

drawer test between the groups, but the side-to-side difference in posterior translation was 3.8 ± 2.2 mm in the higher and 2.0 ± 1.4 mm in the lower group (mean difference, 1.8 mm; $p = 0.037$).

Discussion and Conclusion: A higher femoral tunnel position resulted in better anteroposterior stability than that of the higher position in single bundle PCL reconstruction. However, it was unclear whether the lower femoral tunnel position was clinically superior to the higher femoral tunnel position.

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B0086

The ideal femoral tunnel position using 3D-CT in anatomic single-bundle ACL reconstruction

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Background: The purpose of this study was to find the ideal femoral tunnel position in single-bundle ACL reconstruction using three-dimensional computed tomography (3D-CT) by comparing clinical scores, stability of the knee joint, and graft signal intensity on follow-up MRI.

Materials and Methods: Two-hundred patients underwent arthroscopic single-bundle ACL reconstruction with a soft tissue graft; all patients had the same surgical technique and rehabilitation protocol. Each patient underwent 3D-CT within 1 week after the operation and MRI at 1 year after the operation. Outcomes were evaluated with 3D-CT 1 week postoperatively using the Quadrant method of Bernard et al. We classified patients into three groups based on the femoral tunnel position: group A, AM tunnel; group B, PM tunnel; and group C, center tunnel. We evaluated graft signal intensity on follow-up MRI.

Results: This study included 77 patients (group A, 25 patients; group B, 15 patients; group C, 33 patients). The three groups did not differ significantly in preoperative demographics. There were no significant differences between groups in clinical scores or stability. However, patients in the AM tunnel and center tunnel groups had better graft signal intensity on follow-up MRI than those in the PL tunnel group.

Discussion and Conclusion: Positioning the femoral tunnel near the AM bundle and center led to better graft signal intensity on follow-up MRI in anatomic single-bundle ACL reconstruction than did positioning the femoral tunnel near the PL bundle. There were no differences in clinical scores or stability of the knee joint between groups.

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B0087

Biomechanical comparison of 3 different suture-bridge techniques for rotator cuff tear repair

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Purpose: To compare the biomechanical properties of 3 different suture-bridge techniques for rotator cuff tear repair.

Methods: Twelve pair-matched fresh-frozen shoulder specimens were randomized to 3 groups of different repair types regarding medial-row configuration: the medially Knotted Suture Bridge group (KSB), the medially Untied Suture Bridge group (USB), the Modified Suture Bridge group (MSB). Cyclic loading test and load-to-failure test were performed for all specimens. Parameters of elongation, stiffness, load at failure and mode of failure were finally recorded.

Results: The MSB technique had the significantly greatest load to failure (515.6 ± 78.0 N, $P=0.04$ for KSB group, $P<0.001$ for USB group), stiffness (58.0 ± 10.7 N/mm, $P<0.001$ for KSB and USB group) and lowest elongation (1.49 ± 0.39 mm, $P=0.009$ for KSB group, $P=0.001$ for USB group) among 3 constructs. For the remaining groups, the KSB repair had significantly higher ultimate load (443.5 ± 65.0 N) than USB repair (363.5 ± 52.3 N, $P=0.024$). However, there was no statistical difference in stiffness and elongation between KSB and USB technique ($P=0.229$ and 0.242 , respectively). Modes of failure varied among 3 groups.

Conclusions: Our modified suture bridge technique (MSB) may provide enhanced biomechanical properties when compared with medially knotted or knotless repair.

Clinical Relevance: Our modified technique may represent a promising alternative in arthroscopic rotator cuff repair.

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B0088

Local delivery of controlled-release simvastatin to improve the biocompatibility of polyethylene terephthalate artificial ligaments for reconstruction of the anterior cruciate ligament

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Background: The Ligament Advanced Reinforcement System (LARS) has recently been widely used as the primary graft of choice in ACL reconstruction. But the biological graft–bone healing

still remains a problem. Previous studies have shown that simvastatin (SIM) stimulates bone formation.

Purpose: The objective of this study was to investigate whether surface coating with collagen (COL) containing low-dose SIM microsphere could enhance the surface biocompatibility of polyethylene terephthalate (PET) artificial ligaments to accelerate graft-to-bone healing.

Methods: The in vitro studies demonstrated that BMSCs on the SIM/COL/PET scaffolds proliferated vigorously. Compared with the PET group and the COL/PET group, simvastatin could induce BMSCs' osteoblastic differentiation, high alkaline phosphatase activity, more mineralization and more expression of osteoblast-related genes such as osteocalcin, runt-related transcription factor 2, bone morphogenetic protein-2 and vascular endothelial growth factor growth factor in the SIM/COL/PET group. In vivo, rabbits received ACL reconstruction with different scaffolds.

