Acquired Distal Femoral Deformity After MPFL Reconstruction

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Abstract: Reconstruction of the medial patellofemoral ligament (MPFL) is one of the most frequently performed surgical procedures in skeletally immature patients with patellar instability. There is an inherent risk to the distal femoral physis during femoral tunnel placement. We present a case report of iatrogenic distal femoral valgus deformity caused by lateral femoral physeal growth arrest after MPFL reconstruction. The patient required a distal femoral varus-producing osteotomy.

Key Concepts:

- It is critical to avoid the growth plate when anchoring the femoral attachment of the graft during MPFL reconstruction in growing patients. Failing to do so can result in significant morbidity.

Introduction

Medial patellofemoral ligament (MPFL) reconstruction is a popular operative technique for management of recurrent patellar instability in the pediatric and adolescent population.[1] Despite its widespread use, the procedure carries an overall complication rate of 16 to 26%, with the most common complications being recurrent instability, stiffness and patellar fracture.[2] Given the proximity of the MPFL origin to the distal femoral physis, much attention has been given to determining the ideal site for femoral graft placement and fixation.[3, 4, 5] Drilling of the medial femoral tunnel places the medial distal femoral physis at risk for injury and potential iatrogenic *varus* deformity.[6, 7] We present a case of a skeletally immature patient who underwent MPFL reconstruction which resulted in lateral distal femoral physeal arrest and significant *valgus* deformity. To our knowledge, this is the first case to report lateral growth arrest and subsequent coronal plane deformity following MPFL reconstruction in a skeletally immature patient.

Case Report

A 10-year-old female presented to our clinic for chronic pain and increasing deformity of her left knee. She had previously been treated for patellar instability at an outside institution where she underwent a MPFL reconstruction and drilling of an osteochondral defect 14 months prior to presentation at our hospital. Her operative report indicated that the entry site of the femoral tunnel was placed just distal to the physis as noted in Figure 1B/C. A TightRope (Arthrex, Naples, FL) was used for femoral-sided graft fixation, with the button engaging the lateral femoral cortex after drilling across the femur. The patient subsequently developed

significant stiffness and underwent multiple arthroscopic procedures as well as aggressive physical therapy with minimal improvement. On exam at our institution, the patient had a genu valgum deformity and walked with an antalgic gait. She had diffuse tenderness to palpation about the left knee with laxity to valgus stress. She lacked 5° of extension and could flex her knee to 115°. Her patella appeared stable with no apparent lateral subluxation.

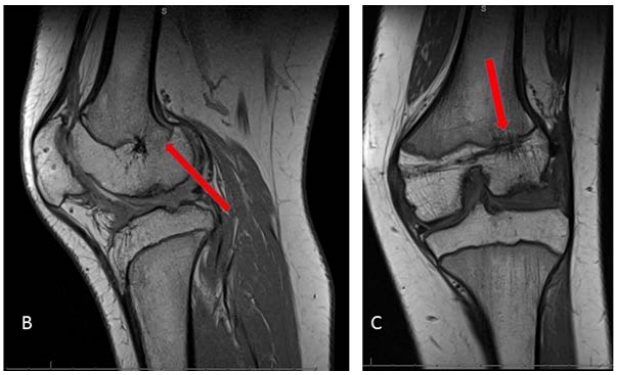

Figure 1A. *Orthoroentgenogram showing valgus deformity of the lateral condyle of the left femur. The mechanical lateral distal femoral angle (mLDFA) is 68°. The mechanical axis is 5cm laterally deviated.*

Figure 1B. *Sagittal view T1-weighted MRI of the left knee showing a bony bar at the posterolateral aspect of the distal femoral physis.*

Figure 1C. *Coronal view T1-weighted MRI of the left knee showing a bony bar at the posterolateral aspect of the distal femoral physis. The signal changes in the epiphysis suggest iatrogenic lateral physeal damage during tunnel placement for MPFL reconstruction.*

An orthoroentenogram demonstrated a valgus deformity of the left distal femur. The mechanical lateral distal femoral angle measured (mLDFA) 68° (Figure 1A). MRI of the left knee confirmed osteochondral defects of both the lateral femoral condyle and lateral tibial plateau, and also demonstrated a bony bar at the posterolateral aspect of the distal femoral physis (Figure 1B, 1C). MRI also showed that the femoral tunnel was adjacent to the physis for 1.6cm in the area of the physeal bar.

Due to the significant angular deformity, the patient underwent a corrective distal femoral varus-producing osteotomy (Figure 2a and 2b). At 6 months postoperatively, she reported minimal pain and had range of motion 5-140° with a stable patella. Radiographs show a healed osteotomy with improved alignment and an aLDFA of 78° (Figure 3).

