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Biological Stabilization of Proximal Tibiofibular Joint Recurrent Instability with Semitendinosus Graft – Surgical Technique and Case Report

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Learning Point of the Article:

Anatomic biologic reconstruction of the proximal tibiofibular joint instability with semitendinosus graft results in favorable clinical results.

Abstract

Introduction: Proximal tibiofibular joint (PTFJ) instability is an uncommon diagnosis of knee pain and is often misdiagnosed. Anatomical reconstruction has been reported to demonstrate improved outcomes with limited complication rates. While the commonly employed anatomical reconstruction methods involve allografts and free grafts, we report the technique and outcomes of anatomical reconstruction of recurrent PTFJ instability management using semitendinosus autograft.

Case Report: A 24-year-old young active woman with the instability of the PTFJ underwent stabilization with suspensory loop fixation using a tightrope device along with common peroneal nerve decompression. At 18 months, she reported recurrent instability with episodic knee pain that prevented her sporting activity. She was identified as the failure of the primary stabilization and anatomic biologic reconstruction with semitendinosus was done. The post-operative period was uneventful without any recurrent symptoms the until 1-year follow-up.

Conclusion: Non-anatomic reconstruction for PTFJ instability results in late complications like recurrent instability. Semitendinosus can be effectively utilized as the graft of choice for the anatomic reconstruction of the PTFJ ligament complex. Biologic anatomic reconstruction of PTFJ with semitendinosus results in improved clinical outcomes without recurrent complications.

Keywords: Proximal tibiofibular joint, semitendinosus, biological stabilization, case report, surgical technique.

Introduction

Proximal tibiofibular joint (PTFJ) instability is an uncommon diagnosis of knee pain and is often misdiagnosed. While the anterior capsulo-ligament complex of PTFJ remains strong, the posterior capsule remains vulnerable to injury due to weaker capsular attachments [1]. During ankle dorsiflexion, the proximal fibula externally rotates at the PTFJ while knee flexion causes gliding movement in the anterior-posterior axis at the PTFJ. As knee flexion increases, the proximal fibula moves anteriorly and the fibular collateral ligament and biceps femoris relax whereas extending the knee causes these tissues to become tense, pushing the fibula posteriorly [2-5]. The instability resulting from injury to PTFJ was explained to the torsional and tensile stresses dissipated by the joint during weight-bearing [6].

Ogden categorized the patterns and the prevalence of PTFJ injuries into four types: Atraumatic subluxation (23.3%), anteromedial dislocation (67.4%), posteromedial dislocation (7%), and superior dislocation (2.3%) [7]. The actual incidence of PTFJ instability remains understated due to the spontaneous reduction and chronic neglect. The available treatment options

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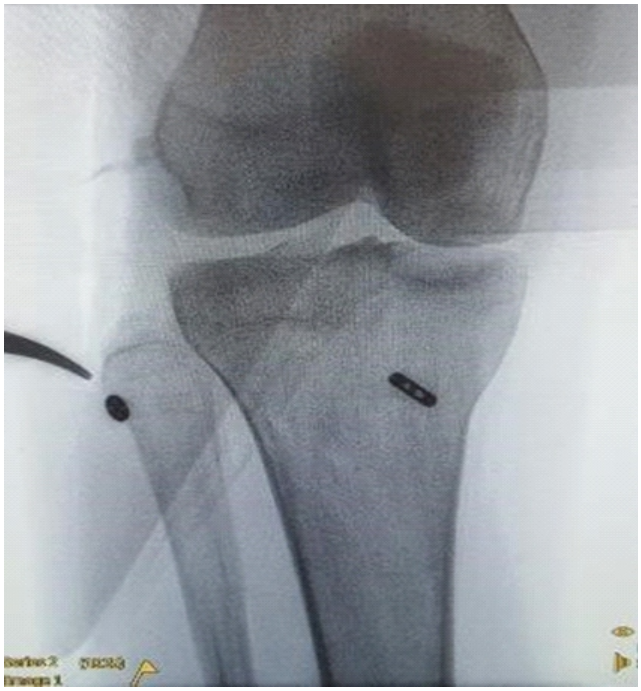