Results: Histological analysis demonstrated that graft–bone healing was significantly greater with angiogenesis and osteogenesis in the SIM/COL/PET group than the others groups. In addition, biomechanical testing at the eighth week demonstrated a significant increase in ultimate failure load and stiffness in the SIM/COL/PET group.

Conclusion: The low dose of simvastatin sustained released from SIM/COL/PET promoted the graft–bone healing via its effect on both angiogenesis and osteogenesis.

This study suggested that collagen containing low-dose SIM microsphere coating on the surface of PET artificial ligaments could be potentially applied for ACL reconstruction.

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B0090

Rotator cuff tears combined with long head of the biceps tendon lesions: Tenotomy versus tenodesis

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Background: Long head of the biceps tendon (LHBT) lesions are often associated with partial or complete rotator cuff tears, especially in elderly patients. Arthroscopic biceps tenotomy and tenodesis with tenodesis are two well-established surgical procedures. However, which technique is preferred over the other in treating patients with LHBT lesions and repairable cuff tears is still a controversy.

Purpose: The purpose of this meta-analysis was to assess whether there are differences in the outcomes between tenotomy and tenodesis in treating LHBT lesions combined with rotator cuff tears.

Methods: We searched for articles comparing tenotomy and tenodesis combined with rotator cuff repair that were published before 2015. The controlled clinical studies that met the inclusion and exclusion criteria were assessed for quality of methodology. These results were evaluated and compared to provide an overview on benefits and drawbacks of the respective surgical procedures.

Results: Both tenotomy and tenodesis are effective and equal for the treatment of long head biceps lesions. Compared with tenodesis, tenotomy is more simple, shorter surgical time, faster pain relief, lower cost, and avoidance of implant complication. Because both the tenotomy and tenodesis with concomitant rotator cuff repair used the same rehabilitation protocol just for rotator cuff repair. Namely, this can somewhat offset the weakness that tenodesis needs a longer rehabilitation period than tenotomy. However, the incidence of the Popeye sign is significantly lower, even though tenodesis does not provide any significant clinical or functional improvement than isolated tenotomy.

Conclusions: Both tenotomy and tenodesis are effective in pain relief and functional improvement in patients with repairable rotator cuff tears. Various factors should be taken into consideration, such as ages, functional demands, cosmesis concern, and surgeon preferences, in order to decide which surgical procedure to choose. Because tenotomy requires a shorter surgical time and results in faster pain relief, we recommend tenotomy with concomitant rotator cuff repair in older than 55 years patients, with a low level of physical activity, no cosmesis concern.

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B0091

Paralabral spinoglenoid cysts with suprascapular nerve palsy – A comparison of two arthroscopic approaches

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Background: Focal spinoglenoid cysts are often excised through a translabral approach. This may be inadequate when treating extensile cysts that progress from spinoglenoid to suprascapular region. Posterosuperior capsulotomy (paralabral approach) allowing better visualization, dissection, and excision of the cyst with suprascapular nerve decompression may be warranted in such cases. This study compares the results of the two arthroscopic approaches in suprascapular neuropathy secondary to spinoglenoid ganglion cysts.

Methods: 27 consecutive patients underwent arthroscopic decompression of spinoglenoid cysts with labral repair. Two cyst types were identified: focal and extensile; and three treatment groups based on approach. Group A included 17 focal cysts excised through translabral approach. Group B included 3 extensile cysts that underwent translabral approach. Group C included 7 extensile cysts excised through paralabral approach. Patients were evaluated preoperatively and 12 months postoperatively by clinical examination, MRI, and ASES scores. 13 patients underwent postoperative EMG. The mean follow-up was 31 months (range=12 to 83 months).

Results: 17 group A (100%), 1 group B (33%), 7 group C (100%) patients had an excellent result with complete clinical recovery and no recurrence. 24 of these 25 revealed complete cyst excision on postoperative MRI. All postoperative EMG in this group confirmed infraspinatus recovery. In two group B patients (66%), a residual cyst was noted on MRI, with persistent EMG findings in one. The mean ASES scores showed significant improvement ($P < 0.001$) (A - 62 to 95 points, B - 58 to 76 points, C - 57 to 92 points). This was significantly better in groups A and C ($P < 0.05$). No complications were encountered in any group.

