B0372

Clinical outcome of arthroscopic fixation for glenoid fracture using a double threaded screw

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Background: The glenoid rim fractures with a small bony fragment are generally treated by suture anchor technique. However, when the bony fragment is large, osteosynthesis would be performed using screws. The purpose of this study is to evaluate clinical outcome of arthroscopic fixation for glenoid fractures using double threaded screws.
Material and Methods: Ten patients who underwent arthroscopic fixation of glenoid fracture were included in this study. Nine patients had glenoid rim fractures (Ideberg type Ia), and one patient had a glenoid transverse fracture associated with body fracture (Ideberg type IVa). The surgeries were performed in all arthroscopic procedure. After reduction of the bony fragment, labrum around the fragment was repaired by suture anchors. Then, the bony fragment was fixed by a double threaded screw. Mean follow-up duration was 25 months. Japanese Orthopaedic Association (JOA) score, Constant score, Japanese Shoulder Society (JSS) shoulder instability score, and Rowe score were assessed.
Results: The average of JOA score, Constant score, JSS shoulder instability score, and Rowe score at final follow-up were 95.2 points, 83.4 points, 90.9 points, and 96.5 points, respectively. Bony union was acquired in all cases at three months after the surgeries without any pain. Postoperative CT scan revealed protrusion of the screw head in eight cases without symptom. The removals of the screws were performed in six cases. In two cases, the patients refused removal of the screws because they were asymptomatic.
Discussion: Fixation of the bony fragment of the glenoid fractures using the double threaded screw was rigid, and early bony union was successfully achieved. Although the screws were arthroscopically inserted underneath the articular cartilage, follow-up CT scan showed protrusion of the screw head inside the joint. To avoid the unnecessary complication, the position and insertion angle of the screw should be carefully planned.
Conclusion: The clinical results of arthroscopic fixation for glenoid fracture using a double treaded screw were satisfactory.
http://dx.doi.org/10.1016/j.asmart.2016.07.079

B0393

Arthroscopic treatment of greater tuberosity avulsion fracture using a double-row technique in elderly

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Background: Arthroscopic treatment of greater tuberosity avulsion fracture using a double-row technique was reported with a good result in many authors. But few authors evaluate the effectiveness of this procedure in elderly.
Material: A retrospective analysis was made on the clinical data of 13 patients with the acute greater tuberosity avulsion fracture after acute shoulder dislocation. There were 2 males and 11 females with an average age of 64.6 years (range, 60-73years). 3 left shoulders and 10 right shoulders were affected. Methods : All cases accepted arthroscopic treatment using a double-row technique with anchor. The cases were evaluated by X-ray films, VAS score and UCLA score.
Results: All cases were successfully performed operations and all cases were followed up 12-35 months (mean, 16.1 months). X-ray films of all cases showed good reduction after operation immediately. But 4 cases showed mal reduction in X-ray films after surgery 3 days, and 2 cases of those were revised by cannulated screw and suture. 1 case showed mal reduction in X-ray films after surgery 3 weeks. The failure rate was 38.5%. The average fracture healing time was 8.7 weeks (range, 6-12weeks). At last follow-up, the mean VAS score was 1.5 ± 1.2, the mean UCLA shoulder function score was 29.3 ± 2.1.
Discussion: Osteoporosis was often accompanied in the elderly especially in female. The suture screw usually could not insert tightly in the greater tuberosity site without cortical bone when the greater tuberosity fractured. The screw or outside row suture would loose after surgery in some cases.
Conclusion: Although the functional recovery was satisfactory, arthroscopic treatment of greater tuberosity avulsion fracture using a double-row technique with high failure rate was not a good choose in elderly patients.
http://dx.doi.org/10.1016/j.asmart.2016.07.080

B0395

Postoperative flexion balance is improved after TKA by modified gap technique with imageless navigation