Figure 1: Anteroposterior radiograph showing the status of primary fixation with artery marking the endo button in the lateral aspect of the fibula and anteromedial aspect of the tibia.

for the symptomatic instability include temporary immobilization [8], arthrodesis [7, 9], internal fixation [10], fibular head resection [11], direct ligament repair [12], reconstruction of the ligament [13], or stabilization with biceps rerouting procedures [9].

Despite the multitude of treatment options available, anatomical reconstruction has been reported to demonstrate improved outcomes with limited complication rates [6]. While the commonly employed anatomical reconstruction methods involve allografts and free grafts, we report the technique and anatomical reconstruction of failed PTFJ instability management using semitendinosus graft.

Case Report

A 24-year-old young active woman presented with episodic anterior knee pain, hypermobility and PTFJ clicks following a soccer injury 10 months ago which made her discontinue soccer for 1 year. Symptoms worsened in the past 4–5 months with demonstrable click over the PTFJ in flexion. Clinical examination demonstrated subluxation of right PTFJ in flexion and extension movement that was exaggerated with varus stress. The movement was mildly painful without joint line tenderness, effusion, or pain on patellar loading. MRI scan reported a small ganglion at PTFJ articulation. Dynamic ultrasound demonstrated clicking and mild hypermobility of the PTFJ.

Under anesthesia, the patient demonstrated unstable PTFJ for which stabilization with suspensory loop fixation using an Arthrex® syndesmotic tight-rope device was done along with common peroneal nerve decompression. During arthroscopy, a discoid lateral meniscus was found with a small tear posteriorly that was debrided with limited saucerization. Post-operatively that joint remained stable with good pain relief at 6, and 12 months follow-up as shown in Fig. 1. At 18 months, she reported an inability to perform deep squats that prevented her from returning to competitive soccer. Clinical examination demonstrated a well-preserved range of movements. However, PTFJ was found to be lax and subluxable. Repeat MRI revealed features consistent with PTFJ effusion, synovitis and instability.

Treatment options considered included PTFJ fusion, excision of the proximal fibula, and anatomic biologic reconstruction with hamstring tendon graft. Considering the age and demand of the patient, PTFJ anatomic biologic reconstruction with

