

Medial Patellofemoral Ligament Reconstruction With Quadriceps Tendon Using an Expanding PEEK Anchor



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Abstract: The medial patellofemoral ligament (MPFL) represents one of the main stabilizers of the patellofemoral joint. Rupture of the MPFL has been reported in 95% to 100% of patients with acute patellar dislocation. In this Technical Note, we describe a method of MPFL reconstruction with quadriceps tendon using a threadless expanding PEEK (polyether ether ketone) interference device that fixes the tendon in a drill hole in the femur. Based on our experience, it is a quick, safe, and reliable tenodesis procedure.

The medial patellofemoral ligament (MPFL) represents one of the main stabilizers of the patellofemoral joint¹; rupture of the MPFL has been reported in 95% to 100% of patients with acute patellar dislocation.² Therefore, reconstruction of the MPFL is getting more attention.³ Dejour et al.⁴ proposed a systematic MPFL reconstruction in any case of objective patellar dislocation. For these reasons, several techniques, grafts, and fixation methods have been proposed. However, none of them is proven to be superior.⁵⁻⁷

A systematic review of MPFL anatomy highlighted that the native MPFL is a broad, flat structure with a similarly broad insertion on the femur and patella. Hence, the native MPFL is morphologically similar to a broad, flat quadriceps tendon (QT) graft.⁸ Moreover, Herbolt et al.⁹ found that the characteristics of a 3-mm-thick by 10-mm-wide QT strip are very similar to the native MPFL (maximum load, yield load, and stiffness).

In the last 20 years, several authors described the MPFL reconstruction by the use of a partial thickness quadriceps tendon (QT) graft, leaving the QT attached to the patella side.¹⁰⁻¹³

The technique described in this report uses a threadless expanding PEEK (polyether ether ketone) interference device (TenoLok Anchor; CONMED, Utica, NY) that fixes the quadriceps tendon inside a half tunnel reamed in the medial femoral condyle. The device has a suture loop through the foot of the implant that holds the tendon in place during insertion. Undeployed, the implant diameter is 5 or 6 mm (Fig 1A). When deployed, this implant expands radially to provide an interference fit in the femur (Fig 1B).

Surgical Technique

Patient Positioning

The patient is supine with a thigh tourniquet. Knee motion between 0° and 120° should be possible. For easy use of the fluoroscope, the contralateral leg is placed in the lithotomy position (Fig 2).

Surgical Steps

Quadriceps Tendon Graft Harvesting. Minimally invasive QT graft harvesting is performed as described and illustrated by Fink et al.¹³ using specialized instrumentation (either Medacta QTH [Medacta International, Balerna, Switzerland] or Karl Storz, Tuttlingen, Germany). In the present technique, we use the instrumentation provided by Karl Storz. Briefly, with the knee at 90° of flexion, a 2- to 3-cm

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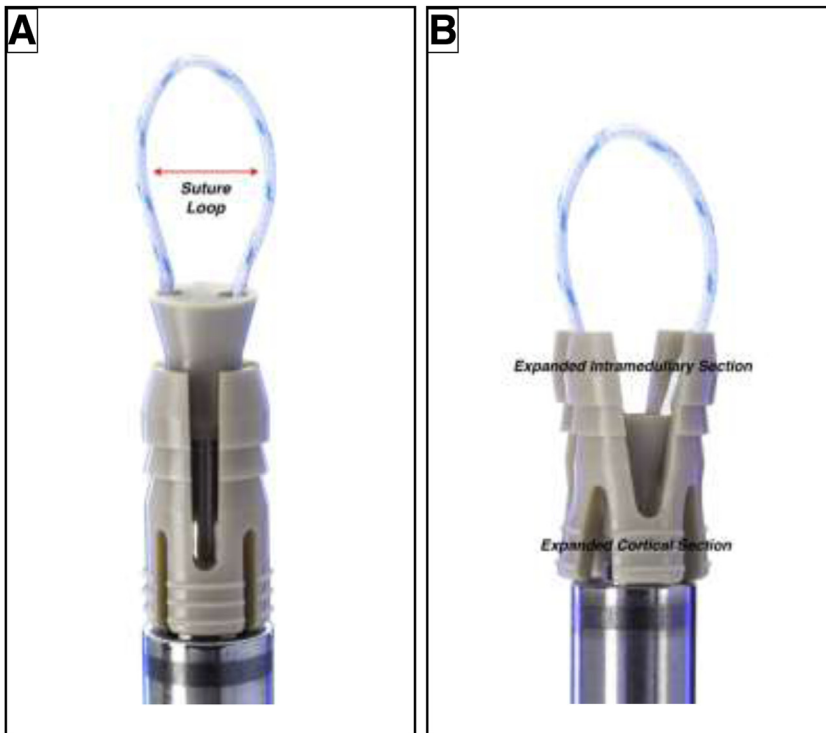


Fig 1. (A) TenoLok Anchor (CONMED) undeployed. The free hand of the quadriceps tendon is secured to the tendon with the suture loop. (B) TenoLok Anchor in the deployed configuration, showing the expanded intramedullary and cortical fixation sections.