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Background: A goal of total knee arthroplasty (TKA) is to obtain symmetrically balanced extension and flexion gaps. To balance the gaps during surgical procedure, two surgical techniques are commonly used. One is measured resection technique (MRT), and the other is gap balancing technique (GBT). Imageless navigation assisted TKA is originally based on MRT in which bony landmarks are used to determine proper component placement. In this technique all bone cutting was underwent with the assistance of the navigation and soft tissue balancing was subsequently carried out to make rectangular shaped gap. Although imageless navigation is known to be useful to accurately reconstruct the mechanical axis of the lower limb, there are some cases in which gap balancing between extension and flexion is difficult after the bone cutting. GBT is reported to offer superior reliability in obtaining proper flexion and extension gap compared to MRT. To obtain both correct mechanical alignment and more well-balanced gap, we have started modified GBT (MGB) TKA with the assistance of imageless navigation since 2013. Therefore, the purpose of this paper is to characterize our current operative technique and to clarify effectiveness of this method to achieve well-balanced gap.
Surgical technique: The Stryker imageless navigation system (Precision version 4.0), which do not need intraoperative fluoroscopy or preoperative CT images, is used for computer-assisted implantation. Following a conventional medial midvastus approach, bony landmarks such as Whiteside line, epicondylar axis and tibia AP axis are registered into the computer navigation. Firstly, distal femoral cut and proximal tibial cut are made perpendicular to the mechanical axis with extramedullary cutting blocks positioned under navigation guidance. The created extension gap is evaluated with a spacer block and soft tissue release or osteophyte resection is performed to obtain the rectangular extension space. Once the rectangular extension gap is created, the extension and flexion gaps are measured at full extension and at 90 degree flexion of the knee by applying 40N torque to the tensioner. Then the difference of the two gaps (extension gap − flexion gap) is calculated and the necessary thickness of posterior condyle bone resection is estimated. The femoral anterior/posterior and chamfer cutting block (4 in one femoral cutting block) is positioned by monitoring on the navigation screen. The navigation system offers real-time feedback of femoral rotation, the risk of anterior femoral notch and the thickness of posterior femoral bone resections. To obtain equal extension and flexion gaps, the position of the femoral cutting block is adjusted to the estimated necessary bone resection value as well as controlling femoral rotation and anterior femoral notch risk. When the flexion gap before bone resection is trapezoidal, femoral rotation is adjusted to maximum 1 degree external or internal from the neutral position on the navigation.
Method: From April 2012 to March 2015, total 144 knees were replaced using imageless navigation. Femoral rotation and flexion gap was determined by conventional MRT between April 2012 and March 2013. Between April 2013 and March 2015, the navigation assisted MGB was utilized. Inclusion criteria in this study is varus osteoarthritis knees and CR type TKA. Twenty-three knees by MRT and 39 knees by MGB were enrolled. Pre-operative variables were recorded, including age, sex, body mass index, frontal alignment, and range of motion. Axial radiograph of the distal femur was taken by the method of Kanekasu et al at 3 months after operation and the flexion soft tissue balance was evaluated. Lift off angle (LOA) of femoral component, which was the angle between tibial cutting line and posterior condylar axis (PCA), was measured on the axial radiograph. The number of outlier of a LOA, which was defined as a deviation >3 degree of the varus or valgus, was compared in both group. Post-operative LOA and outlier of LOA were compared in both group using student t-test.
Result: There was no statistically significant difference in terms of demographic characteristics between MRT group and MGB group. Mean post-operative LOA was 2.3 ± 2.7 degree varus in MRT group and 1.2 ± 1.7 degree varus in MGB group ($p<0.05$). Mean post -operative LOA in MGB group was significantly lower than in MRT group. In other words, flexion balance in MGB group was significantly more rectangular than in MRT group. Outlier in MRT group were 7 cases (30.4%) and in MGB group were 3 cases (7.7%). Outlier decreased significantly in MGB group ($p<0.05$).
Conclusion: The surgical technique by MGB with the assistance of the imageless navigation was shown in detail. In terms of flexion balancing, there was statistically significant improvement in the MGB group compared to MRT group at postoperative axial X-ray of the distal femur. Also there were less outlier more than 3 degree in MGB than MRT. Navigation assisted MGB would improve soft tissue balancing than conventional navigation assisted TKA.
http://dx.doi.org/10.1016/j.asmart.2016.07.081

