Technical Note

Medial Patellofemoral Ligament Reconstruction Using Gracilis Tendon Graft and "All Suture" Knotless Anchors for Patellar Fixation

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Abstract: Patellar dislocation is a frequent sports-related knee injury. The primary restraint to lateral translation of patella is medial patellofemoral ligament. Several treatments for patella dislocation have been described in the literature. The purpose of this Technical Note is to describe the surgical technique for medial patellofemoral ligament reconstruction using gracilis tendon and 2 knotless soft anchors, avoiding patella tunneling.

Patellar dislocation is a relatively frequent injury in young athletes and can lead to high risk of functional impairment, recurrent instability, and progressive osteochondral damage with recurring dislocations.[1] The medial patellofemoral ligament (MPFL) has been recognized in previous cadaveric and biomechanical studies to be the major restraint for lateral translation and subsequent instability within the within the first 30° of knee flexion.[2] It has been reported that all patients with acute patellar dislocation have increased MPFL laxity and demonstrated structural damage during surgical exploration in 50% to 96% of cases.[3]

Several treatments have been described for patella dislocation such as MPFL reconstruction, MPFL repair, soft-tissue procedures, and nonoperative treatment.[4] A recent systematic review compared the results of nonoperative treatment, MPFL repair, and MPFL reconstruction and found that MPFL reconstruction decreases the rate of recurrent dislocation compared with repair and nonoperative treatment.[5] Most of the existing techniques use hamstring tendons as the graft of choice. Other authors, however, have proposed the use of other tendons such as quadriceps.[6] Regardless of graft choice, many of the surgical techniques presented over the years for MPFL reconstruction involve bone tunnels and anchors for graft fixation in the patella. However, some complications have been reported in the literature, the main of which are patellar fractures through the bone tunnels, loss of flexion, postoperative instability, and implant breakage.[7]

The purpose of this Technical Note is to describe a surgical technique using gracilis tendon (GT) for MPFL reconstruction fixed on the femoral side with an interference screw and on patellar side with 2 knotless soft anchors (FiberTtak; Arthrex, Naples, FL) that do not need for bone tunneling, thus minimizing bone loss (Video 1).

Surgical Technique (With Video Illustration)

General Preparation

All patients provide informed consent before undergoing to MPFL reconstruction. Patients receive standard preoperative antibiotics, regional anesthesia, and are placed in a supine position with the knee free to move from full extension to 90° of flexion. A tourniquet is

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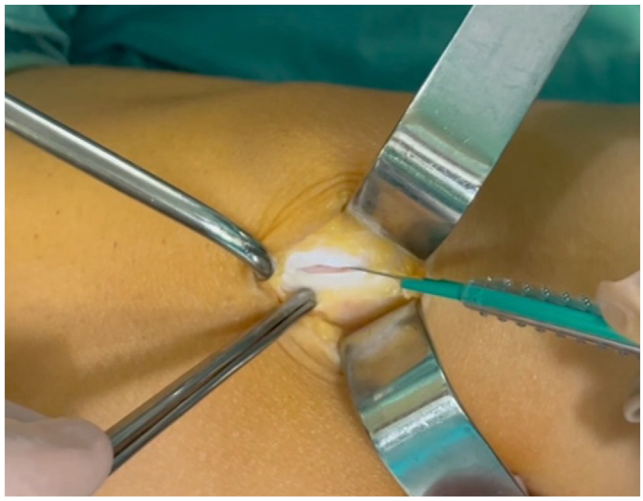

Fig 1. Medial view, supine position of a left knee, the medial retinaculum is identified and dissected, with exposure of the periosteum of the medial patella.

applied to the proximal thigh on the affected side and the leg is prepared and draped in a sterile fashion.

The contralateral limb is lowered slightly to allow the C-arm to execute anteroposterior and true lateral radiographs. A clinical examination under anesthesia is performed on both knees to allow comparison with the contralateral side. Lateral instability is evaluated in full extension and at 30° and 90° of knee flexion.

