Medial Patellofemoral Ligament Reconstruction: A Comprehensive Review

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It has been suggested that in the majority of patellar dislocation cases, the medial patellofemoral ligament (MPFL) is disrupted with a high recurrence rate especially in female patients. Although MPFL tear is not the primary cause of instability, MPFL reconstruction is effective for stabilizing the knee and may alone prevent lateral patellar dislocation. There is limited but growing evidence that MPFL reconstruction for patellofemoral instability leads to excellent functional outcomes. Growing awareness of the biomechanical contribution of the MPFL has led to an upsurge in the publication of techniques and trials dealing with reconstructive techniques, warranting a review that includes the most recent evidence. The aim of this article was to review and summarize the recent literatures concerning MPFL reconstruction and provide a comprehensive review of previous studies ranging from basic science to current surgical techniques and results.

Keywords: Knee, Patellar dislocation, Medial patellofemoral ligament, Reconstruction

Introduction

Acute patellar dislocation is primarily an injury of active young patients of both sexes, with a higher recurrence rate in female patients. The overall recurrence rate after primary patellar dislocation approaches 40%. Patients who have a primary patellar dislocation have a 17% recurrence rate, and patients who sustain repeated patellofemoral joint dislocation have a 49% recurrence rate.

There is growing interest in the soft-tissue structure that helps stabilize the patella. The medial patellofemoral ligament (MPFL) deficiency was reported to be 50% to 96% in those who had experienced traumatic patellar dislocation during open surgical exploration. According to Amis et al., a rupture of this structure always occurs in lateral patellar dislocation because the MPFL can undergo a maximum elongation of 20%–30% (range, 18 to 20 mm); this is far less than the patellar width, which often exceeds 40 mm. The MPFL is often damaged during patellar subluxation or dislocation, and accordingly, over the last decade, several authors have recommended repair or reconstruction of the MPFL to reduce the high incidence of recurrent dislocation, and many different MPFL surgical reconstruction or repair techniques have been described in the literatures. The aim of this article was to review recent literatures and provide a comprehensive review of anatomy, biomechanics, surgical techniques, radiologic anatomy, and clinical results.

Anatomy

In 1957, Kaplan first described the MPFL as the transverse reinforcement between the base of the patella and the tendon of the medial head of the gastrocnemius. Warren and Marshall’s description of the three anatomic layers of the anteromedial 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.

The average length of the MPFL is 56.9±4.69 mm (range, 46.0 to 75.0 mm), the mid-point width is 17.8±4.4 mm (range, 8.0...
to 30.0 mm), the width at the femoral insertion is 12.7±2.6 mm (range, 6.0 to 28.8 mm)\(^8\), and the thickness is 0.44±0.19 mm\(^9\). Lee et al.\(^{10}\) reported on MPFL anatomical measurements in Koreans: the width at the patellar attachment was 14.2 mm (range, 10 to 15 mm), the width at the femoral insertion was 11.5 mm (range, 10 to 12.3 mm), the average length of the upper border was 53.2 mm (range, 47.7 to 59.3 mm) and that at the lower border was 55.4 mm (range, 51.0 to 59.7 mm), and the thickness was 1.7 mm (range, 1.1 to 3.0 mm) on the patellar side and 1.1 mm (range, 0.6 to 1.6 mm) on the femoral side.

The patellar attachment occupies 2/3 of the proximal patella in 56.9% of cases, the proximal half in 41.2%, the distal end in 1.3%, and extends across the entire patella in 1.3%\(^{10}\).

The MPFL extends into the secondary layers below the deep fascia and superficial to the joint capsule along with the superficial band of the medial collateral ligament. Towards the femoral attachment, the MPFL passes beyond the limit of the joint capsule and then overlays the peristeme of the femoral condyle\(^7\). The patellar attachment is usually wider than the femoral attachment and is at the most prominent medial edge of the patella\(^8\).

The femoral attachment is located at 61%±4% of the anteroposterior length from the anterior edge of the femoral condyle. The center of the anterior edge of the femoral attachment of the MPFL is, on average, 9.5 mm proximally and 5.0 mm posteriorly from the center of the medial femoral epicondyle\(^9\). The femoral attachment has been spread by decussating fibers that are attached to both the adductor tubercle and to the superficial fibers of the medial collateral ligament with more direct attachment to the epicondyle\(^9\).

The proximal insertion of the MPFL extends to the quadriceps tendon (Fig. 1). The patellar end of the MPFL passes deep to the distal vastus medialis obliquus (VMO), which overlays the MPFL at the patellar attachment and also attaches to the proximal part of the medial border of the patella\(^6\). The contact surface between VMO and MPFL has been reported as 20.3±6.0 mm\(^9\), 25.7±6.0 mm, and 22 mm (range, 18.8 to 24 mm)\(^{10}\). There is a close relationship between the ligament and aponeurosis of the vastus intermedius and a loose connection with the VMO. AT: center of the adductor tubercle, L: center of the anterior edge of the femoral attachment of the MPFL, ME: center of the medial femoral epicondyle.

Histology of the MPFL is not entirely clear, but macroscopically it resembles a tendon; however, from both anatomical and biomechanical viewpoints, it is undoubtedly a ligament\(^8\).

**Biomechanics**

The patella is positioned within a soft-tissue sleeve extending from the anterior iliac spines of the pelvis and proximal femur to the tibial tubercle. Over the last 30° of knee extension, the patella lies outside the bony limits of the femoral trochlea, becoming more dependent on soft-tissue constraints\(^{11}\).

The MPFL provides approximately 60% of the total medial restraining force against lateral patellar displacement, whereas the medial patellomeniscal ligament, medial retinaculum, and medial patellotibial ligament contribute 13%, 3%, and 3%, respectively, at 20° of knee flexion\(^{11}\). MPFL experiences maximal loads at full knee extension or during early flexion as quadriceps femoris neuromuscular activation pulls the patella toward the femoral troc-