Technical Note

Cortical Button Fixation for Proximal Tibiofibular Instability: A Technical Report

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Abstract: Instability of the proximal tibiofibular joint (PTFJ) is a rare injury pattern than can affect high-demand athletes involved in twisting or pivoting movements on a flexed knee. Instability may produce painful subluxations during provocative activity and occasional neuritic symptoms from tethering of the common peroneal nerve at the fibular neck. There are several reports of reconstruction for symptomatic PTFJ instability; however, no optimal treatment has been elucidated in the literature. Use of a cortical button suspensory device for fixation of the PTFJ offers the advantage of stabilizing the joint without need for free graft harvest or rigid screw fixation. The present technical report illustrates the operative technique and the advantages, disadvantages, pearls, and pitfalls associated with this operation.

Instability of the proximal tibiofibular joint (PTFJ) is a rare pathology that predominantly affects athletes participating in sports involving twisting motions in knee flexion.[1] PTFJ instability can cause significant morbidity and functional impairment during sporting activity because of continuous irritation of the common peroneal nerve.[1] Furthermore, due to the subtlety of its presentation, this injury may often go undiagnosed particularly as symptoms resolve with spontaneous reduction, particularly with atraumatic onset.

Static stabilizers of the PTFJ include anterior and posterior ligaments that connect the fibular head to the lateral tibial condyle.[1] Additional stabilizers include the knee joint capsule, popliteus tendon, and the biceps femoris tendon.[1] Anterolateral instability is the most commonly reported pattern.[1] A myriad of operative treatment options exists to treat PTFJ instability with low complication rates, relief of symptoms, and improved outcomes; however, there is no established optimal treatment modality.[2]

Cortical button suspensory devices fixation has increasingly been used for the stabilization of tibiofibular instability, both distally and to a lesser extent proximally, given their strong biomechanical properties and limited bulk.[3,4] The present technical report presents a cross country athlete with atraumatic, subacute onset of PTFJ instability with common peroneal nerve symptoms. The purpose of this report is to describe successful use of suture button fixation of symptomatic PTFJ instability to facilitate an expeditious return to sport without morbidity.

Surgical Technique

Indications and Preoperative Imaging

Tenderness to palpation of the PTFJ will be present in those with disruption. The patient must be assessed for

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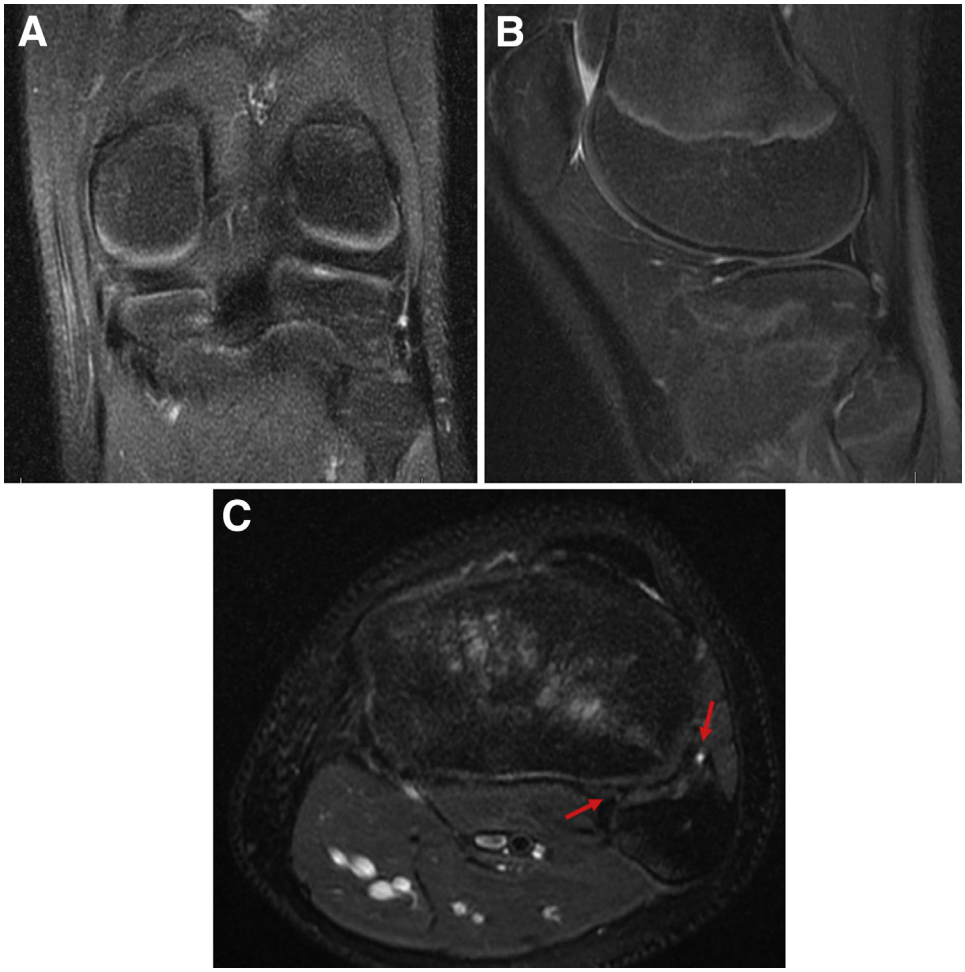