GT Harvest

Ipsilateral GT autograft is the preferred graft of choice. Surgical landmarks for the knee are marked as the femoral medial epicondyle, the medial border of the patella, and the pes anserinus. The GT is harvested through a 3-cm oblique incision centered over the pes anserinus. The distal end of the GT is prepared with a Bunnell-type suture with VICRYL 2.0 (Ethicon, Somerville, NJ). The GT is harvested with a closed stripper, and another Bunnell-type suture is performed at the proximal end. The tendon is then wrapped in gauze-soaked vancomycin and stored for later use.[8]

MPFL Reconstruction

A 3-cm skin incision is made over the medial border of the patella with the knee in extension and dissection is performed until the medial reticulum is achieved. The medial retinaculum is then incised in line with the skin incision 2 to 3 mm from the superomedial edge of the patella to avoid incision of the joint capsule (Fig 1).

Exposure of the medial border of the patella and debridement is then performed to prepare the bony surface for the placement of soft anchors. After preparing the anchor site, using the appropriate guide and the 1.8-mm drill, the 2 knotless soft anchors are placed at two-thirds of the proximal patella. During drilling, it is important to avoid damaging the articular surface or anterior cortex of the patella. The distance between the 2 anchors is approximately 0.8 to 1 cm (Fig 2). Later, a parallel skin incision is performed at the medial epicondyle with the knee flexed to 90° (Fig 3). Blunt dissection is performed using curved arterial forceps to create a tunnel from the medial border of the patella to the medial epicondyle below the second layer of the medial retinaculum without damaging the synovial layer (soft-tissue tunnel) (Fig 4).

The graft is then placed and fixed by a simple suture conversion creating tensionable knotless repair, to restore the anatomical attachment of the native MPFL on the patella (Fig 5). These anchors feature tensionable knotless technology. Finally, the pullout resistance is evaluated.

With the help of the radiograph, the femoral insertion point of the MPFL, the Schöttle point, is identified. It's located between adductor tubercle and medial femoral epicondyle (Fig 6A). Under control, a passing K-wire (2.4 mm with closed eyelet) medial to lateral is placed transversely to the distal femur (Fig 6B).

A 6-mm cannulated drill is inserted over the passing pin to the medial cortex to create a femoral half tunnel of about 40 to 50 mm, sufficient to contain the free ends of the graft. The #2 VICRYL suture is then inserted into the closed eyelet of the K-wire and the graft is passed through the femoral socket. The graft is tensioned according to the patellar tracking and excursion at all degrees of knee flexion–extension.

The graft is then fixed to the femoral insertion point using an absorbable interference screw (7 × 28; Arthrex) with the knee flexed approximately at 20°. Using the free wire from the 2 anchors, a repair of the medial retinaculum layers is performed with slight advancement of the vastus medialis oblique. Lateral release, which may be necessary in case of overtensioning the graft, is not performed in this Technical Note. Surgical technique, pearls, and pitfalls are shown in Table 1.

Fig 2. Medial view, supine position of a left knee. The distance (dotted line) between the anchors is approximately 0.8 to 1 cm.

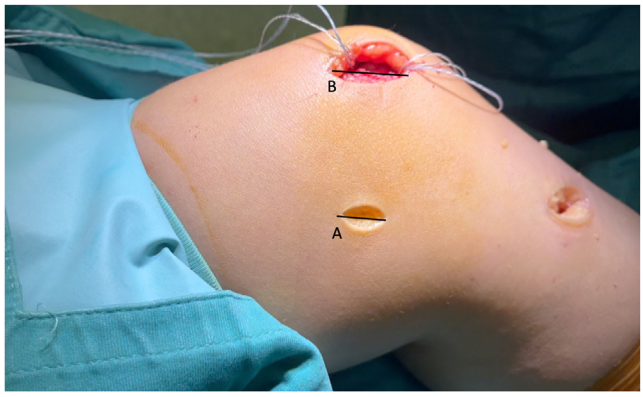

Fig 3. Medial view, knee flexed to 90°. The second skin incision (line A) at the medial epicondyle is drawn parallel to the first patellar incision line (B).

