Technical Note

A Simple Technique for Reconstruction of the Medial Patellofemoral Ligament With Patellar Soft-Tissue Fixation Using Synthetic Suture Tape Internal Bracing

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Abstract: Recurrent patellar dislocation is most commonly treated with an isolated medial patellofemoral ligament reconstruction using autograft tissue. Harvest and fixation of these grafts have some theoretical disadvantages. With this Technical Note, we aim to describe a simple reconstruction of the medial patellofemoral ligament using high-strength suture tape with a soft-tissue fixation on the patellar side and an interference screw fixation on the femoral side, avoiding some of these possible disadvantages.

Patellar dislocation is a common knee injury in both children and adults. An annual incidence of 23.2 per 100,000 person-years is reported, with even greater numbers among adolescents aged 14 to 18 years.[1] Recurrent dislocations occur in 17% to 22.7% of patients.[2] The medial patellofemoral ligament (MPFL) is almost always injured after a primary dislocation, and displaced chondral and osteochondral injuries are common.[3]

After a primary patellar dislocation, in patients without loose chondral or osteochondral bodies, conservative treatment consisting of physical therapy and bracing is recommended. Surgical management is advised in cases with osteochondral injury, loose bodies, or recurrent dislocations. The mainstay of treatment of patellar instability is addressing the MPFL laxity in addition to bony procedures like tibial tuberosity transfer or trochleoplasty. A plethora of surgical techniques that address MPFL laxity are available, including repair and reconstruction techniques, with or without the use of tendon allograft or autograft material, bony or soft-tissue fixation on patella and femur.[4] Recently, synthetic suture tape has become an interesting alternative to biological grafts.[5] In this Technical Note, we describe a simple surgical technique for managing patellar instability using high-strength suture tape to reconstruct the MPFL.

Surgical Technique (With Video Illustration)

Indications for surgery include (1) first-time patellar dislocation with concurrent intra-articular pathology; and (2) recurrent patellar dislocations.

Preoperative Preparation and Positioning

The patient is positioned supine on a standard operating table. A well-padded nonsterile tourniquet is placed on the thigh, and the operative extremity is draped free. Standard preoperative prophylactic antibiotics are administered intravenously before insufflation of the tourniquet. The surgical technique is illustrated in Video 1. Advantages and disadvantages of this technique as well as pearls and pitfalls are detailed in Tables 1 and 2, respectively.

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The authors report the following potential conflicts of interest or sources of funding: P.B. and H.V. report institutional support from Smith and Nephew: research chair; and institutional support from Aqtor!: research chair. Full ICMJE author disclosure forms are available for this article online, as supplementary material.

Received November 3, 2022; accepted January 22, 2023.

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2212-6287/221453

https://doi.org/10.1016/j.eats.2023.01.011

Table 1. Advantages and Disadvantages of Performing Medial Patellofemoral Ligament (MPFL) Augmentation With Suture Tape

Advantages
No hardware on patellar side, minimal risk of patellar fracture
No need for tendon autograft/allograft
Suture tape strands replicate progressive fiber recruitment of native MPFL
Disadvantages
Femoral bone tunnel may damage the distal femoral physis in children
Overtensioning of the tapes is less forgiving
No long-term results available

Before MPFL reconstruction, a routine diagnostic arthroscopy of the knee is performed. Any intra-articular pathology is addressed in this phase.

Approach

Anatomical landmarks are marked before incision. These include scars, the patella, and both epicondyles. A 4-cm longitudinal skin incision is made medial to the patella. Dissection through the subcutaneous layer is performed to layer 1, as described by Warren and Marshall.[6] The vastus medialis obliquus (VMO) muscle is identified. A medial longitudinal parapatellar incision is performed to expose layer 2. This incision is extended proximally along the insertion of the VMO. This proximal extension will be used for imbrication during closure. The virtual extra-articular space between layers 2 and 3 is developed by stump dissection in the direction of the femoral origin of the MPFL between the adductor tubercle and the medial epicondyle (Fig 1).

When a concomitant osteochondral fracture amenable to fixation is present, a medial arthrotomy is performed by opening layer 3 in a longitudinal fashion. The osteochondral fracture is inspected, reduced, and fixed with bioabsorbable pins or screws.

