



Quadriceps Tendon Attachment Technique for Medial Quadriceps Tendon-Femoral Ligament (MQTFL) Reconstruction in the Surgical Treatment of Recurrent Patella Dislocation

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Abstract: Medial quadriceps tendon–femoral ligament (MQTFL) reconstruction for prevention of recurrent patella dislocation is an alternative to medial patellofemoral ligament (MPFL) reconstruction. Because the reconstruction graft attaches to the quadriceps tendon, no patella drill hole is required, thereby eliminating iatrogenic fracture risk. The procedure remains anatomically accurate and early results are comparable to MPFL reconstruction for preventing patella dislocation. The MQTFL reconstruction graft is brought up under the vastus medialis obliquus distal to the patella apex, such that its orientation is directed toward the medial patellofemoral complex (MPFC) midpoint, also known as Tanaka’s point. The graft is then secured by looping it around the vastus medialis and rectus femoris tendons, after which optimal graft length is easily established by cycling the knee, after which it is sutured securely into the deep quadriceps tendon precisely at the anatomic midpoint of the MPFC. Anatomic reconstruction of the MQTFL—in which graft orientation is crucial—confers reliable patellofemoral joint stability in the surgical treatment of patients with recurrent patella dislocations.

Currently accepted medial patellofemoral ligament (MPFL) reconstruction techniques require transosseous patella drilling or unicortical bone sockets for suture anchor placement. These fixation methods create stress risers within the patella, leading to reported cases of iatrogenic patella fracture, a devastating postoperative complication, Bollier et al.¹ noted the

unforgiving nature of intraosseous fixation if MPFL graft placement is inaccurate.

Several authors have described a medial quadriceps tendon-femoral ligament component as part of the medial patellofemoral retinaculum.²⁻⁵ This distinct structure extends from the region just proximal to the MPFL at the anterior extent of the adductor tubercle and inserts anteriorly into the distal quadriceps vastus medialis tendon at the proximal patella and also above the patella into the vastus intermedius and rectus femoris components of the quadriceps tendon.^{6,7} The medial quadriceps tendon–femoral ligament (MQTFL), as well as the MPFL, provides a static connection between the medial femur and extensor mechanism of the anterior knee throughout flexion and extension.^{4,7,8}

An anatomically validated technique for patella stabilization via reconstruction of the MQTFL with bony fixation on the femur and soft-tissue fixation at the distal medial quadriceps insertion was first described in 2013.³ The purpose of this article is to emphasize the anatomic precision of this technique and to clearly delineate the quadriceps side attachment technique at

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the anatomic midpoint of the medial patellofemoral complex (MPFC).

Technique and Results

Surgical Technique

Proper graft orientation and attachment to the quadriceps tendon is illustrated in [Figure 1](#) and [Video 1](#). Various options exist for allograft or autograft with distinct methods of graft preparation and harvest if autograft is used, although the authors prefer the use of posterior tibialis allograft, which is typically procured at the inception of the case. The graft is subsequently whip-stitched with a braided no. 2 ultra-high-molecular-weight polyethylene suture (e.g., No. 2 Ultrabraid suture; Smith & Nephew, Memphis, TN). As previously described,⁹ the femoral attachment site is exposed by dissecting down to the medial surface of the

femur through a longitudinal incision in the region between the adductor tubercle and medial femoral epicondyle along the proximal extent of the adductor magnus tendon. The adductor tubercle may be identified by the insertion of the adductor magnus tendon proximally, with care to avoid the greater saphenous vein, saphenous nerve, and infrapatellar branch of the saphenous nerve as exposure is gained. As previously described, a guide pin may be placed at the desired site of femoral graft fixation at the distal pole of the adductor tubercle within the region that lies between the adductor tubercle and medial femoral epicondyle, then over-reamed with an 8-mm reamer without disruption of the anterodistal origin of the medial collateral ligament.⁹ The whip-stitched end of the grafted tendon is fixed using a 7-mm Tenolock anchor (Conmed, Tampa, FL) into the previously created 8-mm femoral socket.

