole cohort, a 1-s better baseline 6-m timed hop test result was associated with 3.1–7.1 points better 2-year scores for all KOOS subscales (95% CIs 1.1–5.2 to 4.1–10.1 points). A 1.61–2.80 s better test was associated with scores equivalent to previously calculated clinical relevant differences for each KOOS subscale. For the groups of patients treated with ET and APM, respectively, 2.09–3.60 s and 0.63–1.99 s better tests were associated with clinical relevant differences. For the whole cohort, a 1-s better test was associated with 26% (95% CI 15–38%) and 22% (95% CI 11–34%) higher possibility for better or much better GRC Pain and Function scores. Patients treated with ET had 17% (95% CI 2–33%) increased possibility for better or much better GRC Pain score, and patients treated with APM had 65% (95% CI 32–108%) and 70% (95% CI 38–109%) increased possibility for better or much better GRC Pain and Function scores.

Conclusions
The 6-m timed hop test result was a significant prognostic factor for 2-year patient-reported outcomes in middle-aged patients with degenerative meniscal tears, especially in those treated with APM.

Level of evidence
II.

BACK

Hand-held dynamometer identifies asymmetries in torque of the quadriceps muscle after anterior cruciate ligament reconstruction

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DOI: https://doi.org/10.1007/s00167-018-5245-3

Purpose
To verify the validity and diagnostic accuracy of the hand-held dynamometer (HHD) with the isokinetic dynamometer for evaluating the quadriceps strength of subjects who have undergone ACL reconstruction (ACLR).

Methods
This validity and diagnostic accuracy study was conducted prospectively by examining 70 consecutive participants who had undergone ACLR at least 6 months previously. All participants performed strength evaluation of the quadriceps muscle using the HHD and isokinetic dynamometer.

Results
The HHD presented high test–retest reliability [intraclass correlation coefficient (ICC) = 0.98], moderate to good validity with the isokinetic dynamometer when compared for the quadriceps strength (r = 0.62), 100% perfect specificity [LR + infinity, 95% confidence interval (CI) 81.4%–100%] to identify those with LSI > 10%, and a sensitivity of 63.4% (48.9%–76.3%).

Conclusion
The HHD is an instrument valid and reliable of low cost and easy handling compared to the isokinetic dynamometer to evaluate the quadriceps torque and the limb symmetry index after the ACLR with high diagnostic accuracy.

Level of evidence
I.

BACK

Low rate of return to pre-injury sport level in athletes after cartilage surgery: a 10-year follow-up study

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DOI: https://doi.org/10.1007/s00167-018-5255-1

Purpose
Although articular surface is frequently damaged in athletes, results in terms of return to sport and level of activity after cartilage surgery remain rather unpredictable and poorly documented. The aim of this study is to evaluate the clinical outcome in terms of rate and level of return to sport in a group of competitive athletes who underwent matrix-assisted autologous chondrocyte transplantation (MACT), as well as the impact on their athletic career.

Methods
Thirty-one male patients (mean age 22.6 ± 6.3 years) p racticing sport at competitive level, affected by focal chondral/osteochondral lesions of the distal femur, were enrolled and treated with arthroscopic hyaluronan-based MACT. Patients were evaluated prospectively at 1-year intervals with the IKDC subjective, Tegner, and EuroQol VAS scores during their pre-operative visit and subsequent follow-ups for up to 10 years. Return to sport in terms of level, time and maintenance of the activity level was documented, together with surgical or clinical failures.

