improvement of the initial reconstruction to preserve the medial meniscus at the time of the first surgery.
Conclusion: High BMI, early graft failure, severe medial meniscus injury is a cause of inferior outcome of the clinical results of re-ACL reconstruction using ART-BTB technique.
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B0778
Clinical comparison of physeal sparing double bundle anterior cruciate ligament reconstruction and delayed reconstruction in patients with open physes

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Background: Tears of anterior cruciate ligament (ACL) were considered a rare injury in children and adolescents, but a number of recent studies suggest that their incidence is increasing. Treatment strategies for ACL tears in patients with open physes have evolved, however, there are still no clear management guidelines. It used to be thought that surgery should be delayed until skeletal maturity to prevent violation of the physes and consequent disturbance of growth. It is now generally accepted that operative intervention gives a better functional outcome. The purpose of this study is to compare the outcomes of physeal sparing ACL reconstruction and delayed reconstruction in patients with open physes.
Material & Method: We evaluated 12 patients (7 men and 5 women), who were treated for ACL tears either by physeal sparing reconstruction (PS group, n=6) or delayed reconstruction (D group, n=6) between 2009 and 2014. The mean age at the time of injury was 12.1 years for the PS group and 13.7 years for the D group. The physeal sparing reconstruction we performed was as follows. An incision was made to the distal portion of lateral femur and epiphyseal line was identified. Thereafter, the femoral double round tunnels were created distal to epiphyseal line by using outside-in guide. The tibial double round sockets were drilled by using retrodrill system. The results of both groups were compared postoperative Tegner activity score, Lysholm score, International Knee Documentation Committee (IKDC) grade and physical examination findings (Lachman test, Pivot shift test). Statistical analysis was performed using SPSS software (IBM-SPSS, New York, USA). A nominal p value of <0.05 was considered to indicate statistical significance.
Results: The average postoperative Tegner and Lysholm score was 6.8, 98.7 in PS group and 7.0, 99.0 in D group, respectively. There was no significant difference in both score ($p=0.87$, $p=0.75$). One patient in both groups was IKDC grade B, but all other patients were grade A. The results of the Lachman test were all normal, and the results of the pivot shift test were glide for one patient in both group and normal for all other patients. At the time of operation, two patients in D group were noted meniscus tear, which were not found at the time of injury. No patient had a re-rupture or a discrepancy in the length of the lower extremities measured clinically.
Discussion: ACL reconstruction in patients with open physes is a controversial topic. This is the first report of the physeal sparing and anatomic double bundle reconstruction for skeletally immature patients. Our ACL reconstruction technique yields satisfactory clinical results. In this study, two patients were noted meniscus tear in D group, therefore conservative treatment of ACL injuries often leads to poor and unacceptable results.
Conclusion: This case series indicates good results of double bundle ACL reconstruction with use of physeal sparing technique in patients with open physes.
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B0780
Arthroscopic treatment of multidirectional shoulder instability with capsular narrowing and shortening of the anterior, inferior and posterior ligaments: Minimum 2-year follow-up

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Background: Shoulder stabilization for symptomatic multi-directional instability can be performed with open or arthroscopic surgery, but arthroscopy has become the preferred method. There are differences in different arthroscopic capsule narrowing techniques. The aim of this study was to present the clinical outcomes of arthroscopic all round capsular narrowing applied along the axes of the glenohumeral ligaments (GHL) in 2-4-year follow-up period.
Materials: The study included 75 patients who underwent surgery because of symptomatic multi-directional shoulder instability. The diagnosis was made on the basis of patient history, physical examination and arthroscopic findings. Functional outcomes of the all patients were evaluated with the American Shoulder and Elbow Surgeons (ASES) score, Rowe instability score and visual analog pain scale. Stability, strength, degree of pain and range of motion were also evaluated with patient-reported scales.
Methods: The technique applied was arthroscopic shortening of the inferior capsule then the inferior GHL anterior and posterior sections, the medial GHL, and superior GHL. In each case, 3 absorbable screws were used. An arm sling was applied for 3 weeks postoperatively. After 3 weeks, ROM exercises were started without forcing internal and external rotation. At the end of one week, all ROM exercises and strengthening exercises were started. Sporting activities were permitted after 16 weeks.
Results: In the follow-up period of 2-4 years, all postoperative functional scores were rated good to excellent except three cases. There were 2 (2,66%) cases of recurrent dislocation and 1(1,33%) case of symptomatic instability. In the cases of recurrent dislocation, revision was applied with the Latarjet procedure. There were no differences in range of motion compared with the opposite extremity in 72 (96%) cases.
Discussion and Conclusion: The good results obtained with open capsule narrowing have been obtained in recent years with arthroscopic techniques in multi-directional shoulder instability. The results of this study demonstrated that in multi-directional instability, capsular narrowing applied with the arthroscopic technique in the form of all round shortening along the axes of the glenohumeral ligaments is an effective technique which is compatible with the biomechanics of the glenohumeral joint and provides good results in terms of pain relief and clinical stability at a minimum 2-year follow-up.
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B0784
Preoperative evaluation of spinoglenoid ganglion cyst with MRI, EMG and isokinetic muscle test – *Does size matter?*

