

# Medial Patellofemoral Ligament Reconstruction Using Achilles Tendon Allograft With Bone Block

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**Abstract:** Recurrent patellar instability is a common problem and often leads to a tear of the medial patellofemoral ligament. Multiple reconstruction techniques for the medial patellofemoral ligament (MPFL) exist. This Technical Note presents a technique for performing MPFL reconstruction using Achilles tendon allograft with a bone block. The advantages of this technique include (1) bone-to-bone healing in femoral tunnel; (2) docking the bone block in the femoral tunnel obviates the need for calculating graft and tunnel length; (3) fixing the femoral side before the patellar side allows graft tensioning under direct visualization and avoids over-constraint; (4) the fanned portion of the Achilles tendon allows broad-based MPFL footprint coverage on the medial patellar ridge; and (5) it avoids the need for bone tunnel drilling in the patella, reducing the risk to penetration of the drill holes into the articular cartilage surface as well as the risk for patellar fracture.

Patellar instability is a common problem in the young athletic population.<sup>1</sup> Many surgical procedures exist, including repair versus reconstruction of the medial patellofemoral ligament (MPFL), as well as patellar-realignment procedures to correct any bony morphological abnormalities such as a shallow trochlear, patella alta, and a lateralized tibial tubercle.<sup>2</sup>

Many surgical techniques exist for reconstruction of the MPFL, all with a high success rate.<sup>2</sup> However, although complications are infrequent, when they present, they can be devastating to an athlete's career and difficult for surgeons to solve.<sup>3-5</sup> The majority of complications result from drilling bone tunnels in the patella,<sup>3</sup> nonanatomic reconstruction,<sup>4</sup> and over-tensioning of the graft.<sup>5</sup>

This Technical Note describes a technique of MPFL reconstruction the authors have used for the past 5 years that uses an Achilles allograft with a bone block on the femoral side. Indications are the same as for any MPFL reconstruction and include recurrent patellar instability, absence of minimal articular cartilage pathology, skeletally mature, no evidence of severely abnormal anatomy such as patellar alta, shallow trochlear groove, increased tibial tubercle–trochlear groove distance, or increased Q angle. The use of allograft also makes it a great option for patients with connective-tissue disorders, such as Ehlers–Danlos syndrome and other hypermobility syndromes. Advantages of this technique are that the bone block on femoral side allows for bone-to-bone healing, there is no need to calculate the graft, and tunnel length. It avoids drilling holes in the patella, which avoids the creation of a stress riser and potential patella fracture. Lastly, it allows for easy graft tensioning under direct visualization to avoid overconstraint.

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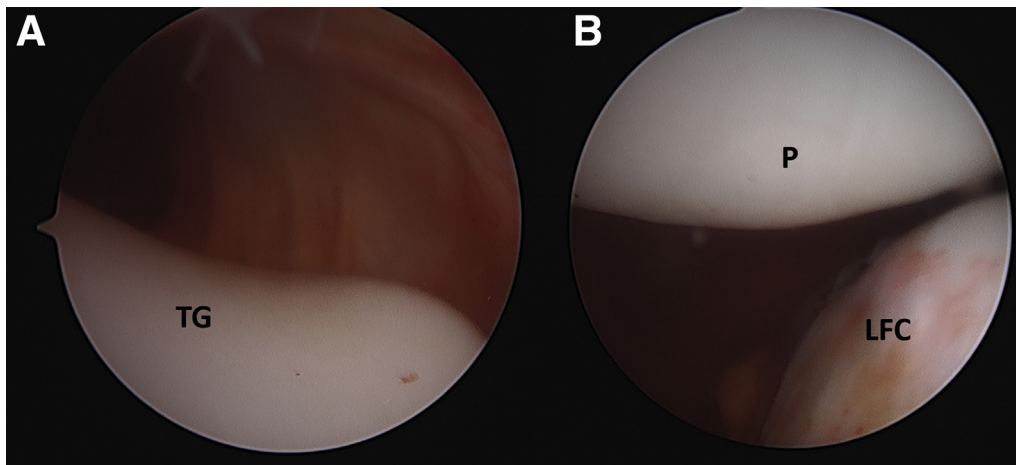
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## Surgical Technique

The technique is shown in [Video 1](#). The patient is positioned supine on the operating room table. General anesthesia is introduced. Examination under anesthesia is performed. A thigh tourniquet is placed, inflated to 275 mm Hg, and the extremity is prepped and draped in routine sterile fashion. A diagnostic arthroscopy using a standard anterolateral and anteromedial portal can be considered to inspect the joint and articular surfaces, as



**Fig 1.** Diagnostic arthroscopy of a right knee of a patient with recurrent patellar instability, viewing from the anterolateral portal. (A) Shallow trochlea is present. (B) The patella is laterally subluxated relative to the trochlea. (LFC, lateral femoral condyle; P, patella; TG, trochlear groove.)

well as trochlear morphology, patellar translation, and tilt (Fig 1).