Results
A marked improvement in all scores was found: IKDC increased from 40.3 ± 13.4 to 81.7 ± 14.4 ($p < 0.0005$) at 12 months; a further improvement was observed at 2 years (89.5 ± 11.3; $p = 0.008$), then results were stable for up to 10 years (87.3 ± 13.6). The analysis of return to sport documented that 64.5% of patients were able to return at a competitive level, and 58.1% performed at the same pre-injury level, with activity rates decreasing over time. The rate of patients returning to competitive level was 84% in those without previous surgery (vs. 33% who had undergone previous surgery), 87% for those with traumatic lesions (vs. 33% and 50% for degenerative and OCD lesions, respectively), and 92.3% in younger patients (age < 20 years). Among these factors, multivariate analysis demonstrated that previous surgery was the single most influencing factor for returning to the same sport level ($p = 0.010$).

Conclusions
These long-term results showed that chondrocyte-based regenerative approach has some limitations in terms of sport-related outcomes. The level of high functional knee restoration needed for such high-demanding activity level can be challenging to achieve, especially in patients with a more compromised joint homeostasis. Return to sport rate varies significantly according to specific patient and lesion characteristics and best results are obtained in young patients with traumatic lesions without previous surgery, which should be considered when treating athletes affected by cartilage lesions.

Level of evidence
IV.

BACK

Higher BMI predicts additional surgery at the time of ACL reconstruction

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DOI: https://doi.org/10.1007/s00167-018-5267-x

Purpose
Despite public recognition, obesity is a growing epidemic affecting an estimated 34% of adults and 20% of children in the U.S. population. As such, the number of ACL reconstructions performed in this population is likely to increase. The goal of this study is to evaluate the risk that increasing BMI poses for additional surgery at the time of ACL reconstruction.

Methods
A retrospective analysis of the American College of Surgeons' National Surgical Quality Improvement Program's (ACS-NSQIP) database for the years 2005–2015 was conducted. Logistic regressions were used to assess the relationship between BMI and additional CPT codes for internal derangement at the time of ACL reconstruction. Internal derangement was defined as any CPT code for treatment of a meniscus tear, chondral lesion, or loose body removal. Surgeries for multi-ligamentous knee injuries were excluded.

Results
A total of 11,403 patients undergoing ACL reconstruction were identified. 41.9% of patients had an associated CPT code for internal derangement. As BMI increased, there was a corresponding increase in the odds of additional surgery. Specifically, for every 1.0 increase in BMI, the risk of additional surgery increased by 1.6% ($p < 0.001$). Compared to patients with a BMI of 18.5–24.9, those with a BMI 25–29.9 had an odds ratio (OR) of 1.112, BMI 30–34.9 had an OR of 1.137, BMI 35–39.9 had an OR of 1.249, and those ≥ 40 had an OR of 1.442 for additional surgery ($p < 0.001$).

Conclusions
This nationally-representative, population-based study demonstrates that patients with elevated BMI are much more likely to require additional surgery in the setting of primary ACL reconstruction. This risk correlates with increasing BMI. Surgeons should keep these risks in mind when evaluating and counseling patients for surgery in the setting of ACL reconstruction.

Level of evidence
Case–control study, Level III.

BACK

Midbody of the medial meniscus as a reference of preservation in partial meniscectomy for complete discoid lateral meniscus

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DOI: https://doi.org/10.1007/s00167-018-5268-9

Purpose
To evaluate the postoperative size of discoid lateral meniscus using magnetic resonance imaging (MRI) after partial meniscectomy relative to the size of medial meniscus midbody.

Methods
This study included 48 patients who underwent arthroscopic partial meniscectomy with or without repair for symptomatic complete discoid meniscus. The intraoperative size of midbody of medial meniscus was used as a reference for partial meniscectomy. MRIs were performed pre- and postoperatively. Quantitative evaluations of the height, width, extrusion of the meniscus, and relative percentage of extrusion in the coronal and sagittal planes were completed. Demographic data, preoperative shift, type of shift, and operative technique were analyzed while considering the remaining meniscus. Logistic regression analyses were used.