Table 2. Pearls and Pitfalls of Medial Patellofemoral Ligament (MPFL) Reconstruction With Suture Tape

Pearls
Use a Kocher clamp to hold the tapes in an overtensioned position during fixation. This will prevent overtensioning of the tapes as they become slack after removal of the clamp.
Interlocking of the tapes during patellar fixation will prevent rip-out.
Lateral-sided femoral fixation is more forgiving with respect to hardware and overtensioning.
Advancement of the VMO during closure will give extra stability to the construct.
Pitfalls
Incorrect development of the interval between layer 2 and 3 can result in intra-articular placement of the suture tape.
The correct femoral tunnel position has to be determined based on surface anatomy landmarks, fluoroscopy, and a dynamic assessment of the isometry. A too-anterior or too-proximal tunnel position results in overtensioning in flexion.
VMO, vastus medialis obliquus.

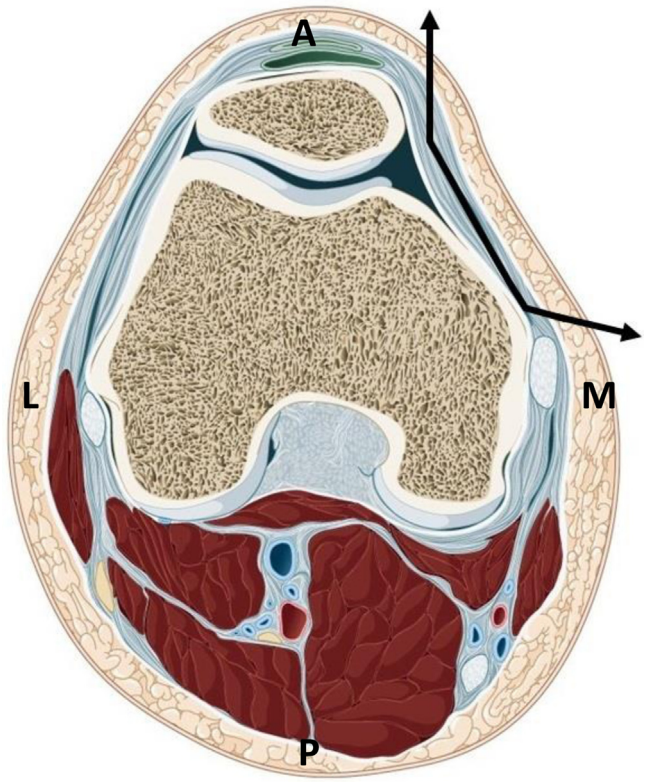

Fig 1. Axial view of virtual space between layers 2 and 3 on the medial side of the patella in a right knee. (A, anterior; L, lateral; M, medial; P, posterior.)

Patellar Preparation and Fixation

The medial patellar soft-tissue sleeve is sharply dissected from the medial patella. Often a recent or old avulsed bony fragment can be identified. This is resected with a rongeur to healthy bone. Patellar soft-tissue fixation is achieved by placing 2 long braided ultrahigh-molecular-weight polyester-polyethylene suture tapes (2 mm FiberTape; Arthrex, Naples, FL) into the superior half of the patellar soft-tissue sleeve mounted on a solid free needle (Figs 2 and 3). This enables the surgeon to reach the prepatellar periosteal layer, allowing solid fixation. The configuration of the stitch has a horizontal pattern with a Mason–Allen-like interlocking suture that functions as a ripstop. Finally, 4 strands will be available covering the proximal and middle third aspects of the medial patella, replicating anatomy and reflecting the typical triangular shape of the native MPFL (replicating the progressive fiber recruitment pattern during the flexion-extension arc).

Femoral Fixation

A medial incision overlying the intersection of the medial epicondyle and adductor tubercle is made. Stump dissection is performed to layer 1. The fascia is split in a longitudinal fashion and the isometric zone

