

**Methods:** Between 2009 and 2014, 65 consecutive patients (71 knees) who underwent MOWHTO using a locking plate (TomoFix, DepuySynthes, Switzerland) were enrolled in this study. Inclusion criteria involved patients who had medial compartment osteoarthritis or spontaneous osteonecrosis of the knee. There were 13 men and 52 women with a mean age of 62 (40–72) years at the time of surgery. In surgical procedure, we performed a complete release of the distal tibial attachment of the sMCL. Then, a biplanar osteotomy of the tibia was performed. Wedged beta-tricalcium phosphate spacer was implanted in the opening space. After repairing the released sMCL and periosteum, a TomoFix plate was fixed onto the proximal tibia. Partial weight-bearing was permitted at 2 weeks after surgery. Full weight-bearing was allowed at 4 weeks after surgery. To assess objective medial instability, the joint line convergence angle (JLCA) and the medial joint space (MJS) was evaluated using a Telos device (Metax, Hungen-Obbornhofen, Germany) with a 150 N valgus force at 20 degrees of knee flexion. The distance of the MJS was calculated according to the method reported by Sawant et al. All patients underwent clinical and radiological examinations before surgery and at one year after surgery. Statistical analysis was made using a Student t test. The significance level was set at  $p = 0.05$ .

**Results:** 1) Postoperatively the mean Japan Orthopaedic Association score significantly improved from 65 to 91 points (total score: 100 points,  $p < 0.0001$ ). 2) The lateral femorotibial angle changed from 179 to 169 degrees. The weight-bearing line percentage shifted to a point 69 % lateral from the medial edge of the tibial plateau. 3) The JLCA and MJS significantly increased immediately after releasing the distal attachment of the sMCL during surgery (7.5 degrees and 12.8 mm). However, there were no significant differences in the JLCA and MJS between pre-operative (0.9 degrees and 6.7 mm) and one-year post-operative evaluations (0.6 degrees and 6.2 mm).

**Discussion:** The present study clearly showed that the valgus instability immediately after releasing the sMCL was significantly greater than before surgery. However, there was no significantly differences in the valgus instability between the 2 periods: before MOWHTO and one year after. These results indicated that the complete release of the distal attachment of the sMCL did not cause the postoperative valgus instability. We consider that this procedure is necessary to avoid not only an increase in medial joint pressure but also neurovascular injury by inserting a protector to the posterior tibia during surgery. However, long-term follow-up evaluations are needed to confirm the superiority found in the present study.

**Conclusion:** The complete release of the sMCL did not cause the postoperative valgus instability one year after MOWHTO procedure.

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#### B0489

##### Staged anatomical reconstruction of MCL using Achilles allograft, a modification to Marx's technique

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**Background:** Medial collateral ligament (MCL) is the primary stabilizer of the knee that provides resistance against valgus deforming forces. Superficial MCL is the largest structure of the medial part of the knee. It originates from 3.2 mm proximal and 4.8 mm posterior to the medial epicondyle at the center of knee motion on the medial femoral epicondyle of the femur. According to LaPrade and Brantigan, it has proximal and distal attachments on the tibia.

Most patients who sustain MCL injuries regain their activity level with nonoperative treatment, but in some severe cases, especially those with multiple ligament injuries, and those with isolated symptomatic chronic MCL laxity, may require operative treatment. There are several techniques to reconstruct the MCL. Some surgeons use semitendinosus autograft with preservation of the tibial insertion, while some use allografts. Double-bundle reconstruction is another technique, which in comparison to single-bundle reconstruction is relatively complex.

Marx et al. described the latest technique for reconstruction of MCL. They used Achilles tendon allografts and reconstructed the MCL at the same time as the cruciates. They secured the allograft by fixing the bone block attached to the allograft into the tibia using a metallic screw and washer. They used tendoachilles allograft with a calcaneal bone block to promote bone-to-bone healing on the femur. Their technique required small incisions. They eliminated the need for extensive exposure and the risk of donor site morbidity with autografts.

While good results have been generated using the Marx technique, some issues have been observed with the technique. For instance, the allografts don't stay in contact with the tibial bone proximal to the allograft's attachment during surgery, as the allograft is fixed only to the superficial MCL distal attachment site. Also, patients have had complaints from the metallic hardware underneath the skin in the proximal and medial parts of their leg. Another issue has been the loss of ROM in some patients, potentially due to reconstruction of the MCL and other ligaments at the same time. The aim of this study was to modify this technique by using anchor sutures instead of metallic hardware and to fix the graft on proximal of tibia.

