



Case Report

Proximal tibiofibular stabilization by anatomical ligamentoplasty and diaphyseal osteotomy of the fibula

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ABSTRACT

Proximal tibiofibular instability is a rare condition for which treatment is poorly codified. A 21-year-old patient, a leisure sportswoman, presented a post-traumatic anterolateral instability of the proximal tibiofibular articulation without cartilage lesion. We propose an original surgical technique based on a review of the literature that combines an anatomical ligamentoplasty of the proximal tibiofibular joint and a proximal fibular diaphyseal osteotomy to reduce the distal tibiofibular mechanical stresses. This original technique allows a favorable evolution with recovery of professional and sports activities at 6 months.

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Introduction

Proximal tibiofibular (PTF) joint instability is a rare condition: only 96 cases have been reported in the published literature.¹ The post-traumatic etiology is most frequently reported as that the initial trauma may be unnoticed and therefore absent in the clinical history. The diagnosis is often unknown and delayed due to its variable and often atypical clinical presentation or association with other more obvious lesions.

PTF joint is an arthrodial (sliding movement) joint stabilized by two tibiofibular ligaments, one anterior and one posterior. In some patients, instability will be caused, apart from the triggering trauma, by a rupture of the thinner anterior ligament² and the oblique orientation^{3,4} of the joint. Thus, the most frequent form of PTF instability is anterior instability.

Several treatments are reported in the literature,⁵ ranging from conservative treatment⁶ to multiple surgical techniques.^{3,7–11} Arthrodesis^{3,7} and resection of the head of the fibula⁹ were the therapies first proposed. A better understanding of the biomechanics of the upper tibiofibular joint has led to improved surgical therapies; nonetheless, no optimal treatment is currently defined

in the literature. The objective of our article is to present a clinical case with an original surgical treatment developed based on a review of the current literature, aiming at optimizing the functional outcome.

Case report

A 21-year-old patient, a leisure sportswoman, had been presenting for 10 years with slight pain on the lateral side of her knee during intense physical effort following a fall, for which the initial injury assessment had revealed nothing. For two years, she had also been experiencing abnormal mobility of the proximal fibula, with increasing discomfort. Pain in the activities of daily living and episodes of knee blockage when jumping from the lateral side of the knee gradually appeared.

Clinical assessment showed a dry, mobile, painless knee for flexion/extension movements without any evidence of anomalies of the collateral ligaments, central pivot, or menisci. The discomfort was centered on the PTF joint. Anterior dislocation of the fibular head was observed during forced maneuvers at 90° of flexion (video Appendix). During this maneuver, the patient indicated her discomfort. There was no sign of irritation of the common fibular nerve.

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X-ray finding was normal. MRI showed a moderate periarticular PTF joint effusion with a normal cartilage appearance. The diagnosis of post-traumatic anterolateral PTF instability according to the Harisson classification¹² was made.

We proposed a PTF ligamentoplasty procedure to the gracilis tendon to stabilize the joint combined with a proximal fibular diaphyseal osteotomy to limit mechanical stress in the PTF and distal tibiofibular joints.

Our case was approved by the local scientific and ethical committee and the patient gave her written consent.

The ligamentoplasty procedure was performed using a lateral approach centered on the PTF joint. After identification and protection of the common fibular nerve and the lateral collateral ligament plane, the head of the fibula was exposed, as was the lateral tibial plateau of Gerdy's tubercle to the posterior aspect of the lateral condyle. We made a 3.5-mm anterior-posterior transosseous tunnel in the head of the fibula and the lateral tibial plateau to pass the gracilis tendon harvested by a standard anterior tibial paratuberosity approach through these two tunnels. The gracilis was sutured to itself in the reduced position of the PTF joint (Fig. 1). A short proximal lateral fibular diaphyseal incision was used to make an osteotomy with resection of 2 cm of fibula and local muscle interposition to avoid secondary consolidation (Fig. 2).

This procedure was performed on an outpatient basis. The patient then wore a knee immobilization splint for 6 weeks with complete discharge and progressive rehabilitation from 21 days after surgery onwards to recover joint mobility and muscle capacity.

At 3 months follow-up, the evolution returned to a dry, painless, and mobile knee. The PTF joint was stable during dislocation maneuvers. Mild initial neuropathic pain had quickly subsided. At this time, painlessness and complete support without technical assistance were regained and resumption of work was possible. The resumption of a leisure sports activity at the same level was observed at 6 months.