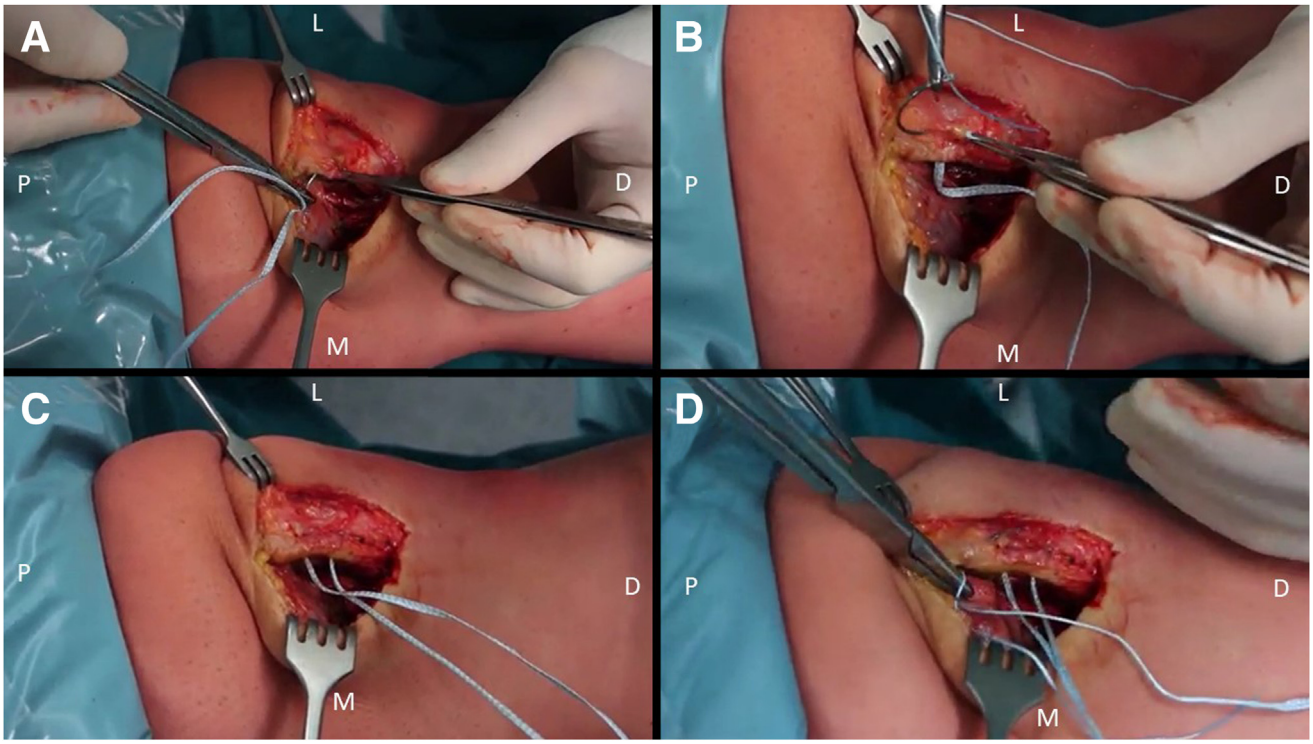

Fig 2. Realization of the Mason–Allen-like stitch with 2 suture tapes in a left knee with the patient in the supine position. The first suture tape is passed through the periosteal layer in a vertical fashion (A). Second pass in a horizontal fashion with interlocking of the strand (B). This is repeated with a second vertical pass which interlocks with the horizontal strand (C). The second suture tape is passed in a similar fashion proximal from the first stitch (D). (D, distal; L, lateral; M, medial; P, posterior.)

is identified using fluoroscopy as described by Schottle et al.[7] Alternatively, the preferred femoral insertion point can be identified by drilling a k-wire, wrapping the suture tape strands around it, and checking if the preferred isometry is present during cycling through flexion-extension (Fig 4). In our daily practice, a situation of favorable anisometry[8,9] is preferred.

The suture tapes are shuttled through the interval between layers 2 and 3. After a final check of isometry and progressive fiber recruitment an eyed drill pin is directed from medial to anterolateral. A bone tunnel is created with a cannulated 4.5-mm drill. Femoral fixation of the suture tape can be either medial- or lateral-sided, in function of surgeon preference. The lateral side is theoretically more forgiving with respect to hardware, and lateral fixation is less prone to overtightening of the tape, but additional lateral incision and dissection is required. The first 25 mm of the tunnel is enlarged with a 6-mm cannulated drill on the medial or lateral side, respectively. The suture tapes are shuttled through the femoral tunnel from medial to lateral and fixed with a 6-mm interference screw on either the medial or lateral side (PEEK [polyether ether ketone]; Arthrex).

