

In the axial plane:

- The angle of the screws: ATB was the “most parallel to the JL option” whereas ATL screws were more divergent than OT ( $p < 0.01$ ).

- The positioning of the CG: OT was significantly more flush to the JL whereas ATB was likely to be more lateral ( $p < 0.01$ ). There was a higher dispersion of the values with the ATL.

- The contact area between CG and the glenoid: There was no significant differences between the different open and arthroscopic techniques although a higher dispersion of the values with the ATL.

In the sagittal plane, when analyzing the percentage of CG under the equator of the glenoid screws: The CG with the ATL was significantly “higher” than with the OT, whereas ATB was “lower” ( $p < 0.001$ ).

**Discussion:** A precise analysis of the positioning of the CG especially with the evolution of new arthroscopic techniques is mandatory. Standard radiographs showed insufficient reliability whereas 2D CT-scans seem to be the gold standard.

Contrary to Kraus *et al*, we found a greater discrepancy between inter-observer ICCs but also intra-observer ICCs, except for screw angle measurements. Difficulties to orient with a reproducible manner the scapula in 3D before starting measurements in 2D were responsible of the errors. The most difficult part is certainly to find the appropriate sagittal plane. Caution in interpretation of results should be taken when analyzing of CG positioning on 2D CT-scans because of possible measurements errors.

**Conclusion:** Orientation of the scapula by an automated system would certainly help to decrease possible measurement errors.

This study showed that arthroscopic Latarjet techniques are reliable, but with a tendency to be a little bit more proud than the conventional open technique.

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#### B0797

**Chondral defects in the knee: Are autologous bone marrow derived mesenchymal stem cells suitable to replace autologous chondrocyte implantation techniques? results from a mid-term observational cohort study**

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**Background:** Autologous chondrocyte implantation (ACI) has limitations, and its position has been challenged by autologous bone marrow-derived mesenchymal stem cells (BMSCs). BMSCs have an added benefit as requires 1 less surgery, reduced costs, and minimized donor-site morbidity. This study was conducted to compare the 6-year clinical outcomes of patients treated with first-generation ACI to patients treated with BMSCs and to assess its feasibility as a replacement for ACI techniques.

**Materials and Methods:** Seventy-two matched (lesion site and age) patients underwent cartilage repair using chondrocytes ( $n = 36$ ) or BMSCs ( $n = 36$ ). Clinical outcomes were measured before operation and 3, 6, 9, 12, 18, 24 months and mid term outcomes were followed up till 6 years after operation. The International Cartilage Repair Society (ICRS) Cartilage Injury Evaluation Package, which included questions from the Short-Form Health Survey, International Knee Documentation Committee (IKDC) subjective knee evaluation form, Lysholm knee scale, and Tegner activity level scale were used for evaluation.

**Results:** At 6-year follow-up, there were 30 patients available for evaluation (ACI = 16, BMSC = 14), with a loss to follow-up rate of 58.3%. There was significant improvement in the patients' quality of life (physical and mental components of the Short Form-36 questionnaire included in the ICRS package) after cartilage repair in both groups. However, there was no difference between the BMSC and the ACI group in terms of clinical outcomes.

The IKDC subjective knee evaluation ( $P = 0.258$ ), Lysholm ( $P = 0.724$ ), and Tegner ( $P = 0.827$ ) scores did not show any significant difference between groups over time. Patients younger than 45 years of age scored significantly better than patients older than 45 years in the ACI group, but age did not make a difference in outcomes in the BMSC group.

**Conclusion:** BMSCs in cartilage repair is as effective as chondrocytes for articular cartilage repair. The mid term results suggest that BMSCs can be used in replacement for ACI as it provides the same effect at 6 years post intervention. In addition, it requires 1 less surgery, reduced costs, and minimized donor-site morbidity.

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#### B0803

**Precise patient selection for hip arthroscopy using ultrasound-guided hip injection**

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**Background:** Acetabular labral tear (ALT) is considered to be the most frequent pathology as a cause of groin pain. Recently, the technique on diagnosis and arthroscopic treatment for labrum tear has progressed. Satisfactory outcomes of hip arthroscopy were reported. However, failure cases of arthroscopic treatment actually exist, and one of the most concerned problem is patient selection for hip arthroscopy. The purpose of this study is to review the patients who underwent conservative treatment including ultrasound-guided hip injection under the diagnosis of ALT,

and to assess the efficacy of the technique of hip injection in order to give a more reliable diagnosis and to reach better operative indication for hip arthroscopy.

