Technical Note

Revision Medial Patellofemoral Ligament Reconstruction for Recurrent Instability After Patellofemoral Arthroplasty

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Abstract: Recurrent patellar instability is a rare complication after patellofemoral arthroplasty (PFA) and usually involves a traumatic injury. Medial patellofemoral ligament (MPFL) reconstruction after arthroplasty is a complicated and technically challenging surgical procedure because the lack of patellar bone stock due to resurfacing significantly increases the risk of patellar fracture. We present our surgical technique for revision MPFL reconstruction for recurrent instability after PFA. This technical note describes the use of 1.8-mm all-suture anchors for revision MPFL reconstruction in patients with decreased patellar bone stock after PFA. This technique reduces the risk of patellar fracture without compromising the integrity of the MPFL graft.

Isolated patellofemoral osteoarthritis may be present in conjunction with patellar instability and may be treated by patellofemoral arthroplasty (PFA) in more severe cases.[1-3] Despite the success of PFA in treating instability and osteoarthritis, recurrent instability remains a rare complication that has not yet been addressed in the literature.[4,5] Recurrent patellar instability occurs in approximately 1% of knees after total knee arthroplasty and accounts for up to 20% of post-arthroplasty complications, commonly requiring surgical revision.[6-9] Risk factors for recurrent instability after arthroplasty include component malpositioning and/or damage to the medial soft-tissue structures owing to a medial parapatellar approach.[10-12] Current treatment options include medial reefing, which has been reported to be 82% effective in avoiding recurrent dislocation but is nonanatomic in young individuals.[13,14] Lateral retinacular release may improve patellar stability but also significantly increases the incidence of patellar fracture because it compromises blood flow to the patella.[12] Medial patellofemoral ligament (MPFL) reconstruction is an effective, standard operation for patellar stabilization after recurrent patellar instability but is more complicated in knees after arthroplasty.[15,16] Treatment options for post-arthroplasty situations are limited by the lack of bone stock for either bone tunnel fixation of the graft on the patella or use of traditional metal, biocomposite, or PEEK (polyether ether ketone) suture anchors. Anchor placement is further compromised by bone stock in revision reconstructions after arthroplasty because previously placed anchors may interfere with positioning. Patients with a previous MPFL reconstruction are at an increased risk of graft failure if there is nonanatomic tunnel placement or use of a single-limbed as opposed to double-limbed reconstruction.[17,18] Thus, we describe a technique using small-diameter "all-suture" suture anchors for patellar fixation of the revision MPFL allograft in a patient with recurrent patellar instability after PFA.

Patient Evaluation, Imaging, and Indications

It is important to rule out other pathologies such as implant loosening. The differential diagnosis may

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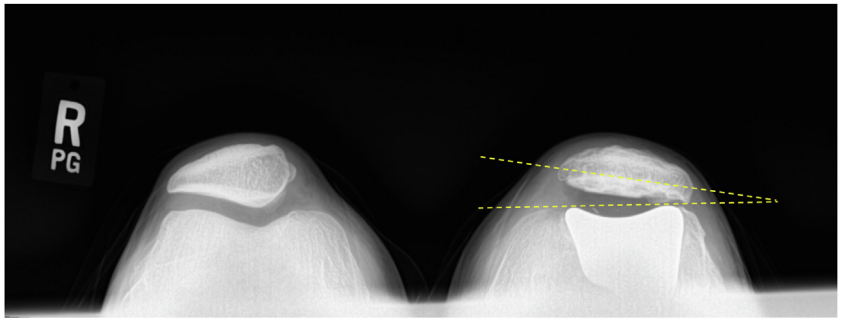

Fig 1. A preoperative bilateral sunrise radiograph shows evidence of prior left knee patellofemoral arthroplasty with lateral patellar tilt. The Merchant angle (shown in yellow) measures approximately 10°. The right knee (R) is indicated in the left of the image by the radiography technician (PG).

include subluxation as opposed to full dislocation, congenital hypermobility, patellofemoral syndrome, or low-grade MPFL sprain, which can be treated nonoperatively. Patients with recurrent instability after arthroplasty present with anterior knee pain and a history of at least 1 patellar dislocation since their patellofemoral or total arthroplasty, which may or may not be related to a traumatic injury. On physical examination, patients show limited passive hyperflexion due to pain. Pain is likely elicited by palpation of the iliotibial band, patella, patellar tendon, and MPFL. A thorough physical examination reveals a positive Ober's test result, crepitation over the patella, and 100% lateral translation of the patella with apprehension. Assessment of strength may show atrophy of the gluteus medius and maximus and 4/5 gluteus medius, gluteus maximus, and hip external rotator strength. Depending on the severity of injury, the patient may be able to dislocate the patella voluntarily. Normal laxity and meniscal test findings help exclude other pathologies.