Discussion

Our technique allows an efficient stabilization of the PTF joint with a favorable long-term evolution, shown as Fig. 3. Three other cases of ligamentoplasty technique with grafting have been reported in the literature. One case involved the gracilis tendon¹¹ and the other two involved the semitendinosus graft.¹³ None of these

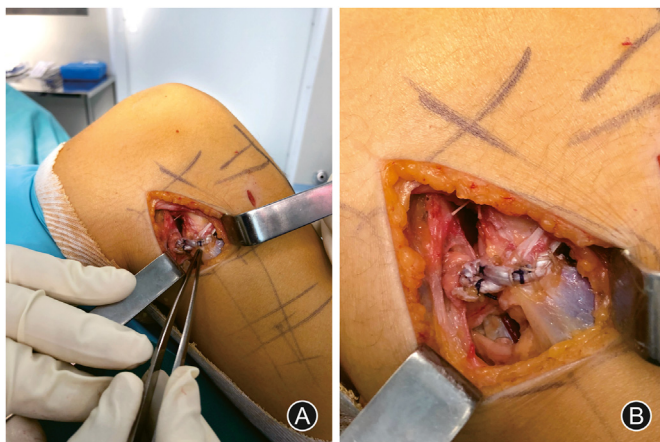


Fig. 1. Intraoperative aspect of anatomical ligamentoplasty in the framework of the proximal tibiofibular joint by a gracilis tendon. The course of the tendon that is ultimately sutured to itself is illustrated.



Fig. 2. Frontal radiographic appearance.

cases had an associated proximal fibular osteotomy procedure. They reported good results, with an initial evolution similar to our patient's (resumption of sports activity at 6 months without pain or recurrence of dislocation). Unlike these three cases, in order to be more economical, we did not use any implantable medical device.

Other techniques proposed in the literature are conservative treatment,⁶ osteosynthesis,⁸ arthrodesis,^{3,7} fibular head resection,⁹ adjustable cortical Endobutton reconstruction,^{14–17} direct ligament repair,¹⁰ and diversion of the biceps femoris tendon.⁷ In 2017, Kruckeberg et al.¹ conducted a literature review to analyze all the published cases of PTF joint instability (96 cases in 44 articles). This review revealed that surgical treatment was superior to conservative treatment which exposed the patient to sequelae pain and the risk of recurrence of the dislocation, with residual symptoms in more than 20% of cases. Anatomical ligamentoplasty techniques (such as ours) and diversion of the biceps femoris were the techniques that result in the fewest complications. However, comparison of the results of different articles is impossible due to the heterogeneity of the articles and the small number of patients.

There are, however, some important points for discussion:

- First, respect for anatomy is important for PTF due to the biomechanical relationships between the PTF and distal tibiofibular joints. Any non-anatomical procedure on one of the

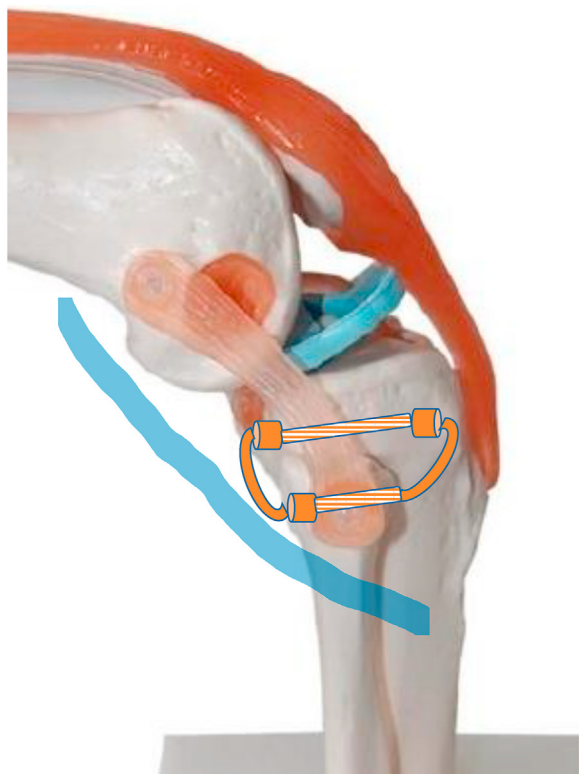


Fig. 3. Surgical technique (orange: ligamentoplasty; blue: common fibular nerve); this figure illustrates the course of the tendon between the tibia and the fibula.

tibiofibular joints influences the biomechanics of the other. As with other ligament reconstructions,^{18–21} this is likely why anatomical surgical techniques give better results than others.