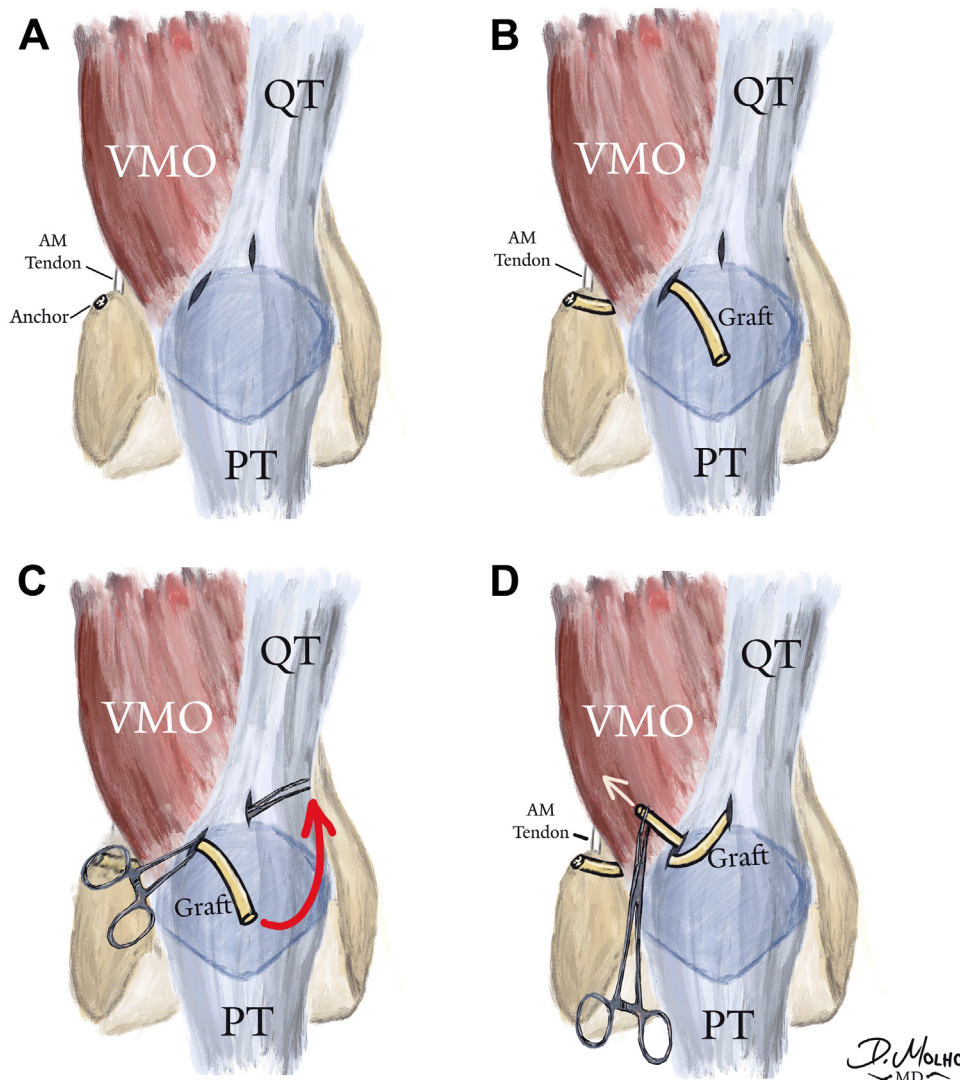
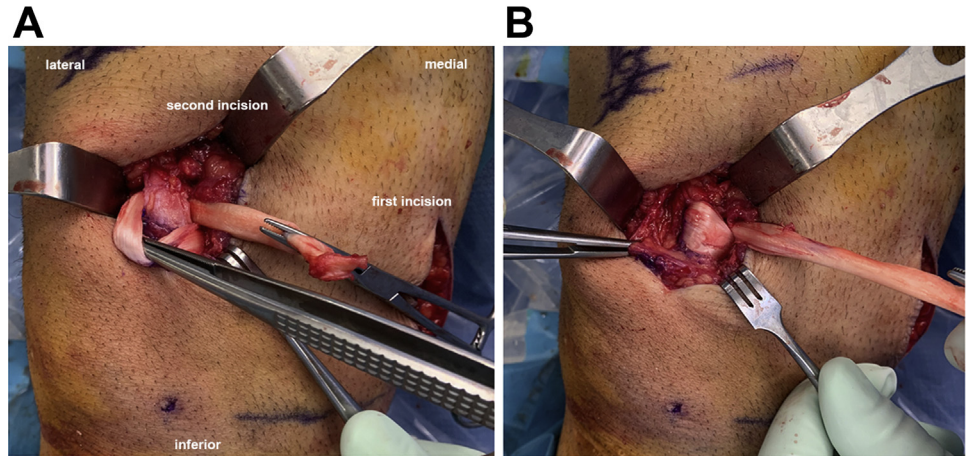