B0396

Efficacy and safety of self-flip technique of tightrope RT button for anterior cruciate ligament reconstruction

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Introduction: The TightRope RT (Arthrex, Naples, FL) is a fixation device for anterior cruciate ligament (ACL) reconstruction. The TightRope RT has an adjustable loop that fits all sizes of tunnels, and it is not necessary for orthopedic surgeons to create an extra socket (6 to 7 mm) to facilitate button flipping. Therefore, relatively short femoral tunnels will be beneficial for anatomic soft tissue ACL reconstruction. However, there is no side suture in the TightRope RT button for flipping. In addition, there is a potential risk that the button will be pulled too far off the lateral femoral cortex into the soft tissue and lead to inappropriate positioning of the button on the vastus lateralis muscle or fascia, because the loop of the TightRope RT is long. So far, various techniques have been reported to seat the TightRope RT button appropriately on the lateral cortex of the femur. However, the reported techniques are relatively difficult. Therefore, our novel technique (Self-flip Technique) was introduced for the button flipping.
The purpose of the present study was to investigate the efficacy and safety of the technique of the button for ACL Reconstruction.

Methods

Paticipants: A total of 67 patients were enrolled in the present study. All the patients underwent arthroscopic single bundle or double bundle ACL reconstruction using hamstring tendon by five surgeons. Average age of the patients was 31 years old.

Self-flip Technique: As preparation, the appropriate diameter of tibial tunnel is created using the ACL tibial guide, and the appropriate diameter of femoral tunnel is also created using inside-out or outside-in technique using the ACL femoral guide under the arthroscopy. A 15-mm femoral socket is then created with a drill adjusted to the diameter of the graft. As to the preparation of the graft, we draw a first line in the loop of the TightRope RT at the same length as the femoral tunnel, and then draw a second line at 7 mm longer than the length of the femoral tunnel as a self-flip line. Moreover, the third line is drawn on the graft at 15 mm from its end that is the same length as the femoral socket.

A braided No. 5 suture is passed from the tibial tunnel to the femoral socket and brought out of the skin laterally. The TightRope RT passing sutures are passed through the tibial tunnel and then through the femoral socket and brought out laterally using the suture. The side sutures are then pulled from the lateral side, with the TightRope RT button being pulled into the femoral socket under direct arthroscopic vision. We confirm the drawn lines in the loop of the TightRope RT through the antero-lateral portal. We then stop pulling the TightRope RT button just at the second line (self-flip line). We should hold the graft at the tibial end on the anterior side not to pull too far. Then, the scope should be removed, and the knee position is changed from 90 degrees flexion to full extension. It is necessary to pull the side suture strongly, with the surgeon holding the graft at the tibial end. The side suture is inclined to the medial side with strong pulling of the suture. Then surgeon pulls the tibial end of the graft until he feels a secure positioning of the TightRope RT on the lateral side of the femoral cortex. The knee position is changed from full extension to 90 degrees flexion. We should insert the arthroscope again and confirm the firstline is just at the exit of the femoral tunnel through the anterolateral portal. Thereafter, final tensioning of the graft is made by pulling the white loop until the third line on the graft aligned to the exit of the femoral tunnel. Countertraction on the tibial end of the graft is applied during graft final tensioning. Finally, double stapling is done for tibial fixation at 20 degrees of knee flexion.

A postoperative radiograph is obtained for each patient to confirm the appropriate positioning of the button. The number of cases was evaluated if the malpositioning of the button was seen. The definition of the malpositioning was as follows; migrating to the vastus lateralis muscle or fascia, and the button left in the femur using the plain radiographs.

Results: In a total of 150 flips in 95 patients, 96% of the buttons were seated correctly on the lateral cortex of the femur using postoperative plain radiographs.