- Second, even though there are little data in the literature on the biomechanics of the PTF joint, the biomechanical disadvantage of this type of reconstruction with a ligamentoplasty is the risk of long-term relaxation of the plasty due to repeated and chronic high mechanical stress. It is to limit this risk that we have proposed combining a PTF with segmental resection to create an underlying pseudoarthrodesis to reduce the biomechanical stresses on the tibiofibular framework. This procedure had been reported by Baciu et al.,²² who proposed an arthrodesis of the PTF joint and a proximal fibular osteotomy to restore the physiological movements of the distal tibiofibular forceps. The principle of this technique is similar to that of the Sauvé-Kapandji wrist procedure.²³ However, he had noted partial secondary ossification of the osteotomy site, which caused nerve pain with the common fibular nerve and necessitated secondary resection. Ollat et al.⁵ reported the same complication. We therefore recommend performing a diaphysal fibular osteotomy with partial resection of the fibula and muscle interposition to limit the risk of consolidation of this proximal diaphysal fibular osteotomy and to promote fibular pseudoarthrodesis.
- Third, the indications between ligamentoplasty and PTF arthrodesis are not clear in the literature. In light of this review of the literature, we propose distinguishing two distinct strategies: (1) PTF instability with little pain and non-degenerative PTF joint: indication for ligamentoplasty (conservative technique); and (2) painful PTFs and/or degenerative tibiofibular joint: arthrodesis (non-conservative treatment).

The most recent literature focused on three topics that are open to discussion without a validated answer: (1) The new fixation technique thanks to the Endobutton system which appears as an efficient one^{24,25}; (2) The possibility of proposing a treatment for acute cases as we could see in case of Maisonneuve injury with PTF dislocation²⁶; and (3) The hoped-for favorable evolution thanks to anatomical reconstruction.^{27,28}

In conclusion, analysis of the literature on the treatment of a PTF instability allowed us to propose an original technique combining anatomical ligamentoplasty with gracilis and proximal diaphysal fibular osteotomy to reduce the constraints on the plasty, resulting in a favorable evolution. This is an efficient and economical technique in cases where conservative treatment of the PTF instability is appropriate.

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Ethical statement

This case has been approved by the local scientific and ethical committee and the patient gave her written consent.

Declaration of competing interest

The authors declare that they have no competing interest.

Author contributions

Choufani Camille participated in the data collection, writing and proofreading of this article. Barbier Olivier participated in the data collection and review of this article.

References

1. Kruckeberg BM, Cinque ME, Moatshe G, et al. Proximal tibiofibular joint instability and treatment approaches: a systematic review of the literature. *Arthroscopy*. 2017;33:1743–1751. <https://doi.org/10.1016/j.arthro.2017.03.027>.
2. Parkes 2nd JC, Zelko RR. Isolated acute dislocation of the proximal tibiofibular joint. *Case Rep J Bone Joint Surg Am*. 1973;55:177–183.
3. Ogden JA. Subluxation and dislocation of the proximal tibiofibular joint. *J Bone Joint Surg Am*. 1974;56:145–154.
4. Bozkurt M, Yilmaz E, Atlihan D, et al. The proximal tibiofibular joint: an anatomic study. *Clin Orthop Relat Res*. 2003;406:136–140. <https://doi.org/10.1097/01.blo.0000030167.56585.2f>.
5. Ollat D, Pero C, Bajard X, et al. Mise au point sur l'instabilité tibio-fibulaire supérieure: À propos d'un cas et revue de la littérature. [Update on proximal tibia-fibula instability: a case report and review of the literature. *J Traumatol Sport*. 2006;23:245–253. [https://doi.org/10.1016/S0762-915X\(06\)71445-0](https://doi.org/10.1016/S0762-915X(06)71445-0).
6. Ashraf MO, Jones HM, Kanvinde R. Acute traumatic fracture dislocation of proximal tibiofibular joint: case report and literature review. *Injury*. 2015;46:1400–1402. <https://doi.org/10.1016/j.injury.2015.01.026>.
7. Sekiya JK, Kuhn JE. Instability of the proximal tibiofibular joint. *J Am Acad Orthop Surg*. 2003;11:120–128. <https://doi.org/10.5435/00124635-200303000-00006>.
8. van den Bekerom MP, Weir A, van der Flier RE. Surgical stabilisation of the proximal tibiofibular joint using temporary fixation: a technical note. *Acta Orthop Belg*. 2004;70:604–608.
9. Kapoor V, Theruvil B, Britton JM. Excision arthroplasty of superior tibiofibular joint for recurrent proximal tibiofibular cyst. A report of two cases. *Joint Bone Spine*. 2004;71:427–429. <https://doi.org/10.1016/j.jbspin.2003.07.011>.
10. Jabara M, Bradley J, Merrick M. Is stability of the proximal tibiofibular joint important in the multiligament-injured knee? *Clin Orthop Relat Res*. 2014;472:2691–2697. <https://doi.org/10.1007/s11999-014-3574-1>.
11. Horst PK, LaPrade RF. Anatomic reconstruction of chronic symptomatic anterolateral proximal tibiofibular joint instability. *Knee Surg Sports Traumatol Arthrosc*. 2010;18:1452–1455. <https://doi.org/10.1007/s00167-010-1049-9>.
12. Harrison R, Hindenach JC. Dislocation of the upper end of the fibula. *J Bone Joint Surg Br*. 1959;41:114–118. <https://doi.org/10.1302/0301-620X.41B1.114>.
13. Morrison TD, Shaer JA, Little JE. Bilateral, atraumatic, proximal tibiofibular joint instability. *Orthopedics*. 2011;34:133. <https://doi.org/10.3928/01477447-20101221-28>.