Fig 1. Illustrated sequence of anatomic medial quadriceps tendon–femoral ligament (MQTFL) graft orientation and positioning for optimal MQTFL reconstruction. (A) The graft is fixated anatomicly on the femoral side, preferably at the level of the distal adductor tubercle. (B) The graft is then brought under the vastus medialis oblique (VMO) muscle using a Kelly or Schnidt clamp. The proximal extent of this VMO incision should be no higher than the apex of the patella to assure that the graft is securely oriented to the MPFC midpoint, also known as Tanaka’s point. (C) A 1.5 cm longitudinal slit is created centrally in the quadriceps tendon, and a Schnidt clamp is used to create an opening connecting the deep aspect of the two incisions, leaving a deep slot through which to loop the graft around the quadriceps tendon fixation site. (D) The graft is then grasped sideways and passed using the Schnidt clamp around the quadriceps tendon fixation strut.

Fig 2. Intraoperative photos demonstrating the looping of the whip-stitched medial quadriceps tendon-femoral ligament (MQTFL) graft through 2 graft incision sites, the first in the region between the adductor tubercle and medial femoral epicondyle and the second just proximal to the superomedial aspect of the patella over the junction of the vastus medialis oblique and quadriceps tendon junction, (A) as the graft is passed around the quadriceps tendon fixation strut and (B) tensioned and brought out to length.



After anatomic fixation of the graft on the femoral side (Fig 1A) at the level of the distal adductor tubercle,⁹ the graft is brought under the vastus medialis oblique (VMO) muscle using a Kelly or Schnidt clamp, grasping the graft sideways near its tip to facilitate graft passage (Fig 1B). The short (1.5 cm) incision in the vastus medialis tendon is extremely important, as this establishes the level of the patellar graft attachment. The proximal extent of this VMO incision should be no higher than the apex of the patella to ensure that the graft is kept securely oriented to the MPFC midpoint (Tanaka's point). This orientation then allows patella stabilization integrating both the MPFL and MQTFL orientation components of the MPFC. Attachment is into the quadriceps tendon only (Fig 1C).

Once the graft has been brought under the VMO, all fat and fascia are thoroughly removed from the distal anterior quadriceps tendon to facilitate healing of the tendon graft, which will be brought across the distal medial anterior quadriceps tendon.

Next, a second 1.5 cm longitudinal incision is created centrally in the quadriceps tendon (Fig 1C). The quadriceps tendon is about 9 mm thick and 7 mm thick, so a 5 to 6 mm deep, partial-thickness tendon-splitting incision is sufficient for excellent fixation. This incision should be just medial to the apex of the patella with its distal base on the dorsal surface of the patella. Because of the slope of the proximal patella dorsum and continuity of the quadriceps over the patella, this incision is based below the proximal pole of the patella, again emphasizing that fixation of the MQTFL reconstruction graft is to the proximal patella, not above the patella.

Once the second quadriceps tendon incision is completed, a Schnidt clamp creates an opening connecting the deep aspects of the 2 incisions, leaving a deep slot through which to loop the graft around the 1 to 1.5 cm long \times 6 to 7 mm deep quadriceps tendon

fixation site at the anatomic midpoint of the medial patellofemoral complex.