**Materials and Methods:** 37 patients with 40 hips (18 men and 19 women) who were diagnosed as ALT, whose groin pain was evaluated using ultrasound-guided hip injection between January 2013 and December 2015, were included in this study. Possible ALT was diagnosed with positive impingement test (flexion and internal rotation), and positive findings on the radial view of MRI. The exclusion criteria included radiographic sign of osteoarthritis of the hip; Tönnis grade 2 or higher and acetabular dysplasia (center-edge angle less than 20°), or other previous history of hip joint pathology. The mean age of the patients at the first consultation was 45 years (17-71 years). As the procedure of hip injection, HI VISION Avius ultrasound system (Hitachi Aloka Medical, Tokyo, Japan) with a 14-6 MHz linear probe was used. Intra-articular injection was performed using an anterior parasagittal approach with the free hand technique. The needle tip was inserted toward the head-neck junction. On the other hand, extra-articular injection was performed via anterior approach targeting the layer of fascia between iliopsoas tendon and rectus femoris. Not only anterior inferior iliac spine (AIIIS) but also iliopsoas tendon and proximal rectus femoris were visualized in the long axis probing. Clinical evaluation was performed with visual-analogue scale (VAS) score and outcomes of the Japanese Orthopedic Association Hip-Disease Evaluation Questionnaire (JHEQ) at pre-injection and at 4 weeks after injection. JHEQ is a validated self-administered questionnaire for QOL of patients with hip disease in the Asian lifestyle, the total score range is 0 (worst) to 84 (best). Additionally, the period between the initial injection and the last injection, frequency of injection, and location of injection (intra-articular space, iliopsoas tendon, proximal rectus femoris) were investigated.

**Results:** Medians of the VAS score, the total score of the JHEQ, and the pain subscale score of the JHEQ significantly improved after hip injection, and the movement and mental subscale scores of the JHEQ also improved. Conservative treatment including hip injection was effective in 30 hips (75%). The mean period between the initial injection and the last injection was 5 months (range: 1-24 months), the mean times of injection was 4.5 times, and 10 hips out of 30 hips were performed injection of less than 3 times. In 7 hips, injection to iliopsoas tendon or proximal rectus femoris was more effective than that to intra-articular injection. Ten hips (25%) failed conservative treatment and required arthroscopic treatments. In these patients, the mean 2.4 times of injection were performed before surgery.

**Discussion:** Recently, Failure factors of hip arthroscopy have been reported. Not only the etiology but also pathomorphological problem and external-articular pathology is important. Considering the source of groin pain, even if intra-articular pathology is detected by radiograph or MRI, extra-articular pathology could not be ruled out. Various causes of groin pain might be hidden behind obvious pathologies such as ALT. Ultrasound-guided injection could help surgeons to give a more precise diagnosis of the origin of groin pain, which leads to select better operative indication for hip arthroscopy.

**Conclusions:** 37 patients with 40 hips who were diagnosed as acetabular labral tear (ALT), whose groin pain was evaluated using ultrasound-guided hip injection were investigated. Conservative treatment including hip injection was effective in 30 hips (75%). In 7 hips out of 30 hips, injection to iliopsoas tendon or proximal rectus femoris was more effective than that to intra-articular injection. Various causes of groin pain may coexist behind obvious pathologies. Ultrasound-guided injection could be useful for precise diagnosis of the cause of groin pain and could lead to better operative indication for hip arthroscopy.

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#### B0804

**Medial gap technique: New surgical concept for quantitative and safer soft tissue balancing in posterior-stabilized TKA**

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**Background:** Although gap balancing technique has been reported to be beneficial for the intra-operative soft tissue balancing in posterior-stabilized (PS)-TKA, excessive release of medial structures for achieving perfect ligament balance would be more likely to result in medial instability, which would deteriorate post-operative clinical result with persistent pain [1].

We have devised a new surgical concept, named as “medial gap technique” aiming at medial stability with permitting lateral looseness. With the quantitative soft tissue balance measurement using newly developed offset type tensor [2], we modified conventional gap balancing technique to provide quantitative and safer intra-operative soft tissue balancing with avoiding medial instability. In this study, we compared intra-operative soft tissue balance between medial gap technique (MGT) and measured resection technique (MRT) in PS-TKA.

**Material:** The subjects were 256 patients with varus type osteoarthritic knees, underwent primary PS-TKAs. The surgical techniques were MGT in 112 patients (96 female, 16 male) and MRT in 144 patients (118 female, 26 male). There were no significant differences between two groups in the pre-operative clinical features including age, sex, ROM and deformity.

**Method:** A distal femoral and a proximal tibial osteotomy were performed perpendicular to the mechanical axis. Ligament imbalance in the coronal plane was corrected by medial soft tissue release, which should be carefully performed not to be excessive until a spacer block corresponding to resected bone thickness from lateral tibial plateau could be inserted at extension. The residual lateral laxity was permitted. Following extension gap preparation, a varus angle (°) and joint center gap (mm) at the knee extension and 90° of flexion were measured using an offset type tensor with applying 40 lbs. (177.9N) of joint distraction force.