14. Oksum M, Randsborg PH. Treatment of instability of the proximal tibiofibular joint by dynamic internal fixation with a suture button. *Arthrosc Tech*. 2018;7:e1057–e1061. <https://doi.org/10.1016/j.eats.2018.08.004>.
15. Veth RP, Klasen HJ, Kingma LM. Traumatic instability of the proximal tibiofibular joint. *Injury*. 1981;13:159–164. [https://doi.org/10.1016/0020-1383\(81\)90052-8](https://doi.org/10.1016/0020-1383(81)90052-8).
16. Lewandowski LR, Tintle SM, D'Alleyrand JC, et al. The utilization of a suture bridge construct for tibiofibular instability during transtibial amputation without distal bridge synostosis creation. *J Orthop Trauma*. 2013;27:e239–e242. <https://doi.org/10.1097/BOT.0b013e31828d2c67>.
17. Tafazal SI, Flowers MJ. Proximal tibiofibular joint instability in a child: stabilization with Tightrope. *J Pediatr Orthop B*. 2013;22:363–366. <https://doi.org/10.1097/BPB.0b013e32836026b1>.
18. Geeslin AG, LaPrade RF. Outcomes of treatment of acute grade-III isolated and combined posterolateral knee injuries: a prospective case series and surgical technique. *J Bone Joint Surg Am*. 2011;93:1672–1683. <https://doi.org/10.2106/JBJSJ.01639>.
19. LaPrade RF, Spiridonov SI, Coobs BR, et al. Fibular collateral ligament anatomical reconstructions: a prospective outcomes study. *Am J Sports Med*. 2010;38:2005–2011. <https://doi.org/10.1177/0363546510370200>.
20. LaPrade RF, Wijdicks CA. Surgical technique: development of an anatomic medial knee reconstruction. *Clin Orthop Relat Res*. 2012;470:806–814. <https://doi.org/10.1007/s11999-011-2061-1>.
21. Spiridonov SI, Slinkard NJ, LaPrade RF. Isolated and combined grade-III posterior cruciate ligament tears treated with double-bundle reconstruction with use of endoscopically placed femoral tunnels and grafts: operative technique and clinical outcomes. *J Bone Joint Surg Am*. 2011;93:1773–1780. <https://doi.org/10.2106/JBJSJ.01638>.
22. Baciu CC, Colaru I, Tudor A. La luxation récidivante idiopathique tibio-péronière proximale chez l'adulte. Trois cas traités par une technique opératoire originale [Idiopathic recurrent proximal tibiofibular dislocation in adults. 3 cases treated by an original surgical technic]. *Rev Chir Orthop Reparatrice Appar Mot*. 1983;69:75–79.
23. Sauvè L, Kapandji M. Nouvelle technique de traitement chirurgical des luxations récidivantes isolées de l'extrémité inférieure du cubitus. *J Chir*. 1936;47:589–594.
24. Beck EC, Gowd AK, Nabor D, et al. Cortical button fixation for proximal tibiofibular instability: a technical report. *Arthrosc Tech*. 2020;9:e1415–e1421. <https://doi.org/10.1016/j.eats.2020.05.023>.
25. Okoroha KR, Mahan MC, Matar R, et al. Proximal tibiofibular dislocation repaired with syndesmotic suture buttons: a case report. *J Orthop Case Rep*. 2018;8:82–85. <https://doi.org/10.13107/jocr.2250-0685.1224>.
26. Alencar Neto JB, Cavalcante MLC, Pinto Neto LH, et al. Maisonneuve variant lesion with proximal tibiofibular dislocation. *Rev Bras Ortop (Sao Paulo)*. 2019;54:339–342. <https://doi.org/10.1055/s-0039-1692625>.
27. Dekker TJ, DePhillipo NN, Kennedy MI, et al. Clinical characteristics and outcomes after anatomic reconstruction of the proximal tibiofibular joint. *Arthroscopy*. 2020;36:1649–1654. <https://doi.org/10.1016/j.arthro.2020.01.056>.
28. Mamound A, Hoencamp R, Bosman WM, et al. Proximal tibiofibular joint dislocation: a rare entity. *BMJ Case Rep*. 2019;12, e227953. <https://doi.org/10.1136/bcr-2018-227953>.