Results
The mean remaining discoid meniscal width in the coronal plane of MRI was not significantly different from the width of midbody of medial meniscus (9.1 ± 4.2 mm vs. 9.4 ± 1.4 mm, n.s.) Absolute meniscal extrusion and relative percentage of extrusion in the coronal plane and the ratio of t meniscus in sagittal plane of the final MRI were significantly increased as compared with the preoperative MRI. Preoperative shift was a risk factor for the reduction of remaining meniscal width (odds ratio 11.997, p = 0.016, 95% CI 1.586–90.737).

Conclusion
The size of midbody of medial meniscus could be a reference for partial meniscectomy in symptomatic complete discoid meniscus. Preoperative shift represents a risk factor for decreased remaining meniscal width. These findings could be helpful in ensuring appropriate surgical planning and explaining poor prognostic factors.

Level of evidence
Prospective cohort study, Level II.

BACK

Tunnel placement in ACL reconstruction surgery: smaller inter-tunnel angles and higher peak forces at the femoral tunnel using anteromedial portal femoral drilling—a 3D and finite element analysis

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DOI: https://doi.org/10.1007/s00167-018-5272-0

Purpose
Recent studies have emphasized the importance of anatomical ACL reconstruction to restore normal knee kinematics and stability. Aim of this study is to evaluate and compare the ability of the anteromedial (AM) and transtibial (TT) techniques for ACL reconstruction to achieve anatomical placement of the femoral and tibial tunnel within the native ACL footprint and to determine forces within the graft during functional motion. As the AM technique is nowadays the technique of choice, the hypothesis is that there are significant differences in tunnel features, reaction forces and/or moments within the graft when compared to the TT technique.

Methods
Twenty ACL-deficient patients were allocated to reconstruction surgery with one of both techniques. Postoperatively, all patients underwent a computed tomography scan (CT) allowing 3D reconstruction to analyze tunnel geometry and tunnel placement within the native ACL footprint. A patient-specific finite element analysis (FEA) was conducted to determine reaction forces and moments within the graft during antero-posterior translation and pivot-shift motion.

Results
With significantly shorter femoral tunnels ($p < 0.001$) and a smaller inter-tunnel angle ($p < 0.001$), the AM technique places tunnels with less variance, close to the anatomical centre of the ACL footprints when compared to the TT technique. Using the latter, tibial tunnels were more medialised ($p = 0.007$) with a higher position of the femoral tunnels ($p = 0.02$). FEA showed the occurrence of higher, but non-significant, reaction forces in the graft, especially on the femoral side and lower, however, statistically not significant, reaction moments using the AM technique.

Conclusion
This study indicates important, technique-dependent differences in tunnel features with changes in reaction forces and moments within the graft.

Level of evidence
II.

BACK

Anterior cruciate ligament reconstruction is associated with greater tibial tunnel widening when using a bioabsorbable screw compared to an all-inside technique with suspensory fixation

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DOI: https://doi.org/10.1007/s00167-018-5275-x

Purpose
To compare clinical outcomes and tunnel widening following anterior cruciate ligament reconstruction (ACLR) performed with an all-inside technique (Group A) or with a bioabsorbable tibial screw and suspensory femoral fixation (Group B).

Methods
Tunnel widening was assessed using computed tomography (CT) and a previously validated analytical best fit cylinder technique at approximately 1-year following ACLR. Clinical follow-up comprised evaluation with IKDC, KSS, Tegner, Lysholm scores, and knee laxity assessment.

Results
The study population comprised 22 patients in each group with a median clinical follow-up of 24 months (range 21–27 months). The median duration between ACLR and CT was 13 months (range 12–14 months). There were no significant differences in clinical outcome measures between groups. There were no differences between groups with respect to femoral tunnel widening. However, there was a significantly larger increase in tibial tunnel widening, at the middle portion, in Group B (2.4 ± 1.5 mm) compared to Group A (0.8 ± 0.4 mm) ($p = 0.027$), and also at the articular portion in Group B (1.5 ± 0.8 mm) compared to Group A (0.8 ± 0.8 mm) ($p = 0.027$).