As for the flexion gap preparation, in the MGT group, the level of femoral posterior condylar osteotomy was determined based on the difference of joint center gap between extension and flexion, and femoral rotation angle were based on the varus angle difference.

Intra-operative joint gap kinematics was measured with femoral trial in place and patello-femoral (PF) joint reduced [2]. We measured varus angle and joint component gap at 8 different knee flexion angles; 0°, 10°, 30°, 45°, 60°, 90°, 120°, and 135°. From these component gaps and varus angles, we calculated a medial compartment gap (MCG) and a lateral compartment gap (LCG) by using a trigonometric function. Also we calculate the increase of both compartment gaps from those at full extension, named as joint gap loosening (mm). Both compartment gaps and joint gap loosening were compared between 2 groups using unpaired t-test, and the difference between medial and lateral gaps in each group were compared using paired t-test ( $p < 0.05$ ).

**Results:** The mean MCG with the knee at 0°, 10°, 30°, 45°, 60°, 90°, 120° and 135° were 10.9, 13.3, 14.0, 13.8, 13.9, 14.1, 13.7 and 12.5 mm respectively in MGT group and 10.3, 13.0, 14.0, 14.2, 14.6, 15.3, 14.1, and 12.2 mm respectively in MRT group. The mean LCG at 8 different flexion angles were respectively 12.7, 15.7, 17.1, 17.2, 17.5, 17.7, 17.4 and 15.4 mm in MGT group and 12.0, 15.2, 16.8, 17.4, 17.9, 18.8, 18.0 and 15.8 mm in MRT group. In both groups, LCG showed significantly larger values than MCG at all flexion angles, and both LCG and MCG showed the largest values at 90° of knee flexion. Both medial and lateral joint gap loosening were significantly lower in MGT group than MRT group at 30° to 120° for medial, and 45° to 135° for lateral joint loosening.

**Discussion:** In the present study, we found the stability at the medial compartment were significantly higher than the lateral throughout range of motion in both groups. The lateral looseness was physiologically observed in normal knee [3] and also important for post-operative knee flexion after TKA [4]. In MGT, we quantitatively measured intra-operative soft tissue balance, and calculated the appropriate resection thicknesses from posterior femoral condyles. Therefore, joint gap loosening with knee flexion were significantly smaller in MGT group than MRT group. This would be beneficial for the post-operative knee stability.

We have found the higher joint distraction force resulted in the higher varus imbalance during tensor measurement [5]. This phenomenon would be caused by the stiffness difference between medial and lateral soft tissues. This would be a reason why gap balancing technique was difficult to be performed quantitatively and safely by many surgeons. We also found the difference in varus angle between extension and flexion would not differ with different joint distraction force between 20 to 60 lbs. Therefore, we used this difference to determine the external rotation angle of femoral component, and the less joint gap loosening with knee flexion in both medial and lateral compartment were observed in MGT group.

**Conclusion:** We introduced a new surgical concept named “medial gap technique (MGT)” aiming at medial stability and safer soft tissue balancing in PS-TKA. We have found MGT was effective for intra-operative soft tissue balancing to be quantitative, consistent and safer.

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#### B0805

##### Arthroscopic results of the cartilage repair using fusion technique of island osteochondral autograft transfer (OAT) and microfracture for severe osteoarthritis in younger patients

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**Background:** Total knee replacements are generally selected for the treatment of severe osteoarthritis in which the joint space is completely or almost completely lost. However, the joint preserving procedures, such as cartilage repair and high tibial osteotomy (HTO), should be taken into account as an alternative for the patients who are the age of 60 or younger, because total knee replacements in younger patients can be followed by early revision surgery. The purpose of this study was to evaluate the arthroscopic results of the cartilage repair using fusion technique of island osteochondral autograft transfer (OAT) and microfracture which was performed for the patients who have suffered from severe osteoarthritis in their younger ages.

**Materials:** Among 149 knees which high tibial osteotomies and cartilage repair procedures were performed in Segyero hospital from Jan. 2011 to Dec. 2014, 43 knees were selected for this study. Inclusion criterion were patients who underwent high tibial osteotomy and cartilage repair with the above-mentioned fusion technique for ICRS Grade 4 lesion of medial femoral condyle, and then second look arthroscopy when the plate was removed after around 1 year postoperatively. Exclusion criterion were the patients of whom microfracture or OAT only was performed for medial femoral condylar lesion and the patients for whom second look arthroscopy was not performed

**Methods:** Surgical technique: After thorough arthroscopic examination of the joint, operative procedures, such as meniscectomy, synovectomy, and chondroplasty etc. were performed. Microfracture was arthroscopically done for ICRS Grade 4 lesion of medial tibial plateau (MTP). Osteochondral autograft transfer of island pattern and microfracture was performed

for ICRS Grade 4 lesion of medial femoral condyle (MFC) after abrasion of sclerotic subchondral bone through open wound. Finally, opening wedge HTO was done with the use of Puddu plate. Postoperatively continuous passive motion (CPM) exercise was encouraged 6- 8 hours per day for 6 weeks.

