Technical Note

Revision Proximal Tibiofibular Joint Reconstruction for the Treatment of Chronic Instability Secondary to Suture Button Construct Failure

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Abstract: Recurrent proximal tibiofibular joint (PTFJ) instability can result from nonanatomic repair using a suture button construct. During initial reconstruction, proper identification of anatomic landmarks is critical for proper placement of suture button construct components and successful patient outcomes. In cases of symptomatic recurrent instability, a PTFJ reconstruction revision is warranted to alleviate symptoms of pain and instability. This Technical Note describes a technique for performing an anatomic PTFJ reconstruction revision and fibular collateral ligament reconstruction in which the semitendinosus is used as a graft for both the FCL and posterior ligamentous complex of the PTFJ. The biceps femoris is also repaired following a tear that resulted from a misplaced suture button.

The proximal tibiofibular joint (PTFJ) is stabilized by anterior and posterior ligament complexes. The posterior ligament complex is composed of a single, thin band and is significantly weaker than the anterior ligament complex, which is composed of 2 to 3 thick bands reinforced by the biceps femoris tendon. Biomechanically, the posterior ligamentous complex has been reported to withstand only up to an average of 48% of the force that the anterior ligamentous complex can withstand.[1] Consequently, anterolateral dislocations account for up to 85% of PTFJ dislocations.[1] PTFJ instability is often misdiagnosed or missed entirely.[1,2] PTFJ instability can present as lateral knee pain, discomfort with activities, or common peroneal neuropathy with paresthesias and radiating pain down to the ankle and foot. In the setting of acute dislocations, reduction, immobilization of the knee in extension, and restricted weight-bearing for 6 to 8 weeks is the recommended treatment.[3] In the chronic setting, before surgery, a 4- to 6-week trial of taping the PTFJ in a reduced position is done to confirm the diagnosis and validate the patient's candidacy for surgical reconstruction. Patients with chronic PTFJ instability often undergo fixation using a screw or a suture button construct, but this can lead to overconstraint or malreduction of the PTFJ, leading to continued symptoms. Furthermore, as this is a nonanatomic reconstruction, over time the construct can loosen and eventually fail.[4] In patients with symptomatic chronic PTFJ instability, anatomic PTFJ reconstruction using a free tendon graft to restore stability and treat the symptoms is recommended.[4-6] This Technical Note describes the technique for an anatomic reconstruction of the PTFJ as a treatment for chronic instability secondary to failure of nonanatomic PTFJ fixation with a suture button construct along with a concurrent fibular collateral ligament (FCL) reconstruction and biceps femoris repair secondary to iatrogenic injury (Fig 1).

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The authors report the following potential conflicts of interest or sources of funding: R.F.L. reports personal fees from Arthrex, grants and personal fees from Ossur and Smith & Nephew, and personal fees from Linvatec, outside the submitted work; the editorial boards of American Orthopaedic Society for Sports Medicine (AOSSM), Journal of Experimental Orthopaedics*, and* Knee Surgery, Sports Traumatology, Arthroscopy*; and the committees of AOSSM, AANA, and International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine. Full ICMJE author disclosure forms are available for this article online, as supplementary material.*

Received August 29, 2021; accepted November 16, 2021.

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2212-6287/211259

https://doi.org/10.1016/j.eats.2021.11.018

Operative Technique (With Video Illustration)

The patient is placed in the supine position on the operating table. After induction of general anesthesia, a bilateral knee examination is performed to evaluate for any concurrent ligamentous instability and to assess for knee range of motion. A well-padded high-thigh tourniquet is subsequently placed on the operative leg, which is then placed into a leg holder (Mizuho OSI, Union City, CA), while the contralateral knee is placed into an abduction stirrup (Birkova Product, Gothenburg, NE). The foot of the operating table is then removed, allowing the surgeon to freely manipulate the knee as needed. In this case, range of motion of the left knee shows 5 cm of heel height to 140° of flexion. Range of motion of the right knee shows 3 cm of heel height to 140° of flexion. Lachman, valgus stress test, dial test, and posterior drawer tests are normal bilaterally. The patient's PTFJ shows twice as much motion as his right stable knee. Varus stress testing is 2+ in extension and 3+ in 30° of flexion. Two grams of cefazolin is given before incision.