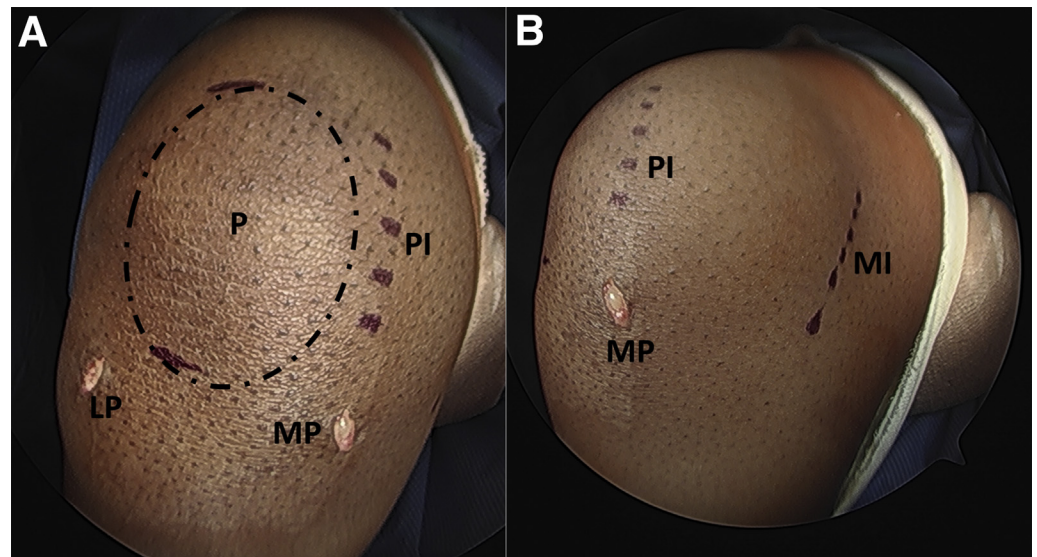
For the open portion, a 1-inch medially based incision is placed over the upper two-thirds of the patella, centered over the patellar insertion site of the MPFL. A second, similar-sized incision is made at the femoral attachment of the MPFL over the medial femoral condyle of the femur (Fig 2). By using both the anatomic landmarks of the adductor tubercle, medial epicondyle, as well as fluoroscopy of Schöttle point, the MPFL femoral origin is identified and a Beath pin is placed. This pin is directed proximally and anteriorly by 45 degrees to provide an intraosseous tunnel of about 70 mm in total depth. The pin is then overdrilled to a size 10 by 25 femoral tunnel.

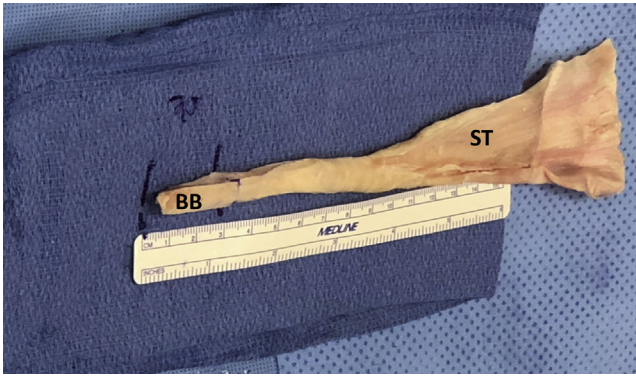
Next, the Achilles tendon allograft is prepared on the back table to a 10- by 25-mm bony plug and ensuring

about a 14- to 16-mm width flared soft-tissue portion (Fig 3). A 2-mm hole is placed in the bone block and a No. 2 FiberWire suture (Arthrex, Naples, FL) is placed through it. The Beath pin is used to pass the FiberWire suture through the femoral tunnel and dock the bone plug in the femoral tunnel. The bone block is then fixed with a 9- by 25-mm bioabsorbable interference screw (Stryker, Kalamazoo, MI; Fig 4).