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Background: There are few studies correlating the size of ganglion cyst at the spinoglenoid notch with electrophysiological alterations, muscle power or pain severity.
Materials and Methods: Between June 2010 and November 2014, 30 patients (24 males and 6 females) who diagnosed with a ganglion cyst at the spinoglenoid notch on MRI were evaluated by EMG/NCV test and isokinetic muscle test. Maximum cyst diameter was measured on MRI and used for comparison. Pain severity was estimated by visual analogue scale (VAS). And, pooled sensitivity and specificity analysis was conducted, with an assessment of the summary receiver operating characteristic (ROC) curve.
Results: EMG/NCV test were examined in 27 out of 30 patients. Eight out of 27 patients were diagnosed with suprascapular neuropathy. The overall mean cyst size was 2.1cm. The cyst size of EMG positive group was 2.7cm, and size of EMG negative group was 1.8cm. When the size of ganglion cysts was increased 1cm, probability of an abnormal EMG/NCV test were increased 4.32 times (odds ratio: 4.32, $p = 0.023$). Area under the ROC curve (AUC) was 0.822, and set point 2.2cm had most sensitivity (87.5%), specificity (73.7%), positive likelihood ratio (3.3). However, there was no significant difference in the peak torque deficit on external rotation (mean: 30.2 (> 2.2 cm) vs. 20.7 (< 2.2 cm); $p = 0.156$) and abduction (mean: 28.6 (> 2.2 cm) vs. 18.4 (< 2.2 cm), respectively; $p = 0.28$) according to the size of ganglion cyst. The mean pain VAS of all 30 patients was 6.22 (range: 3~9), and there was no statistical difference in pain VAS according to the cyst size (mean: 6.06 (> 2.2 cm) vs. 6.50 (< 2.2 cm), respectively; $p = 0.841$). Twenty eight out of 30 patients had a labral lesion associated with spinoglenoid notch cyst on MRI. We performed SLAP repair in 19 cases, biceps tenodesis in 6 cases, biceps tenotomy in 3 cases, and cyst decompression only in 2 cases.
Discussion: Large spinoglenoid notch cysts may compress the suprascapular nerve. Tung et al [1] reported that average maximum diameter of cysts associated with muscle denervation was 3.1cm. However, this study diagnosed muscle denervation on MRI, not the EMG/NCV study. The strengths of this study were as follows; 1) The current study used needle EMG for the diagnosis of suprascapular neuropathy. 2) This is the first study regarding the correlation with cyst size and suprascapular neuropathy. 3) All patients in the present study have taken EMG/NCV test, isokinetic muscle performance test and MRI evaluation. The limitation of study was 1) small number for subgroup analysis, 2) postoperative external rotation power and EMG follow up were not analyzed.
Conclusion: The current data suggested that cyst size reflect the compressive suprascapular neuropathy. Therefore, the decompression surgery would be justified in patients with cyst size greater than 2.2 cm.
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B0788
Safe needle insertion points of FAST-FIX 360

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Background: FAST-FIX (FF) 360 is an implant developed with consideration for mechanical performance, safety and handiness among a number of implants. However, it has a demerit of a needle of the implant inserting blindly over the meniscus, and consequently, the installation site of the implant cannot be confirmed. Therefore, it is important to understand the anatomy around the insertion site and meniscus to prevent such a shortcoming.