The surgical technique is demonstrated in Video 1. With the previous incision being located too far posterior to access the normal anatomic landmarks for both the PTFJ tunnel and the FCL reconstruction on the femur, the incision is moved more anteriorly. Dissection is performed down to expose the iliotibial (IT) band. Dissection is performed over the superficial layer of the IT band and along the course of the long and short head of the biceps femoris toward the fibular head, where significant scarring is identified.

The common peroneal nerve is identified to be adhered under the posterior aspect of the long head biceps tendon in an abnormal position. A slow and meticulous common peroneal nerve neurolysis is performed to minimize the risk of a foot-drop postoperatively and to decrease the dysesthesias the patient already has (Fig 2 and Table 1).

The surgeon then enters the biceps bursa and identifies the FCL to be loose and nonfunctional. Further subperiosteal dissection is performed along the fibular head, and one of the suture button constructs is found to be directly over the FCL at its attachment site on the fibular head, consistent with an iatrogenic injury. The suture button construct is then cut and removed at this time.

The surgeon dissects slightly posterior to the fibular head and finds another suture button construct piercing the biceps femoris and notes that the biceps is not well-attached to the posterolateral aspect of the fibular styloid. This suture button construct is also removed, and a repair of the biceps femoris tendon fibular attachment would be performed later in the case.

An elevator is used to elevate the soft tissue and soleus muscle up off the posteromedial aspect of the fibular head where the tunnel exit will be positioned at the fibular attachment of the posterior PTFJ. A fibular head collateral instrument guide is used to drill a 2.4-mm guide pin across the fibular head from anterolateral to posteromedial. This is followed by reaming with a 6-mm reamer while protecting the posterior neurovascular

