

Reconstruction of the Medial Patello-Femoral Ligament



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In 1957 Kaplan, in an article discussing knee stabilizers, described on the region of the medial aspect, a transversal reinforcement of the patella toward the tendon of the gastrocnemius medial head. This has been regarded as the first reference in the literature of medial patelofemoral ligament (MPFL).

Warren and Marshall's 1979 classic work, in which they described the three anatomic layers of the antero-medial region of the knee, was the first to describe and name the MPFL and its location in the second layer, between the medial epicondyle and the patella

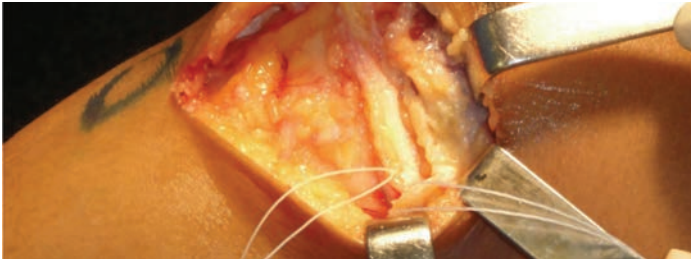
After its anatomic description, studies carried out on specimens showed that the MPFL is responsible for 50–60% of the resistance against patellar lateralization, allowing its rupture to be accepted as the essential lesion of the lateral luxation of the patella.

Despite this biomechanical importance, the valorization of MPFL reconstruction is relatively recent, having occurred in the last two decades, mainly. In spite of the great variety of techniques described for its reconstruction, with different sources of graft and fixing methods, evidence that shows good clinical results of this surgical procedure has been gathered, with a very low instability relapse rate.



In this article, we shall discuss some points which have been considered controversial when it comes to MPFL reconstruction surgery. We will do it taking current evidence into consideration.

Firstly, it's necessary to discuss the anatomy of the region. The femoral origin of the ligament has already been described in the adductor tubercle, at the fore portion of the medial epicondyle, at the posterior portion of the medial epicondyle distal to the adductor tubercle, at the medial and proximal epicondyle itself and posterior to the epicondyle, immediately distal to the adductor tubercle. The variation of these descriptions shows that the femoral origin of this ligament is not a clearly identifiable structure, with the convergence of several anatomic structures, making its individualization a difficult task. Our team, based on both the literature and our own studies, agrees with Nomura et al, that the femoral origin of the MPFL is located between the medial epicondyle and the adductor tubercle. This point is also consistent with what was described in radiographies by Schottle et al, in 2007. With the objective of making MPFL reconstruction more reproducible, they carried out a study in which a metallic marker was placed in the femoral insertion of MPFL, and side radiography was produced afterwards. The average point can be reproduced by positioning the femoral center of the MPFL insertion 1 mm prior to the distal projection of the posterior femoral cortical line, 2,5 mm distal to the posterior origin of the femoral condyles and proximal to the level of the posterior point of Blumensaat line. A study that may also be mentioned is the one by Stephen et al in 2012 about MPFL, finding as the most isometric point, and thus the most recommended for the reconstruction, the same point between the medial epicondyle and the adductor tubercle. Servien et al published a critical analysis of the positioning of its points of femoral fixation. They found 65% (using RNM to confirm the localization) to 69% (using radiographies) of well positioned tunnels, showing the difficulty to obtain good positioning of the tunnels during surgery. They, therefore, suggest a routine of radiographic checking of the tunnel as often as possible.



Another important concern is the consequence of a positioning mistake when applying a graft during the MPFL reconstruction. It is known that small mistakes of 5 mm from the ideal position or the tensioning of the graft $> 2N$, have led to the increase of the articulate forces in the medial patellar facet, increasing the risk of pain and the degeneration of the patellar cartilage. So, during the MPFL reconstruction, the surgeon must never over tension the graft. It must be positioned without loosening and fixed in the anatomic position. The graft only becomes tense with the lateralization of the patella. Mistakes in the positioning of the graft on the proximal-distal axis generate much more anisometry than mistakes in the anterior-posterior axis. The changes of the patellar insertion exert a minor effect on the MPFL isometry.