Fig 2. An axial magnetic resonance imaging view (T2) of the left knee reveals increased T2 signal intensity in the previously implanted medial patellofemoral ligament graft (blue arrow), indicative of prior lateral patellar dislocation. The patient presented after a fall onto the anterior knee, after which he could voluntarily dislocate the patella with quadriceps flexion. The patient's history and symptoms were consistent with a medial patellofemoral ligament injury.

Recommended plain radiographs include a weight-bearing bilateral posteroanterior standing view at 30° of flexion, bilateral Merchant view, and lateral view. Radiographs reveal evidence of prior patellofemoral or total arthroplasty and may reveal lateral patellar tilt or lateral subluxation or dislocation of the patella (Fig 1). Radiographs also assist in ruling out other pathologies including implant loosening.[19,20] Magnetic resonance imaging (MRI) is the best method to evaluate for attenuation or tearing of the prior MPFL graft. Given the patient's history of arthroplasty, a knee MRI study without contrast should be performed using the metal artifact reducing sequence (MARS) protocol. Axial views best visualize the MPFL. Signal changes along the MPFL and any surrounding edema are indicative of prior lateral patellar dislocation (Fig 2). MRI also further rules out implant loosening and other pathologies.[21] This surgical technique is indicated for patients who have undergone patellofemoral or total arthroplasty because this leaves patients with limited patellar bone stock. This technique is appropriate for both primary and revision MPFL reconstruction.

Surgical Technique

Patient Positioning and Examination Under Anesthesia

The patient is placed in the supine position. An ultrasound-guided adductor canal nerve block is administered with subsequent induction of general anesthesia. The patient examination reveals 4 quadrants of instability with lateral translation of the patella.

Table 1. Advantages and Disadvantages

Advantages	Disadvantages
Anatomic tunnel placement despite lack of bone stock	Dependent on alignment of previous tunnels
Use of existing scars over medial epicondyle and medial aspect of patella for cosmesis	Patellar onlay as opposed to inlay
Lower risk of patellar stress fracture or damage to patellar implant	Technically challenging

Graft Preparation

A peroneus brevis allograft is prepared with a 7.5-mm doubled-over diameter and 280-mm length to allow for a 140-mm doubled-over length. The graft is prepared with whipstitches on both ends of the graft and is tensioned on an Acufex Graftmaster tensioning device at 20 lb of tension.

Diagnostic Arthroscopy

By use of a standard lateral viewing portal and medial working portal, the PFA is viewed and observed to be intact without damage. The suprapatellar pouch, medial and lateral gutters, medial and lateral compartments, medial and lateral menisci, cruciate ligaments, and posteromedial and posterolateral compartments are visualized to be intact without loose bodies, tears, or chondromalacia. Scar tissue from prior PFA and MPFL reconstruction is resected (Video 1). Lateral alignment of the patella is confirmed arthroscopically (Video 1).

Graft Passage Through Medial Approach

Previous scars are excised over the medial epicondyle and medial aspect of the patella. With a medial distal femoral incision, subcutaneous tissue is dissected while the saphenous nerve is protected posteriorly. The previous graft tunnel is identified and is likely nonanatomic. C-arm fluoroscopy and a spinal needle are used to identify the intersection between the Blumensaat line and the posterior cortex of the femur, and the anatomic position of the MPFL is noted as the intended tunnel (Video 1). A guidewire is centered over the anatomic femoral origin of the MPFL and drilled to a depth of 30 mm, and an 8-mm acorn reamer is used to ream to a depth of 20 mm. A 6-mm PEEK ConMed TenoLok anchor is then affixed to the peroneus brevis graft, which was doubled over at the central portion. This anchor-tendon complex is inserted into the femoral bone tunnel, and the anchor is expanded, providing excellent fixation of the graft.