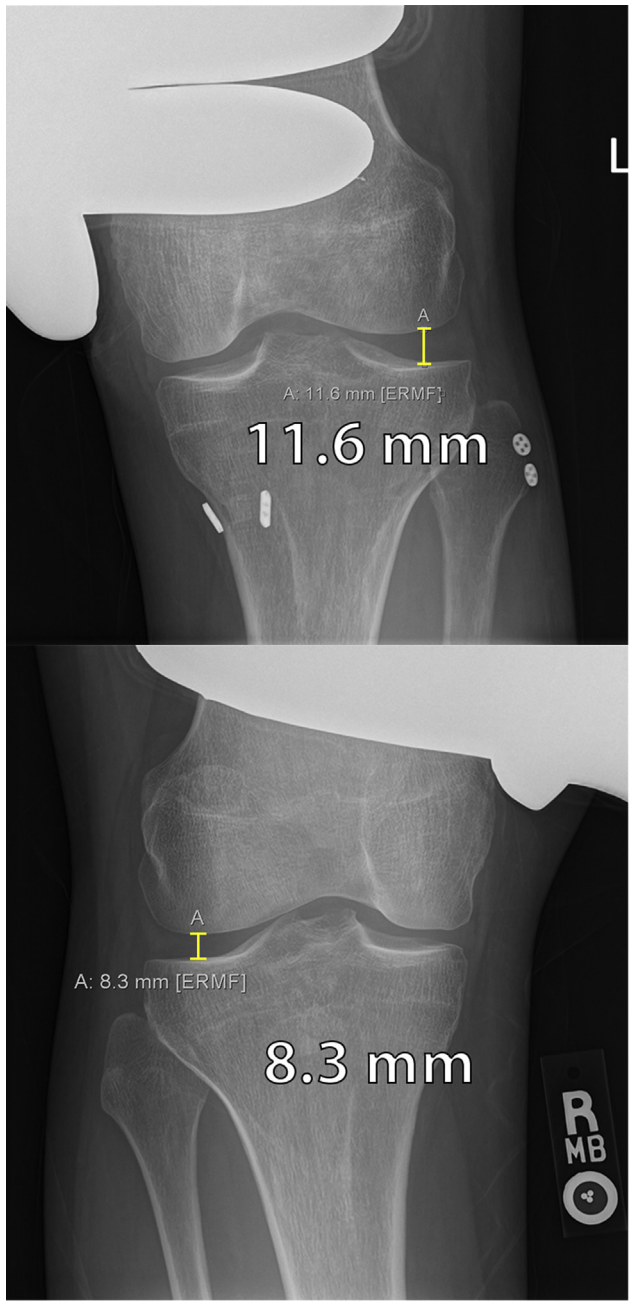

Fig 1. Varus stress radiographs illustrating a side-to-side difference of 3.3 mm of lateral compartment gapping. The left knee shows significantly more gapping than the right knee. This is suggestive of an isolated complete tear of the FCL. A side-to-side difference of greater than 2.7 mm is indicative of an isolated FCL tear, whereas a side-to-side difference in gapping of greater than 4.0 mm is indicative of injury to the FCL and posterolateral corner (PLC). (FCL, fibular collateral ligament.)

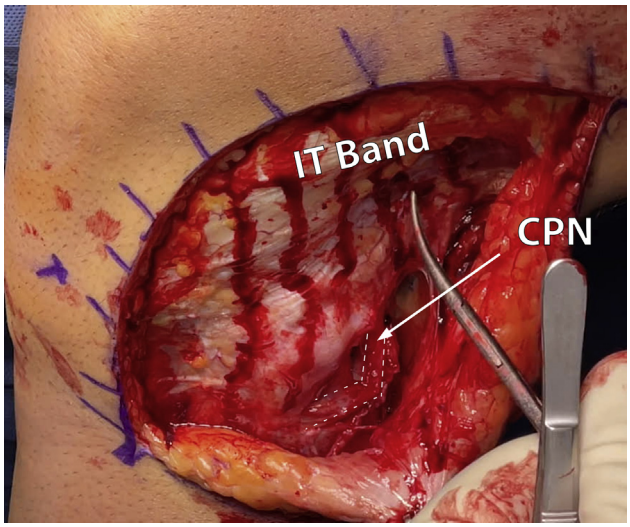

Fig 2. Intraoperative imaging of the CPN neurolysis. The CPN (white arrow) can be found coursing inferiorly to the long head of the biceps femoris. The CPN must be separated from surrounding scar tissue to minimize the risk of postoperative complications such as footdrop or lower extremity paresthesia. (CPN, common peroneal nerve; IT, iliotibial.)

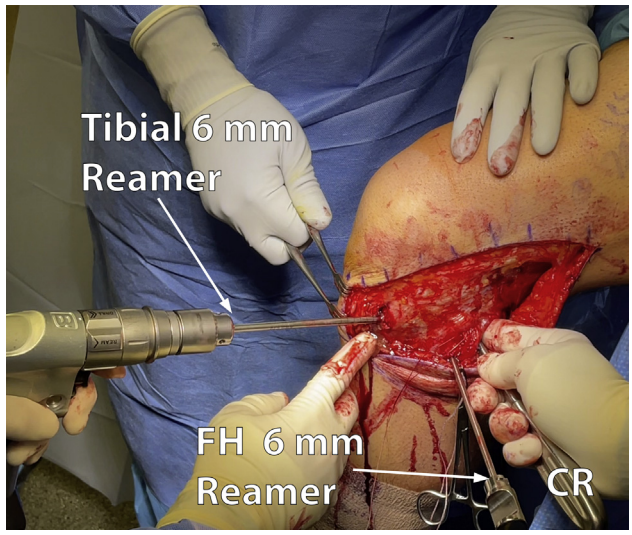

Fig 3. Intraoperative image illustrating reaming of the tibial tunnel from anterior to posterior direction. This tunnel is drilled at the flat spot that is distal and medial to Gerdy's tubercle. The FCL graft is passed through this tunnel in the final steps of the procedure to restore PTFJ stability. (CR, Chandler retractor; FCL, fibular collateral ligament; FH, fibular head; PTFJ, proximal tibiofibular joint.)

structures with a large Chandler retractor (Surtex Instruments, New Malden, United Kingdom), followed by placement of a passing stich with the loop placed anteriorly, thereby permitting later graft passage from anterior to posterior across the fibular head.