The plane of the native MPFL is developed subcutaneously and extra-articularly between the 2 incisions. The soft-tissue portion of the graft is passed through this plane from the medial to the patellar incision (Fig 5). The upper two-thirds of the patella is exposed, and a rongeur is used to prepare the medial edge of the patella to have a healthy bleeding bony bed for healing. Next, 2 bioabsorbable SutureTac suture anchors loaded with SutureTape (Arthrex) are placed in the anatomic

**Fig 2.** (A) Anterior view and (B) medial view of a right knee depicting the location for the portals and incisions for this surgical technique. (LP, lateral portal; MI, medial-sided incision; MP, medial portal; P, patella; PI, patellar-sided incision.)





**Fig 3.** Picture of an Achilles allograft with a bone block showing a long graft length, the bone block used for the femoral side (BB), and the fanned soft-tissue end (ST) used on the patellar side.

insertion site of the native MPFL in the medial border of the patella. Next, with the knee between 25 and 45 degrees of flexion, the patella is positioned centrally within the trochlear groove. The Achilles allograft is reduced to the medial border of the patella. The sutures are passed in mattress fashion through the flared soft-tissue portion of the Achilles allograft and tied (Fig 6). Patellar stability is checked at full extension and the knee is ranged to ensure there is no overconstraint. After this is satisfactory, the excess allograft tissue can be excised. Repeat arthroscopy can be used to confirm central position of the patella within the trochlear groove.

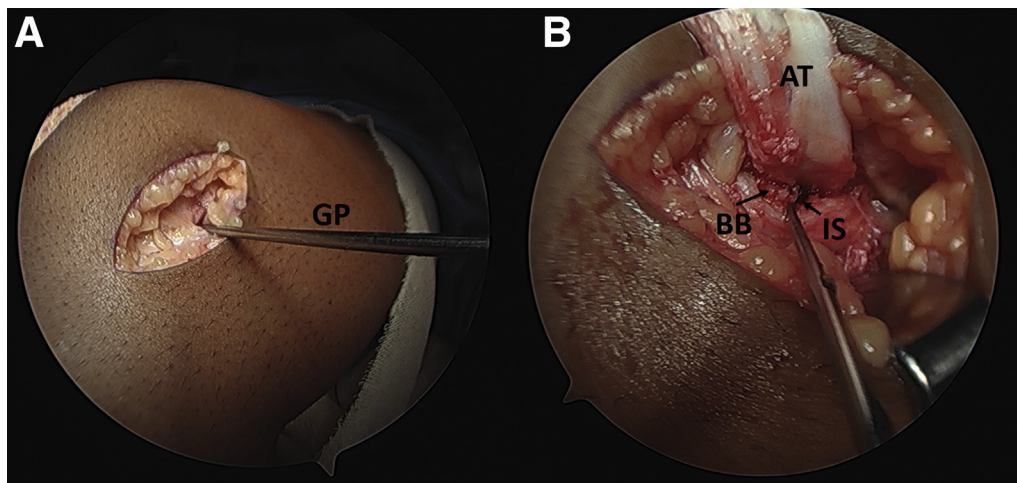
The tourniquet is deflated, hemostasis obtained, and the incisions are closed in a layered fashion. Arthroscopic portals are closed. A sterile dressing is placed, followed by a postoperative hinged knee brace locked

in full extension. The patient is then awoken from anesthesia and transferred back to the recovery room for same-day discharge.