Discussion

MPFL reconstruction in skeletally immature patients is widely regarded as safe and effective.[5] While recent literature has drawn attention to the theoretical risk of damage to the medial distal femoral physis during this procedure, this is a rarely reported complication. There is one case report describing a patient with a growth disturbance of the distal femur after MPFL reconstruction.[8] Unlike our patient who developed a lateral growth arrest, this case described an injury to the *medial* femoral physis due to inadvertent physeal breach during graft fixation. In this case, physeal arrest was thought to have resulted from violation of the physis during femoral tunnel placement leading to subsequent distal femoral flexion deformity, which required revision surgery to correct.[8]

Safe femoral tunnel placement in skeletally immature patients is challenging because of the complex anatomy of the distal femoral physis. Several authors have drawn attention to the complex anatomy of the medial femoral physis, noting that the standard radiographic landmarks for femoral tunnel placement may be misleading on fluoroscopic imaging. While these articles draw attention to the MPFL insertion site and its relationship to the medial femoral physis, little attention has been

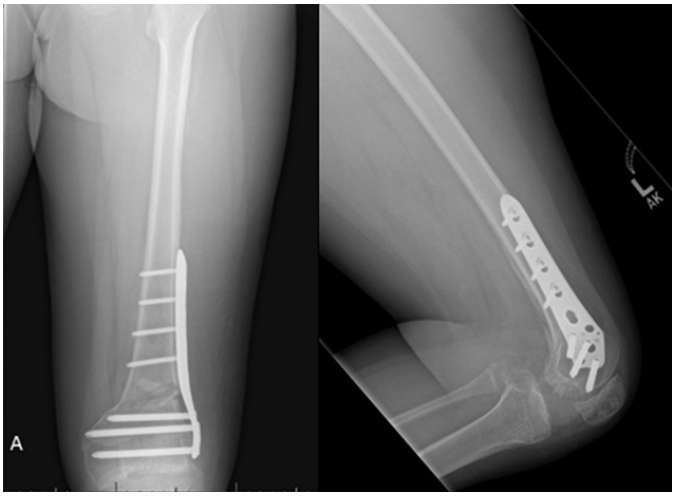

Figure 2. *AP and lateral radiograph of the left knee 2 weeks after osteotomy.*

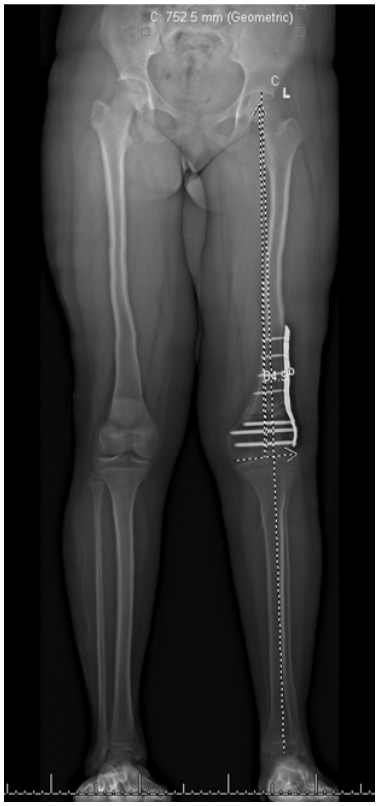

Figure 3 *At the most recent followup, orthoroentgenogram showing healed osteotomy and final correction. The mechanical lateral distal femoral angle (mLDFA) is 84°.*

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given to the risk associated with drilling across the entire physis during MPFL reconstruction. Other authors recommend angling the femoral tunnel distally and slightly anterior within the medial epiphysis to avoid damage to the physis.[4, 9] Liu, et al.[10] quantified the topographical anatomy of the distal femoral physis and found that the lowest point of the physis is located either anteromedial or posterolateral. As demonstrated in our case, the physis can be damaged even if it is not breached and the drill is placed too close to the physis, perhaps leading to thermal rather than direct damage. Modified reconstruction techniques or alternative fixation may be used to mitigate the risk of physeal injury in skeletally immature patients. These techniques include the use of bone anchors, soft tissue slings, or sutures to prevent lateral physeal injury during femoral graft fixation.[11, 12, 13]

Conclusion

The case presented here highlights the importance of understanding the distal femoral anatomy, the undulating nature of the distal femoral physis throughout its entire course and avoiding areas where the physis may be violated. This case demonstrates that lateral physeal arrest is possible even when the medial physis is not violated and the tunnel is created adjacent to the physis. Patients and families should be educated about the risk of growth arrest associated with MPFL reconstruction, and surgeons should be aware of the complex anatomy of the distal femoral physis when drilling into the epiphysis and when selecting graft fixation options.

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