Attention is paid to avoid medial overconstraint of the patella. To achieve this, a Kocher clamp is placed under the tapes before final fixation with the interference screw. The knee is positioned in 30° of flexion. Optionally, the tourniquet can be deflated at this time to attain physiologic patellofemoral tracking. Figure 5 illustrates the final construct.

Closure

The ends of layer 1 are imbricated by advancing the VMO insertion 5 to 10 mm lateral and distal on the prepatellar soft tissue with no. 2 nonabsorbable braided sutures (e.g., ETHIBOND; Ethicon, Somerville, NJ) placed in a pants-over-vest fashion. This is supplemented with a running stitch of no. 0 absorbable suture (e.g., VICRYL; Ethicon) to smooth out the rough edges of the construct. Subcutaneous closure is performed with interrupted 2/0 absorbable sutures (e.g., VICRYL; Ethicon) in a standard fashion.

Postoperative Management

Postoperatively, patients are placed into a range-of-motion brace and allowed to bear weight as tolerated with the brace locked in full knee extension. Mobilization under the supervision of a physiotherapist is

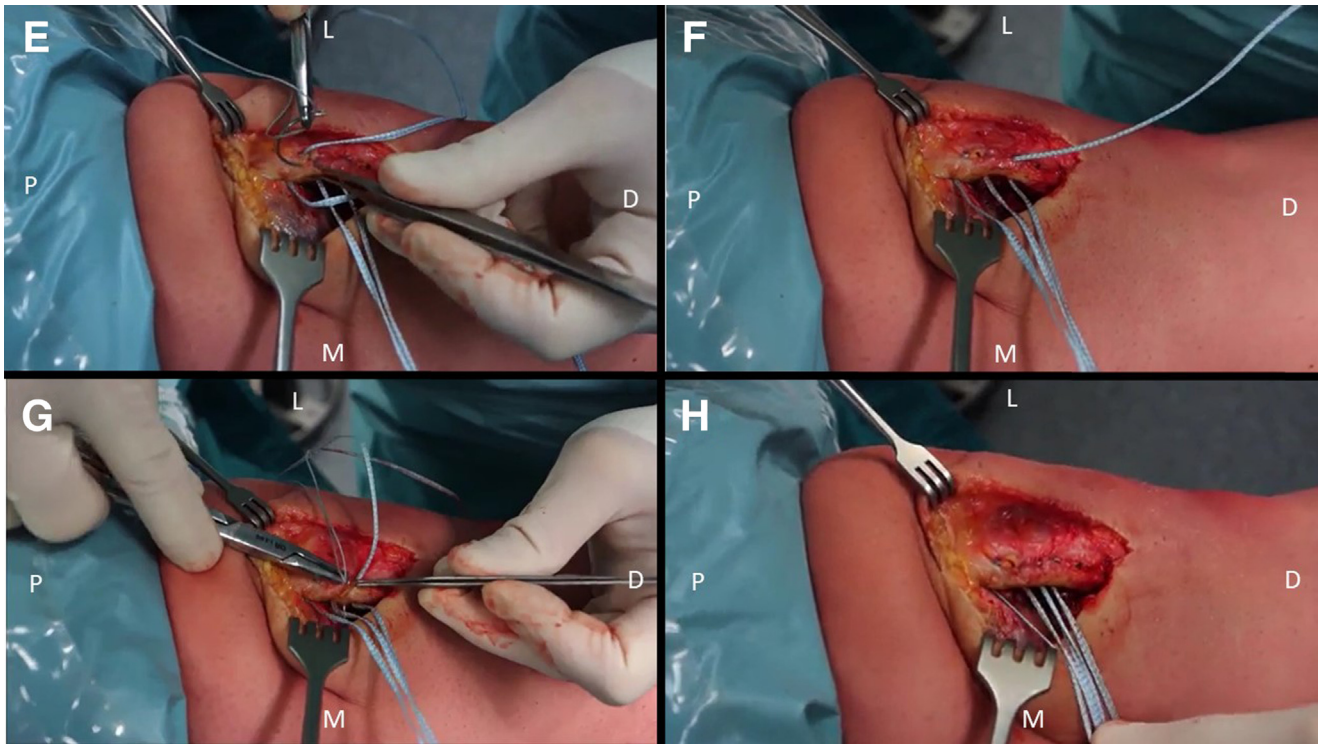

Fig 3. Realization of the Mason–Allen-like stitch with 2 suture tapes in a left knee with the patient in supine position. The horizontal component of the second suture tape stitch is aimed to end between both limbs of the first suture tape (E-F). As a result, the final vertical pass interlocks both suture tapes (G). Recreation of a solid suture tape construct with four strands covering the proximal half of the medial patella (H). (D, distal; L, lateral; M, medial; P, posterior.)