Fig 2. Patient setup. Medial patellofemoral ligament reconstruction of the right limb; the left limb is placed in the lithotomy position.

transverse skin incision is made over the superior pole of the patella. Subcutaneous dissection is performed, and the QT is exposed. A double knife (Karl Storz) with a

width of 10 mm (optionally, 12 mm) is introduced, starting at the middle of the superior patellar border and pushed proximally to obtain a graft of a minimum of 9 cm in length (Fig 3). Subsequently, a tendon separator and tendon cutter are used to get a free hand of the QT graft. The muscle fibers are carefully removed (Fig 4A). The quadriceps tendon strip is peeled from the bony surface of the patella at an angle of 45° to allow a 90° turn over the medial side of the knee. The most medial part of the graft is left attached on the patella surface and tied on the periosteum with 2 nonabsorbable No. 2-0 sutures (Ethibond Excel) to avoid further detachment from the bone (Fig 4B). The proximal third of the medial patellar border is exposed, and a tunnel between the patella periosteum and bone is created. A surgical clamp is introduced into the tunnel from medial to lateral, and the graft is passed through the tunnel. The graft is then secured to the retinaculum tissue on the medial patellar edge by nonabsorbable No. 2-0 sutures (Ethibond Excel). Alternatively, the QT graft can be harvested using a conventional open approach with a longitudinal incision of about 3 cm in length without the use of special instrumentation (Fig 3C).

Femoral Preparation and Fixation. Due to the use of previous instruments, such as the tendon knife and separator (10 × 3 mm; Karl Storz), measurement of the QT graft diameter is not necessary, and 5 mm of a TenoLok Anchor with a 6.5-mm drill size is used for

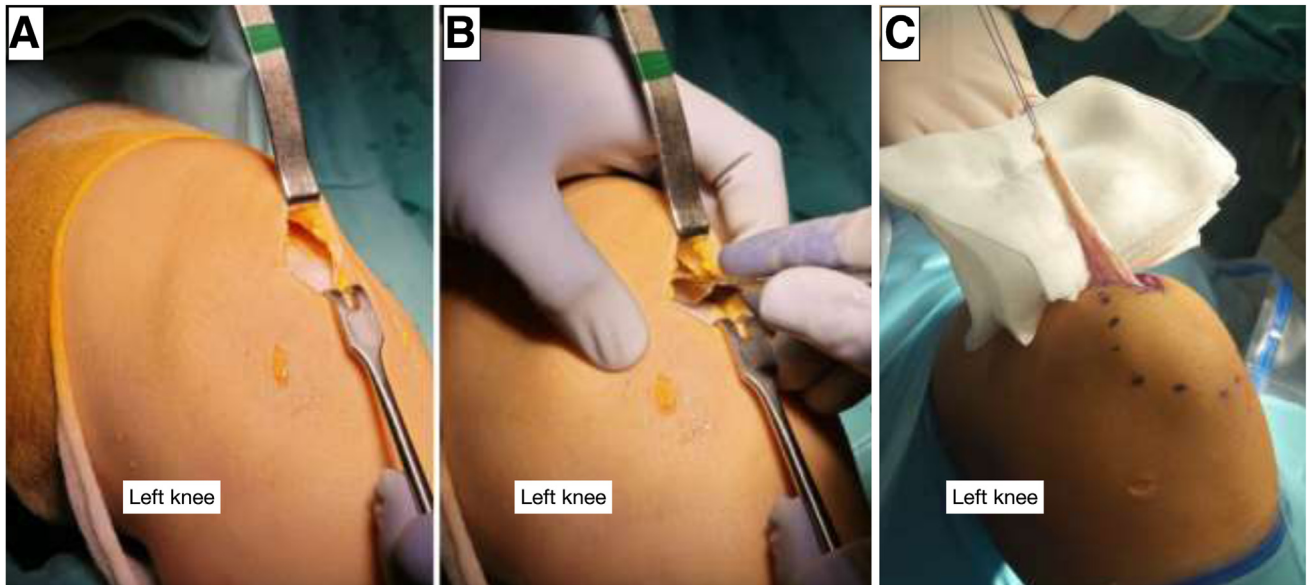


Fig 3. (A) A small 2- to 3-cm transverse incision in the upper pole of the patella. A long Langenbeck is introduced to check the length of quadriceps tendon graft. (B) A 10-mm \times 3-mm tendon knife (Karl Storz) is inserted. (C) Alternatively, a 3-cm longitudinal incision in the upper pole of the patella can be used for quadriceps harvesting.