Postoperative Rehabilitation Protocol

A short knee brace with a C-shaped pad medializing the patella is applied postoperatively for the first 4 weeks. The brace is locked in extension for the first 2 weeks and then unlocked for the remaining 2 weeks. Weight-bearing with brace and crutches is allowed, as tolerated on postoperative day 1. The first week is focused on pain and swelling control, with ice and anti-inflammatory drugs. Range of motion exercises are started 2 weeks after surgery with the goal to achieve and maintain full extension and progressively recover flexion. Full range of motion is obtained by a maximum of 6 weeks after surgery. The brace is removed at four weeks after surgery, and the patient starts a supervised strengthening program. Sports activities are allowed 6 months postoperatively.

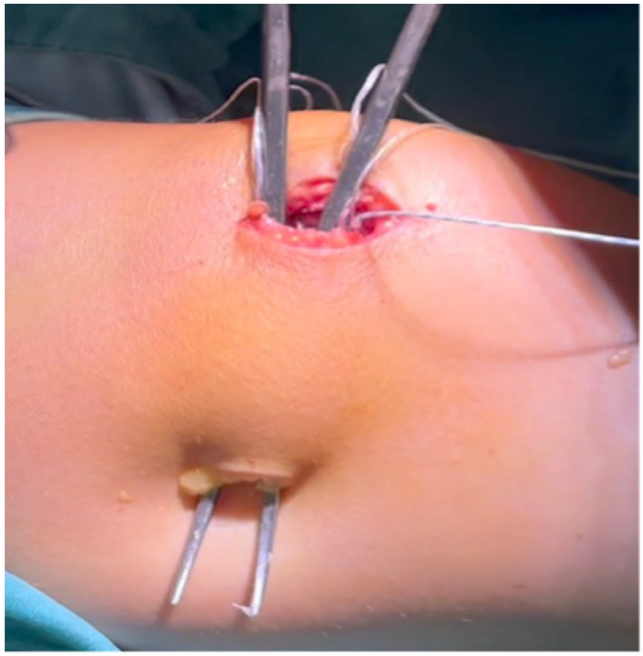

Fig 4. Medial view, supine position of a left knee, knee in full extension, soft-tissue tunnel placed between 2 to 3 layers of the medial retinaculum, avoid to violate joint capsule.

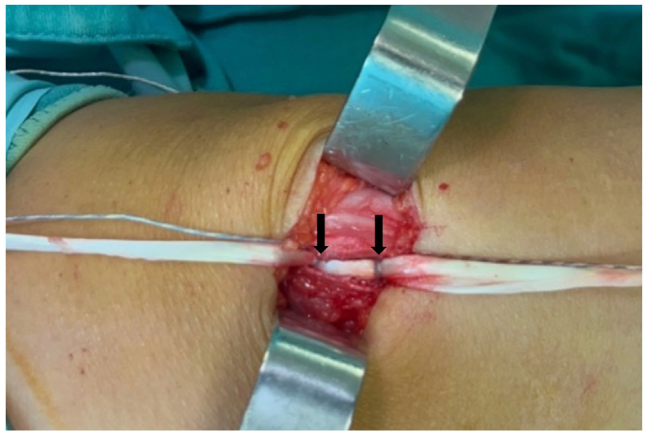

Fig 5. Medial view, supine position of a left knee. (A) Fixation of the graft using knotless all-suture anchors (black arrow), to restore the anatomical attachment of the native medial patellofemoral ligament on the patella.