Then, attention is turned toward identification and reaming of the tibial tunnel for the PTFJ reconstruction. The subcutaneous tissues are elevated anteriorly and dissection is performed down to Gerdy's tubercle. The surgeon then identifies the flat spot that is distal and medial to Gerdy's tubercle and slightly lateral to the patellar tendon. A blunt obturator is placed through the fibular head tunnel to serve as reference for where the PTFJ reconstruction tunnel should exit the posterior aspect of the tibia. A tibial collateral instrument guide is used to drill a 2.4-mm guide pin from anterior to posterior, and the surgeon verifies that this tunnel is directly in line with the tunnel exiting the fibular head. A 6-mm reamer is used to over-ream while using a large Chandler retractor to protect the neurovascular structures posterior to this (Fig 3). Another passing stitch is placed through this tunnel, with the loop left posteriorly to facilitate graft passage from posterior to anterior.

Then, using the FCL remnant as a guide to identify the FCL origin on the femur, the IT band is incised longitudinally in line with its fibers, and the FCL origin is identified and sharply incised, and the surgeon will fall into a sulcus containing eburnated bone, confirming the anatomically correct position. An eyelet pin is now drilled anteromedially across the thigh using a femoral collateral instrument guide, followed by over-reaming using a 6-mm reamer and a 7-mm tap. A passing stich is placed, and the channel is cleared to later pass the FCL graft under the IT band.

Attention is then turned to a hamstring autograft harvest. An incision is made over the pes anserine bursa, and a suture button construct is identified

Table 1. Pearls and Pitfalls

Pearls	Pitfalls
Early identification and protection of the CPN is critical to avoid a foot drop.	PTFJ taping should be used as a screening tool preoperatively. If the taping significantly improves the symptoms, this validates candidacy for a PTFJ reconstruction.
The tibial tunnel should exit at the same level as the fibular tunnel, use a blunt obturator in the fibular tunnel to serve as reference.	Thorough preoperative examination required so that concomitant pathology (i.e., fibular collateral ligament injury) is not missed and address all pathology at time of surgery.
Fix the PTFJ graft in the tibial tunnel with knee flexed at 70° and with the PTFJ reduced manually.	Failure to protect the posterior neurovascular bundle during drilling of the tibial tunnel can result in complications.

CPN, common peroneal nerve; PTFJ, proximal tibiofibular joint.