The status of cartilage regeneration was identified by arthroscopic examination while removing the plate around 1 year postoperatively. We evaluated the regenerated cartilage about the lesion coverage, hardness, surface fibrillation, marginal integration into surrounding cartilage, and hypertrophy.

**Results:** The average age was 50.7 years (range: 39-60 years). Seven knees were for men, and thirty-six knees for women. The size of ICRS grade 4 lesion of MFC and MTP were 4.3 cm<sup>2</sup>, 1.6 cm<sup>2</sup> in average, respectively. Better cartilage regeneration was noted in MFC lesion than in MTP lesion. For MFC Grade 4 lesion, it showed Grade 1 in 28knees, Grade 2 in 14 knees, and Grade 3 in 1 knee on arthroscopic examination performed around 1 year postoperatively. Thirty-one knees had Grade 4 lesion in MTP. On postoperative arthroscopic examination for MTP Grade 4 lesion, it showed Grade 1 in 14knees, Grade 2 in 8 knees, Grade 3 in 8 knees, and Grade 4 in 1 knee. During the second-look arthroscopy microfracture was performed in one knee due to small marginal delamination and 3 knees due to small uncovered area. Preoperatively radiologic findings demonstrated Kellgren - Lawrence grade 4 in 38 knees, Grade 3 in 5 knees. On Radiologic examination checked around 1 year postoperatively, there's no knees with Grade 4, 14 knees with Grade 3, 25 knees with Grad 2, and 4 knees with Grade 1. Anatomic knee alignment pre-operatively and postoperatively was 0 degree in average (range: -10 – 6.8 degrees), 8.2 degrees in average (range: 2.5–13.7 degrees), respectively.

**Discussion:** It is well known that the microfracture can be effective for cartilage repair of contained lesion. Cartilage loss of the medial femoral condyles in severe osteoarthritis is usually not a contained lesion. However the noncontained lesion in MFC can be changed into contained lesion through island OAT and abrasion of subchondral bone so that the microfracture can be effective. In addition, osteochondral graft inserted with island pattern will give the blood clot generated by the microfracture structural integrity to prevent certain damages from the shear stress.

**Conclusion:** Cartilage repair using fusion technique of OAT and microfracture could be a good alternative to TKR in severe osteoarthritis of younger patients as a salvage procedure. However, longevity of the cartilage regenerated by fusion technique of OAT and microfracture is still unknown. Therefore performing the procedure together with high tibial osteotomy would be desirable and long-term follow-up is required in the future.

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#### B0821

##### Reversal of suprascapular neuropathy following arthroscopic repair of massive rotator cuff tear with routine nerve release

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**Background:** This study was aim to investigate the prevalence of suprascapular neuropathy (SSN) in the setting of massive rotator cuff tear (MRCT) and to determine if arthroscopic rotator cuff repair with routine nerve release, was associated with reversal of SSN and clinical improvement in pain and function.

**Methods:** Over a 1 year period, 22 of 316 patients with cuff tears treated operatively were identified to have MRCT associated with retraction and severe fatty infiltration of the supraspinatus and infraspinatus muscles. All patients had pain and marked weakness in abduction and external rotation which did not improve with conservative treatment. Electromyographic (EMG) and nerve conduction velocity (NCV), as well as pre- and postoperative questionnaire and physical examination, were performed. Arthroscopic repair was performed on patients identified to have a MRCT in association with SSN.

**Results:** Eleven of these 22 (50%) was confirmed SSN preoperatively, 2 had an associated upper trunk brachial plexus injury, and 1 had a cervical radiculopathy. All patients underwent arthroscopic cuff reconstruction with routine suprascapular nerve release, follow-up EMG/NCV after 6 months demonstrated partial or full recovery of the SSN that correlated with complete pain relief and marked improvement in function.

**Conclusion:** SSN is found in a significant proportion of patients with MRCT, and is associated with pain and dysfunction. Arthroscopic rotator cuff repair with nerve release can result in reversal of SSN and better heal of the rotator cuff, which may correlate with substantial improvement in pain and function.

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#### B0831

##### An open-wedge osteotomy of the proximal tibia with hemicallotasis – Technique and outcome

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**Background:** High tibial osteotomy is a well-established procedure for osteoarthritis of the medial compartment of the knee with a varus deformity. Either a closed-wedge osteotomy or a dome osteotomy has been widely conducted while, during the last two decades, medial opening-wedge osteotomy has gained popularity. Among the procedures of proximal tibial open-wedge osteotomy, “hemicallotasis (HCO)” has been first described by Turi G. et al. as a new technique with an external fixator using a gradual distraction. The purpose of this study is to