



Simple Cost-Effective Reinsertion of Avulsed Medial Patellofemoral Ligament in Acute Patellar Dislocation

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Abstract: The medial patellofemoral ligament (MPFL) is the main restraining force against lateral patellar displacement in the first 20° of flexion and is disrupted after patellar subluxation or dislocation. Management of acute patellar dislocations is controversial, and many clinicians opt for conservative treatment in the acute phase. However, a traumatic rupture of the MPFL warrants surgical attention. Several considerations must be made by surgeons attempting reinsertion of the MPFL, including the choice of implant and timing of surgery, to restore the anatomy and biomechanics of the patellofemoral joint. Our aim is to achieve robust reinsertion of the MPFL restoring the anatomy and biomechanics of the patellofemoral joint using a simple, reproducible, and economical technique. We present MPFL reinsertion to the medial border of the patella in an acute patellar dislocation with a braided No. 2 ultrahigh-molecular-weight polyethylene suture (No. 2 Ultrabraid; Smith & Nephew, Memphis, TN) that is passed through 3 transverse parallel tunnels and tied over a bone bridge on the lateral border of the patella. This technique is simple with no implanted hardware, does not have the risk of donor-site morbidity of MPFL reconstruction, and can be performed in skeletally immature patients without growth plate concerns.

The medial patellofemoral ligament (MPFL) is the main restraining force against lateral patellar displacement in the first 20° of flexion and is often disrupted after patellar subluxation or dislocation.^{1,2} The patellofemoral joint is stabilized by static and dynamic structures. The static stabilizers include the MPFL, which prevents lateral subluxation of the patella. The dynamic stabilizers are muscular components around the knee such as the vastus medialis obliquus (VMO) muscle fibers that are attached to the

upper two-thirds part of the medial aspect of the patella, along with the MPFL.³

Classically, the 3-layer concept described by Warren and Marshall,⁴ identifies the MPFL in layer II, deep to the deep fascia or crural fascia (layer I) and superficial to the capsule (layer III). Anatomic studies have described the MPFL to course from the medial patellar margin to the posteromedial capsule and have found the deep fibers of the MPFL to be continuous with the posteromedial capsule and anchored to the bone just distal to the adductor tubercle.^{5,6}

Nonoperative treatment of an acute patellar dislocation is associated with a high recurrence rate, impaired knee function^{7,8} that may be related to altered biomechanics and patellofemoral joint contact pressure, and patellofemoral osteoarthritis at long-term follow-up.^{9,10} If one is to advocate initial surgical management to stabilize the patella, sufficient evidence should exist that the patient's outcome can be improved with surgical intervention. Currently, there is no firm evidence that the natural history of a primary patellar dislocation is improved by acute surgical intervention in the absence of a torn MPFL. Surgical stabilization of the patella is not recommended after an initial dislocation event. After a second dislocation event, a much higher risk of redislocation exists (49%) and surgical intervention may be considered.¹¹

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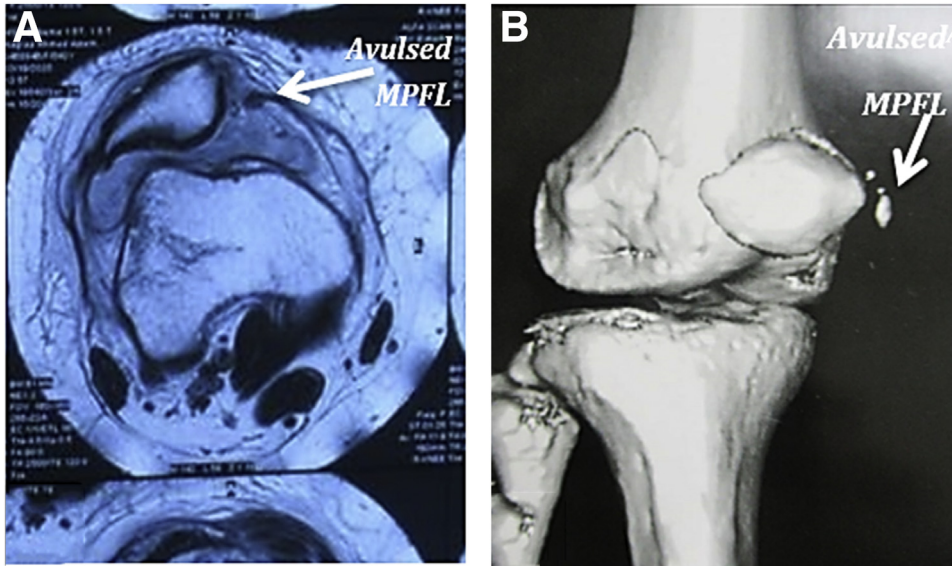