Fig 1. Magnetic resonance imaging of the left knee in (A) coronal, (B) sagittal, and (C) axillary slices that reveal no focal edema surrounding the proximal tibio-fibular joint. Red arrows: anterior and posterior superior tibiofibular ligaments.

existence of foot drop or aberrant sensation in the peroneal nerve distribution over the anterolateral leg with and without activity. Physical examination of the knee is used to determine whether alternative ligamentous instability exists or patellar maltracking that may be responsible for patient symptoms. Shuck testing is then performed to determine anterior-posterior translation of the fibula with respect to the tibia. Guarding and apprehension may be present on shuck testing.

Plain film radiographs are first obtained to determine any osseous abnormalities. Magnetic resonance imaging is then obtained to further evaluate the PTFJ ligaments (Fig 1). On magnetic resonance imaging, the PTFJ is in anatomic position, with convex tibial articulation, and congruent reduction when in full extension and without focal edema or evidence of acute ligamentous disruption. Patients are first trialed with nonoperative management through physical therapy and activity modification. The decision to pursue operative intervention is made with persistence of pain and dysfunction that precludes return to daily activities.

Patient Positioning

The patient is positioned supine on a standard operating room table. Tourniquet is placed over the left lower extremity. A lateral post is positioned at the midthigh and a foot bolster is placed to allow the knee to rest at 70 to 90° of flexion. The patient is prepped and draped in a standard sterile fashion. Examination under anesthesia is performed to confirm anterolateral instability of the PTFJ. A tourniquet is used for the duration of the case.

Operative Technique

Diagnostic Arthroscopy

Diagnostic arthroscopy is performed using standard medial and lateral parapatellar portals to exclude intra-articular pathology, particularly at the lateral joint line. Synovitis in the compartments of the knee may be debrided at this time. The structures of the knee, including the medial and lateral menisci, popliteus tendon, ligamentum mucosum, and anterior and posterior cruciate ligaments are examined to ensure integrity.

Fig 2. Posterior-based 5- to 7-cm incision centered over top the fibular head.

Arthroscopic equipment is removed, and portal sites are closed primarily. The knee is then brought to 90° of flexion. A posterior-based incision is made approximately 5 to 7 cm in length and centered over the fibular head (Fig 2).

Surgical Approach

Dissection is carried down to fascia developing full thickness skin flaps. The peroneal nerve is identified 2 cm distal from the proximal tip of the fibula using manual palpation and careful dissection with Metzenbaum scissors. Care is taken to preserve surrounding vasculature throughout the course of the nerve as it is mobilized both proximally and distally. After mobilization, the nerve is safely retracted inferiorly to gain exposure to the PTFJ (Fig 3).

Implant Fixation

The drill site is identified at the area of metaphyseal thickening on the fibula (Fig 4). At approximately 30° angled anteriorly in the coronal plane toward the tibia, a 3.7-mm trocar-shaped drill is advanced perpendicular to the PTFJ across all 4 cortices under fluoroscopic guidance (Fig 5).

With the knee in 70 to 90° of flexion, a suspensory cortical fixation device (TightRope, Arthrex, Naples, FL, USA) is deployed in standard fashion. The implant is passed through the proximal fibula and tibia cortices from the lateral side using a shuttle wire. Each suture tail is wrapped around tensioning handles. The tensioning handles are pulled, 1 at a time, until the button lay flush on the medial tibial cortex (Fig 6). Fluoroscopy is used to confirm adequate deployment of the suture button so that it is seated flat along the medial tibia. A blunt hemostat is placed underneath the lateral button, whereas the alternating suture is passed so that the lateral button is seated flat on the proximal fibula (Fig 7). The pull-through sutures are cut and removed, whereas the lateral sutures are cut flush. Fluoroscopy is used to confirm accurate placement of the device (Fig 8).

