Case Report

Severe inwardly pointing knee after medial patellofemoral ligament reconstruction: a case report

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ABSTRACT

We report the case of a 26-year-old woman who presented with a profound gait disturbance and total disability following a medial patellofemoral ligament (MPFL) reconstruction for recurrent patellar dislocation. It is common knowledge that patellar instability is associated with multiple risk factors, including but not limited to loss of the MPFL, trochlear dysplasia, patella alta, an abnormally placed tibial tuberosity on the tibia, quadriceps contracture, genu valgum, excess of femoral anteversion, excess of external tibial torsion, and foot pronation. Since the relative importance of each is unknown, it is imperative that pre-operative evaluation considers these. Two additional surgeries failed to improve her severe disability. Subsequent evaluation, 8 years after her initial MPFL reconstruction, revealed the presence of an excess of external tibial torsion and genu valgum. Complete resolution of disability resulted following tibial osteotomy, suggesting the importance of torsional deformity contributing to patellofemoral instability. Gait disturbance is an unrecognised complication after MPFL reconstruction.

The case

- We present a case of inwardly pointing knee after medial patellofemoral ligament reconstruction in a patient with pathological external tibial torsion.
- The importance of external tibial torsion in this case is suggested by the successful outcome after derotational tibial osteotomy.

Lessons learned

- The reported case illustrates the importance of external tibial torsion as a risk factor for potential complications after medial patellofemoral ligament reconstruction.
- The right way to determine the mechanical axis of the lower limb is with the patella pointing to the front.

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INTRODUCTION

Currently, isolated medial patellofemoral ligament reconstruction (MPFLr) is a safe and effective technique to treat recurrent patellar dislocation [1]. However, it is not a surgical technique that is free of complications [2,3]. Additionally, the presence of certain anatomical factors such as external tibial torsion (ETT) is associated with worse postoperative outcomes [4].

The main objective of this paper is to report a case of an inwardly pointing knee provoking a profound gait disturbance (scissoring gait) and disabling disability following an MPFLr for recurrent patellar dislocation. An inwardly pointing knee provoking a severe and disabling disability can be the result of several anatomical factors, including ETT [5]. In our case, it was secondary to an excess of ETT that became evident after MPFLr. The importance of ETT in our patient is suggested by the successful outcome after a derotational tibial osteotomy.

Case presentation

A 26-year-old woman presented at our office because of an inwardly pointing knee provoking a profound gait disturbance (scissoring gait) and disabling disability following an MPFLr for recurrent patellar dislocation (Fig. 1). While walking, the left foot pointed forward, whereas the right foot pointed outward [video]. She walked with the help of one or two crutches and a brace that is used for multi-ligamentous knee injuries. In the video presented as supplementary material, one can see the way she was going up and down stairs and ramps. Moreover, she had severe patellofemoral pain (Visual Analogue Scale score: 8 points), but her main complaint was gait disturbance. She had Central Sensitization Inventory (CSI: 53). She experienced quite significant limitations in her daily living activities (Kujala score: 12) as well as a consequential decrease in her quality of life (EuroQol 5D: 2-1-3-3-2 [0.3573]). She also had depression (Hospital Anxiety and Depression Subscale, HAD: 17), anxiety (HAD: 17), catastrophizing ideas (Pain Catastrophizing Scale, PCS: 32) and kinesiophobia (Tampa Scale for Kinesiophobia, TSK: 46). What is more, she also had left patellar instability. But the knee that caused serious problems was the right one.