Discussion: A translabral approach is adequate for focal spinoglenoid cyst excision, but is inadequate for extensile cysts. A paralabral approach to the spinoglenoid notch via a posterolateral capsulotomy is necessary for extensile cysts. This allows better visualization of the cyst and facilitates thorough dissection and excision of the cyst walls. Moreover, the inferior branch of the suprascapular nerve is decompressed and traced under visualisation.

Conclusion: Both arthroscopic approaches are safe and effective, results in excellent clinical outcomes, and avoid cyst recurrence when applied for the specific type of cyst location.

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B0096

Novel anatomical single bundle ACL reconstruction using a rounded rectangle femoral dilator

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Background: During the past 10 years, the main trend for ACL reconstruction has shifted to anatomic reconstruction. There is no significant difference in the postoperative stability and clinical results between single and double bundle ACL reconstruction. So, an attention has returned to single bundle ACL reconstruction with grafts that are placed at the center of anatomical footprint. In the conventional circular femoral bone tunnel, creation of a large anatomical bone tunnel is not possible because of roof impingement. Several anatomical studies have reported that the femoral insertion of the ACL has a rounded rectangle shape, and we have also realized that the quadrupled semitendinosus tendons appear to be a rounded rectangle, rather than circular. Therefore, we created an original femoral dilator and developed a new ACL reconstruction technique: "Rounded rectangle femoral tunnel ACLR" (RFTR). This study aimed to compare the femoral tunnel size and clinical results between conventional anatomical single bundle ACL reconstruction (ASBR) and RFTR.

Material: Between May 2010 and January 2015, 120 primary ACL reconstructions were performed. After implementation of inclusion criteria, 97 ACL reconstructions were analyzed (ASBR = 57 patients, 21 male, 36 female; age, 24.1 ± 9.3 years; RFTR = 40 patients, 24 male, 16 female; age, 23.2 ± 8.3 years). The evaluation items were area of the femoral tunnel, anteroposterior laxity with KT-1000, pivot-shift test, and Lysholm score.

Results: RFTR created a bigger femoral tunnel area than did ASBR (average area, 51.9 ± 5.3 mm² vs 47.0 ± 7.3 mm²; $P < 0.01$). RFTR resulted in better anteroposterior stability and Lysholm score than did ASBR (average side-to-side difference for anterior tibial translation, 0.8 ± 1.1 mm vs 1.8 ± 1.2 mm; $P < 0.01$); average Lysholm score, 98.9 ± 2.7 vs 97.6 ± 3.3 ; $P = 0.03$). Differences in rotational stability between groups were not statistically significant (negative pivot shift, 90.0% vs 82.5%; $P = 0.39$).

Conclusion: Compared with conventional anatomical single bundle ACL reconstruction, rounded rectangle femoral tunnel ACL reconstruction created a large femoral tunnel and improved anteroposterior laxity and clinical results.

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B0099

Clinical and radiological results of double level osteotomy for varus knee osteoarthritis. Review of our experiences

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Introduction: Osteotomies around the knee is generally indicated for patients with high activity level who have uni-compartmental knee osteoarthritis because total knee arthroplasty in this patient population may not be a good option. In addition, recent progresses in surgical procedure such as bi-plane osteotomy and use of rigid fixation device (LCP) and bone substitute materials (β -TCP) have facilitated early functional recovery and expanded the indication for osteotomy. In Japan, we frequently encounter osteoarthritic patients with severe varus knee deformity requiring surgical treatment. We have indicated and performed double level osteotomy (DLO) in such situation. The concept of DLO was to obtain anatomical knee joint-line by bi-plane cut closed wedge distal femur osteotomy (DFO) and bi-plane cut open wedge high tibial osteotomy (HTO) with the use of LCP and β -TCP. The purpose of the study was to examine clinical and radiological outcomes of this procedure in our practice.

Patients & Methods: Fourteen knees in 13 patients with severe varus knee deformity who underwent DLO and could be followed up for clinical and radiological assessments were included in the study. DLO was indicated for medial compartment osteoarthritic knees with severe varus malalignment. Surgical goal of DLO is to reconstruct the anatomical knee joint line while correcting the varus malalignment. Whole leg weight-bearing radiographs at the preoperative period and 6 months after surgery were available for 10 patients. Radiological parameters measured for analysis were as follows: mechanical tibiofemoral angle (mTFA), mechanical lateral distal femoral angle (mLDFA), medial proximal tibia angle (MPTA), and joint-line

convergence angle (JLCA). In addition, pre- and postoperative clinical outcomes were evaluated using the KOOS and the IKDC score.