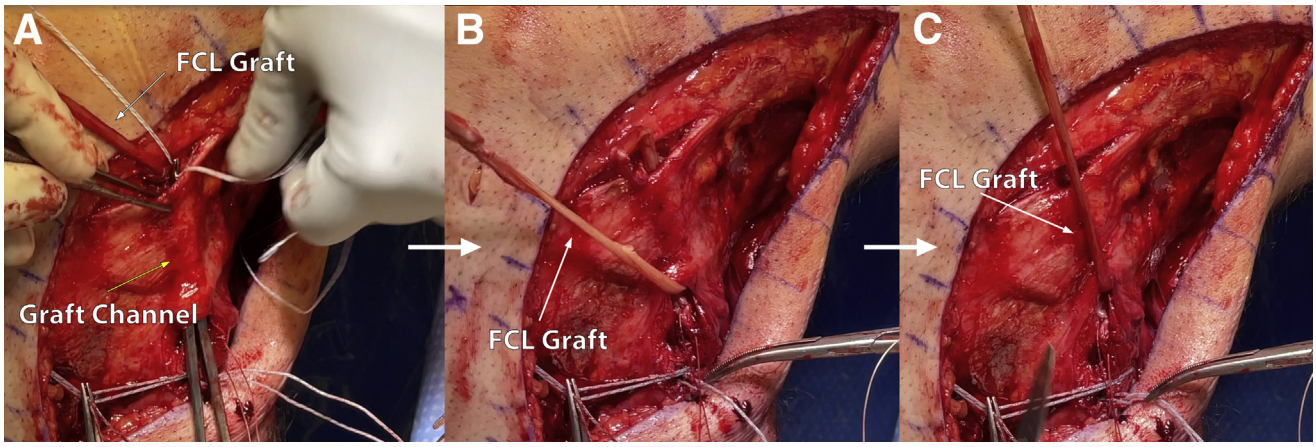

Fig 4. Intraoperative imaging of the FCL graft being passed through the channel created deep to the iliotibial band. The graft is passed through the channel following fixation in the femoral tunnel and prior to fixation in the fibular and tibial tunnels. (A) illustrates the graft before passage through the previously created channel (yellow arrow), (B) illustrates the graft (white arrow) during passage, and (C) illustrates the graft (white arrow) after passage through the channel. (FCL, fibular collateral ligament.)

catching the gracilis tendon. Significant investing scar about the pes tendons and medial collateral ligament is encountered. The surgeon then carefully dissects around the scar tissue to remove the second suture button construct and isolate the semitendinosus, which was verified to be viable for graft harvesting. Once free of scar tissue, the semitendinosus is then harvested with an open hamstring harvester. An assistant then prepares the combined FCL and PTFJ reconstruction graft by whipstitching each end with #2 nonabsorbable sutures. A brief arthroscopy is performed to rule out any concomitant pathology within the knee joint.

The FCL graft is then passed into the femoral tunnel and held in place with a 7- × 20-mm bioabsorbable screw. The FCL graft is passed through the previously created channel (Fig 4) and through the fibular head tunnel from anterior to posterior. The graft is fixed in the fibular head tunnel with the knee flexed to 20°, the foot in neutral rotation, a slight valgus reduction force applied to the knee, traction on the graft, and the surgeon holding the PTFJ joint in reduction. Complete elimination of varus gapping is accomplished.

The PTFJ reconstruction graft, which now exits the fibular head tunnel at its anatomic origin, is passed from posterior to anterior within the tibia and fixed