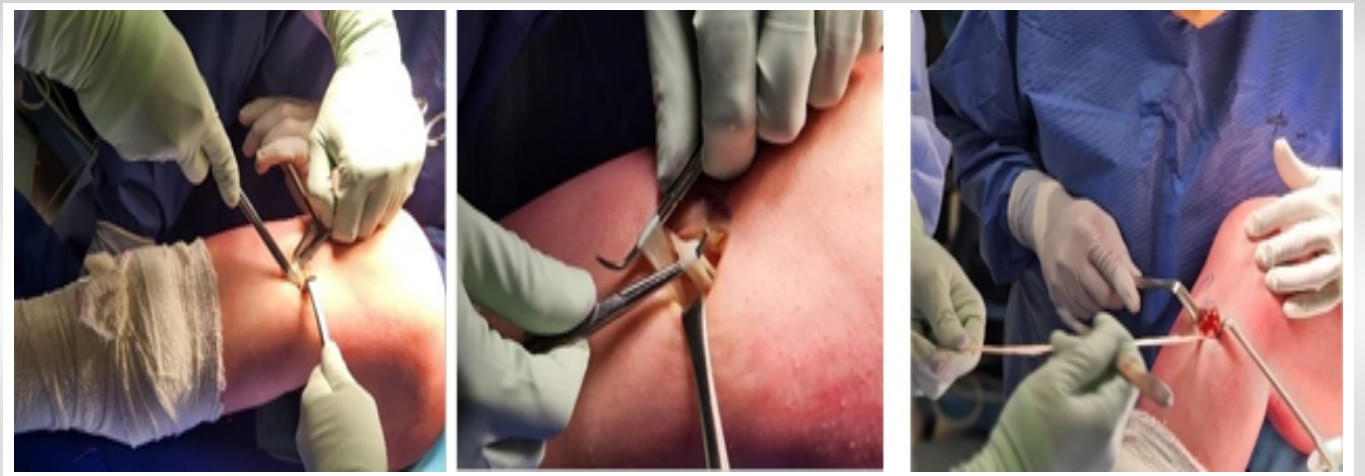

Figure 2: (a) (left): Skin incision showing the pes anserinus; (b) (middle): Identification of the semitendinosus insertion; (c) (right): Harvesting of the semitendinosus graft.

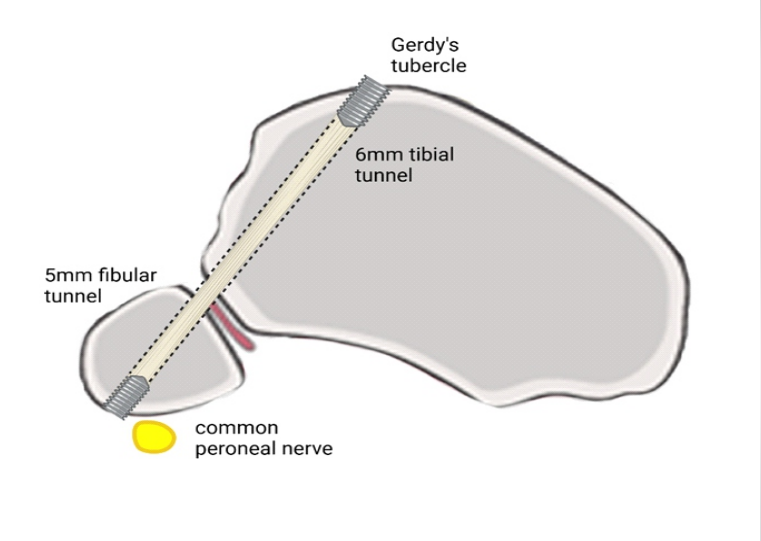

Figure 3: Schematic of the autograft fixation technique showing tibial 6 mm tunnel from the Gerdy's tubercle to anterior aspect of the tibiofibular joint and 5 mm tunnel in the fibula with hamstring tendon spanning the tunnel with ends secured with interference screws. Created with biorender.com.

autograft was deemed appropriate.

Surgical technique

The patient was placed in a supine position under the femoral block and general anesthesia with tourniquet control at the proximal thigh region. Under anesthesia, right PTFJ instability was noted in the anterior-posterior direction while left PTFJ was also found to be subluxable, albeit of lesser severity than the right knee and was clinically asymptomatic.

A 2–3 cm vertical incision (Fig. 2a) was made over the pes anserinus attachment at about 5 cm below the medial joint line and 1–2 cm below the tibial tuberosity. The semitendinosus tendon insertion was palpated (Fig. 2b) and traced proximally. Using a tendon stripper graft was harvested (Fig. 2c).

A schematic of the tunnel is presented in Fig. 3. A curvilinear mid-iliotibial band incision was made extending from a point proximal and posterior to the lateral femoral epicondyle extending distally between Gerdy's tubercle and fibular head. The skin markings were demonstrated in Fig. 4a. The skin was incised in the plotted line, followed by an incision of subcutaneous tissue in line with the skin incision as shown in Fig. 4b. Common peroneal nerve was identified and protected as shown in Fig. 4c. The PTFJ was then exposed through an anterior capsulotomy. Synovial debridement was performed. Fibula head exposure for tunnel placement was performed and good reduction of the joint was confirmed through palpation.