Conclusion
Tibial tunnel widening after ACLR using hamstring tendon autograft is significantly greater with suspensory femoral fixation and a bioabsorbable tibial interference screw when compared to an all-inside technique at a median follow-up of 2 years. The clinical relevance of this work lies in the rebuttal of concerns arising from biomechanical studies regarding the possibility of increased tunnel widening with an all-inside technique.

Level of evidence
III.

BACK

Synovitis following anterior cruciate ligament reconstruction using the LARS device

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DOI: https://doi.org/10.1007/s00167-018-5280-0

Purpose
The Ligament Augmentation and Reconstruction System (LARS®) has been at the forefront of a recent revival in the use of synthetic ligaments for ACL reconstruction. However, despite promising short-to-mid-term results its role has been approached with caution due to a high number of major complications in previous synthetic graft designs including mechanical failures, synovitis and osteoarthritis. This study aims to report on the incidence of synovitis in a series of patients undergoing second-look surgery following LARS ACL reconstruction.

Methods
A retrospective analysis was performed of a single surgeon's series of 12 patients that underwent second-look arthroscopic surgery following primary LARS ACL surgery for indications including mechanical symptoms (meniscal tears/cyclops lesions/chondral flaps) and/or symptomatic instability secondary to LARS failure. In all cases an examination under anaesthesia (EUA) was performed, and a qualitative assessment of the synovium was carried out and graded as normal, reactive or inflammatory. A synovial biopsy was performed in all knees with visible evidence of synovitis and in all cases of LARS failure.

Results
The second-look arthroscopy was performed at a mean of 23 months (7–66) after the index surgery. In 6 (50%) knees the LARS device had failed necessitating removal and revision ACL reconstruction, while in the remaining 6 knees the LARS was still intact. Arthroscopic evaluation of the synovium revealed a normal appearance in 8 knees (67%) and reactive synovitis in 4 knees (23%); of these 4 knees, one had an intact LARS device and 3 had failed LARS. Histological examination from these 4 knees and the 3 knees with graft failures without visible synovitis revealed chronic hypertrophic synovitis (moderate 2, mild 5) in all cases with rare giant cells, consistent with a reaction to foreign body material.

Conclusions
Foreign body synovitis is a common finding in our series of patients undergoing a repeat arthroscopy following a LARS ACL reconstruction. The histological diagnosis of synovitis was more frequently encountered than an arthroscopic appearance of synovitis. Whilst the results of this case series cannot support a direct causative link between LARS failure and the development of synovitis, this study highlights the need to remain vigilant about the risk of reactive synovitis following LARS ACL reconstruction due to exposure of the knee to foreign body material.

Level of evidence
Level IV, case series.

BACK

Quadriceps weakness associates with greater T1ρ relaxation time in the medial femoral articular cartilage 6 months following anterior cruciate ligament reconstruction

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DOI: https://doi.org/10.1007/s00167-018-5290-y

Purpose
Quadriceps weakness following anterior cruciate ligament reconstruction (ACLR) is linked to decreased patient-reported function, altered lower extremity biomechanics and tibiofemoral joint space narrowing. It remains unknown if quadriceps weakness is associated with early deleterious changes to femoral cartilage composition that are suggestive of posttraumatic osteoarthritis development. The purpose of the cross-sectional study was to determine if quadriceps strength was associated with T1ρ relaxation times, a marker of proteoglycan density, of the articular cartilage in the medial and lateral femoral condyles 6 months following ACLR. It is hypothesized that individuals with weaker quadriceps would demonstrate lesser proteoglycan density.