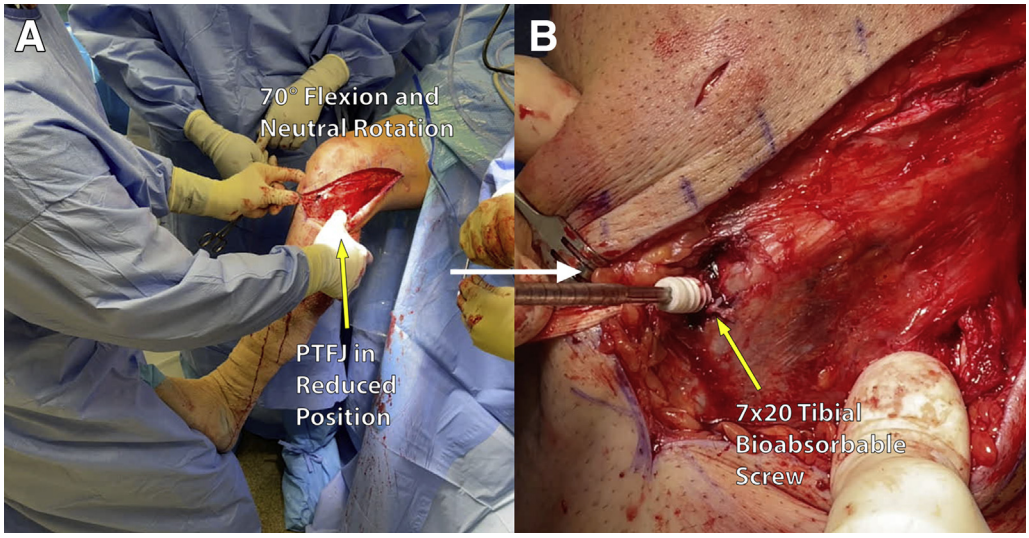

Fig 5. (A) Intraoperative imaging illustrating proper positioning of the knee before fixing the FCL graft. The knee should be held at 30° of knee flexion and neutral rotation while the surgeon holds the PTFJ in a reduced position (yellow arrow). This will allow for restoration of PTFJ stability following screw fixation of the FCL graft. (B) Intraoperative image illustrating fixation of the FCL graft with a bioabsorbable screw (yellow arrow) while the knee is held in the position illustrated by (A). (FCL, fibular collateral ligament; PTFJ, proximal tibiofibular joint.)

Table 2. Advantages and Disadvantages

Advantages	Disadvantages
Use of a tendon graft better replicates the biomechanics of the native PTFJ.	If using a hamstring autograft, it requires a second incision for graft harvest.
Anatomic reconstruction has shown improved outcomes over nonanatomic reconstruction.	More technically demanding surgical technique than using suture button construct.

PTFJ, proximal tibiofibular joint.

with a 7- × 20-mm bioabsorbable screw with the knee flexed to 70°, in neutral rotation, and the surgeon holding the PTFJ reduced (Fig 5). PTFJ stability is then noted to be normal.

A Q-fix anchor (Smith & Nephew, Andover, MA) is used to repair the biceps femoris tendon back to the posterolateral aspect of the fibular styloid, with great care being taken to protect the common peroneal nerve, and the sutures are passed into the biceps tendon with a free needle and tied with the knee in full extension.

The tourniquet is let down and hemostasis is achieved. The deep tissues were closed with 0 and 2-0 VICRYL (Ethicon, Raritan, NJ) followed by a Monocryl (Ethicon) stitch for the skin. Steri-Strips (3M, St. Paul, MN) are loosely applied followed by application of a sterile dressing.

The patient should start physical therapy rehabilitation on postoperative day 1, which will focus on quadriceps activation, edema control, and knee motion. Patients should be non–weight-bearing for 6 weeks. DVT prophylaxis is with Lovenox (Pfizer, New York, NY) 40 mg subcutaneously for 2 weeks followed by daily aspirin (Bayer, Leverkusen, Germany) 325 mg daily until 6 weeks postoperatively. Flexion is limited to 90° for the first 2 weeks and then is increased as tolerated. Active hamstring activation and strengthening is avoided for the first 4 months to protect the biceps femoris repair. At 6 weeks, the patient will go into a medial unloader brace to protect the FCL reconstruction graft since he is in near varus alignment. The brace should be worn for the first 4 to 5 months when weightbearing, and postoperative stress radiographs will be obtained at 6 months.

Discussion

PTFJ reconstruction can be used to address chronic instability secondary to a failed suture button construct and also to address iatrogenic FCL and biceps femoris tendon injuries. Suture button constructs can fail due to nonanatomic initial repairs, which can result from using more posteriorly located and smaller incisions than are needed to find and directly measure the appropriate landmarks for anatomic reconstruction.[4,7] Failure to address chronic symptomatic instability of the PTFJ may result in instability of the surrounding structures within the posterolateral corner. Recent literature has highlighted the benefits of using autograft reconstruction techniques instead of fixation with a suture button construct.[2,3,5,6,8] PTFJ reconstruction is a safe and low-risk procedure; however, clinicians must protect the common peroneal nerve and posterior neurovascular bundle to avoid serious complications. One limitation of this procedure is that it can be more technically demanding than using a suture button construct. Dekker et al.[5] report on a cohort of 16 patients who underwent anatomic reconstruction of the PTFJ and 84.6% were able to return to full desired activity and previous level of sport (Table 2).

There is a paucity of data on the rates of suture button construct failure resulting in chronic instability of the PTFJ. Proper placement of hardware is essential to avoid damaging surrounding structures such as the collateral ligaments, hamstring insertions, and neurovascular structures. Overall, anatomic reconstruction of the PTFJ using the semitendinosus as a graft is a reliable and effective method of restoring PTFJ function and stability.

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