However, where exactly in the knee must the graft be tensioned? It is known for sure that this ligament does not present an isometric behavior, showing itself to be more tense between 0° and 60° of flexion, relaxing with more intense flexion. Once more the literature is conflicting. It is possible to find fixations recommended between 30° and 45° , 45° and 60° , and 60° and 90° of flexion. A recent study analyzed in vivo the change in length of the MPFL from its total extension to 120° of flexion through RNM. The results showed a minimal diminution in the MPFL length until 60° , and a significant diminution from 60° . In addition, when analyzing fiber orientation, they concluded that MPFL is tenser around 60° of flexion. This angle is also introduced by our team, based on findings in the study by Sadigursky et al in 2012.

Another point to be observed is the choice of the graft fixation method. The resistance to the MPFL traction and of some ways of mending and reconstruction were studied by Mounthey et al. The resistance found in the experiment was 208N in the full MPFL, 37N with the isolated suture (Kessler), 142N with anchors associated to the sutures, 126N with tendon grafts fixed in a blind tunnel and 195N with tendon grafts fixed in a bone tunnel going through the femur up to the lateral cortical. The series registered in the literature include the most varied fixations, all of which presenting satisfying results. Considering the native MPFL resistance around 200N, the graft choice should be a personal choice of the surgeon, since the commonly used grafts present satisfactory resistance. It is possible to find, in the literature, series using synthetic grafts, part of the adductor tendon, semitendinosus, gracilis, part of the quadriceps tendon, part of the patellar tendon and allograft, all presenting favorable results. Therefore, the only recommendation based on evidence that is possible to make about the graft and its fixation is that isolated suture must be avoided. Our choice is the use of the medial third of the patellar tendon as described by Camanho et al. We consider this technique easy to apply and a low cost one as well.

After the fixation of the MPFL graft, there is discussion concerning its dynamization through a solidarization with the vastus medialis obliquus. Several anatomic studies have described the close relation between these two structures, with real connection fibers between them. Moreover, several clinical studies describe its use in series of cases with good results. As a consequence, our team always recommends this solidarization.

To sum up, it is important to find in the literature the evidence of the effectiveness of the surgery. The first systematic review of the results of MPFL reconstruction was published in 2007 by Smith et al. The review included 8 papers with the total of 186 MPFL reconstructions. Despite the favorable clinical and radiographic results, the critical analysis revealed methodological problems in the available published material, including small samples, lack of control for confusion variables, absence of data concerning rehabilitation, works limited to case series, varied surgical techniques and limited statistical analysis. It was not possible to reach a consensus about the choice of graft, positioning, tensioning or between static or dynamic reconstruction. In 2010, two more systematic reviews were published, one by Buckens and Saris and the other by Fisher et al, with conclusions which were similar to the ones in the study by Smith et al.

Even if the surgery is performed in the ideal way, it is not known for sure what its effect will be on the biomechanics of this articulation, mainly when it comes to patients with multiple anatomic variations (trochlea and patellar dysplasia and height) as it is frequent in this population. The literature is still poor in terms of objective criteria to provide the correction of these factors, which must always be taken into account. Only the medialization of the anterior tibial tuberosity on knees with TT-TG measured over 20 mm is more established. The studies on the results of MPFL reconstruction were limited to describing the clinical aspects, with the incidence of pain, functional improvement and the occurrence of luxation relapse. The dynamic biomechanical evaluation of this articulation is very difficult, since the available exams for its study are static (radiography, CT and MRI). Studies of better methodological quality are still necessary, since for the treatment of chronic patellar instability the current level of evidence for MPFL reconstruction is "C". Only for acute luxation there is level "A" evidence for the effectiveness of this surgery.