Methods
Twenty-seven individuals (15 females, 12 males) with a patellar tendon autograft ACLR underwent isometric quadriceps strength assessments in 90°of knee flexion during a 6-month follow-up exam. Magnetic resonance images (MRI) were collected bilaterally and voxel by voxel T1ρ relaxation times were calculated using a five-image sequence and a monoexponential equation. Following image registration, the articular cartilage for the weight-bearing surfaces of the medial and lateral femoral condyles (MFC and LFC) were manually segmented and further sub-sectioned into posterior, central and anterior regions of interest (ROI) based on the corresponding meniscal anatomy viewed in the sagittal plane. Univariate linear regression models were used to determine the association between quadriceps strength and T1ρ relaxation times in the entire weight-bearing MFC and LFC, as well as the ROI in each respective limb.

Results
Lesser quadriceps strength was significantly associated with greater T1ρ relaxation times in the entire weight-bearing MFC ($R2 = 0.14$, $P = 0.05$) and the anterior-MFC ROI ($R2 = 0.22$, $P = 0.02$) of the ACLR limb. A post hoc analysis found lesser strength and greater T1ρ relaxation times were significantly associated in a subsection of participants ($n = 18$) without a concomitant medial tibiofemoral compartment meniscal or chondral injury in the entire weight-bearing MFC, as well as anterior-MFC and central-MFC ROI of the ACLR and uninjured limb.

Conclusions
The association between weaker quadriceps and greater T1ρ relaxation times in the MFC suggests deficits in lower extremity muscle strength may be related to cartilage composition as early as 6 months following ACLR. Maximizing quadriceps strength in the first 6 months following ACLR may be critical for promoting cartilage health early following ACLR.

Level of evidence
Prognostic level 1.

BACK

Lower patient-reported function at 2 years is associated with elevated knee cartilage T1rho and T2 relaxation times at 5 years in young athletes after ACL reconstruction

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DOI: https://doi.org/10.1007/s00167-018-5291-x

Purpose
The purpose was to test the following hypotheses: (1) magnetic resonance imaging (MRI) markers of early knee cartilage degeneration would be present in the involved limb of young athletes after anterior cruciate ligament reconstruction (ACLR) and (2) poor knee function would be associated with MRI markers of cartilage degeneration.

Methods
Twenty-five young athletes after primary, unilateral ACLR (mean age, 16.7 years) were followed to 5-year post-return-to-sport (RTS) clearance, as a part of a larger, prospective cohort study in young athletes post-ACLR. At 2-year post-RTS, patient-reported knee function was evaluated using the Knee injury and Osteoarthritis Outcome Score (KOOS). At 5-year post-RTS, qualitative MRI sequences (3 T) and quantitative T1rho and T2 maps segmented into six regions at the femur and tibia were performed for the involved and uninvolved knee cartilages. Relaxation times were compared between knees using Holm-corrected paired t tests. Linear regression was used to examine the association between KOOS scores at 2 years and relaxation times at 5 years.

Results
Elevated T1rho and T2 relaxation times were observed in the involved knee at the anterior medial femoral condyle compared to the uninvolved knee ($p = 0.006$, $p = 0.024$, respectively). Lower KOOS-Pain, KOOS-Symptoms, KOOS-ADL, and KOOS-Sport scores at 2-year post-RTS were associated with higher T1rho or T2 relaxation times in various regions of the involved knee at 5-year post-RTS (all $p < 0.05$).

Conclusions
MRI markers of early cartilage degeneration were identified in the medial compartment of the involved knee in young athletes 5-year post-RTS after ACLR. Lower KOOS scores at 2-year post-RTS were associated with elevated knee cartilage T1rho and T2 relaxation times at 5-year post-RTS. Evaluating patient-reported function over time after ACLR appears to provide insight into future degenerative changes in the knee cartilage matrix.

BACK

Anatomical rectangular tunnels identified with the arthroscopic landmarks result in excellent outcomes in ACL reconstruction with a BTB graft

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DOI: https://doi.org/10.1007/s00167-018-5300-0

Purpose
To elucidate tunnel locations and clinical outcomes after anatomic rectangular tunnel (ART) anterior cruciate ligament reconstruction (ACLR) using a bone–patellar tendon–bone (BTB) graft.