Repeat examination of the PTFJ is performed with anterior and posterior shuck testing; this is comparable to the contralateral side. The wound is irrigated and closed in layers, with a subcuticular closure and application of an adhesive skin glue. Final postoperative films are acquired (Fig 9).

Rehabilitation

The patient is limited to toe touch weightbearing from 0 to 2 weeks after surgery, with the knee locked in full extension, and passive range of motion is allowed from 0 to 90°. From 2 to 4 weeks, the patient is advanced to partial weightbearing with crutches with the knee locked in full extension. From 4 to 6 weeks, the patient

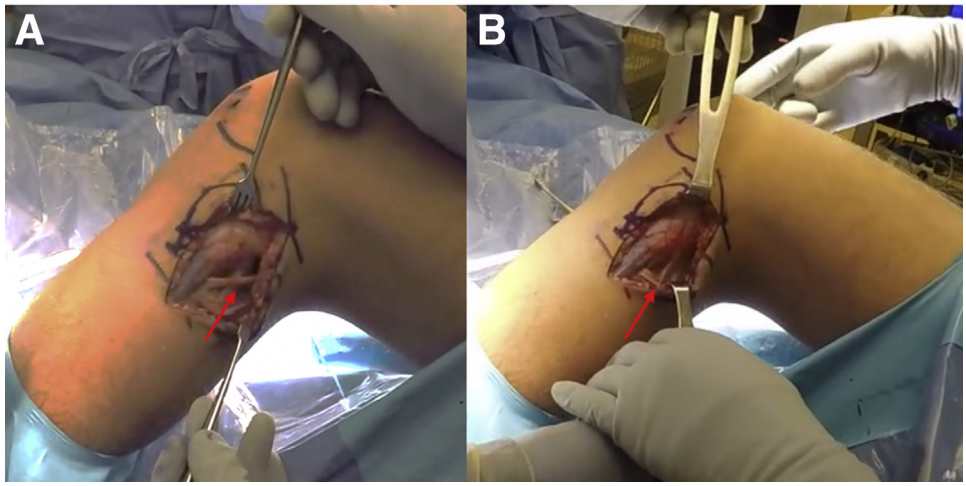

Fig 3. Patient left knee positioned supine and in 90° flexion with (A) identification of the common peroneal nerve and (B) retraction inferiorly. Red arrow: common peroneal nerve.

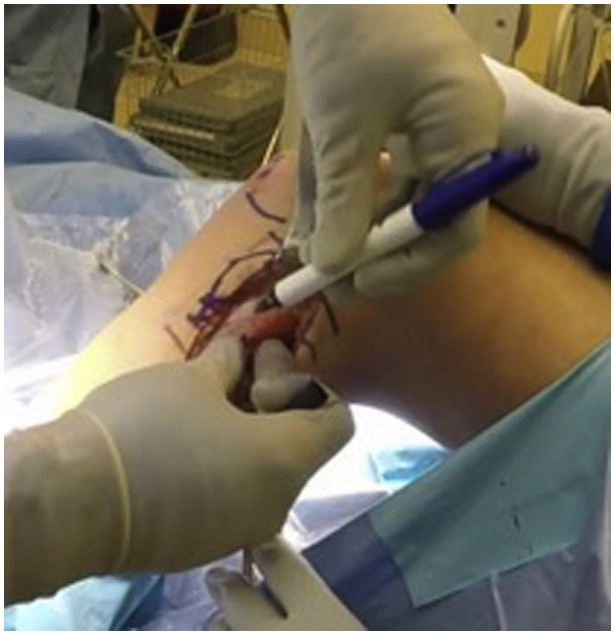

Fig 4. Drill site for insertion of button fixation of the proximal tibia-fibular joint in left knee, positioned supine and in 90° flexion.

is advanced to full weightbearing as tolerated with the brace unlocked. The patient is weaned from crutches as tolerated and progressive strengthening and conditioning training is initated at 6 weeks. A running program, or alternative sport specific programs, may be used to advance the patient's return to sport. Jogging is advanced first to 0.5 to 1 mile. If able to be performed asymptomatic, the patient is advanced to half-speed sprints. This is advanced to full speed as tolerated depending on the level of pain. Next, the patient is advanced to performing 6 80-yard sprints with cutting and advanced speed as tolerated. This program is performed each day until the patient was able to tolerate the program without pain. Upon completion of the running program, the patient is able to return to competition (Table 1).

Fig 5. Establishment of drill site of proximal tibiofibular fixation using fluoroscopic guidance.