Table 2. Pearls and Pitfalls

Pearls	Pitfalls
Ensure anatomic graft alignment	Nonanatomic tunnel placement
Ensure graft has neither tension nor slack	Improper graft tensioning
Ensure 25% lateral translation of patella before closing	Patella not held in anatomically reduced position

Graft Fixation With Tension Adjustment

Via the incision over the medial patella, a tunnel is dissected with a tonsil instrument between layers 2 and 3 of the medial knee (Video 1). After the medial retinaculum is visualized between these layers to ensure that the graft would be extra-articular, 2 No. 2-0 Vicryl sutures (Ethicon) are passed through the tunnel. The medial aspect of the patella is dissected, along with the superior one-third of the patella, for graft placement. One double-loaded ConMed 1.8-mm TruShot anchor is placed at the superior portion of the superior one-third of the patella, and a second anchor is placed 10 mm distally, still in the superior one-third of the patella (Video 1).

The graft limbs are passed through the tunnel between layers 2 and 3, and the patella is held in the anatomically reduced position to ensure reduction while sutures are passed through the graft in a Mason-Allen fashion to prevent suture cutout and are tied down. Graft tensioning is performed by holding the graft directly over the patellar anchors, ensuring that there is neither tension nor slack. Anatomic reduction of the patellofemoral joint with only 25% lateral translation of the patella is confirmed to avoid overtightening at the completion of the case (Video 1). The remaining graft is resected, the joint and wounds are copiously lavaged, and the wound is closed in routine fashion (Video 1).

Post-operative Protocol

Post-operatively, the patient is placed in a hinged knee brace locked in extension and allowed to bear weight as tolerated. The patient begins formal physical therapy focusing on increasing range of motion, gaining quadriceps control, and normalizing gait while phasing out brace use. The patient then begins a return—to—full activity program, which limits movements involving potential dynamic valgus, before being cleared for full agility training.

Advantages and disadvantages of the described technique are presented in Table 1, and pearls and pitfalls are listed in Table 2.

Discussion

Although MPFL reconstruction is considered a highly successful procedure for patellar stabilization, common complications include loss of flexion, patellar fracture, patellofemoral pain, and continued recurrent

instability.[1,9,22-24] In typical cases of MPFL reconstruction, recurrent instability may be attributed to nonanatomic positioning of the femoral graft.[1] In the setting of a patellar implant, the remaining patellar bone stock may be only half of the original anatomic size. Thus, traditional techniques using bone tunnels or metal, biocomposite, or PEEK suture anchors place the patient at a higher risk of patellar stress fracture or damage to the patellar implant. With the use of 1.8 mm all-suture anchors, excellent fixation can still be obtained in patellae that measure approximately 12 mm in thickness at the time of revision surgery. Anatomic graft alignment is crucial in this situation because the limitation of patellar bone loss can increase the risk of MPFL complications should the graft be incorrectly positioned. Despite patellar bone loss, patients who undergo revision MPFL reconstruction with proper fixation and postoperative rehabilitation are expected to regain stability and the ability to perform activities of daily living, as well as recreational activities, pain free.