Discussion

A surgical technique based on MPFL reconstruction using GT and 2 knotless soft anchors is described in this Technical Note. The rationale behind this technique is minimization of bone removal, thus reducing the risk of iatrogenic patella fractures, preservation of good bone stock in case of revision, and recovery of normal knee function. MPFL reconstruction has been proven to be a reliable technique in patellofemoral instability with low rates of recurrent instability, excellent functional outcomes, and low postoperative morbidity.[9] Several techniques are currently reported for MPFL reconstruction. Although there are many recent studies focusing on the optimal MPFL reconstruction techniques, there is currently no evidence on the best graft type and femoral/patellar fixation device, with similar results reported with each technique.[10] The most typical grafts used are hamstrings, allografts, and, more recently, synthetic grafts.[10] MPFL reconstruction with allograft has been shown to be a viable alternative with similar results to reconstruction with autograft in terms of revision rates, persistent instability, and clinical outcomes, as shown in a recent systematic review and also in another study on adolescents at a minimum follow-up of 2 years.[11,12]

Concerning the timing of MPFL reconstruction, the management of patients at the first episode of dislocation remains unclear and controversial.[13] Historically, the first patella dislocation is treated conservatively, although it has been seen that 44% of patients experience recurrent dislocations resulting in subsequent chondral damage.[14,15] Risk factors for recurrent dislocation after the first episode include young age, open

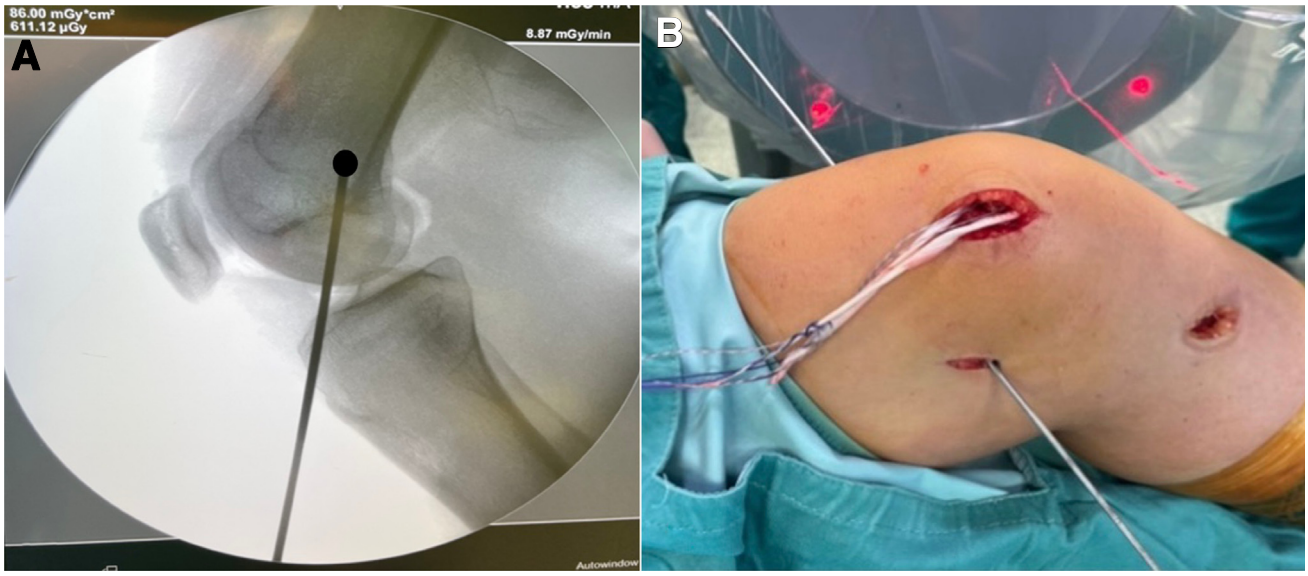

Fig 6. Medial view, knee flexed approximately to 90°. (A) The Schöttle point (circle) is identified on a lateral radiograph. Radiographically, originates slightly anterior to the posterior femoral cortex reference line and immediately posterior to the most posterior aspect of the Blumensaat line. (B) The closed eyelet K-wire is shuttled medial to lateral transversely to the distal femur.

physes, trochlear dysplasia, high distance between tibial tuberosity and trochlear groove, and patella alta.[16] A recent international survey has shown that in patients treated conservatively, most surgeons allow for weight-bearing to tolerance and place a knee brace for the first 4 weeks, with full extension range of motion at 30° in the first 2 weeks and up to 60° for other 2 weeks. The surgical indication is reserved for patients in the second and third decade of life who play in contact sports and have risk factors such as trochlea dysplasia type C and D according to Dejour classification[17] and patella alta.[13] Although the gold standard for first-episode patellar dislocation still remains conservative treatment, a study by Cohen et al.[14] showed that MPFL reconstruction after the first episode showed a recurrence rate of 7% compared with the 30% present in the conservatively treated group with a greater Kujala score.