History prior to our visit

This patient had done a lot of sports until the age of 18 (running, tennis, swimming, skating). She had also had 8 episodes of lateral patellar dislocation in the right knee. At the age of 18, she had an operation in which an MPFLr was performed. After the surgery, there was 20° of knee flexum, associated with a noticeable scissoring gait, which was non-reducible [video]. Seven months after the index surgery, the MPFL-graft was resected, but the functional situation worsened noticeably as she experienced an instability that she did not have before. One year and a half after the second surgery, a third surgery was performed. That third one was a medial collateral ligament (MCL) reconstruction using an allograft for both bundles, superficial MCL and Posterior Oblique Ligament (POL). Before coming to our office, a femoral varus osteotomy to correct the valgus deformity had been proposed, based on an inaccurate x-ray of the lower limbs (Fig. 2). In addition, another surgeon offered her a knee arthrodesis as the last option to obtain a stable and painless knee.

Physical examination

During physical examination, there was complete range of motion (ROM). There was an over-tightening of the medial retinacular complex, as can be deduced by the lack of a normal lateral patellar glide upon physical examination. The patient experienced pain in the medial aspect of the knee, with lateral displacement of the patella. There was no medial patellar instability, no joint effusion, no varus instability, no valgus instability, and no anteroposterior instability. The J-sign was negative. There was significant pronation of the right foot [video]. The Achilles tendon was not tight. Thigh and calf atrophy were significant in both limbs. However, right hip abduction and external rotation strength, evaluated using a dynamometer, were as on the contralateral left side. The internal rotation and external rotation of the hip in the prone position were similar.

Imaging findings

In the lateral x-ray, the different fixation points of the different grafts can be seen. There are two femoral tunnels because of an MCL reconstruction [video]. The location of the femoral tunnel was correct. Total limb alignment was measured by using standing x-rays of the lower limbs. In a correct standing x-ray of the lower limbs used to evaluate the coronal plane, the patella should be well-centred on the distal femur (Fig. 3). A line from the centre of the femoral head to the centre of the knee was run. This is the femoral mechanical axis (Fig. 4). Then a second line was run from the centre of the knee to the centre of the talus. This line is the tibial mechanical axis (Fig. 4). To measure femoral alignment, a tangent line was run across the distal end of the medial and lateral femoral condyles (Fig. 4). The angle between the distal femoral tangent and the femoral mechanical axis should be 93° on the medial side and 87° on the lateral side. In the same way, tibial alignment is defined as the angle between the tangent on the top of the tibial plateau and the tibial mechanical axis (Fig. 4). This should be 87° on the medial side and 93° on the lateral side.

![Fig. 1. Inwardly pointing right knee.](image1)

![Fig. 2. Incorrect standing x-ray of the lower limbs to evaluate the coronal plane.](image2)
In our case, the distal femoral medial angle was 95° (Fig. 4). The angle between the distal femoral and proximal tibial tangent, the so-called joint convergent or joint congruent angle, was less than 1° (Fig. 4). In young people, both lines are always parallel. The proximal tibial medial angle was 89° (Fig. 4). Thus, our patient has 2° of valgus in the femur, less than 1° valgus in the joint, and 2° valgus in the tibia for a total valgus of 4°. Torsional computed tomography (CT) showed 43° of ETT on the right and 26° on the left side. Therefore, there was a pathologic ETT on the right side. Moreover, to perform a segmental analysis of ETT, a third line tangential to the posterior tibial cortex below the tibial tubercle is drawn (Fig. 5). The right femoral anteversion angle, according to Murphy’s method, was normal (15°). The external knee rotation was 5° for the right knee and 11° for the left one. There was no trochlear dysplasia. The Tibial tuberosity (TT)–Trochlear Groove (TG) distance was 10 mm on the right side. The patient also underwent magnetic resonance imaging in which no pathological findings were evidenced. Stress x-rays were performed prior to surgery. An arthroscopy was performed, taking advantage of the fact that we put the patient under to do the stress x-rays. Nothing pathological was observed during arthroscopy [video]. Stress radiographs showed an overtightening of the medial retinacular complex and very slight persistent valgus laxity on the right knee [video].