**Material:** We enrolled 11 patients and repaired their ligaments according to our technique after obtaining consent.

**Methods:** In order to address the abovementioned issues, we have implemented a modification to the Marx technique. We used Achilles tendon allograft without a bone block attached to it. We fixed the allograft on the proximal and distal attachment footprints of the superficial MCL and used 3 suture anchors for that purpose, 2 sutures on the distal attachment footprint and one on the proximal. Also for preventing loss of knee ROM we reconstructed MCL and other ligaments in 2 separate stages. At the last follow up we evaluated the range of knee motion, knee ligament laxity and functional outcome scores, subjective International Knee Documentation Committee [IKDC] and Lysholm score. Follow up range was from 12 to 27 months.

**Results:** Knee motion was maintained in all cases. Two cases demonstrated 1+ valgus instability at 30 degree of knee flexion. Both were treated for combined MCL and PCL tear, the rest were completely stable. Average IKDC-subjective score was  $93 \pm 4$  and average Lysholm score was  $92 \pm 3$ . All patients were completely satisfied and returned to their previous level of activity.

**Discussion:** In the modified Marx technique, we reconstructed the superficial MCL closer to its anatomical construct by attaching the allograft on the proximal and distal footprints of the superficial MCL. This resulted in better adhesion of allograft onto the bone, kept the allograft in complete contact with the tibial bone and completely restored the knee stability. By not using metallic hardware in the proximal medial side of the leg, patients didn't have any complaints and the need for second surgery to remove the hardware was avoided. Also reconstructing the ligaments in 2 stages helped to better preserve the knee motion.

**Conclusions:** Staged MCL reconstruction with modified Marx technique have good short term results.

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#### B0491

##### Clinical outcome of a novel fixation system for open-wedge high tibial osteotomy: Comparison with tomofix

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**Background:** We have developed a novel fixation system (TriS Medial HTO Plate System; Olympus Terumo Biomaterials, Japan) for medial open-wedge high tibial osteotomy (OWHTO). The purpose of this study was to compare implant position and clinical outcome of the TriS and TomoFix (DepuySynthes, Switzerland) plates in OWHTO.

**Methods:** 46 patients (48 knees) who underwent OWHTO with a locking plate were enrolled in this study. Inclusion criteria involved patients who had medial osteoarthritis or spontaneous osteonecrosis of the knee. There were 30 women and 16 men with a mean age of 61 (51–68) years at the time of surgery. In the first 33 knees, the TomoFix was fixed to the tibia between 2010 and 2013 (Group F). In the remaining 15 knees, the TriS was fixed between 2014 and 2015 (Group S). In surgical procedure, we performed a biplanar osteotomy of the tibia. Beta-TCP spacer was implanted in the opening space. Then, a locking plate was implanted onto the tibia. All patients underwent clinical, radiological, and CT examinations before surgery and at 12 months after surgery. Concerning CT evaluation, a posterior reference line (PL) was drawn tangent to the posterior contour of the medial and lateral cortex on the axial view of the proximal tibia. The anteroposterior length of the proximal tibia (AP1) and the distance between the anterior edge of the tibia to the center of the proximal plate (AP2) were measured perpendicular to the PL. The plate position was defined with the %AP2/AP1. For each proximal-posterior screw, the screw angle was defined as the angle between the screw axis and the PL on the axial view of the tibia. The distance from the proximal-posterior screw axis to the center of the popliteal artery was measured perpendicular to the proximal-posterior screw axis.

**Results:** There was no significant difference in the background of the 2 groups. Postoperatively, the knee score significantly improved in each group. Concerning the post-operative knee alignment and clinical outcome, there was no statistical difference in each parameter between the 2 groups. CT examination showed that there was a significant difference ( $p=0.01$ ) in the plate position between Groups S (28%) and F (17%). The screw angle was significantly lower ( $p=0.02$ ) in Group S (18°) than in Group F (27°). The distance from the screw to the popliteal artery was significantly shorter ( $p=0.01$ ) in Group F (14mm) than in Group S (19mm).

**Discussion:** In both plate systems, the medial knee pain had resolved in all cases. The TriS plate was posteriorly fixed at the proximal tibia. The TriS screw was also inserted more parallel to the posterior cortex of the tibia. Previous studies reported that application of the plate in a more posterior position provides greater stability. The use of the TriS plate system provides better stability with its optimal placement and rigid fixation. The position of the proximal screw affects not only the stability of the osteotomy site but also safety during surgery.

**Conclusion:** This study demonstrates that the TriS plate produces superior stability and safety for bony fixation in medial open-wedge HTO procedures.

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