References

1. Dandy DJ. Chronic patellofemoral instability. *J Bone Joint Surg Br* 1996;78:328-335.
2. Cuthbert R, Tibrewal S, Tibrewal SB. Patellofemoral arthroplasty: Current concepts. *J Clin Orthop Trauma* 2018;9:24-28.
3. Argenson JN, Guillaume JM, Aubaniac JM. Is there a place for patellofemoral arthroplasty? *Clin Orthop Relat Res* 1995;(321):162-167.
4. Cartier P, Sanouiller JL, Grelsamer R. Patellofemoral arthroplasty. 2-12-Year follow-up study. *J Arthroplasty* 1990;5:49-55.
5. Farr J II, Barrett D. Optimizing patellofemoral arthroplasty. *Knee* 2008;15:339-347.
6. Assiotis A, To K, Morgan-Jones R, Pengas IP, Khan W. Patellar complications following total knee arthroplasty: A review of the current literature. *Eur J Orthop Surg Traumatol* 2019;29:1605-1615.
7. Cooney WPIV, Sierra RJ, Trousdale RT, Pagnano MW. Revision total knees done for extensor problems frequently require reoperation. *Clin Orthop Relat Res* 2005;440:117-121.
8. Eisenhuth SA, Saleh KJ, Cui Q, Clark CR, Brown TE. Patellofemoral instability after total knee arthroplasty. *Clin Orthop Relat Res* 2006;446:149-160.
9. Shatrov J, Colas A, Fournier G, Batailler C, Servien E, Lustig S. Can patella instability after total knee arthroplasty be treated with medial patellofemoral ligament reconstruction? *Arthroplast Today* 2022;16:130-139.
10. Carmont MR, Crane T, Thompson P, Spalding T. Medial patellofemoral ligament reconstruction for subluxating patellofemoral arthroplasty. *Knee* 2011;18:130-132.
11. Lamotte A, Neri T, Kawaye A, Boyer B, Farizon F, Philippot R. Medial patellofemoral ligament reconstruction for patellar instability following total knee arthroplasty: A review of 6 cases. *Orthop Traumatol Surg Res* 2016;102:607-610.
12. Putman S, Boureau F, Girard J, Migaud H, Pasquier G. Patellar complications after total knee arthroplasty. *Orthop Traumatol Surg Res* 2019;105:S43-S51 (suppl).
13. Jiang J, Yi Z, Li J, Liu Y, Xia Y, Wu M. Medial patellofemoral ligament reconstruction is preferred to repair or reefing for first-time patellar dislocation: A systematic review and meta-analysis. *Indian J Orthop* 2022;57:177-188.
14. Nha KW, Kim HS, Cho ST, Bae JH, Jang KM, Kim SG. Arthroscopy-controlled medial reefing and lateral release for recurrent patellar dislocation: Clinical, radiologic outcomes and complications. *BMC Musculoskelet Disord* 2021;22:430.
15. Bollier M, Fulkerson J, Cosgarea A, Tanaka M. Technical failure of medial patellofemoral ligament reconstruction. *Arthroscopy* 2011;27:1153-1159.
16. Wilkens OE, Hannink G, van de Groes SAW. Recurrent patellofemoral instability rates after MPFL reconstruction techniques are in the range of instability rates after other soft tissue realignment techniques. *Knee Surg Sports Traumatol Arthrosc* 2020;28:1919-1931.
17. Chatterton A, Nielsen TG, Sørensen OG, Lind M. Clinical outcomes after revision surgery for medial patellofemoral ligament reconstruction. *Knee Surg Sports Traumatol Arthrosc* 2018;26:739-745.
18. Weinberger JM, Fabricant PD, Taylor SA, Mei JY, Jones KJ. Influence of graft source and configuration on revision rate and patient-reported outcomes after MPFL reconstruction: A systematic review and meta-analysis. *Knee Surg Sports Traumatol Arthrosc* 2017;25:2511-2519.
19. Stotter C, von Roth P. Lockerungsdiagnostik in der Knieendoprothetik [Diagnosis of loosening after knee arthroplasty] [in German]. *Orthopade* 2021;50:972-978.
20. Wautier D, Ftaïta S, Thienpont E. Radiolucent lines around knee arthroplasty components: A narrative review. *Acta Orthop Belg* 2020;86:82-94.
21. Endo Y, Burge AJ, Koff MF, et al. Diagnostic performance of MRI for component loosening in total knee arthroplasty compared with radiography. *Radiology* 2022;304:128-136.
22. Parikh SN, Nathan ST, Wall EJ, Eismann EA. Complications of medial patellofemoral ligament reconstruction in young patients. *Am J Sports Med* 2013;41:1030-1038.
23. Shah JN, Howard JS, Flanigan DC, Brophy RH, Carey JL, Lattermann C. A systematic review of complications and failures associated with medial patellofemoral ligament reconstruction for recurrent patellar dislocation. *Am J Sports Med* 2012;40:1916-1923.
24. Geßlein M, Roessler PP, Schüttler KF, Biber R, Bail HJ, Efe T. Complications and failure of MPFL reconstruction with free tendon grafts in cases of patellofemoral instability. *Technol Health Care* 2015;23:659-666.