Technical Note

Combined Medial Quadriceps Tendon-Femoral Ligament and Medial Patellofemoral Ligament Reconstruction for Revision Patellofemoral Soft-Tissue Stabilization

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Abstract: Patients with recurrent patellofemoral instability in whom prior medial patellofemoral ligament (MPFL) reconstruction fails present unique challenges for revision soft-tissue stabilization owing to scar tissue formation, limited patellar bone stock for anchor placement, and increased risk of patellar fracture. We describe a technique for revision patellofemoral soft-tissue stabilization that combines MPFL and medial quadriceps tendon–femoral ligament reconstruction techniques through combined fixation to the patella with 1 suture anchor and soft-tissue fixation to the quadriceps tendon. The proposed technique maximizes restoration of resistance to lateral translation by attempting to recreate the native MPFL attachment and minimizes patellar fracture risk in the setting of poor bone stock through the use of a single 1.8-mm all-suture suture anchor rather than bone tunnels or multiple anchor placement for bony fixation.

Patellofemoral instability is a common cause of knee pain and disability in young, active patients. In cases of recurrent instability, surgical management may include both bony procedures (e.g., tibial tubercle osteotomy) and soft-tissue procedures (e.g., medial patellofemoral ligament [MPFL] reconstruction). In the primary setting, soft-tissue stabilization procedures are often successful, with low complication and recurrent dislocation rates, high return-to-sport rates, and significant improvement between preoperative and postoperative patient-reported outcomes.[1]

For patients with persistent recurrent instability after soft-tissue stabilization, revision procedures present unique challenges, including scar tissue formation, limited patellar bone stock for anchor placement, and increased risk of patellar fracture. Recent anatomic studies describing medial patellar soft-tissue stabilizer anatomy have suggested that soft-tissue reconstruction beyond isolated revision MPFL reconstruction may be beneficial in improving outcomes.[2,3] Fulkerson and Edgar[4] described the medial quadriceps tendon–femoral ligament (MQTFL) as the medial retinacular fibers that insert anteriorly into the distal quadriceps tendon. As such, several studies have proposed an MQTFL reconstruction technique as an alternative to MPFL reconstruction, which eliminates the need for bony fixation by creating a soft-tissue attachment of the reconstruction graft to the quadriceps tendon. Subsequent studies have shown favorable short-term outcomes in the setting of primary patellofemoral soft-tissue stabilization.[4,5]

In this Technical Note, we describe a technique for revision patellofemoral soft-tissue stabilization that combines MPFL and MQTFL reconstruction techniques, with the goal of achieving bony fixation while minimizing patellar fracture risk in the setting of poor bone stock. This technique addresses the challenge of preexisting patellar tunnels or anchors present in the revision setting and maximizes restoration of resistance to lateral translation through combined fixation to the patella with 1 suture anchor and soft-tissue fixation to the quadriceps tendon.

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Surgical Technique

The patient is placed in the supine position with a tourniquet applied. A standard inferolateral arthroscopy portal is made, followed by an inferomedial instrument portal made under direct visualization. Diagnostic arthroscopy is performed for debridement of any concomitant cartilage lesions and removal of loose bodies. The limb is then exsanguinated with an elastic Esmarch bandage, and the tourniquet is inflated to 250 mm Hg. By use of a 4-cm medial parapatellar approach, the interval between the medial retinaculum and the capsule is identified. Electrocautery is used to remove soft tissue from the superior 50% of the medial patella. If present, prior suture or suture anchor material is identified and removed. One 1.8-mm Q-FIX anchor (Smith & Nephew, Memphis, TN) is placed in the medial patella at the junction of the proximal one-third and distal two-thirds of the patella (Fig 1). A longitudinal incision is then made in the quadriceps tendon at the junction of the medial and central one-third of the quadriceps tendon, approximately 1 cm proximal to the superior border of the patella. A semitendinosus allograft is marked at the midpoint. The graft is secured to the Q-FIX anchor and tied down with sutures from the anchor at the mark on the graft (Fig 2A). The proximal limb of the graft is then passed beneath the quadriceps tendon using a clamp, exiting from deep to superficial through the longitudinal split made in the quadriceps tendon (Fig 2 B and C). The graft is secured to the quadriceps tendon via 2 figure-of-8 No. 2 Orthocord sutures (DePuy Synthes, Johnson & Johnson, New Brunswick, NJ).

A 2-cm incision is made just posterior to the medial epicondyle. The sulcus between the adductor tubercle and the medial epicondyle is palpated, and a guide pin is placed. If required, prior hardware is removed to ensure the appropriate location of femoral graft fixation. The 2 free ends of the graft are tunneled down to the guide pin between the capsule and the retinaculum. Isometry of the graft is checked through a full range of motion. Fluoroscopy is used to confirm the placement of the guide pin, and a femoral tunnel measuring 35 mm in length is drilled with a 7-mm-diameter reamer (Fig 3). The 2 ends of the graft are prepared with FiberLoop suture tape (Arthrex, Naples, FL) and a TightRope device (Arthrex). The graft is then passed with a suture and secured into the femoral tunnel with the TightRope. The end point of the patella is examined at full extension and 30° of flexion, and the knee is taken through a complete range of motion. The wounds are then closed in layers in standard fashion (Video 1).