Fig 1. Right knee. (A) T2-weighted magnetic resonance image: axial cut. (B) On computed tomography, the coronal cut shows an avulsed fragment from the medial border of the patella, which is retracted medially, with the avulsed medial patellofemoral ligament (MPFL).

Patients with traumatic dislocations commonly have tearing of the MPFL that leads to loss of static medial patellar stabilizers and thus may require surgical reinsertion or reconstruction of the MPFL for restoration of the anatomy and biomechanics of the patellofemoral joint. Several studies have shown that the MPFL is always ruptured or avulsed in cases of acute dislocation—mostly on the patellar side. With restoration of the medial stabilizers, it is sometimes important to perform a lateral release in patients with tight lateral structures and a positive patellar tilt finding on examination.

According to the variable anatomy of the MPFL and functional outcomes, several techniques have been described in the literature for ligament repair or reconstruction using different femoral and patellar fixation techniques and different grafts (autograft,

allograft, and synthetic graft).³⁻¹² These techniques have disadvantages including the cost of implants; hardware irritation, which may later require removal; donor-site morbidity if autograft is used; antigenicity when using allograft; and risk of disease transmission.

Lateral release in the treatment of lateral patellar instability has fallen out of favor and is reserved for cases with lateral patellar tilt. It carries the risk of medial instability or medial over-tightening and overload if performed before medial reconstruction and plication. If performed, caution should be exercised.

This article presents our technique for performing lateral release and presents some pearls and pitfalls. We describe, with video illustration, MPFL reinsertion to the medial border of the patella in an acute patellar dislocation without implant insertion.

Fig 2. A vertical incision is made at the medial border of the patella, starting at the distal border of the vastus medialis obliquus and ending at the inferior pole of the patella, to identify the avulsed medial patellofemoral ligament (MPFL) from the patella.