Objectives: Safe procedures associated with FF 360, particularly intraarticular needle insertion points and extraarticular implant points were investigated by using knees of cadavers.
Materials and methods: Five knees of cadavers were used. All insertions at the knee were implemented in a flexed position. The superficial layer of the medial collateral ligament and lateral collateral ligament were separated at the femoral side in cases with a narrow joint space. Anchors T1 and T2 were inserted 12 mm and 17 mm, respectively. Under endoscopy, FF 360 was inserted into 7 points of the medial meniscus (femoral side of the middle segment: 1 point, femoral side of the border of the middle and posterior segments: 2 points, femoral side of the posterior segment: 2 points, and tibial side of the posterior segment: 2 points), as well as 5 points of the lateral meniscus (femoral side of the middle segment: 1 point, femoral side in the popliteal hiatus: 1 point, femoral side of the posterior segment: 2 points, and tibial side of the posterior segment: 1 point). After the procedure, dissection was performed, and needle insertion points on the meniscus and extraarticular implant points were confirmed.
Results: Anatomic sites of the placed implant included middle segment of the medial meniscus on the medial retinaculum in all five cases. With regard to the border of the middle and posterior segments of the medial meniscus, the needles were placed on the superficial layer of the medial collateral ligament in all five cases. In case of the femoral side of the posterior segment, the needles were placed on the joint capsule or on the meniscus in all cases. For the tibial side, insertion failure was observed in 3 cases.
In addition, there was no insertion of the needle on the semimembranosus tendon at the posterior segments of the medial meniscus, which was a procedure we were concerned. For the middle segments of the medial meniscus, the needles were placed on the iliotibial tract in one case, and for the anterior border of the popliteal hiatus, the needles were placed on the lateral collateral ligament in four cases. In all cases, the needles were placed on the joint capsule or on the meniscus for the posterior segment.
Discussion: Through examination of safe insertion sites for FF360 by using five cadavers, our results predicted that placement of the needles on the border of the middle and posterior segments of the medial meniscus and the anterior border of the popliteal hiatus of the lateral meniscus would be difficult due to grasping of the superficial layer of MCL and parenchyma of LCL. Around the middle segment, the needles were placed on the medial retinaculum for the medial side and on the iliotibial tract for the lateral side. In addition, the needle is placed on the popliteus tendon for the posterior segment when a needle was inserted in a wrong direction. These results suggest that visualization of the tissues around the meniscus where needle insertion points as well as installation sites of FF360 are located is necessary to conduct operation.
Complications of suture techniques include joint irritation, cyst formation, chondral lesions and unpredicted pain; therefore, when FF360 is used, it is required to visualize the tissues around the meniscus and foresee avoidable failure to prevent unpredicted pain. In addition, the operation should be conducted not only solely dependent on FF360 but also with consideration for other suture techniques.
Conclusions: Based on the needle insertion points, it is possible to predict tissues that will be grasped outside the joint. Considering postoperative pain from grasping, it is necessary to recognize the anatomy of the tissues around the knee
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B0794

Advantages of computer-assisted navigation system in open-wedge high tibial osteotomy

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Background: It has been reported that posterior tibial slope (PTS) tends to increase following open-wedge high tibial osteotomy (OWHTO). The present study investigated the usefulness of the navigation system in control of PTS in OWHTO.
Methods: Sixteen knees in 16 patients who underwent OWHTO using a navigation system for medial knee osteoarthritis (OA) were examined (Group NS). The amount of the change of PTS (°) on the navigation system was recorded at the time of surgery in each patient. The PTS change was also measured by pre- and postoperative digital radiographs. The angle change was expressed as a positive values regardless of decrease or increase in the slope to evaluate the amount of the change. The PTS changes on the navigation system and on the radiographs were compared to assess the validity of the navigation system. Twenty-eight knees in 28 patients who underwent OWHTO without using the navigation system were also examined (Group non-NS). The PTS changes in Group non-NS were compared with those in Group NS on radiographs.
Results: In Group NS, PTS increased in 10 knees and decreased in 5 knees on the radiographic evaluation. In Group NS, PTS increased in 15 knees and decreased in 9 knees and did not change (less than 0.5° change) in 3 knees. In Group NS, the mean PTS change was $2.4 \pm 1.4°$ on the navigation system and $2.38 \pm 1.20°$ on radiographs. There was no statistically significant difference between the mean values on the navigation system and the radiographs. The mean difference in the PTS change between on the navigation system and on radiographs was $0.38 \pm 0.50°$. There was a strong correlation between the measurement value on the navigation system and the value on radiographs ($R = 0.97$). The mean change of the PTS in Group non-NS was $1.59 \pm 4.21°$. There was no statistically significant difference in the PTS change on radiographs between Group NS and Group non-NS. However, 10 knees (36%) in Group non-NS showed a change of greater than 4° while none of the knees in Group NS showed a change of greater than 4°.
Discussion: The measurement values of PTS change obtained by the navigation system strongly correlated with the radiographic measurement. In addition, the mean difference between the two measurement systems was less than 0.5°. These results suggest that the navigation system is reliable to control PTS during surgery at least if plain radiographs are used to evaluate the PTS change. The PTS often changed greater than 4° when OWHTO was performed without using the navigation system. In contrast, the PTS changes were below 4° in all the knees when OWHTO was performed using the navigation system, suggesting that the navigation system is useful to control PTS and reduce a large error of the PTS change during OWHTO.
Conclusions: Our results suggested that navigation system is useful to accurately perform OWHTO by monitoring the change of PTS during surgery.
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B0795

Comparison of coracoid graft positioning between arthroscopic and open latarjet procedures: A 2D CT-Scan analysis.