started at 0 to 60° and progresses to reach at least 90° of knee flexion by postoperative week 4. The brace is unlocked at postoperative week 4 to allow mobility between 0 and 90°. The brace is weaned after 6 weeks. The brace is discontinued once full active extension is achieved and the patient demonstrates no extension lag with a supine straight leg raise. Patellar mobilizations are not allowed during the first 6 weeks after surgery.

Patients are allowed to return to their sport at 4 to 6 months.

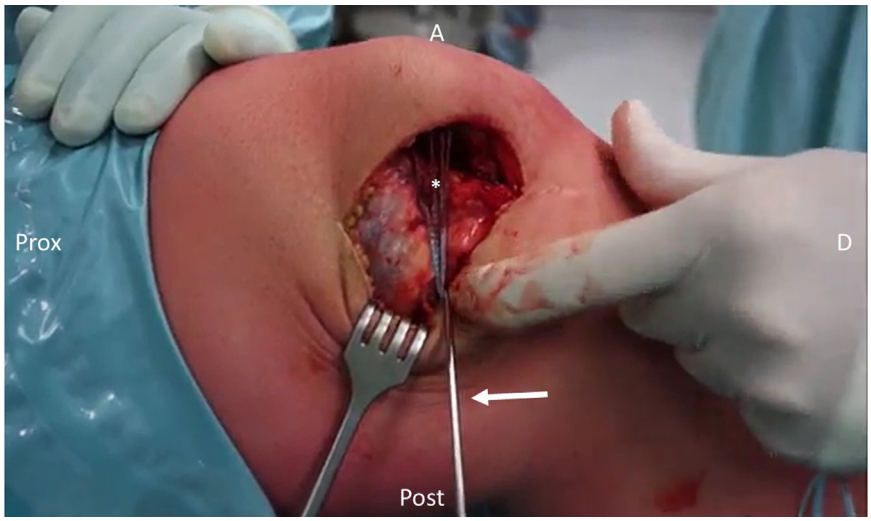

Fig 4. The isometry of the construct is tested by wrapping the suture strands around a drill pin placed in the preferred location on the medial femur and observing tension on these strands during the flexion–extension arc of the knee. Medial aspect of left knee with the patient in supine position. Arrow: femoral guidewire; asterisk: 4-strand suture tape construct. (A, anterior; D, distal; Post, posterior; Prox, proximal.)

Fig 5. Illustration of the final 4-strand suture tape construct (arrow) fixed on the medial femur of the right knee with an interference screw (arrowhead).

Discussion

Classical MPFL reconstruction with tendon autograft has some theoretical disadvantages. Hamstring graft harvesting can cause donor-site morbidities such as bleeding, muscle weakness, and nerve damage.[10] Moreover, it adds surgical time to the procedure. Bony fixation on the patellar side reduces patellar bone stock and can increase fracture risk.[11] In addition, malpositioning of anchors can result in chondral damage. Implant loosening is a final concern. The use of hamstring tendon allograft is impeded by availability issues, additional costs, and risk of disease transmission.[12,13]

We describe a surgical technique of MPFL reconstruction using high-strength suture tapes to overcome these points. The length of the tape also prevents tendon length mismatch. Another theoretical argument is the use of tape when recurrent patellar dislocation is associated with generalized hyperlaxity.

Conclusions

The technique described in this Technical Note provides an alternative technique to conventional MPFL reconstruction with hamstring tendon autograft. The patellar soft-tissue–only fixation avoids the presence of fixation anchors preserving patellar bone stock and possibly reducing the risk of fracture. In addition, this suture tape MPFL reconstruction obsoletes the need for tendon autograft or allograft, ultimately reducing the morbidly and cost compared with the conventional reconstruction techniques.

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