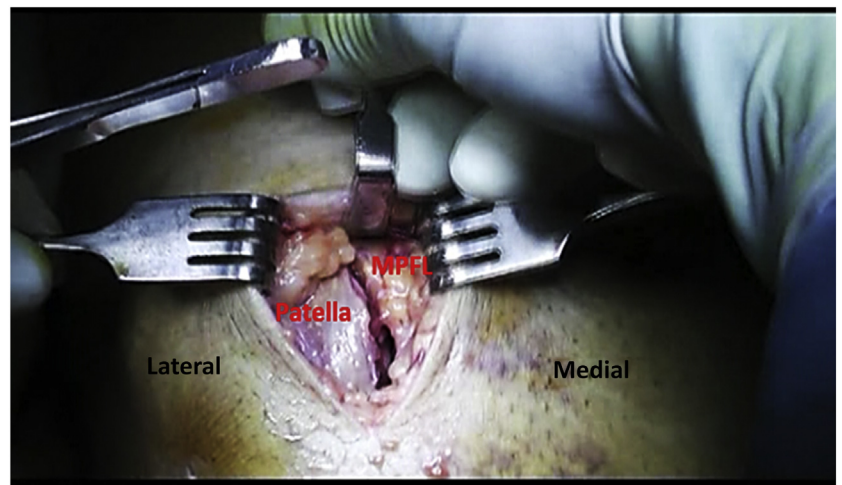
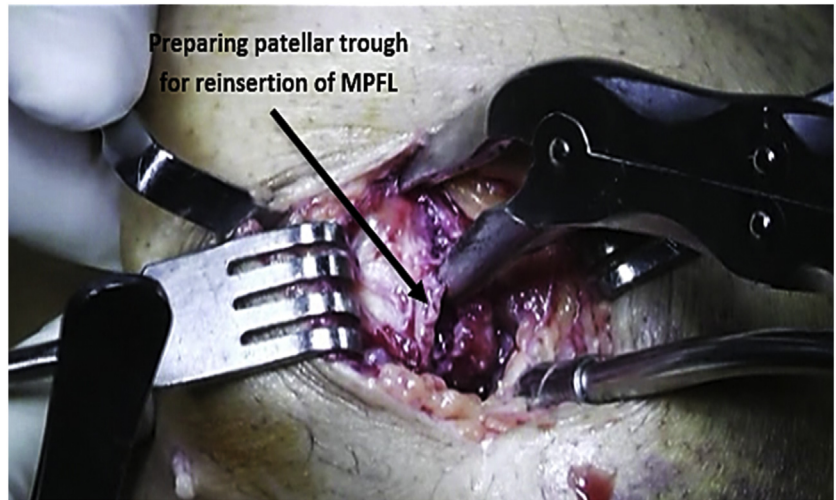


Fig 3. The medial border of the patella is rasped at the junction of the proximal and medial thirds of the patella to prepare the patellar insertion of the medial patellofemoral ligament (MPFL).



Surgical Technique

The patient is assessed clinically and radiologically using plain radiographs in the anteroposterior and lateral views, as well as magnetic resonance imaging (MRI) and computed tomography scans. The diagnosis is mainly established through the history and the MRI and computed tomography findings. A traumatic rupture is identified on the axial cuts of the MRI scan, best seen on T2-weighted images. The avulsed fragment is seen on MRI, and knee aspiration of a tense hematoma is performed in the clinic if surgical management will be delayed for any reason (Fig 1).

Informed written consent is obtained from all patients. All patients are operated on in the supine position under general anesthesia with tourniquet control. Before tourniquet inflation, an examination under anesthesia is performed, documenting patellar instability and a positive

J sign, with a comparison to the normal contralateral knee.

Diagnostic knee arthroscopy is performed through standard anterolateral and anteromedial portals. We then perform evacuation of the hematoma, noting the trochlear morphology, any loose bodies or osteochondral fragments, the ligaments' status, meniscal lesions, and the ability to displace the patella laterally. Any pathology is dealt with accordingly.

Surgical Approach and MPFL Identification

A medial parapatellar approach is used. A vertical medial parapatellar skin incision is made, starting at the level of the proximal pole of the patella and extending to the level of the distal pole of the patella. The patella is exposed together with the medial portion of the quadriceps tendon, the vastus medialis, and the medial