Conclusions: According to previous studies, malpositioning of the button may lead to either soft tissue irritation or migration of the button. In addition, a previous study indicated that a rate of soft-tissue interposition between the button and the lateral cortex of the femur would be up to 25.2% on postoperative radiographs obtained after ACL reconstruction. A positive correlation between this complication and a higher rate of button migration was also seen. This technical error can result in a worse clinical outcome. The advantages of the self-flip are: easy preparation of the graft, easy confirmation of the drawn line as the same length of the femoral tunnel, safe procedure for the patient, easy procedure for novice surgeons, and it does not take much time.

http://dx.doi.org/10.1016/j.asmart.2016.07.082

B0397

Arthroscopic repair for the hypermobile lateral meniscus

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Background: Hypermobile lateral meniscus (HLM) is one of the causes of knee pain and locking. The way to treatment of HLM was controversial despite of various past reports. We describe the new arthroscopic repair technique for HLM.

Material: From January 2010 to April 2015, twenty-eight consecutive patients (29 knees) underwent arthroscopic HLM repair by a single surgeon. 13 patients were men, 15 were women. Mean age at the time of surgery was 36.1 years old (15-67 years old). All of the patients complained of a locking sensation that occurred when the knee was flexed deeply. The diagnosis were decided by the physical examination and virtual load 3D MRI.

Method: Arthroscopic HLM repair was performed on all of the patients. The HLM were easily translated to anterior site through the lateral condyle under arthroscopy. Vertical stacked sutures were performed to repair the HLM by inside out techniques. The mobility of the lateral meniscus was confirmed carefully each sutures. The surgery was finished once the abnormal mobility of the lateral meniscus was restricted. Post operatively, the weightbearing was permitted the day after surgery with a knee brace. After 4weeks, the brace was removed. Squatting and return to sport were permitted after 12 weeks. Tegner activity score, Lysholm scale, and absence of locking symptom were evaluated before surgery and final follow up.

Results: The mean duration from surgery to final follow up was 30.4 months (5-68 months). The all of the lateral meniscus were easily dislocated across to the lateral femoral condyle by pulling the posterior aspect of it under arthroscopy. In arthroscopy, the paradoxical motion of the lateral meniscus, translating to anterior during deep flexion and posterior during full extension, was found. We succeeded in acquiring the physiological motion of the lateral meniscus, translating to posterior during flexion and anterior during extension, by 4.9 ± 1.6 vertical stacked suture. Mean Tegner activity score before and after surgery was 4.6. The Lysholm scale was significantly increased from 72.1 ± 9.2 to 97.9 ± 5.0. There were no recurrences of the locking symptoms.

Discussion: We reported the clinical results of the arthroscopic repair for the 29 knees of HLM. Surprisingly, paradoxical motion was found in all of the HLM. It was reported that the rupture of the popliteomeniscal fascicles was one of the causes of HLM. It might lead to the abnormal motion of the lateral meniscus. In arthroscopic surgery, we performed inside out suture techniques for safety and security. We confirmed the motion of the meniscus each sutures, and surgery was finished after obtaining the physiological motion of the lateral meniscus. Therefore, the excellent clinical results were acquired by just 4.9 vertical stacked sutures.

Conclusion: The excellent clinical results were acquired by inside out vertical stacked suture for HLM. It seems important to confirm the alleviation of abnormal meniscal motion with each sutures.

http://dx.doi.org/10.1016/j.asmart.2016.07.083

B0404

Increased medial meniscal slope is associated with greater risk of ramp lesion in non-contact anterior cruciate ligament injury

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Background: A special type of meniscal lesion involving peripheral attachment of the posterior horn of medial meniscus (PHMM) is commonly associated with anterior cruciate ligament (ACL) injury, which is termed “ramp lesion” [1]. However, no study has investigated its anatomical risk factors. Recently, increased meniscal slope has been identified as an independent anatomical risk factor for non-contact ACL injury [2].

Material & Methods: From January 2011 to December 2013, 1012 consecutive patients were diagnosed as having non-contact ACL injuries and underwent primary ACL reconstructions. Among them, 160 patients were arthroscopically verified to have concomitant ramp lesions. Exclusion criteria were partial ACL rupture, multi-ligamentous injury, associated medial/lateral meniscal lesions other than ramp lesion, skeletal immaturity, general joint laxity, severe malalignment of lower extremity, history of previous knee surgery, lack of available pre-operative MRI, and history of trauma to the proximal tibia. This left 53 patients in the study group (ACL + ramp group), which were matched in a 1:1 fashion to 53 control participants (isolated ACL group) who were arthroscopically verified to have isolated complete ACL injury during the same study period. Patients were matched by age, sex, and time from injury (TFI). Subjects from the matched control group were selected by applying the same exclusion criteria as mentioned above. The MMS and medial posterior tibial slope (MPTS) were measured on the pre-operative MRI in a blinded fashion. Predictors of ramp lesion, including the MMS, MPTS, body mass index (BMI), grade of pivot-shift test, and KT-1000 side-to-side difference were assessed by multi-variable conditional logistic regression analysis.