A 5 mm diameter fibular tunnel was made using the fibula head jig from Arthrex® collateral ligament reconstruction set in an anteroposterior direction as shown in Fig. 5a and the length of the fibular tunnel is measured using a depth gauge (Fig. 5b). A 6 mm diameter tibial tunnel was made using the tibial jig of the collateral ligament reconstruction set. The tunnel is made from Gerdy's tubercle to exit at a point 1–2 cm medial to the tibial aspect of PTFJ.

Suture lasso and nitinol wire loops were used to pass the whip-sutured semitendinosus graft across the fibula tunnel from anterior to posterior and then through the tibial tunnel posterior to anterior as shown in Figs. 6 and 7, respectively. The graft was then fixed to the fibula using interference screws of 4.75 mm in the fibula and 6 mm in the tibia. Ends were further sutured to soft tissues and the capsule of the PTFJ using a 2-0 non-absorbable suture. The stabilization is checked for stability and wounds are closed in layers in a sterile fashion.

The post-operative period was uneventful without any recurrent symptoms in the right knee until 1 year. The left knee continued to be asymptomatic and was closely monitored.

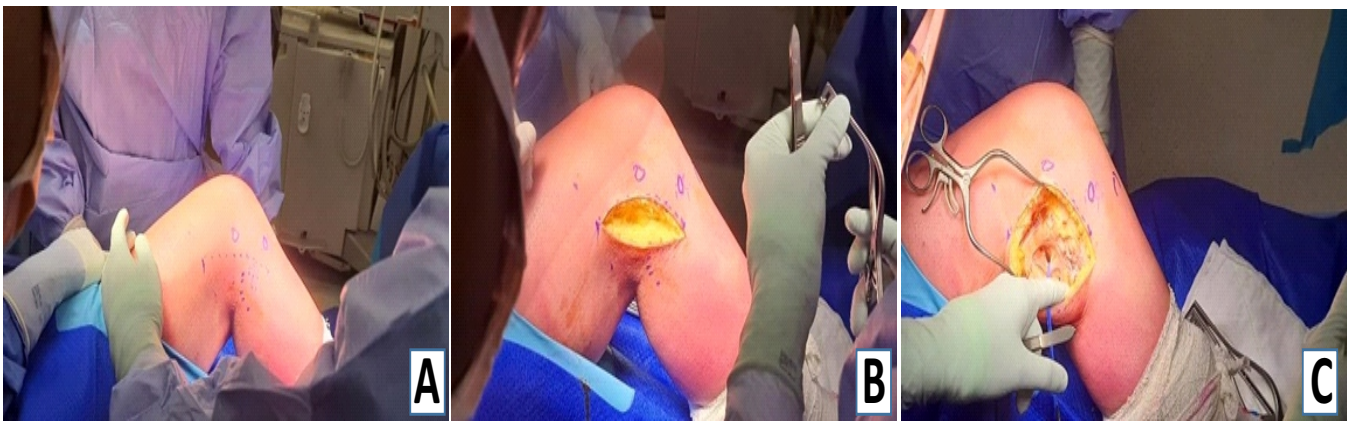

Figure 4: (A) Skin markings for incision; (B) elevation of skin and subcutaneous tissue as single flap; [C] identification and isolation of common peroneal nerve.

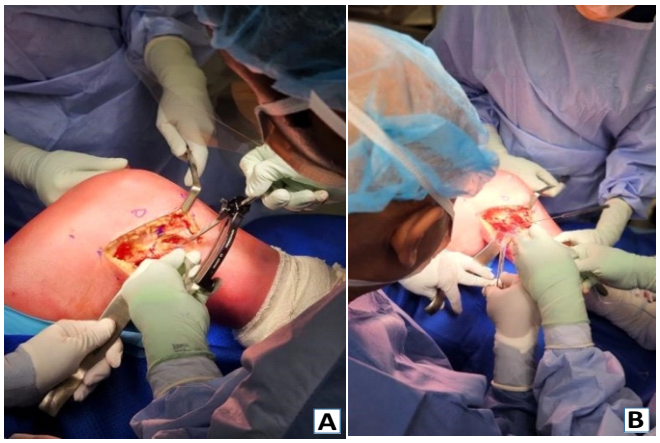

Figure 5: (A) Fibular tunnel creation using collateral ligament jig; (B) canal depth measurement using depth gauge.