Interpretation of imaging findings—treatment proposal

In conclusion, our patient had 4° of total valgus with 2° for the femur and 2° for the tibia. It is not reasonable to attempt a 2° correction on both the tibia and femur considering our capacity for surgical precision. The morbidity is too great, and the potential for error on one side or the other side is too great. A computer simulation of a varus osteotomy of 4° was performed on tibia that showed a mechanical axis just lateral to the medial spine (Fig. 6). Therefore, our proposal was a tibial infratuberosity biplanar osteotomy immediately below the distal tunnel of the previous MCL reconstruction, with internal rotation of 20° and 4° of varus. A lateral opening of a straight osteotomy using a Synthes Tomofix lateral locking plate was performed (Fig. 7). A fibular osteotomy was not done because the planned rotation did not exceed 20°. However, a release of the peroneal nerve was performed. The peroneal nerve was not taut after the derotational osteotomy. After osteotomy, the overtightening of the medial retinacular complex was re-examined. It had disappeared. Upon
waking from anaesthesia, the peroneal nerve was functioning well, but the patient had paralysis the following day.

Follow-up

At the 8-month follow-up, she had no pain (Visual Analogue Scale: 0 points), no central sensitisation (CSI: 14), no limitations in her daily living activities (Kujala score: 80), and no decrease in her quality of life (EuroQol 5D: 1-1-1-1-1 [1]). Neither did she have depression (HAD: 0), anxiety (HAD: 0), catastrophizing (PCS: 1), or kinesiophobia (TSK: 24). The 20 points that were missing to reach 100 in Kujala’s score correspond to the running and jumping items because she was not allowed to do those activities at that time. An excellent correction of the deformity was achieved (Fig. 8). Moreover, she had a completely normal gait [video].
She now wears a drop-foot orthosis. Two weeks after surgery, she began to recover ankle eversion. At 5 months, she had begun to move her ankle and toes slightly. She is now living a completely normal life. She now walks without limitations or crutches and hikes and manages stairs and ramps perfectly. Moreover, she can fully squat without any problems or support and the valgus of the heel has normalised. The patient’s perception is particularly good. After almost 8 years, she is driving again and is walking without crutches and without the knee brace. She has even started working. In the supplementary video, you can observe the functional status of the patient.

Discussion

In this case report, we present a 26-year-old woman who was treated for an impressive inwardly pointing knee with a severe scissoring gait and disabling disability after MPFLr. Gait disturbance is an unrecognised complication after MPFLr. It was resolved simply by correcting 20° of tibial torsion and 4° of valgus. Although the follow-up on our case is quite short, what is relevant about the case is seeing how powerful a derotational osteotomy is in correcting a lower-limb deformity, a pathological gait pattern and a disabling disability. That is to say, the relevance of the case is that it leads us to explore the pathophysiology of complications after an MPFLr more deeply.

It is common knowledge that patellar instability is associated with multiple risk factors, including but not limited to loss of the MPFL, trochlear dysplasia, patella alta, an abnormally placed tuberosity on the tibia, genu valgum, excess femoral anteverision, excess ETT, and foot pronation. Since the relative importance of each is unknown, it is imperative that pre-operative evaluation considers these. Two additional surgeries failed to improve her severe disability. Subsequent evaluation, 8 years after her initial MPFLr, revealed the presence of genu valgum and an excess of ETT.

Our patient had a very noticeable scissoring gait. A scissoring gait suggest, at the first sight, a femoral anteverision. However, the femoral anteverision angle was normal in our patient according to Murphy’s method. Another cause of an inwardly pointing knee might be an external knee rotation. However, the CT showed 5° in the right and 11° in the left. It has been demonstrated that tibiofemoral rotation equal to or greater than 15° is a contributing factor for patellar dislocation [6]. Therefore, it does not seem that the problem is an excess of tibiofemoral rotation in our case. Moreover, the weakness of hip abductor and external rotators was discarded. Another aetiology of this gait disturbance could be excessive ETT, as was seen in this patient. If there is excess ETT, there will be excess internal tibial torque, which forces the subtalar joint into hyper pronation, as occurs in our patient. Moreover, the knee-joint axis is thrust medially causing a valgus force on the knee if there is excess ETT.