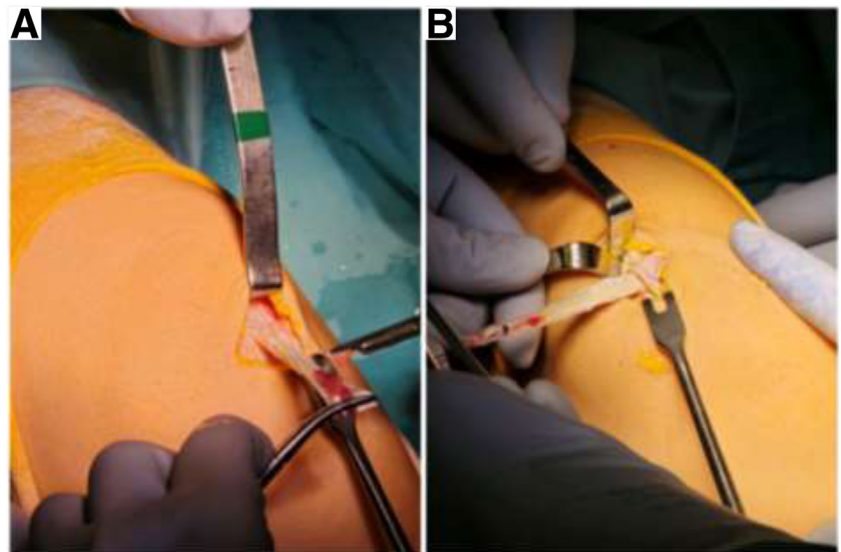


Fig 4. (A) Muscle is removed from the free hand of quadriceps tendon graft. (B) The quadriceps tendon graft is turned subperiosteally 90° medially under the medial border of the patella.

femoral fixation. On the other hand, if the QT graft is harvested by an open approach without specific instrumentation, we advise measuring tendon size to select the appropriate implant and drill hole size. The guidewire is placed in correspondence with Schöttle's point. Then, 2 cm of a femoral half tunnel is reamed using a 6.5-mm cannulated drill over the guidewire. The free hand of the QT graft is pulled through the suture loop at the foot of the TenoLok implant and provisionally tightened 20 mm distally to Schöttle's

point (Fig 5 A and B). The tenodesis position is rehearsed by laying the anchor over the drill hole. The tension of the graft is double-checked by observing the position and tracking the patella during flexion and extension of the knee. If the graft is too tight, the system is deployed and the graft is slid and left a few millimeters longer. The anchor and the attached tendon are directed into the drill hole and tapped into the bone until the top of the implant is flush with the outer cortical surface of the femur.

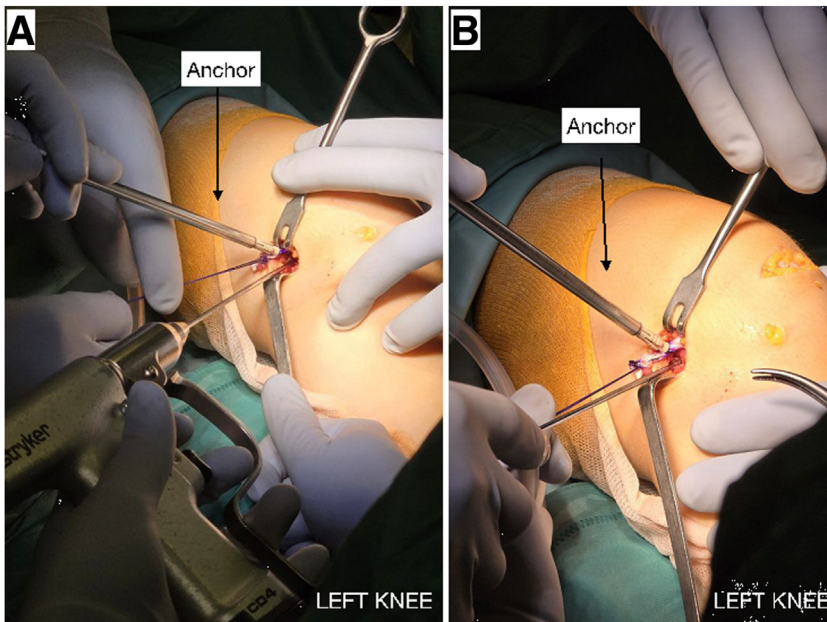


Fig 5. (A) A guide pin is inserted in Schöttle's point under fluoroscopic control. (B) The free hand of the quadriceps tendon graft is passed through the suture loop at the foot of the TenoLok (CONMED), and then the suture loop is closed by pulling the suture of the loop.

