

Distally Based Patella Tendon Shortening With Medial Patellotibial Ligament Reconstruction



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Abstract: Patella alta is a common pathoanatomic contributor to various knee pathologies, including patella instability, fat pad impingement, and patellar tendinopathy. The 2 most common surgical techniques used to treat patella alta include a distalizing tibial tubercle osteotomy and patella tendon imbrication. Although these 2 surgical techniques are effective, they are associated with significant surgical morbidity and a limiting postoperative course with prolonged rehabilitation. In this Technical Note, we propose a simple means of distalizing the patella and improving patella maltracking via the addition of a medial patellotibial ligament reconstruction. The described technique is easy to perform, has little postoperative morbidity, and is familiar to most knee surgeons who perform anterior cruciate ligament reconstruction.

Patella alta results in alteration of normal patellofemoral joint biomechanics and is a known risk factor for patellofemoral instability. Many surgeons elect to perform a distalizing tibial tubercle osteotomy for the treatment of pathologic patella alta, especially in the setting of recurrent patella instability. Imbrication of the patella tendon has emerged as an alternative treatment option for patella alta, and contrary to a tibial tubercle osteotomy, can be used in skeletally immature patients. Previously described techniques for patella tendon imbrication or shortening require a significant disruption of the longitudinal fibers of the patellar tendon. In this Technical Note, we describe our preferred technique for patella tendon shortening which has low morbidity and little disruption of the patellar tendon.

Surgical Technique

Preoperative radiographs and imaging are used to assess patellar height and patellotrochlear overlap.

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After examination under anesthesia, the operative extremity is prepped and draped in a sterile fashion. Diagnostic arthroscopy is generally performed, as these patients often have associated knee pathology. After arthroscopic intervention, a skin incision is marked from just distal to the distal pole of the patella to just distal to the tibial tubercle. Sharp dissection is carried down to the paratenon. The overlying paratenon is incised longitudinally and retracted to expose the PT. The central 10 mm or one-third of the PT width is marked and a no. 15 blade scalpel is used to incise the tendon in entirety in a parallel fashion. Distally, the periosteum is incised in line with the PT incisions for an additional 2 cm, then incised transversely connecting the 2 periosteal incisions (Fig 1). The periosteum and PT attachment are then carefully dissected from the tubercle, and the tendon slip is reflected proximally (Fig 2; white arrow depicts dissected periosteum). The distal end of the central slip is tagged with suture for control. The resultant gap in the PT is closed using either no. 2 suture tape or a no. 0 Vicryl suture (Ethicon, Somerville, NJ) in a side-to-side fashion. In contrast to PT anterior cruciate ligament (ACL) surgery, where a few sutures are placed to reapproximate the tendon edges, here the purpose is to intentionally close this space, which results in effective shortening of the tendon. A minimum of 6 figure-of-8 sutures are used to close this defect (Fig 3). The defect is closed in extension, which facilitates distalization of the patella. Fluoroscopy is used to assess the degree of distalization of the patella. The central third tendon is then returned distally. In the majority of cases, enough distalization



Fig 1. Intraoperative image of right knee demonstrating the patella tendon after being incised in a parallel fashion with the distal 2 cm of periosteum dissected off the tubercle. (PT, patella tendon.)



Fig 2. Intraoperative image of right knee demonstrating the incised patella tendon reflected proximally. Note the extra tissue dissected off the tubercle (white arrow).

will occur from closing the central patella tendon defect with the knee extended. The central tendon is affixed with a 2.6-mm FiberTak anchor (Arthrex, Naples, FL) with a combination of running locking stitches or modified Mason-Allen stitches medial to the 0.5 to 1 cm medial to the tubercle. If additional distalization is desired, the central slip can be used to pull the patella slightly more distally (Fig 4). Alternatively, if distalization is required without additional patellar stabilization, the tendon slip can be affixed distally in-line with the tubercle. The edges of the superficial PT slip are then sewn to the underlying PT (Fig 5). The knee is brought through a range of motion to ensure the construct is stable and not overtensioned. The paratenon and skin are closed according to the surgeon's preference. Key steps of the described technique can be seen in Video 1.

Postoperative Care

If this procedure is performed with other reconstructive interventions such as medial patellofemoral ligament (MPFL) reconstruction, a range-of-motion brace is used and the standard MPFL reconstruction rehabilitation protocol is followed. If this procedure is performed in isolation, no brace is required and patients

are allowed to bear weight with the use of crutches for 2 weeks and progress weight bearing and range of motion as tolerated.