Results: Each of the radiological parameters improved after surgery. The postoperative changes in measured values for mTFA, MPTA, mLDFA, and JLCA from the preoperative to the 6-month evaluation were -14.1° to 1.6° , 82.4° to 91.2° , 91.2° to 85.1° and 6.0° to 4.5° respectively. KOOS and IKDC scores also improved after surgery from 130 to 349 and 35 to 55, respectively.

Discussion: This study showed that DLO for patients with severe varus malalignment and medial compartment osteoarthritis could accomplish satisfactory clinical outcomes by normalizing coronal alignment while avoiding joint line obliquity.

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B0104

Comparison of three different methods for drilling PLB femoral tunnel in double bundle ACL reconstruction

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Purpose: The purpose of this study was to compare the PL femoral tunnel geometry between flexible and rigid drilling systems in TP technique and OI technique based on three-dimensional image analysis of postoperative CT images.

Method: Postoperative CT images at 1 week were available for analysis in 67 patients. Rigid drill, flexible drill and OI group was 20, 27 and 20 knees. Thereafter, three-dimensional CT image analysis using ZioTerm2009OR imaging software was applied to the PL femoral tunnels, and the following parameters were evaluated: position of the center of the tunnel aperture, tunnel length, shape of the intraarticular aperture (major axis length of the ellipse in relation to the original drilling diameter), and bending angle of the graft (angle formed by long axes of the intra-articular graft and femoral bone tunnel).

Results: Assessment of the tunnel center location based on the Bernard and Hertel method showed that anatomic tunnel placement was achieved. There are no significant difference in the tunnel length. The major axis of the aperture/drill diameter ratio averaged 1.29 in the flexible drill group, 1.24 in the rigid drill group and 1.13 in the OI group. The mean graft bending angle at the femoral tunnel aperture was 63.4° in the flexible drill group, 63.6° in the rigid drill group and 99.4° in the OI group.

Conclusions: The present study showed that anatomic placement of the femoral tunnel was feasible with both TP and OI techniques. The shape of the tunnel aperture was more ellipsoidal with both TP techniques, it was not more round aperture with the flexible drilling system. It was thought that the flexible drill guide was constrained by the preserved remnant. The graft bending angle at the tunnel aperture was sharp with OI drilling technique, which may increase the mechanical stress at the aperture.

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B0105

Influence of initial tension on the postoperative tibiofemoral relationship after anatomic anterior cruciate ligament reconstruction

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Background: The initial tension at graft fixation is one of the keys for successful outcomes after ACL reconstruction. Mae et al. previously reported good clinical outcomes after anatomic double-bundle (ADB) ACL reconstruction with a total initial tension of 20 N (Mae T, et al. Arthroscopy 2010). Recently, anatomic triple-bundle (ATB) procedure was developed in order to mimic the closer morphology of the native ACL and provided the better immediate postoperative stability than the ADB procedure with the same initial graft tension of 20 N (Mae T, et al. Arthroscopy 2013). Thus, we hypothesized that the ATB procedure might provide good postoperative outcomes with the smaller initial tension. The aim of this study was to prospectively compare the tibiofemoral relationship after the ATB ACL reconstruction with 10 N of initial tension to that with 20N.

Materials and Methods: The ATB ACL reconstruction using a hamstring tendon graft via 2 femoral and 3 tibial tunnels was performed in 27 patients with unilateral ACL injury. After graft passage, grafts were fixed with Endobutton-CLs on the femur. Then the patients were divided into 2 different pre-tensioning groups (a total graft tension of 10 N (13 knees) and 20 N (14 knees)), and the grafts were finally fixed at 20 degree of knee flexion with Double Spike Plates (Meira co, Nagoya, Japan) on the tibia. After knee immobilization for 2 weeks in both groups, range of motion exercise was started. Full weight bearing was allowed at 4 weeks, followed by a return to sports at 6 to 8 months. Computed tomography scans were obtained preoperatively, 3 weeks, and 6 months postoperatively. The patients lay in a prone position at 15° of knee flexion, in which the tibia caught an anterior load by the calf weight. The imaging data were constructed to 3-dimensional computer models. The anterior-posterior translation and the internal-external rotation of the tibia relative to the femur were measured. Then the side-to-side difference of tibial position was compared between the 2 groups. Likewise, the side-to-side difference at a maximal anterior load with KT-2000 Knee Arthrometer was calculated 6 months after surgery. Wilcoxon rank sum test was used for the statistical analysis with a significant value of $P < 0.05$.