Another interesting aspect of discussion that this clinical case allows us to look at is how to make a correct x-ray to evaluate coronal plane alignment. In this patient, standing X-rays of the lower limbs with the patella pointing to the front and pointing to the inside were available. With the patella pointing to the inside, the patella is subluxed, and the mechanical axis passes through the lateral compartment, simulating a very severe valgus. This radiological projection should not be used to measure coronal plane alignment because it will provoke a pseudo-valgus. That can lead us to make an incorrect surgical indication and cause even more iatrogenesis in the patient. The previously described way of doing a standing x-ray of the lower limbs is completely incorrect. The right way to determine the mechanical axis of the lower limb is with the patella being well-centred on the distal femur. Obviously, you will internally rotate the knee-joint axis too far if the patella is subluxed laterally and you face it forward for the x-ray. This case also allows us to reflect on how we should locate the origin of the valgus deformity and how to determine the level at which the osteotomy should be performed.

Stress radiographs provide a lot of information when evaluating a patient with patellar instability [7]. It can be assumed that the MPFL is tight with stress radiographs. It might be that her inwardly oriented knee position is used to increase the lateral displacement on the patella to compensate for the overtight medial retinacular complex. That is, the inwardly pointing knee may be a mechanism to avoid pain. Moreover, there is persistent slight valgus laxity. It is obviously functionally severe due to her inwardly pointing knee.

Finally, another debatable issue in derotational tibial osteotomy surgery is the level of the osteotomy. In this case, there is ETT of 43°. The TT–TG distance is 10 mm. Our correction proposal was 20°. A 20°
supratuberosity osteotomy will produce a 6.8-mm mediatisation of the TT that will provoke a final TT–TG distance of 3.2 mm. Frankly, that is pathological. As such, supratuberosity osteotomy will provoke an overload on both the medial patellofemoral and tibiofemoral joints. With that, our option was to perform an infratuberosity osteotomy in this case. Moreover, a segmental analysis of ETT was performed in our patient. On the right side, 60% of ETT is supratuberositary origin, whereas 40% is infratuberositary origin. On the contralateral side, which has normal ETT, 88% of the torsion is supratuberositary, and only 12% is infratuberository. This would be another argument for performing an infratuberositary osteotomy. Another argument for infratuberosity osteotomy is that ETT is an infratuberosity deformity [8]. Moreover, Tenho et al. [9] found that the TT–TG distance has no linear correlation with tibial tubercle lateralisation. However, tibiofemoral rotation strongly correlated with the TT–TG distance in patients with recurrent patellar dislocation. From there, they concluded that the TT–TG distance was more affected by tibiofemoral rotation than by tibial tubercle lateralisation. Therefore, its use as an indicator for tibial tubercle transfer might be inappropriate.

Additionally, Lee Pace’s paper presents a sound argument for infratuberosity osteotomy. The argument is that a lateral tubercle is not common, and thus a lateral tubercle is not the problem [10]. With a supratuberosity tibial osteotomy, the argument is that a lateral tubercle is the problem. Therefore, while supratuberosity osteotomy will provoke an overload on both the medial patellofemoral and tibiofemoral joints, it is much less likely to provoke a significant problem of external rotational malalignment.

CONCLUSION

Gait disturbance is an unrecognised complication after MPFLr. The lack of diagnosis of torsional deformities can lead to this failure. It is essential to consider limb alignment when presented with a patellofemoral patient. The alignment must include varus–valgus, torsion, and flexion–extension.

Ethical approval

The patient was informed that their data would be submitted for publication and provided consent.

Informed consent

The patient was informed that their data would be submitted for publication and provided consent.

Declaration of competing interest

No funds have been received in support of this work. No benefits in any form have been or will be received from a commercial party related to, directly or indirectly, the subject of this article.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jisako.2024.05.010.

References