The main complications of MPFL reconstruction techniques reported in the literature are patella fracture due to transosseous tunnels, damage to the articular surface, and implant failure.[18] For this reason, several studies have evaluated patellar fixation devices of an MPFL graft. A study by Russ et al.[19] compared fixation with classic solid suture anchors versus interference screws. They found that the interference screw group exhibited greater stiffness and ultimate load at failure than the solid anchor group. However, the solid anchors provided adequate fixation strength with load resistance comparable with that of the native MPFL. In contrast, another study compared classical solid anchors with soft anchors showing that there were no statistically significant biomechanical differences.[18] Furthermore, by evaluating the tensile strength of the native MPFL, they found how fixation with all-soft suture anchors exceeded the ultimate load until failure of the native MPFL made these anchors suitable for fixation.[18,20]

Concerning the transosseous patellar tunnel creation for MPFL reconstruction, it was observed that tunnels that breached the anterior cortex showed a greater probability of fracture but no statistically significant difference in tensile load to failure compared with the

Table 1. Pearls and Pitfalls

Pearls	Pitfalls
• Two all-suture anchors are placed at two-thirds of the proximal patella • Soft-tissue tunnel placed between 2 to 3 layers of the medial retinaculum, avoid to violate joint capsule. • Postoperatively, medializing patella brace placement to avoid excessive tension and stress on the graft • The graft should be wrapped in gauze soaked in vancomycin to reduce the risk of infection	• Avoid violation of articular surface or anterior cortex of patella during placed the ASAs • Avoid to overtensioning the graft that can lead to patellar maltracking

ASAs, All-suture anchors.

Table 2. Advantages/Disadvantages of This Technique

Advantages	Disadvantages
• Staple effect of anchors, lower stress, and greater graft hold	• Donor-site morbidity (gracilis tendon)
• Ability to recreate native insertion of MPFL on patellar side, regardless of patellar size	• Costs
• Low risk to patellar fracture and violation of articular surface (no patella tunneling)	
• Short surgical incisions, minimally invasive surgery and respect for cosmetics	

MPFL, medial patellofemoral ligament.

native patella.[21] Bone tunnel formation can also cause a loss of graft length.[21]

Matassi et al.[22] considered 58 young athletic patients after isolated MPFL reconstruction with a minimum follow-up of 8 months. At 8 months, 31 patients (53.4%) returned to sport at preoperative levels, and 23 (39.6%) participated in sports at lower levels. Four patients (6.9%) did not return to any sport because of decreased knee function. There were no cases of recurrence. Several recent studies have shown reduced rates of recurrence and complications with MPFL reconstruction.[23]

Shatrov et al.[24] demonstrated effective long-term treatment for isolated MPFL reconstruction with GT, with low recurrence rates and radiographic evidence of PFA more than 10 years in one-third of patients.

In addition, it is also important to discern whether the arthritis is a consequence of patellar instability or is related to the surgical procedure. Recent studies have shown that recurrent femoral instability can lead to cartilage degeneration.[15,25]

This surgical technique has several advantages. The use of all-suture anchors allows a strong and direct fixation of the graft on medial side of patella. Moreover, the use of all-suture anchors reduces the risk of patellar fracture and joint surface violation. Finally, the graft loop is fixed on the patellar side trying to better recreate the anatomical insertion of the native MPFL, whereas the 2 free ends are fixed on the femoral side ensuring adequate tension (Table 2).

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