Methods
Sixty-one patients with a primary unilateral ACL injury were included. Tunnels were created inside the ACL attachment areas after carefully removing the ACL remnant and clearly identifying the bony landmarks. Using 3-dimensional computed tomography (3-D CT) images, the proportion of the tunnel apertures to the anatomical attachment areas was evaluated at 3 weeks. The clinical outcomes were evaluated at 2 years postoperatively.

Results
Geographically, the 3-D CT evaluation showed the entire femoral tunnel aperture; at least 75% of the entire tibial tunnel aperture area was consistently located inside the anatomical attachment areas surrounded by the bony landmarks. In the International Knee Documentation Committee (IKDC) subjective assessment, all patients were classified as ‘normal’ or ‘nearly normal’. The Lachman test and pivot-shift test were negative in 98.4% and 95.1% of patients, respectively. The mean side-to-side difference of the anterior laxity at the maximum manual force with a KT- 1000 Knee Arthrometer was 0.2 ± 0.9 mm, with 95.1% of patients ranging from − 1 to + 2 mm.

Conclusion
By identifying arthroscopic landmarks, the entire femoral tunnel aperture and at least 75% of the entire tibial tunnel aperture area were consistently located inside the anatomical attachment areas. With properly created tunnels inside the anatomical attachment areas, the ART ACLR using a BTB graft could provide satisfactory outcomes both subjectively and objectively in more than 95% of patients.

Level of evidence
Case series, Level IV.

BACK

American Journal of Sports Medicine (AJSM), Volume 47, Issue 10

Complex Tears, Extrusion, and Larger Excision Are Prognostic Factors for Worse Outcomes 1 and 2 Years After Arthroscopic Partial Meniscectomy for Degenerative Meniscal Tears: A Secondary Explorative Study of the Surgically Treated Group From the Odense-Oslo Meniscectomy Versus Exercise (OMEX) Trial

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First Published July 12, 2019; pp. 2402–2411

https://doi.org/10.1177/0363546519858602

Background Few studies have examined morphological findings from preoperative magnetic resonance imaging (MRI) and arthroscopic findings as prognostic factors for outcomes 1 and 2 years after arthroscopic partial meniscectomy (APM).

Purpose/Hypothesis The purpose was to evaluate prognostic factors of preoperative findings from MRI and arthroscopic evaluation on lower extremity performance at 1 year and patient-reported outcomes at 1 to 2 years after APM. The hypothesis was that medial compartment abnormalities would be prognostic for 1- and 2-year functional outcomes.

Study Design Cohort study; Level of evidence, 2.

Methods This secondary analysis from the OMEX (Odense-Oslo Meniscectomy Versus Exercise) trial included 40 patients treated surgically. Regression analyses with adjustments for age, sex, and body mass index explored associations between MRI findings (tear complexity and extrusion), arthroscopic findings (tear length, cartilage injury, and amount of excised meniscal tissue), and the following: lower extremity performance tests and thigh muscle strength at 1 year and the 5 Knee injury and Osteoarthritis Outcome Score (KOOS) subscales at 1 and 2 years.

Results A complex meniscal tear was a significant and clinically relevant prognostic factor for worse KOOS Symptoms subscores at 2 years (mean, 14.1 points [95% CI, 6.1-22.2]). Meniscal extrusion of at least 11%, 25%, and 20% were significant and clinically relevant prognostic factors for worse KOOS Activities of Daily Living (ADL) subscores at 1 year and worse KOOS Sports and Recreation (Sports/Rec) subscores at 1 and 2 years, respectively. Tear lengths of at least 7.0 mm, 6.7 mm, and 6.5 mm were significant and clinically relevant prognostic factors for better KOOS Symptoms subscores at 1 year and better KOOS Sports/Rec subscores at 1 and 2 years, respectively. A cartilage injury in the medial compartment was a significant and clinically relevant prognostic factor for worse KOOS ADL and Quality of Life (QoL) subscores at 2 years (mean, 10.4 and 19.4 points, respectively [95% CI, 3.4-17.4 and 7.7-31.1, respectively]). More than 20% meniscal tissue excised was a significant and clinically relevant prognostic factor for worse KOOS Pain, Symptoms, ADL, and Sports/Rec subscores at 1 and 2 years (mean, 8.9-41.5 points [95% CI, 2.2-15.5 to 21.0-62.0]) and worse KOOS QoL subscores at 2 years (mean, 25.3 points [95% CI, 13.6-37.0]).