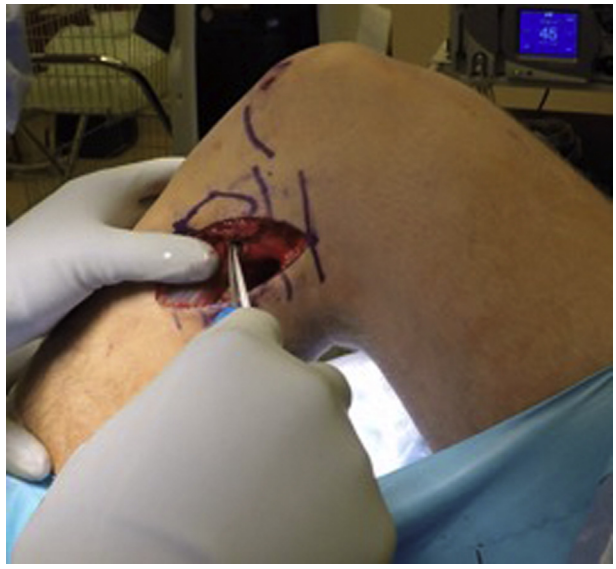

Fig 6. Insertion of suspensory ligament device into the predrilled proximal fibula and tibia to reconstitute the proximal tibiofibular joint in left knee, positioned supine and in 90° flexion.

Discussion

The present technique article presents the operative management of PTFJ instability using the popular suspensory cortical button fixation device (Video 1). The

Fig 7. Final tensioning of the suspensory ligament device using tensioning handles wrapped around device's suture tails in left knee, positioned supine and in 90° flexion.

Fig 8. Fluoroscopy anteroposterior view of the left knee demonstrating suspensory cortical fixation device traversing the proximal tibia fibular joint.

presented patient had a successful outcome with surgery and was able to return to sport in less than 6 months. Outcomes regarding PTFJ instability are limited; however, continued investigations should be aimed at using cortical suspensory devices to fix the joint.

The PTFJ is stabilized predominantly by the ligamentous complex anteriorly and posteriorly and the popliteus tendon posteriorly.[1] Anterolateral dislocation is most reported in the literature, and coincides with injury to the anterior and posterior capsular ligaments.[1] Nonoperative treatment through immobilization has been reported in 35 patients, which resulted in improvement without persistent symptoms in 59% of patients.[2] Various fixation methods have been reported in the literature, including internal fixation with screw, free graft reconstruction, and cortical button suspensory fixation.[2] Kruckeberg et al.[2] performed a systematic review wherein 16 patients were treated with screw alone and 62.5% of patients reported no instability with fixation. Fibular head resection was performed in 8 patients, and resulted in no instability symptoms; however, 1 patient had persistent temporal peroneal nerve palsy.[2] Alternative reconstructive options include free graft and a suture bridge construct.[5] In patients receiving free graft reconstruction, none had instability symptoms; however, 2 patients were reported to have sustained a fracture perioperatively.[2] Tafazal et al.[6] used a cortical button suspensory construct in a single case report in an 8-year-old child for management of isolated, chronic PTFJ instability. The patient developed peroneal nerve neuropraxia which resolved by 5 months, and successfully returned to sport. The patient had persistent pain in the anteromedial aspect of the leg and the implant was removed thereafter, which resolved all symptoms.[6] A recent Technical Note discussed treatment of symptomatic PTFJ instability with a 2-device cortical suspensory device.[7] The present case found adequate fixation with use of 1 device and an earlier progression of rehabilitation to prevent stiffness.

Cortical suspensory fixation devices have become increasingly used in the repair of ligamentous structures, particularly the distal syndesmosis.[8,9] Biomechanically,