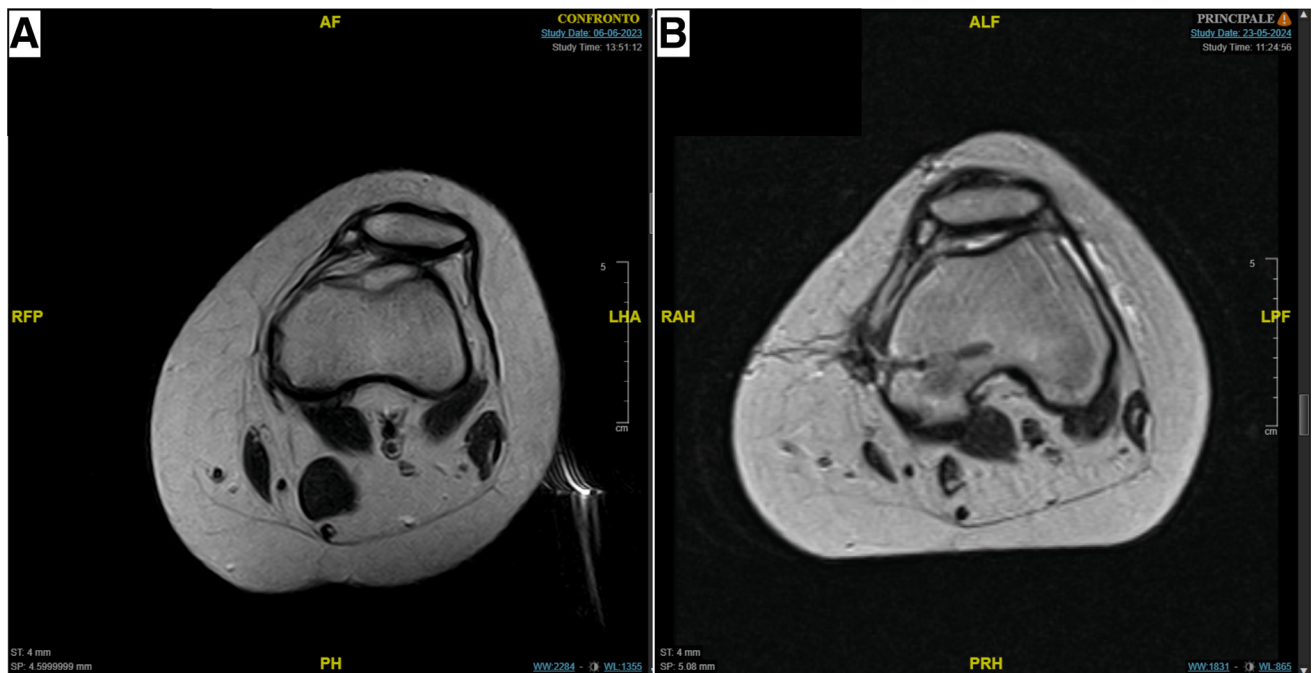


Fig 6. Left knee. Pre- and postoperative magnetic resonance imaging (MRI) of the knee of a 13-year-old girl with patellar instability treated by medial patellofemoral ligament reconstruction using a quadriceps tendon graft and TenoLok (CONMED). (A) Preoperative MRI shows a lateralization of patella. (B) Three-months postoperative MRI shows a well-centralized patella on trochlea groove.

Note that it is important to maintain the position of the QT graft under the foot of the implant during insertion so that it does not slide to the side of the implant, compromising fixation. The device is deployed by grasping the white section of the handle to prevent

rotation and then turning the black knob clockwise until a loud click is felt and heard, indicating that the implant has fully expanded. The retaining suture loop is unwound from the cleats on the inserter, and the handle is removed. The suture can then be removed

Table 1. Advantages and Disadvantages of the Technique

Advantages	Disadvantages
Optimal control of tension	Cost
Wide area of tenodesis	Not an implant-free technique
Single implant	Requires 20 mm of the femoral socket
Easy, fast, and reproducible	Requires 20 mm of extra length from Schöttle's point

from the anchor. At the end of the procedure, the patella should have a mediolateral glide between 2 and 9 mm.