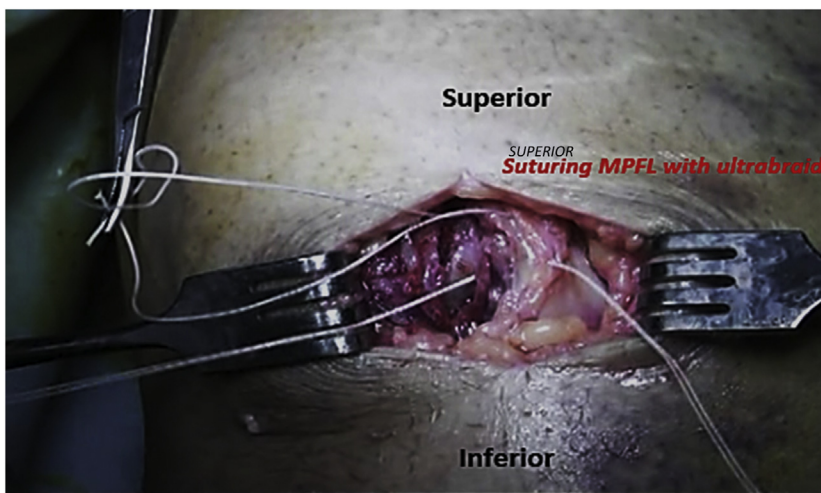


Fig 4. The medial patellofemoral ligament (MPFL) is prepared by whip stitching with 3 braided No. 2 ultrahigh-molecular-weight polyethylene sutures (No. 2 Ultrabraid) extending 1 cm from the edge of the patella; this allows medial plication of the MPFL.

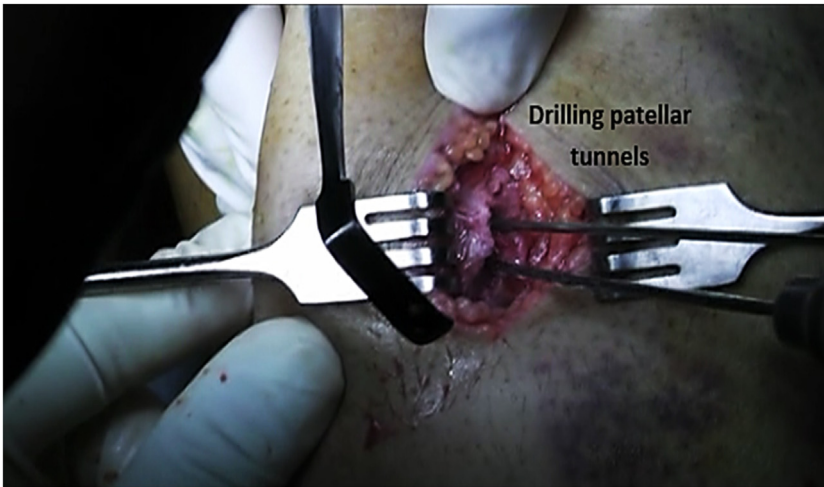


Fig 5. Three patellar tunnels are drilled from medial to lateral in a parallel fashion using a 2.5-mm drill bit.

retinaculum. A vertical incision is made at the medial border of the patella, starting at the distal border of the VMO and ending at the inferior pole of the patella. Now, we can identify the avulsed MPFL from the patella (Fig 2, Video 1).

MPFL Reinsertion, Tensioning, and Fixation

The medial border of the patella is rasped at the junction of the proximal and medial thirds of the patella to prepare the patellar insertion of the MPFL (Fig 3). The MPFL is prepared by whip stitching with 3 braided No. 2 ultrahigh-molecular-weight polyethylene sutures (e.g. No. 2 Ultrabraid; Smith & Nephew, Memphis, TN) extending 1 cm from the edge of the patella; this allows medial plication of the MPFL (Fig 4). Three patellar tunnels are drilled from medial to lateral in a parallel fashion using a 2.5-mm drill bit (Fig 5). Great caution should be exercised to avoid breaching the lateral-facet

cartilage. The 2 limbs of each Ultrabraid suture are then passed through the transverse patellar tunnels (Fig 6) and tied laterally over a bone bridge (Video 1).

Lateral Retinacular Lengthening

Lateral retinacular lengthening is performed if the tilt test result is positive on examination under anesthesia. Under direct visualization, partial-thickness cuts in the lateral retinaculum are created, analogous to the “pie-crusting” medial collateral ligament–lengthening technique, at multiple locations throughout the lateral retinaculum. The patellar tilt test is again performed. If the test result remains positive, the lateral retinacular pie-crusting technique is repeated until the tilt test result is negative. No full-thickness lateral releases are performed in any patient.

Patellar mobility is assessed; with the knee flexed to 30°, the patella is forced laterally, checking for adequate

Fig 6. The 2 limbs of each Ultrabraid suture are passed through the transverse patellar tunnels and tied laterally over a bone bridge.