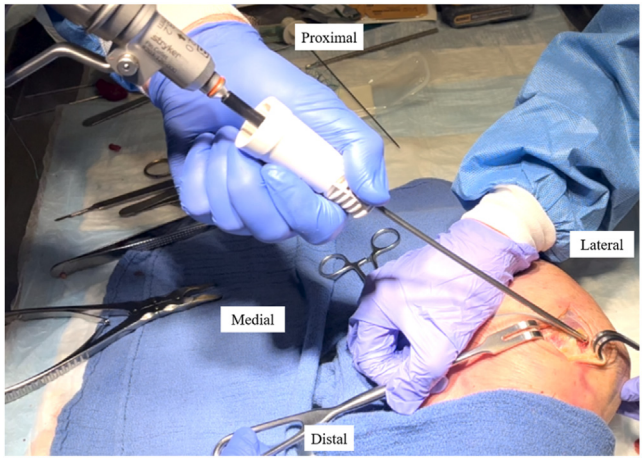

Fig 1. Left cadaveric knee in supine position. By use of a 4-cm medial parapatellar approach, one 1.8-mm Q-FIX anchor is placed in the medial patella at the junction of the proximal one-third and distal two-thirds of the patella.

Postoperative Care

The patient is placed in a locked hinged knee brace and taken to the recovery room. The patient is allowed immediate weight bearing as tolerated after surgery with the knee brace locked in full extension for ambulation until adequate quadriceps control is achieved. Immediately postoperatively, the patient may perform active and active-assisted range-of-motion exercises as tolerated, with the goal of achieving full extension to 90° of flexion at 2 weeks postoperatively. The use of crutches may be discontinued once the patient demonstrates appropriate quadriceps control and strength. After 6 weeks postoperatively, the patient may discontinue the use of the knee brace with the guidance of his or her physical therapist.

Discussion

Patients in whom prior MPFL reconstruction fails show varying degrees of patellar bone loss, either as a result of subsequent instability episodes or due to prior hardware. In these cases, using a combined bony and soft-tissue fixation strategy limits patellar fracture risk while providing excellent patellofemoral stability. In the described technique, several steps are taken to minimize the risk of iatrogenic patellar fracture, including the use of a 1.8-mm-caliber drill and the use of an all-suture suture anchor to minimize bone removal and stress riser formation in the patella.

Although MQTFL reconstruction in the revision stabilization setting eliminates the risk of iatrogenic patellar fracture by avoiding bony fixation altogether, we prefer to combine both bony and soft-tissue graft fixation. The use of 1 suture anchor over sole soft-tissue fixation to the quadriceps tendon more accurately reproduces the native MPFL attachment. Biomechanical studies have revealed that traditional MPFL reconstruction led to significantly less lateral translation than the Fulkerson MQTFL technique, with no significant difference between patellofemoral mean or peak contact pressures.[6,7] Fixation of the distal limb of the graft

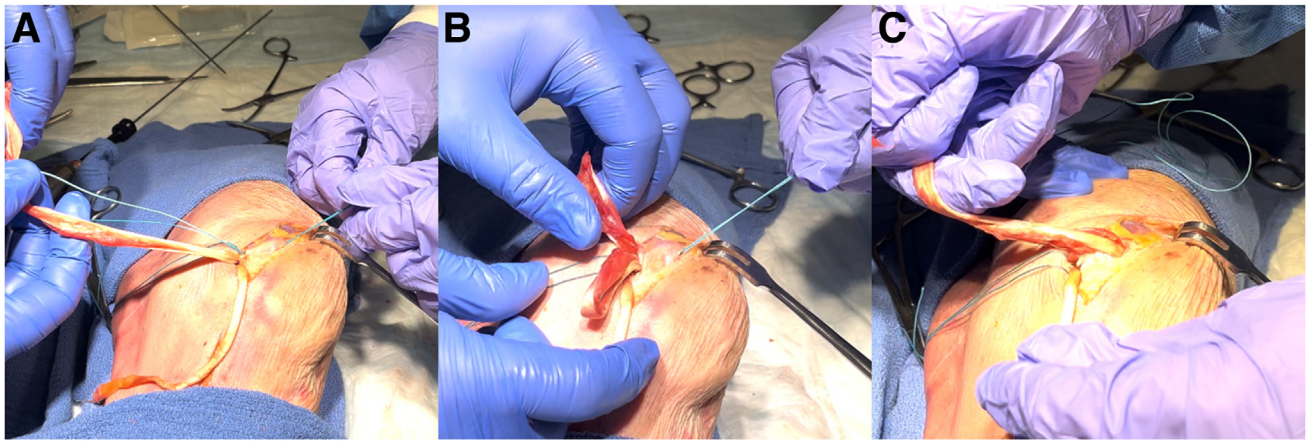

Fig 2. Left cadaveric knee in supine position. (A) A medial parapatellar approach is taken to make a longitudinal incision at the junction of the medial and central one-third of the quadriceps tendon, approximately 1 cm proximal to the superior border of the patella. (B, C) After the midpoint of the gracilis allograft is secured to the Q-FIX anchor with suture, the proximal limb of the graft is passed beneath the quadriceps tendon via the prior incision, exiting from deep to superficial.

to the medial patella attempts to re-create the native MPFL attachment and its associated force vector.