Discussion

Patella alta is a pathoanatomic condition resulting in untoward biomechanical effects on the knee joint and greater rates of patella instability, patellar tendinopathy, and fat pad impingement.¹⁻⁵ Numerous surgical techniques have been described for managing patella alta. Historically, a TTO with distalization has been the preferred method for normalizing the patella-trochlea relationship; however, complications such as delayed union, nonunion, fracture, arthrofibrosis, and symptomatic implants requiring additional surgery have been reported.⁶⁻⁸ Given the innate loss of fragment stability associated with a distalizing osteotomy, there is typically a prolonged course of restricted weight-bearing postoperative rehabilitation required.^{4,9} Moreover, TTO is also not an ideal option for young patients with open physes.¹⁰ From a pathologic perspective, patella alta is the result of a long tendon and not a proximal tibial tubercle. As such, although effective, a distalizing osteotomy may be trading one nonanatomic



Fig 3. Intraoperative image of right knee (in extension) demonstrating the patellar tendon defect closed in a side-to-side fashion using no. 0 Vicryl suture (white arrow).



Fig 4. Intraoperative image of right knee demonstrating the central slip of the patella tendon affixed 0.5 to 1 cm medial to the medial most attachment of the patellar tendon on the tibial tubercle (white arrow) using an all-suture anchor.

problem for another. Therefore, some surgeons have sought alternative treatments for patella alta.

Recently, PT-based imbrication techniques have shown promise in distalizing the patella and effectively shortening the PT.¹⁰⁻¹⁴ Contrary to a TTO, PT shortenings can be performed in patients who are skeletally immature, as they do not violate the physis. These often require partial-thickness transection and elevation of the tendon flap with imbrication of tissue and repair and require slow rehab to allow for tendon healing. Some authors have suggested such techniques should be approached with caution because of the potential for overtransection of the partial-thickness flap.¹⁵

Multiple studies have demonstrated advantages of adding a medial patellotibial ligament (MPTL) reconstruction for recurrent lateral patella instability.¹⁶⁻¹⁸ Philippot et al.¹⁹ demonstrated that the MPFL is the primary restraint to lateral patella translation, but the role of the secondary stabilizers including the MPTL and medial patellomeniscal ligament become important in deeper knee flexion. In patients with patella alta, the bony restraint afforded by the trochlear groove occurs later in the knee flexion arc. Thus, in patients with

multiple risk factors such as a lateralized tubercle, patella alta, and trochlear dysplasia, the addition of restraint more than MPFL alone may be advantageous.¹⁷ MPTL augmentation to MPFL reconstruction may be more critical in patients when risk factors such as a high tibial tubercle trochlear groove distance are not correctable.²⁰

This surgical technique has several advantages over alternative PT shortenings. It is easy to perform and familiar to surgeons who perform PT harvesting for ACL reconstruction. Just as one would allow full range of motion and weight bearing after an ACL reconstruction with ipsilateral PT autograft, the same aggressive rehabilitation protocol can be applied after this procedure if performed in isolation. Because the longitudinal collagen fibers of the PT are not disrupted and no collagen is removed, there is a theoretical advantage of this shortening technique when contrasted with one in which the fibers of the tendon are partially transected. As with other described PT shortenings, this can be performed in skeletally immature patients. Contrary to alternative techniques, however, the central slip of tendon can be transposed



Fig 5. Intraoperative image of right knee demonstrating the medial and lateral borders of the transposed slip of the patellar tendon sewn to the underlying patellar tendon.

medially, improving patellar tracking and providing additional patella restraint. We have performed this surgery in 11 patients and have no complications thus far aside from 1 patient with early postoperative stiffness, which resolved with physiotherapy. All have improved patellar height on postoperative imaging (Fig 6).

The Roux-Goldthwait surgery was historically used for patients who are skeletally immature with recurrent patellar instability and high tibial tuberosity-to-trochlear groove distance. Although the aforementioned technique has some similarities to the Roux-Goldthwait, there are several notable differences. As originally described, the Roux-Goldthwait is a distally based transfer of the lateral half of the PT to the tibia, passing deep to the medial (intact) PT, and fixation medial to the tubercle. Some authors have expressed concern regarding the introduction of patellar malrotation with the Roux-Goldthwait.²¹ Other concerns include a posteriorly directed force on the patella as the transposed tendon half passes posteriorly to the intact tissue leading to increased patellofemoral contact pressure. In the aforementioned technique, only one-third (vs one-half) of the tendon is transferred,