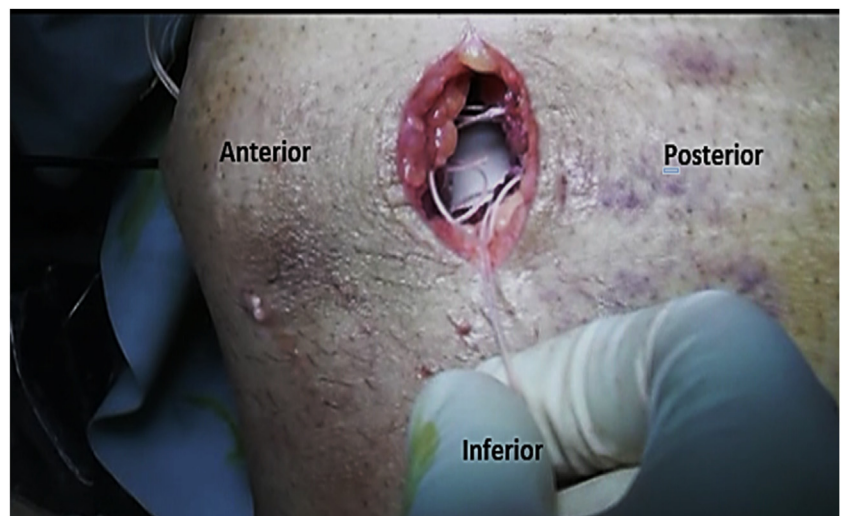


Table 1. Advantages and Disadvantages of Avulsed MPFL Reinsertion

Reinsertion
Advantages
The technique is simple, with no hardware being used.
The technique does not have the donor-site morbidity of an MPFL reconstruction.
The technique can be performed in children without growth plate concerns.
Rehabilitation is facilitated.
Disadvantages
Separating layers II and III and identifying the MPFL cord structure may be difficult when the approach is performed for the first time or in extremely acute cases with extensive disruption of the medial structures.
The technique can be performed in acute cases only.
There is a risk of patellar or lateral-facet fractures.

MPFL, medial patellofemoral ligament.

MPFL tension, as well as patellar stability, and verifying that adequate knee flexion is achieved. This ensures that the patella is not overconstrained, a cause of ongoing pain and restriction in function.

Rehabilitation

Postoperatively, the knee is put in a knee immobilizer for 6 weeks. Full weight bearing is allowed as tolerated with the immobilizer and aid of 2 crutches for balance and support. Gentle passive range of motion is started immediately, along with static quadriceps exercises and gluteus activation exercises. The immobilizer is discarded after 6 weeks, and active quadriceps contraction is initiated with a focus on VMO strengthening. Sports activities are initiated at 3 to 4 months after surgery and according to muscular and functional recovery.

Discussion

There is growing interest in performing acute reinsertion or reconstruction of the MPFL among many surgeons. Complications of MPFL reconstruction techniques include recurrent dislocation, subluxation, patellar fracture, improper graft placement, positive apprehension test results, and over-tightening leading to stiffness and pain^{13,14} (Tables 1 and 2).

Sillanpaa et al.¹⁵ recently published a randomized prospective study on stabilizing surgery for primary traumatic patellar dislocations. Forty patients were randomized to initial surgical stabilization versus conservative care (including those who underwent arthroscopy for osteochondral fragments), with an average follow-up period of 7 years. The operative group received either a reefing or Roux-Goldthwait procedure, based on surgeon preference. The redislocation rate was 27% in the conservative group versus 0% in the surgical stabilization group. Despite fewer redislocations in the operative group, Kujala subjective outcome scores and activity levels were the same for both groups.¹⁵