Conclusion Complex meniscal tears, larger extrusion, cartilage injuries, and larger meniscal excision were significant and clinically relevant prognostic factors for worse outcomes 1 and 2 years after APM.

BACK

Outcomes and Patient Satisfaction With Arthroscopic Partial Meniscectomy for Degenerative and Traumatic Tears in Middle-Aged Patients With No or Mild Osteoarthritis

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First Published June 28, 2019; pp. 2412–2419

https://doi.org/10.1177/0363546519857589

Background
There is controversy about the benefit of arthroscopic partial meniscectomy (APM) for degenerative lesions in middle-aged patients.

Purpose
To compare satisfaction with APM between middle-aged patients with no or mild knee osteoarthritis (OA) and a degenerative meniscal tear and those with a traumatic tear.

Study Design
Cohort study; Level of evidence, 2.

Methods
A comparative prospective study at 5 years of middle-aged patients (45-60 years old) with no or mild OA undergoing APM for degenerative (n = 115) or traumatic (n = 143) tears was conducted. Patient satisfaction was measured by a 5-point Likert scale and functional outcomes by the Knee injury and Osteoarthritis Outcome Score (KOOS) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). Univariate and multivariate regression analyses were used to identify factors correlating with patient-reported satisfaction at 5 years postoperatively.

Results
Baseline patient characteristics were not different between groups. At the 5-year evaluation, the satisfaction rate in the traumatic and degenerative groups was 68.5% versus 71.3%, respectively (P = .365). Patient satisfaction was significantly associated with functional outcomes (r = 0.69; P = .024). In the degenerative group, 43 patients (37.4%) had OA progression to Kellgren-Lawrence (K-L) grade 2 or 3, but only 24 patients (20.8%) had a symptomatic knee at final follow-up. Multivariate regression analysis for patient dissatisfaction at 5-year follow-up showed the following significant independent factors: female sex (odds ratio [OR], 1.6 [95% CI, 1.1-2.3]; P = .018), body mass index >30 kg/m2 (OR, 2.6 [95% CI, 1.7-4.9]; P = .035), lateral meniscal tears (OR, 0.6 [95% CI, 0.1-0.9]; P = .039), and OA progression to K-L grade ≥2 at final follow-up (OR, 1.4 [95% CI, 1.2-2.6]; P = .014). At the final evaluation, there were no significant differences between groups in pain scores (P = .648), WOMAC scores (P = .083), or KOOS-4 scores (P = .187). Likewise, there were no significant differences in the KOOS subscores for Pain (P = .144), Symptoms (P = .097), or Sports/Recreation (P = .150). Although the degenerative group had significantly higher subscores for Activities of Daily Living (P = .001) and Quality of Life (P = .004), the differences were considered not clinically meaningful.

Conclusion
There were no meaningful differences in patient satisfaction or clinical outcomes between patients with traumatic and degenerative tears and no or mild OA. Predictors of dissatisfaction with APM were female sex, obesity, and lateral meniscal tears. Our findings suggested that APM was an effective medium-term option to relieve pain and recover function in middle-aged patients with degenerative meniscal tears, without obvious OA, and with failed prior physical therapy.