Discussion

Reconstructing the proximal tibiofibular ligaments has been found to enhance patient outcomes and function, despite its technical difficulty [14]. Although the previous case reports employed either arthrodesis or fibular head excision in the management of similar scenarios, they suffered from complications such as late-instability, knee and ankle joint pain making them less attractive [5, 15]. Recent studies have detailed several soft-tissue reconstruction strategies for PTFJ [2, 6, 16]. These include non-anatomic rerouting procedures (e.g., biceps femoris or iliotibial band) and free autografts/allografts for anatomic reconstruction [13, 14]. Non-anatomic treatments suffer from long-term complications due to the aberrant biomechanics leading to over-constraint or stretching over time [6, 17]. Further, autografts were shown to demonstrate favorable long-term results with the least incidence of complications compared to other treatment methods for PTFJ instability [6].

Advancements in knee ligament reconstruction surgery have led to the development of autograft-based procedures in the management of PTFJ instability [13]. This case report illustrates the technique for addressing PTFJ instability with open direct reconstruction of ligament complex using semitendinosus autograft and screw fixation. Giachino [15] proposed utilizing the biceps femoris tendon for reconstruction, while Shapiro et al. [18] suggested using the iliotibial band. Kobbe et al. [19] and Morrison et al. [20] described the use of hamstring grafts to reconstruct the anterior and posterior ligaments of PTFJ. However, we considered semitendinosus graft for the reconstruction for reasons such as proximity to the site of surgery, ease of harvest and familiarity in its usage for cruciate ligament reconstruction.

Considering the inherent stability of the anterior ligament complex, reconstructing the anterior components was not considered essential by some authors. Based on recent recommendations, semitendinosus graft may be solely used to rebuild the posterior ligament complex [2]. However, we reconstructed the entire ligament complex using a semitendinosus graft.

Different techniques have been described to reconstruct the PTFJ ligament complex following injury and instability. Based on the recent systematic review of all the techniques by Kruckeberg et al., anatomic reconstruction of PTFJ with grafts was shown to result in improved pain relief and functional outcomes with the least complication rates. The autograft technique used in our case is salient for its simplicity and ease of procedure apart from being cost-efficient compared to allograft choices.

Conclusion

Non-anatomic reconstruction for PTFJ instability results in late complications like recurrent instability. Semitendinosus can be