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Background: The Latarjet procedure remains the main effective operation to treat recurrent shoulder instability. However an overhanging position of the coracoid graft (CG) may lead to early arthritis and an excessively medial position may lead to failure. It is difficult to standardize plain X-rays for accurate and reproducible position analysis; therefore CT-scans appear to be a better option. Numerous studies report evaluation of positioning of the CG (for arthroscopic or open procedures) using OSIRIX™ software. The aim of the study was:
1) To define and to evaluate a reliable and reproducible 2D CT-scan analysis protocol to assess the coracoid graft positioning after Latarjet procedure in the axial and sagittal planes (preliminary study)
2) To compare arthroscopic technique to conventional open technique in terms of positioning (SFA Symposium)
Material: 9 surgeons in 9 centers participated in the multicentric prospective study promoted by the French Society of Arthroscopy, from March 2013 to June 2014 for the inclusions (IRB: CERC-VS-2016-02-1). The follow-up continued until September 2015 to obtain at least one year of follow-up. We included patients operated for recurrent shoulder instability with the Latarjet procedure (arthroscopic and open techniques). 390 patients were enrolled: 104 (27%) with the open technique as described by G. Walch (OT) performed by 2 surgeons, 222 (57%) with the arthroscopic technique as described by L. Lafosse (ATL) performed by 6 surgeons, and 64 (16%) with the arthroscopic technique as described by P. Boileau (ATB) performed by 1 surgeon. Mean age at surgery was 27.8 years old (range,13.6-66.6). Mean ISIS score was 5.
Methods
1) Preliminary study (n=15)
15 postoperative CT-scans of Latarjet (5 open, 5 mini-open and 5 arthroscopic procedures) were included to assess intra-observers reproducibility and inter-observer reproducibility according a standardized CT-scan analysis (modified protocol initially published by Kraus *et. al*) among 3 senior and 3 junior shoulder surgeons. DICOM images were extracted from Native CDs using OSIRIX™ software.
In the axial plane, we measured:
- The angle of the screws from the joint line (JL)
- The positioning of the CG at 50% and 25% of the height of the glenoid. The CG was considered as too medial if it laid more than 4mm medial from the JL, overhanged if over than 1 mm lateral and flush in between.
- The contact area between CG and the glenoid by measuring the angle between the undersurface of the CG and the glenoid anterior cortical
In the sagittal plane, we measured the percentage of CG under the equator of the glenoid
Statistical analysis with ADSCIENCE™ software allowed inter-class agreement (ICC or Kappa coefficient), 2 by 2 among inter- and intra-observers.
2) SFA Symposium (n=390)
211 CT-scans/Patients were available for position analysis (79 OT, 86 ATL, 42 ATB). The different previous parameters were analyzed to compare arthroscopic techniques versus open. For the ATB, using endobutton instead of screw for coracoid fixation, the axe of the drilled tunnel was used as “the inferior screw” for the other techniques.
Results
1) Preliminary Study
In the axial plane:
- The angle of the screws: the ICC in Intra-observer agreement was substantial to almost perfect (mean: 0.80; range, 0.70 to 0.94) and Inter-observer agreement was moderate to almost perfect (mean: 0.60; range, 0.43 to 0.92).
- The positioning of the CG at 50% and 25%: the ICC in Intra-observer agreement was slight to almost perfect (mean: 0.67; range, 0.16 to 0.90) and Inter-observer agreement was slight to substantial (mean: 0.47; range, 0.08 to 0.79).
- The contact area between CG and the glenoid: the ICC in Intra-observer agreement was fair to almost perfect (mean: 0.69; range, 0.31 to 1.0) and Inter-observer agreement was moderate to almost perfect (mean: 0.53; range, 0.43 to 0.87).
In the sagittal plane, when analyzing the percentage of CG under the equator of the glenoid screws: the ICC in intra-observer agreement was moderate to almost perfect (mean: 0.69; range, 0.45 to 0.85) and inter-observer agreement was slight to almost perfect (mean: 0.42; range, 0.13 to 0.90).
2) SFA Symposium