Postoperative Treatment

A knee brace with range of motion from 0° to 60° is used for first 3 weeks during postoperative rehabilitation. Toe-touch weightbearing is allowed, and passive mobilization exercises to a maximum of 60° are encouraged. Progressive weightbearing and full range-of-motion recovery are started from 3 weeks postoperatively. A full return to pivoting sports occurs between 4 and 5 months after the surgery.

Discussion

The technique presented has mainly been used and has been reliable and reproducible in our hands with satisfying clinical results (Fig 6). The present technique does not require implants or bone tunnels in the patella without the risk of patellar fracture. It could also be used for MPFL revision surgery. In the past years, several authors reported promising results of MPFL reconstruction in objective patellar instability using the QT graft.^{10,12,14} The present technique is analogous to that described by Fink et al.¹³ in 2014 regarding skin incision, QT harvesting, and graft passage deep to the patella periosteum and the medial retinaculum. The 2- to 3-cm transverse skin incision following Langer's lines and the use of dedicated instrumentation for harvesting allow satisfactory cosmetic results. We recommend starting slightly lateral to the midline of the patella to avoid the vastus medialis oblique muscle mass and obtain the maximum length of the graft. With regard to graft routing, we redirect the tendon on the medial border of the patella, passing subperiosteally, to provide a broad bed for bone-tendon healing and to more closely re-create the native origin of MPFL.^{12,15} Several authors have described different methods for femur fixation of the QT graft, including interference screws and anchors.^{10,12-14}

Table 2. Pearls and Pitfalls of the Present Technique

Pearls	Pitfalls
Graft length minimum 9 cm	PEEK materials could determine osteolysis
Harvest slightly lateral from the patella midline to get a longer graft and avoid muscle mass (VMO)	Check under fluoroscope the distal femoral physis
Check with arthroscope before harvesting	
Tapping the anchor, pushing the patella slightly laterally with the thumb to avoid overtensioning	Excessive tightening of the graft could lead to patellar maltracking and pain
Two nonabsorbable sutures between the graft and patella periosteum to secure patella fixation	
Mark 2 cm in the QT graft distal to Schöttle's point (Fig 7)	

PEEK, polyether ether ketone; QT, quadriceps tendon; VMO, vastus medialis oblique.

In the present technique, the use of the TenoLok implant presented several advantages (Table 1). The free hand of the QT graft is pulled through the suture loop at the foot of TenoLok, allowing a flat tenodesis. By using a suture loop to fix the tendon to implant, a Krackow suture is not required. The sliding suture of the TenoLok allows surgeons to gather and tension the tendon before fixation. In conclusion, the present technique is safe, fast, and reproducible (Video 1). Pearls and pitfalls are listed in Table 2.

Disclosures

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: L.F. has received financial support and speaking and lecture fees from CONMED. All other authors (V.A., M.A.C., M.G., S.R., A.M., A.G.) 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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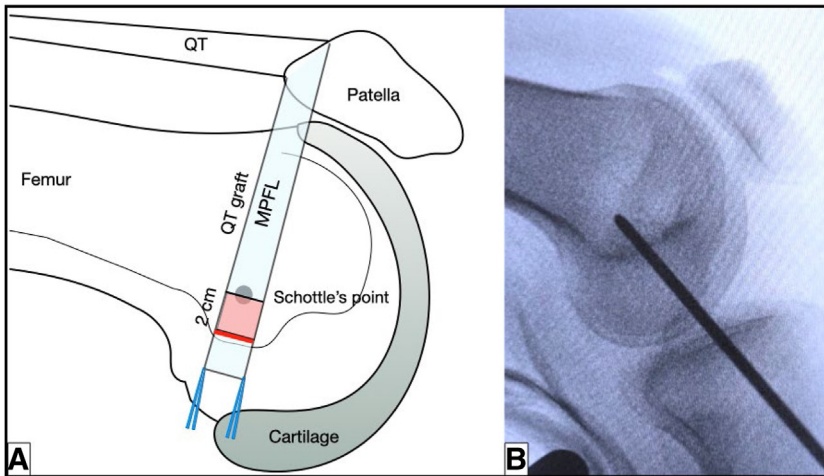


Fig 7. Femoral fixation of the quadriceps tendon graft. It is important to mark the free hand (red line) of the quadriceps tendon graft 2 cm distal to Schöttle's point to get adequate fixation. The loop of the TenoLok (CONMED) should be tight in correspondence with the red line.

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