BACK

Hip Arthroscopic Surgery in Borderline Developmental Dysplastic Hips: A Systematic Review

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First Published November 27, 2018; pp. 2494–2500

https://doi.org/10.1177/0363546518803367

Background
It remains controversial whether hip arthroscopic surgery should be applied to patients with a borderline developmental dysplastic hip (BDDH).

Purpose
To review the outcomes of hip arthroscopic surgery for a BDDH and which factors influence these outcomes.

Study Design
Systematic review.

Methods
PubMed, Embase, and the Cochrane Library were searched through March 2018 for studies reporting the outcomes of primary hip arthroscopic surgery in patients with a BDDH. Inclusion in the review was based on the definition of a BDDH, patient-reported outcomes, and duration of follow-up. The primary outcome was the modified Harris Hip Score (mHHS). The failure rate, visual analog scale, satisfaction score, and patient-reported outcomes such as the Hip disability and Osteoarthritis Outcome Score were defined as secondary outcomes.

Results
Nine studies with 425 patients who underwent hip arthroscopic surgery were included in this review. The mean follow-up times ranged from 25.4 to 28.8 months across the studies. A significant improvement was obtained in the mHHS, with a mean score of 61.8 preoperatively to 82.8 postoperatively; all other patient-reported outcomes also improved significantly, except the 12-Item Short Form Health Survey mental component summary. The overall failure rate was 14.1%, and the mean reoperation rate was 8.5%. The rate of conversion to total hip arthroplasty ranged from 4.4% to 26.0%, and the rate of conversion to periacetabular osteotomy was 4.0%. Combined defects such as cartilage damage, hip osteoarthritis, ligamentum teres tears, and femoroacetabular impingement could influence the outcomes after arthroscopic surgery in BDDHs.

Conclusion
Hip arthroscopic surgery was demonstrated to be a promising approach for BDDHs, but the outcomes could be influenced by multiple risk factors. A higher level of evidence is still needed to support current findings.

BACK

Miscellaneous

Arthroscopy, Volume 35, Issue 3

Suture Tape With Broad Full-Width Core Versus Traditional Round Suture With Round Core: A Mechanical Comparison

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Arthroscopy, Volume 35, Issue 8

https://doi.org/10.1016/j.arthro.2019.03.053

Purpose
To compare the inherent mechanical properties of suture in tape configuration with a flat, evenly distributed core to a round suture with a round core composed of the same materials.

Methods
SutureTape and FiberWire composed of equivalent materials were used to tie surgical knots. Knot height was measured. Knot security was measured at the maximum load at 1, 2, and 3 mm of displacement and at failure. Tensile strength and stiffness were measured using untied samples.

Results
SutureTape demonstrated superior knot security with greater ultimate load to failure (327.2 ± 15.4 N vs 257.4 ± 12.2 N; P = .002), maximum load at 1 mm of displacement (149.8 ± 18.6 N vs 108.8 ± 13.8 N; P = .001), and 2 mm of displacement (242.7 ± 38.6 N vs 181.2 ± 24.4 N; P = .008). It also demonstrated greater stiffness (5.4 ± 0.3 N/mm vs 2.8 ± 0.3 N/mm; P < .001) and tensile strength (378.8 ± 13.6 N vs 235.6 ± 4.8 N). Knot height differences (1.27 ± .11 mm vs 1.37 ± .08 mm; P = .110) and load at 3 mm of displacement (279.3 ± 42.4 N vs 225.5 ± 46.1 N; P = .062) were not statistically significant.

Conclusions
During mechanical testing, SutureTape with a broad core distributed over the full width of the tape demonstrated greater knot security, ultimate load to failure, and tensile stiffness than FiberWire, a round core suture. We found no significant difference in knot stack height between the suture designs.

Clinical Relevance
The study demonstrates the superior mechanical properties of suture in tape configuration over similarly composed round suture without a significant difference in knot stack height. Suture in tape configuration has the potential to perform as well as round suture in the clinical setting.

BACK