Results: The mean MMS in the study group was found to be 3.5°, which was significantly larger than that in the control group (2.0°, $P < .001$). In addition, increased MMS was significantly (odds ratio [OR], 5.180; 95% confidence interval [CI], 1.814 - 32.957; $P < .001$) associated with concomitant ramp lesion in non-contact ACL injury, especially for those with the TFI more than 6 months (OR, 13.819; 95% CI, 2.251 - 49.585; $P < .001$). However, no significant association was identified between MPTS and concomitant ramp lesion.

Discussion: The MPTS of the bony tibial plateaus is frequently mentioned for its association to increased anterior tibial translation in ACL-deficient knees [3]. Some authors have already presumed that with increased anterior tibial translation, greater ligament loading occurred and placed the ACL at higher risk of injury. Furthermore, Lee et al. [4] reported that the incidence of secondary medial meniscal lesions was significantly higher in patients with increased degree of MPTS after ACL injuries. However, in a matched case-control study recently performed by Hudek et al.[5], no obvious link between the MPTS and non-contact ACL injury was found. Additionally, Markl et al. [6] concluded that higher MPTS was not associated with increased prevalence of medial meniscal lesions after non-contact ACL injuries. Until now, clinical data about the connection between the higher MPTS and secondary medial meniscal lesions are inconsistent.

The lack of consensus might be attributed to the use of bony tissue to define the tibial slope. The soft tissues covered on the tibial plateau (e.g. meniscus), may influence the bony tibial slope and consequently play an important role in controlling the anterior tibial translation, especially for an ACL-deficient knee. Cinotti et al. [7] claimed that since menisci accomplished most of tasks, such as shock absorption, load sharing, and passive stabilization, they should be taken into account in evaluating the sagittal tibial slope. They further showed that both menisci were thicker in their posterior than in their anterior portion. Similarly, Lustig et al. [8] found that the menisci generated a more horizontal slope than the bony tibial slope when measured on MRI. Assessment of the meniscal slope has thus received considerable interest, with some arguing that it could reflect more accurately the relation between the femoral condyle and the tibial surface.

Conclusion: Increased MMS is identified to be an independent anatomical risk factor of concomitant ramp lesions in non-contact ACL injuries, particularly for those with the TFI more than 6 months. This may provide additional information for counseling patients who have increased MMS on greater risk of secondary PHMM lesions if their ACL-deficient knee joints are not well stabilized initially.

References

1. Liu X, Feng H, Zhang H, Hong L, Wang XS, Zhang J. Arthroscopic prevalence of ramp lesion in 868 patients with anterior cruciate ligament injury. *Am J Sports Med*. 2011;39(4):832-837.

2. Sturnick DR, Van Gorder R, Vacek PM, DeSarno MJ, Gardner-Morse MG, Tourville TW, Slauterbeck JR, Johnson RJ, Shultz SJ, Beynnon BD. Tibial articular cartilage and meniscus geometries combine to influence female risk of anterior cruciate ligament injury. *J Orthop Res.* 2014;32(11):1487-1494.

3. Tanaka M, Vyas D, Moloney G, Bedi A, Pearle AD, Musahl V. What does it take to have a high-grade pivot shift? *Knee Surg Sports Traumatol Arthrosc.* 2012;20(4):737-742.

4. Lee JJ, Choi YJ, Shin KY, Choi CH. Medial meniscal tears in anterior cruciate ligament-deficient knees: effects of posterior tibial slope on medial meniscal tear. *Knee Surg Relat Res.* 2011;23(4):227-230.