Several prior studies have described suturing the soft-tissue reconstruction to the medial patellar periosteum, which also avoids suture anchor bony fixation. This strategy has been shown to be effective in the primary stabilization setting, especially in young patients with a robust periosteal layer. However, in the revision setting, this periosteal layer may be replaced by scar tissue after primary stabilization procedures, thereby precluding robust periosteal fixation. As a result, we prefer to use all-suture anchor fixation as described to optimize bony healing. The described combined MQTFL and MPFL reconstruction with a single graft in patients with failed prior soft-tissue patellofemoral stabilization provides a versatile tool for restoring patellar stability while combining soft-tissue and bony fixation and preserving patellar bone stock (Tables 1 and 2).

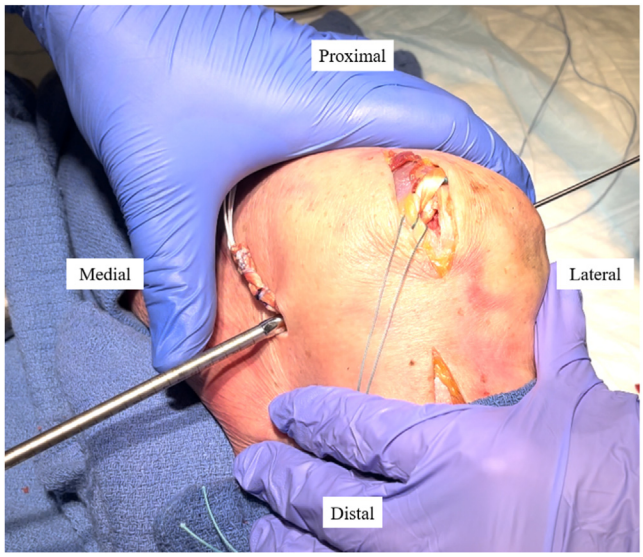

Fig 3. Left cadaveric knee in supine position. For femoral graft fixation of the semitendinosus allograft, a femoral tunnel is placed at the sulcus between the adductor tubercle and the medial epicondyle, measuring 35 mm in length, with a 7-mm-diameter reamer.

Disclosures

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: A.H.G. reports a consulting or advisory relationship with Vericel, Smith & Nephew, Organogenesis, and Bioventus; receives speaking and lecture fees from Vericel, Linvatec, and Pacira Pharmaceuticals; and owns equity or stocks in Smith & Nephew. S.M.S. reports a consulting or advisory relationship with Smith & Nephew, Vericel, and

Table 1. Pearls and Pitfalls

Pearls
The surgeon should ensure that the semitendinosus allograft is of good quality with a diameter > 5 mm.
Semitendinosus allograft should be used to avoid hamstring weakness.
The tendon length needs to be ≥22 cm to weave around the quadriceps tendon.
Pitfalls
The surgeon should avoid the prior suture anchor site on the patella.
The surgeon should remove loose bony fragments and/or avulsion fractures of the medial patella because these may obscure the medial border of the patella.
When tensioning the graft, the surgeon should ensure that the patella is centered in the trochlea with the knee in 30° of flexion.

Table 2. Advantages and Disadvantages

Advantages
The technique has a lower implant cost (1 anchor vs 2 anchors).
The native MPFL attachment on the proximal patella is more accurately reproduced (as opposed to isolated MQTFL reconstruction).
Suture anchor fixation in the patella versus sewing the graft to the periosteum allows for optimal bony healing.
Suture anchor fixation limits the fracture risk compared with bone tunnels.
Use of a 1.8-mm all-suture suture anchor limits stress riser formation.
Disadvantages
Combined MPFL-MQTFL reconstruction requires a slightly larger incision than isolated MPFL or MQTFL reconstruction.
The required graft may be slightly longer than that for standard MPFL reconstruction.
Combined MPFL-MQTFL reconstruction does not eliminate patellar fracture risk.

MPFL, medial patellofemoral ligament; MQTFL, medial quadriceps tendon–femoral ligament.

Miach Orthopaedics; owns equity or stocks in Smith & Nephew; receives speaking and lecture fees from Smith & Nephew, Vericel, and Miach Orthopaedics; and receives travel reimbursement from Smith & Nephew. All other authors (M.E.R., T.J.U.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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