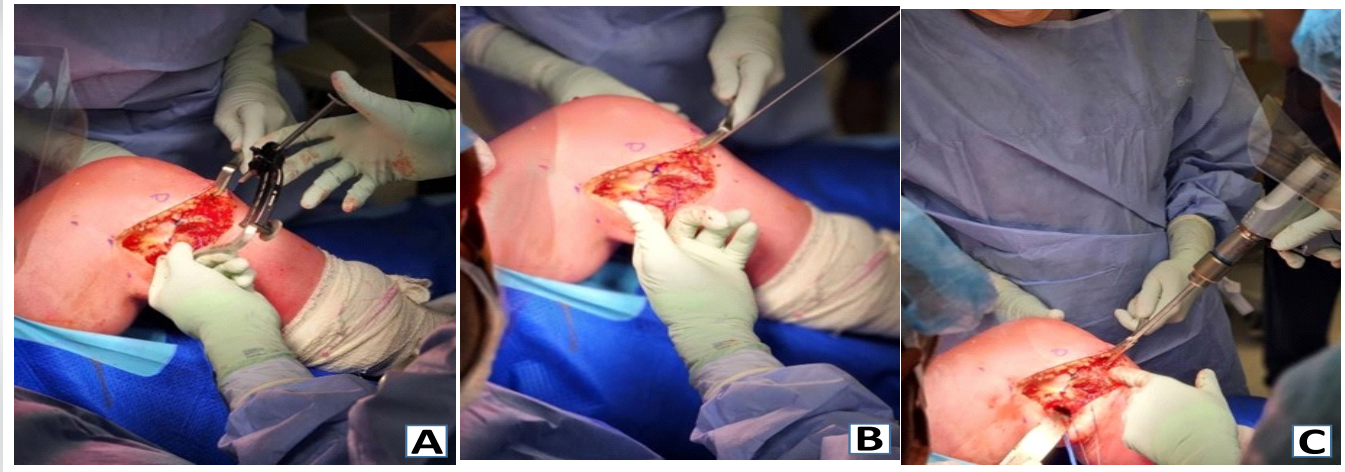

Figure 6: (A) Tibial tunnel creation using collateral ligament jig; (B) guide pin passage; [C] tunnel drilling.

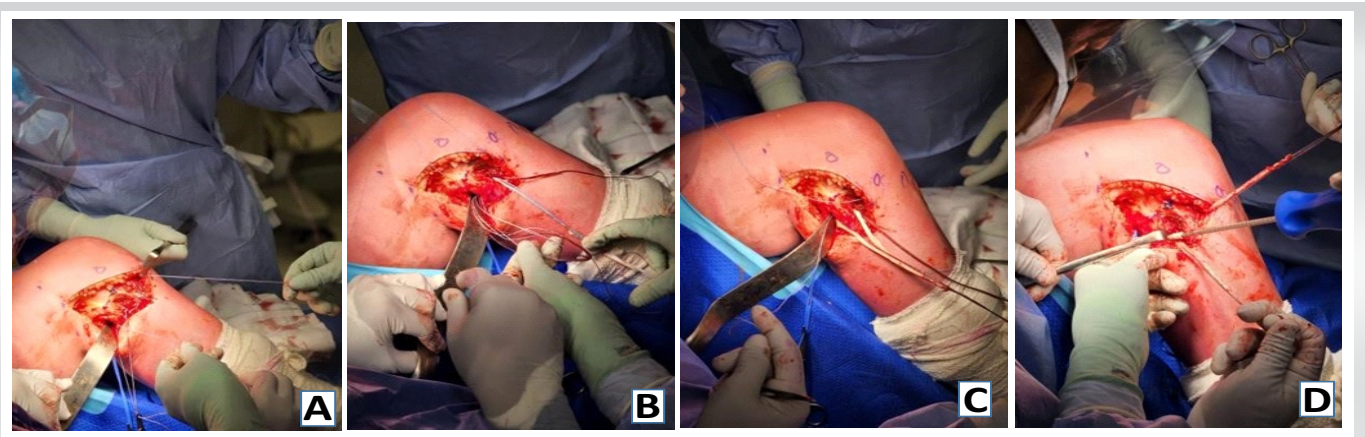

Figure 7: (A) Loop shuttling through the tibial and fibular tunnel; (B) attachment of the harvested graft to the shuttle loop; (C) passing the graft through the tunnel; (D) fixation of the graft with an interference screw.

effectively utilized as the graft of choice for the anatomic reconstruction of the PTFJ ligament complex. Biologic anatomic reconstruction of PTFJ with semitendinosus results in improved clinical outcomes without recurrent complications

Clinical Message

- Non-anatomic reconstruction for PTFJ instability results in late complications like recurrent instability.
- Semitendinosus can be effectively utilized as the graft of choice for the anatomic reconstruction of the PTFJ ligament complex.
- Biologic anatomic reconstruction of PTFJ with semitendinosus results in improved clinical outcomes without recurrent complications.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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