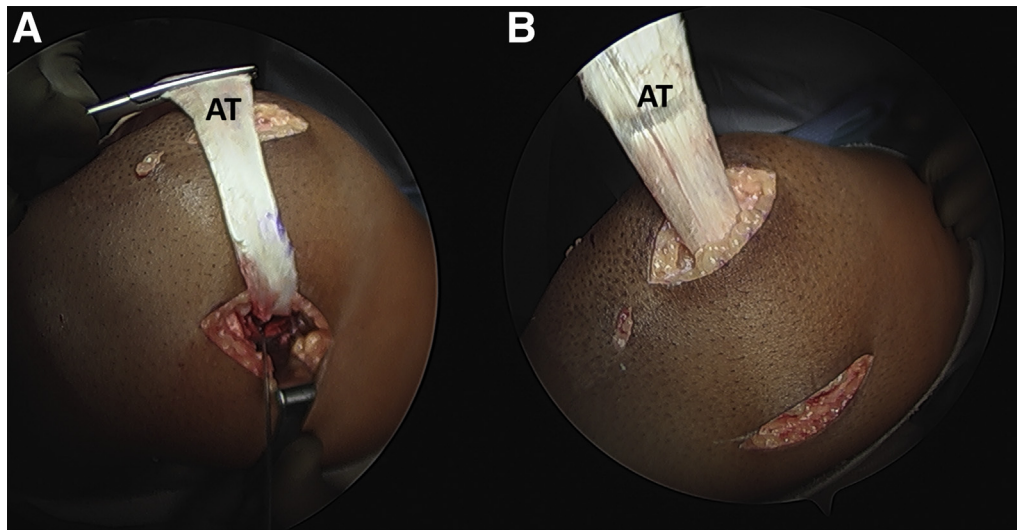
The patient is seen at 1-week postoperatively for a wound check and to set up formal physical therapy. They can be weight-bearing as tolerated and weaned off crutches when quadriceps control is regained. The brace is locked for sleep for the first 4 weeks and removed for physical therapy to work on regaining normal range of motion. The goal is 90 degrees at 2 weeks, 110 degrees at 4 weeks, and full at 6 weeks. Initial exercises include stationary bike, step ups, mini-/half-squat, balance board, and leg presses using both legs. Slow jogging can generally be started at 2 to 3 months postoperatively. Jumping and agility drills can start as early as 4 months postoperatively and return to sports can occur at 6 months.

## Discussion

This note presents the authors' technique for performing MPFL reconstruction using Achilles tendon allograft with a bone block on the femoral side. The advantage of this technique as compared with previously described techniques are as follows. It allows bone to bone healing in femoral tunnel. Docking the bone block in the femoral tunnel obviates the need for calculating graft and tunnel length. Fixing the femoral side before the patellar side allows graft tensioning under direct visualization and avoids overconstraint.<sup>5</sup> The fanned portion of the Achilles tendon allows broad-based MPFL footprint coverage on the medial patellar ridge.<sup>6</sup> Lastly, it avoids the need for bone tunnel drilling in the patella, reducing the risk for penetration of the drill holes into the articular cartilage



**Fig 4.** View of the medial incision on a right knee. (A) A Beath guide pin (GP) is placed in Schöttle's point using both anatomic landmarks and fluoroscopic guidance. (B) The GP is overdrilled to a 9- by 25-mm bone tunnel. The bone block (BB) is passed into the tunnel using a FiberWire passing suture placed into the Beath pin. The bone block is then secured with a 9- × 25-mm biointerference screw (IS). (AT, Achilles tendon allograft.)

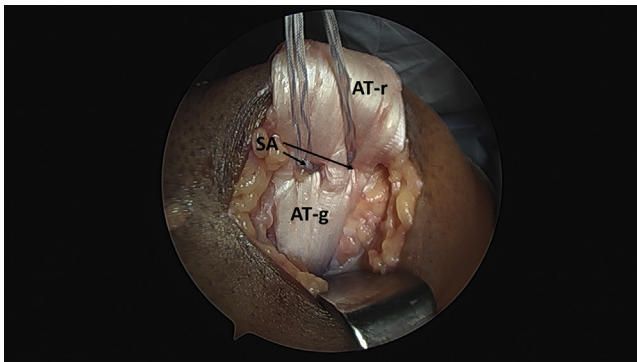


**Fig 5.** Medial view of a right knee. (A) Soft-tissue part of the Achilles allograft (AT) overlying the skin to demonstrate adequate length. (B) The plane of the native medial patellofemoral ligament is developed subcutaneously and extra-articularly between the 2 incisions. The soft-tissue portion of the graft is passed through this plane from the medial to the patellar incision.

surface as well as patellar fracture.<sup>3</sup> The use of a strong allograft material also makes it a good option for those patients with connective-tissue disease for whom autograft may not be a viable option.<sup>7</sup>

The limitation of this technique is that it requires the availability of allograft material, which may depend on practice type and geographic location. Allograft has a small theoretical risk of disease transmission, and tissue quality is variable based on donor type and processing method.<sup>8</sup> An issue infrequently encountered by the authors is that sometimes the femoral fixation

with the bioabsorbable interference screw is suboptimal. In this scenario, backup fixation with a suspensory fixation button over the lateral femoral cortex should be considered. This requires a small incision on the lateral aspect of the knee and use of a snap to dissect down to bone to seat the button directly onto the cortex. Pearls and pitfalls of the technique are summarized in Table 1, and Table 2 explains the advantages and disadvantages.



