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 consider 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 suggests the importance of torsional deformity contributing to patellofemoral instability. Gait disturbance is an unrecognized complication after MPFL reconstruction.

Keywords: Inwardly Pointing Knee, External Tibial Torsion, MPFL reconstruction, Extensor lag.

“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 learnt”

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.

**Introduction**

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

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. 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 [figure 1]. While walking, the left foot pointed forward while 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 Analog Scale -VAS- 8 points), but her main complaint was gait disturbance. She had central sensitization (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 2-50 1-3-3-2 [0.3573]). She also had depression (HAD 17), anxiety (HAD 17), catastrophizing ideas
and kinesiophobia (TSK 46). What is more, she also had left patellar instability. But the knee that caused serious problems was the right one.

Figure 1. Inwardly pointing right knee.

**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 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 [figure 2]. In addition, another surgeon offered her a knee arthrodesis as the last option to obtain a stable and painless knee.
Figure 2. Incorrect standing x-ray of the lower limbs to evaluate the coronal plane.

Physical examination

During physical examination, there was complete ROM. There was an overtightening 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 like on the contra-lateral 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 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-
86 centered on the distal femur [figure 3]. A line from the center of the femoral head to the center of
87 the knee was run. This is the femoral mechanical axis [figure 4]. Then a second line was run from
88 the center of the knee to the center of the talus. This line is the tibial mechanical axis [figure 4]. To
89 measure femoral alignment, a tangent line was run across the distal end of the medial and lateral
90 femoral condyles [figure 4]. The angle between the distal femoral tangent and the femoral
91 mechanical axis should be 93° on the medial side and 87° on the lateral side. In the same way, tibial
92 alignment is defined as the angle between the tangent on the top of the tibial plateau and the tibial
93 mechanical axis [figure 4]. This should be 87° on the medial side and 93° on the lateral side. In our
94 case, the distal femoral medial angle was 95° [figure 4]. The angle between the distal femoral and
95 proximal tibial tangent, the so called joint convergent or joint congruent angle, was less than 1°
96 [figure 4]. In young people, both lines are always parallel. The proximal tibial medial angle was 89
97 degrees [figure 4]. Thus, our patient has 2° of valgus in the femur, less than 1° valgus in the joint
98 and 2° valgus in the tibia for a total valgus of 4°. Torsional computed tomography (CT) showed 43°
99 of external tibial torsion on the right and 26 on the left side. Therefore, there was a pathologic ETT
100 on the right side. Moreover, to perform a segmental analysis of ETT, a third line tangential to the
101 posterior tibial cortex below the tibial tubercle is drawn [figure 5]. The right femoral anteversion
102 angle, according to Murphy’s method, was normal (15°). The external knee rotation was 5° for the
103 right knee and 11° for the left one. There was no trochlear dysplasia. The TT-TG distance was 10mm
104 on the right side. The patient also underwent magnetic resonance imaging (MRI) in which no
105 pathological findings were evidenced. Stress x-rays were performed prior to surgery. An
106 arthroscopy was performed, taking advantage of the fact that we put the patient under to do the
107 stress x-rays. Nothing pathological was observed during arthroscopy [video]. Stress radiographs
108 showed an overtightening of the medial retinacular complex and very slight persistent valgus laxity
109 on the right knee [video].
Figure 3. Correct standing x-ray of the lower limbs to evaluate the coronal plane. The patella is well-centered on the distal femur.

Figure 4. Way to calculate the origin of the valgus deformity.
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 [figure 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 [figure 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 again. It had disappeared. Upon waking from anesthesia, the peroneal nerve was functioning well, but the patient had paralysis the following day.
Figure 6. Computer simulation of a varus osteotomy of 4° performed on the tibia showing a mechanical axis just lateral to the medial spine (blue line). In red the original mechanical axis.

Figure 7. A lateral opening of a straight osteotomy using a Synthes Tomofix lateral locking plate.

Follow-up

At the 8-month follow-up, she had no pain (Visual Analog Scale 0 points), no central sensitization (CSI 14), no limitations in her daily living activities (Kujala score 80), and no decrease in her quality of life.
154 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 [figure 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, hikes, and manages stairs and ramps perfectly. Moreover, she can fully squat without any
problems or support and the valgus of the heel has normalized. The patient's perception is
particularly good. After almost 8 years, she is driving again, 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.

Figure 8. Clinical correction of the deformity.
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 unrecognized 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 anteversion, excess ETT, and foot pronation. Since the relative importance of each is unknown it is imperative that pre-operative evaluation consider 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 first sight, a femoral anteversion. However, the femoral anteversion 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. Therefore, it does not seem that the problem is an excess of tibiofemoral rotation in our case. Moreover, the weakness hip abductor and external rotators was discarded. Another etiology 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 well-centered 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. 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 10mm. Our correction proposal was 20°. A 20° supratuberosity osteotomy will produce a 6.8mm medialization of the TT that will provoke a final TT-TG distance of 3.2mm. 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 of supratuberositary origin while 40% is of infratuberositary origin. On the contralateral side, which has normal ETT, 88% of the torsion is supratuberositary and only 12% is infratuberositary. This would be another argument for performing an infratuberositary osteotomy. Another argument for infratuberosity osteotomy is that ETT is an infratuberosity deformity. Moreover, Tensho et al. found that the TT-TG distance has no linear correlation with tibial tubercle lateralization. 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 lateralization. Therefore, its use as an indicator for tibial tubercle transfer might be inappropriate. Additionally, Lee Pace’s paper presents a sound argument for infratuberosity tibial osteotomy. The argument is that a lateral tubercle is not common and thus a lateral tubercle is not the problem. With a supratuberosity osteotomy, we medialize the tibial tubercle. If the lateralization of the tibial tubercle is not the problem, it does not make sense to modify its position. Peroneal nerve palsy is a well-known complication after tibial derotational osteotomy. Internal rotation of the distal tibial fragment puts traction on the nerve. It can result in peroneal nerve palsy. However, in our case, the nerve was not tense after the tibial rotation. The transverse fibular osteotomy, which is quite unstable and moves back and forth with knee and ankle motion, may result in peroneal nerve palsy. In our case fibular osteotomy was not performed. In addition, there was no hematoma that could justify compression of the nerve and the resultant paralysis. In our case, the nerve worked well immediately after surgery. Nonetheless, paralysis appeared some hours later. It is possible that going from a 20° flexed knee maintained for years after her first surgery to full extension has something to do with the cause of the nerve paralysis in our patient. When the knee begins to straighten out, there will be more tension in the nerve. That might be the underlying reason for the peroneal palsy.

Conclusion
Gait disturbance is an unrecognized 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.

Statement of informed consent

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

Ethics

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, to the subject of this article.

References


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