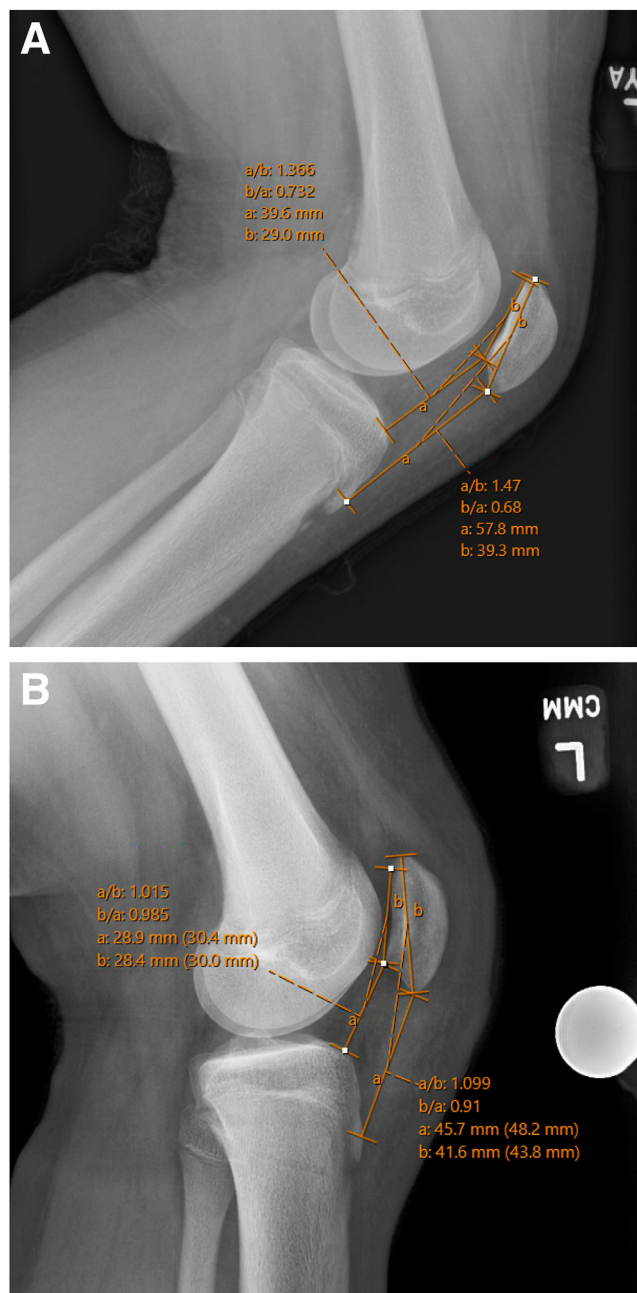


Fig 6. (A) Preoperative lateral view of left knee radiograph demonstrating patella alta with Caton-Deschamps index = 1.36 and Insall-Salvati ratio = 1.47. (B) Postoperative lateral view of left knee radiograph demonstrating improved patella height with Caton-Deschamps index = 1.02 and Insall-Salvati ratio = 1.10.

leaving more PT collagen intact. The central slip is transferred anterior rather than posterior to the medial intact tendon, which creates a more favorable force vector and may result in less alteration of patellofemoral contact pressures. By pulling from the central patella, and leaving both the medial and lateral PT slips intact, we believe less patella malrotation is introduced. In addition, the PT defect is

closed before tendon transfer and the surgeon can distalize the patella first, then assess where to fixate the transposed central slip of tendon, resulting in more evenly distributed forces across the entire PT complex after repair. The purpose of the Roux Goldthwait is to effectively correct a lateralized attachment of the PT, where the aforementioned technique aims to provide additional lateral restraint via a MPTL reconstruction for patients with multiple risk factors for recurrent patellar instability, and where MPFL alone may be insufficient.

The largest disadvantage of this surgical technique is the lack of short- and long-term outcomes. In addition, the MPTL reconstruction is not truly anatomic, as the native MPTL originates from the patella medial to the PT. The rationale for using a central slip of the PT is to improve the force vector as the extensor mechanism contracts directing the apex of the patella medial into the trochlear groove. As seen with PT ACL reconstruction, potential risk of PT rupture is a concern. However, contrary to an ACL graft harvest, collagen is rearranged and not removed in this technique. As with any patella distalizing procedure, the potential to increase patellofemoral contact pressures exists. By transferring the central slip anterior to the medial PT, the force vector should theoretically be anteriorized and not posteriorized. Further biomechanical studies are required to compare changes in patellofemoral contact pressures between surgical techniques for the treatment of patella alta. Additional disadvantages include the limited ability to distalize large amounts. As such, we recommend this technique for patients with mild-to-moderate alta and/or in cases in which a TTO is contraindicated. Ultimately, further biomechanical and clinical research is needed to evaluate this surgical technique.

Disclosures

The authors declare the following financial interests/ personal relationships which may be considered as potential competing interests: H.S. reports consulting or advisory for Arthrex. All other authors (J.P., C.A., H.B., and W.M.P.) 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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