**Fig 6.** Medial view of a right knee. The upper two-thirds of the patella has been exposed and prepared and 2 bioabsorbable suture anchors (SA) have been placed in the anatomic insertion site of the native medial patellofemoral ligament. The patella has been positioned centrally within the trochlear groove with the knee in 25 degrees of flexion. The Achilles allograft (AT-g) has been reduced to the medial border of the patella. The sutures have been passed through the flared soft-tissue portion of the Achilles allograft and tied. After testing of tension and knee motion, the residual graft can be removed (AT-r).

**Table 1.** Pearl and Pitfalls of Medial Patellofemoral Ligament Reconstruction Using Achilles Tendon Allograft with Bone Block

Pearls	Pitfalls
Proper patient selection, i.e., recurrent patellar instability, failed conservative management without evidence of significant bony malalignment.	In proper patient selection: significant abnormal bony anatomy, i.e., shallow trochlear groove, patella alta, increased tibial tubercle—trochlear groove (TT-TG) distance. Also, first-time dislocates, no attempt at conservative treatment, anterior knee pain without instability.
Use of the adductor tubercle and medial epicondyle anatomy, as well as fluoroscopy of Schöttle's point to determine femoral tunnel placement.	Nonanatomic femoral tunnel positioning resulting in abnormal graft kinematics and forces.
Use the trochlea to reduce the patella when the graft is fixed by having the patella fully engaged in the trochlea.	Overconstraint of the graft, resulting in abnormal patellofemoral contact pressures and osteoarthritic changes.

**Table 2.** Advantage and Disadvantages of MPFL Reconstruction Using Achilles Tendon Allograft With Bone Block

Advantages	Disadvantages
It allows bone to bone healing in femoral tunnel.	It requires the availability of allograft material, which may depend on practice type and geographic location.
Docking the bone block in the femoral tunnel obviates the need for calculating graft and tunnel length.	Allograft has a small theoretical risk of disease transmission and tissue quality is variable base on donor type and processing method.
Fixing the femoral side before the patellar side allows graft tensioning under direct visualization and avoids overconstraint.	Sometimes the femoral fixation with the bioabsorbable interference screw is suboptimal, requiring backup fixation with a cortical button.
The fanned portion of the Achilles tendon allows broad-based MPFL footprint coverage on the medial patellar ridge	
It avoids the need for bone tunnel drilling in the patella, reducing the risk for penetration of the drill holes into the articular cartilage surface as well as patellar fracture.	
The use of a strong allograft material also makes it a good option for those patients with connective-tissue disease for whom autograft may not be a viable option.	

MPFL, medial patellofemoral ligament.

## References

- Sanders TL, Pareek A, Hewett TE, Stuart MJ, Dahm DL, Krych AJ. High rate of recurrent patellar dislocation in skeletally immature patients: A long-term population-based study. *Knee Surg Sports Traumatol Arthrosc* 2018;26:1037-1043.
- Diduch DR, Kandil A, Burrus MT. Lateral patellar instability in the skeletally mature patient: Evaluation and surgical management. *J Am Acad Orthop Surg* 2018;26:429-439.
- Schiphouwer L, Rood A, Tigchelaar S, Koeter S. Complications of medial patellofemoral ligament reconstruction using two transverse patellar tunnels. *Knee Surg Sports Traumatol Arthrosc* 2017;25:245-250.
- Stephen JM, Kittl C, Williams A, et al. Effect of medial patellofemoral ligament reconstruction method on patellofemoral contact pressures and kinematics. *Am J Sports Med* 2016;44:1186-1194.
- Elias JJ, Kelly MJ, Smith KE, Gall KA, Farr J. Dynamic simulation of the effects of graft fixation errors during medial patellofemoral ligament reconstruction. *Orthop J Sports Med* 2016;4:2325967116665080.
- Tanaka MJ, Chahla J, Farr J 2nd, et al. Recognition of evolving medial patellofemoral anatomy provides insight for reconstruction. *Knee Surg Sports Traumatol Arthrosc* October 28, 2018 [Epub ahead of print.].
- Shirley ED, Demaio M, Bodurtha J. Ehlers-Danlos syndrome in orthopaedics: Etiology, diagnosis, and treatment implications. *Sports Health* 2012;4:394-403.
- Giedraitis A, Arnoczky SP, Bedi A. Allografts in soft tissue reconstructive procedures: Important considerations. *Sports Health* 2014;6:256-264.