Two other randomized controlled trials comparing nonoperative treatment and repair of the MPFL in acute patellar dislocations were recently published. In one of these studies, Christiansen et al.¹⁶ randomized 80 patients with primary patellar dislocations, at a mean of 50 days after injury, to either bracing or surgery. The surgical technique in all patients was an anchor-based reattachment to the adductor tubercle. The redislocation rates were 17% and 20% in the operative and conservative groups, respectively, which were not significantly different given the size of the study's sample. This study assumed that MPFL rupture occurred at the adductor tubercle; it did not attempt to identify the location of MPFL rupture in the operative group.¹⁶ A similar study performed by Camanho et al.¹⁷ did address the location of MPFL rupture in acute dislocators. The MPFL was repaired in 8 acute dislocators at the site of injury as determined by MRI, and no recurrences were found, in contrast to a 50% recurrence rate in the nonoperative group at a mean follow-up of 40.4 months. Of the 17 patients in the operative group, 10 had an MPFL injury at the patella and 7, at the femur.⁴

The aforementioned results suggest that surgical repair of a discrete lesion in the MPFL in acute dislocations may reduce the risk of recurrence. These results have not been duplicated, but they do represent the first published Level I evidence indicating that immediate surgical repair may improve outcomes after a first-time patellar dislocation.

Hopper et al.¹⁸ described MPFL repair with suture tape to reinforce the ligament and act as a secondary stabilizer. This promotes natural healing by protecting the ligament during the healing phase, as well as allowing early mobilization. Furthermore, it does not require the use of a graft, thereby avoiding the unnecessary morbidity of graft harvest. In addition, protection of the ligament is achieved by suture tape augmentation. However, complications of this technique include excess tensioning, which can lead to irritation and may result in quadriceps inhibition, synthetic augmentation, and medial epicondyle tenderness; moreover, it is important to establish anatomic accuracy.¹⁸

Camp et al.¹⁹ described the outcomes of 27 patients who underwent MPFL repair with either suture anchors or a medial reefing technique with a minimum 2-year

Table 2. Pearls and Pitfalls of Avulsed MPFL Reinsertion

Pearls
The suture tape should be tensioned during the first 20°-30° of flexion.
Lateral release is performed by pie crusting to prevent an excessive release.
Pie crusting prevents cutting through of the sutures.
Pitfalls
Excessive tension will result in postoperative pain and restriction in function.

MPFL, medial patellofemoral ligament.

follow-up. In 28% of patients, a recurrent lateral patellar dislocation occurred, with 5 of these patients requiring further surgery. The authors found that a significant number of recurrences were due to nonanatomic anchor placement. (It is important that the insertion point of the anchor be at the midpoint of the insertion of the MPFL at the anteromedial angle, where the superior surface meets the medial wall.) Another disadvantage of their technique is the high cost of using anchors.¹⁹

Dragoo et al.,²⁰ using an algorithm-based approach, at a mean follow-up of 51 months, recently compared 24 patients who underwent either MPFL reconstruction or MPFL repair. They found no differences between the 2 groups, and only 1 patient in the MPFL repair group had a further dislocation; a benefit of MPFL repair over MPFL reconstruction is that there is no donor-site morbidity.²⁰

Several authors have described a simple surgical technique of hamstring graft fixation to the insertion site of the MPFL at the patella with transosseous sutures. However, bone tunnels at the patella act as stress risers and may lead to an intraoperative or postoperative fracture.²¹⁻²⁴ An up to 90% strength reduction in bone has been reported depending on the geometry and size of the bony defects.²⁵ Moreover, exact anatomic placement of the tunnels at the insertion site of the MPFL may be difficult. Alternatively, resorbable suture anchors may be used to fixate the hamstring tendon graft.^{26,27} However, in a cadaveric study, Mountney et al.²⁸ showed that suture anchors failed at a mean load of 142 N, being significantly weaker than the native MPFL (208 N).

In conclusion, in our technique, the tunnels drilled are smaller, with less risk of patellar fracture. Moreover, we do not use the hamstrings, which may be needed for later anterior cruciate ligament treatment.

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