To pass the graft, the Schnidt clamp is placed into the first slot so that its tip protrudes from the second, more central slot. The jaws of the clamp are used to spread the channel to allow for easy passage of the graft. The Schnidt clamp is then used to grasp the end of the graft sideways and bring it around the quadriceps tendon fixation strut (Fig 1D).

Tensioning the graft then becomes easier and more accurate, because the knee may then be cycled freely and the mechanics examined. Our preferred method of tensioning is to mark the graft with methylene blue and cycle it to remove crimp, after which it is brought "out to length" (Fig 2). This process obviates the risk of graft overtensioning by using the methylene blue to precisely determine the optimal graft length, at which point it is sutured down with 5 nonabsorbable no. 2 sutures, being

Table 1. Pearls/Pitfalls

Pearls	
Proximal end of the VMO incision should be no higher than the superior apex of the patella to maintain graft orientation to the MPFC midpoint (Tanaka's point)	
Attach the graft into only the quadriceps tendon	
Create central longitudinal incision in the quadriceps tendon medial to the apex of the patella, below the proximal pole of the patella	
Mark graft with methylene blue, cycle graft to remove crimping, and bring graft out to length prior to tensioning.	
Pitfalls	
Common mistake to fix the MQTFL graft above the patella rather than to the proximal patella. The graft should be fixed to the proximal aspect of the patella and no higher.	
Graft over-tensioning	
Failure to close incision in quadriceps tendon when determining graft length prior to fixation	

VMO, vastus medialis oblique; MPFC, medial patellofemoral complex; MQTFL, medial quadriceps tendon-femoral ligament.

Table 2. Advantages/Disadvantages

Advantages	
Lower risk of graft over-tensioning compared to conventional MPFL reconstruction techniques	
Greater adherence to anatomic orientation of native knee structures that confer patellofemoral joint stability	
Disadvantages	
Small risk of MPFC over-constraint remains	
Potential for violation of the suprapatellar joint capsule with exposure of the intertendinous plane in the medial quadriceps tendon	

MPFL, medial patellofemoral ligament; MPFC, medial patellofemoral complex.

sure to close the slots and fixate the tendon graft accurately to the quadriceps tendon, which is set at maximum length to avoid over-constraint. It is important to monitor patella tracking arthroscopically to avoid over-tensioning, as suggested by increased constraint with knee flexion. If graft tension is considered suboptimal at any point with excessive laxity or stiffness through the arc of knee flexion and extension, sutures should be removed and the graft retensioned (Table 1).

Rehabilitation

The patient is placed in a knee immobilizer after wound closure and dressing. We allow immediate range of motion and weightbearing with crutches for 6 weeks. Physical therapy will be full weightbearing, and patients may resume light daily activity as tolerated but should not return to sports for at least 4 months.

Discussion and Conclusions

MQTFL reconstruction for the surgical treatment of recurrent patella dislocation is a prudent alternative to traditional MPFL reconstruction, which typically relies on patella drill holes and fixation to patella bone. MQTFL reconstruction eliminates the risk of intraoperative or postoperative patella fracture and results compare favorably with those of MPFL reconstruction. Looping the graft around the distal quadriceps tendon below the patella apex and securing it with careful graft orientation to the medial patellofemoral complex midpoint yields reliable and safe results.^{10,11}

Anatomic reconstruction of the MQTFL confers the advantages of re-establishing anatomy with increased precision of graft tensioning with a lower, albeit not entirely obviated, risk of MPFC overtensioning compared to conventional MPFL reconstruction (Table 2). MQTFL reconstruction with the graft orientation and attachment technique described herein risks

violation of the suprapatellar joint capsule as the intertendinous plane in the medial quadriceps tendon is developed, although this issue has never been encountered by the authors over years of practice. Optimal results of MQTFL reconstruction depend on anatomic MQTFL graft attachment in the treatment of patients with recurrent patellar instability.

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