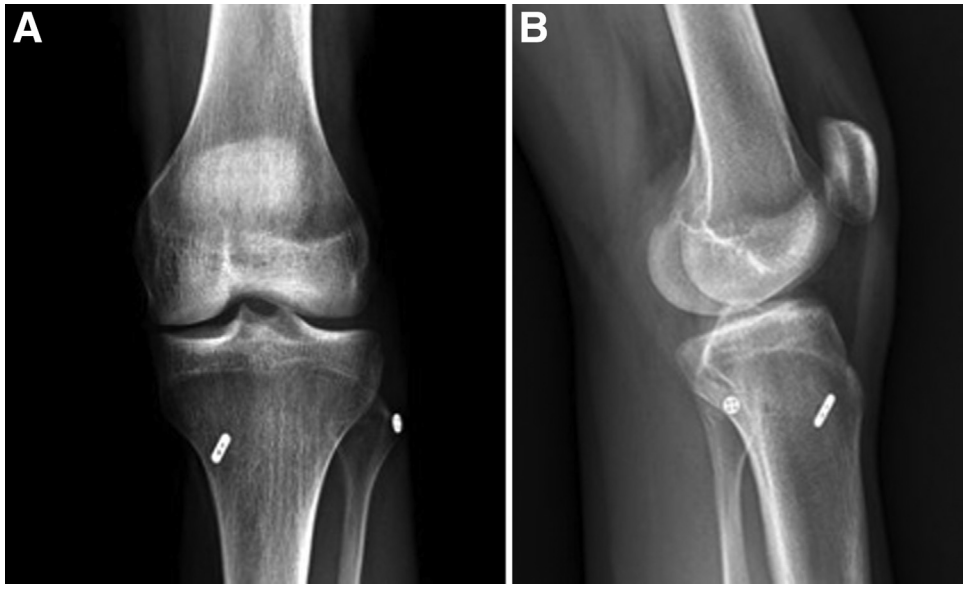

Fig 9. Final postoperative radiographs at 4 months following surgery demonstrating (A) anteroposterior and (B) lateral views of the left knee.

Table 1. Rehabilitation Protocol Following Proximal Tibiofibular Joint Reconstruction

Time Interval	Rehabilitation
0-2 weeks	Weightbearing: Toe touch weightbearing Range of motion: Knee locked in full extension in hinged knee brace
2-4 weeks	Weightbearing: Partial weightbearing with crutches Range of motion: Knee locked in full extension in hinged knee brace
4-6 weeks	Weightbearing: Full weightbearing as tolerated Range of motion: Knee remain in hinged knee brace, unlocked Strengthening: Advance as tolerated; begin sports-specific exercise

suture button devices have demonstrated superiority in comparison to screws and plate-screw constructs in restoring the distal syndesmosis.[3,4] Clinically, suture button constructs have shown either equivalent or superior outcomes in comparison to syndesmotic screws alone.[10,11] Additionally, cortical suspensory devices are less likely to cause fracture during drilling when compared to free graft constructs.[2] Use of such devices to reconstruct the PTFJ have had successful reports in recent case reports.[12] Additionally, fixation with suspensory device provides less rigid fixation in comparison to screw only to allow for earlier range of motion (Table 2, Table 3). The primary risk associated with this technique is persisten peroneal nerve symptoms. However, fixation through alternate modes of fixation such as a screw, pin, or bone graft are reported to have a higher incidence of such symptoms.[2] Careful dissection and retraction prevents this injury. Alternatively, wound infection, dehiscence, and heterotopic ossification have also been reported.

Continued reports may be used to validate the efficacy of fixation through cortical suspensory devices and compare constructs with that of free graft reconstruction or rigid screw fixation. The present technical report demonstrates the pearls and pitfalls of treating PTFJ instability with a single suspensory device and found no morbidity, resolution of instability symptoms, and swift return to sport in this single case.

Table 2. Advantages and Disadvantages of Cortical Suspensory Device Fixation of the Proximal Tibiofibular Joint

Advantages	Disadvantages
Small unilateral incision centered over fibula	Reliance on synthetic implant for syndesmotic instability
Allows for range of motion and partial weight bearing within 2-4 weeks and return to sport within 6 months	Free graft reconstruction required in event of failure
Smaller drill size compared to free graft constructs limits secondary fracture	
Lack of donor site morbidity from graft harvest	

Table 3. Pearls and Pitfalls of Cortical Suspensory Device Fixation of the Proximal Tibiofibular Joint

Pearls	Pitfalls
Careful dissection required to preserve common peroneal nerve, distal branches, and surrounding vasculature	Cognizant of anatomic variants with more proximal bifurcated common peroneal nerve Avoidance of the pes anserinus complex and saphenous nerve during far-cortex drilling and deployment of the far cortex button
Mobilization of nerve to allow for ease of retraction without excessive pressure	Failure to retract the common peroneal nerve or use a drill guide can result in damage adjacent structures
Drill must be angled anteriorly (approximately 30°) to reconstitute the proximal tibiofibular joint	Confirm button implant is flipped correctly through fluoroscopy
Central pin positioning in the proximodistal and anteroposterior planes of the proximal fibular metaphysis is critical to ensure anatomic and stable fixation	Eccentric drilling can result in iatrogenic failure or loss of fixation during final construct tensioning

Conclusion

The present technical report demonstrates use of cortical button suspensory device for fixation of the PTFJ. This technique offered early rehabilitation and return to sport without morbidity. Further research may be performed to compare efficacy with alternative constructs.

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