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Case Report

Correction of Idiopathic Tetratorsional Malalignment of the Lower Extremities in a Young Adult Patient — A Case Report

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Abstract

Background: The static and dynamic relationships of the underlying tibia and femur determine the pattern of patellofemoral tracking. Extensor mechanism realignment alone has a high failure rate when the underlying cause of patellofemoral pain is tibial or femoral rotation. It is suggested that correction of miserable lower extremity malalignment may lead to improvements in function, pain, and self-image. The surgical correction of torsional deformity remains a controversial issue and most of the published data are found in the pediatric literature, with little application to the adult population.

Case Presentation: This is a young adult patient with tetratorsional malalignment of the lower extremities who underwent percutaneous corrective osteotomy of the bilateral femur and tibia.

Conclusion: Evolution with this technique can be expected to have a successful outcome similar to those reported in the literature.

Keywords: *Miserable Malalignment, Tetratorsional Malalignment, Patellofemoral Malalignment.*

Introduction

The patella is a passive component of the extensor mechanism, where the static and dynamic relationships of the tibia and femur determine the patellofemoral tracking pattern (1).

When there is increased internal torsion of the femur plus excessive external torsion of the tibia (miserable malalignment syndrome), the knee most commonly faces inward. This introduces excessive force that pulls on the medial soft tissues and compresses the bone laterally. This can result in hip, knee and ankle pain, patellar instability and chondromalacia that can evolve to osteoarthritis in the hip and knee in adults, and may also be related to femoroacetabular impingement (2).

Surgical intervention is uncommon but may be advantageous in appropriate patients with symptomatic deformity. It is suggested that correction of miserable bilateral or tetratorsional lower extremity malalignment may lead to improvements in function, pain, and self-image. Minimal complications and no iatrogenic deformity have been reported in case reports (3).

Tetratorsional malalignment syndrome is best treated with simultaneous ipsilateral rotational osteotomies and intramedullary nailing or plate fixation. Osteotomy for the treatment of external tibial torsion can restore kinetic and kinematic parameters of knee motion to normal values (4). Fixation can be performed with an intramedullary nail, plates, or an external fixator. Extensor mechanism realignment alone has a high failure rate when the underlying cause of patellofemoral pain is tibial and/or femoral rotation (5).

Surgical correction of torsional deformity remains a controversial topic and most published data are found in the pediatric literature, with little application to the adult population.

We report a surgical case where the correction of idiopathic tetratorsional malalignment was performed in a young adult patient using two-stage ipsilateral femoral and tibial derotating osteotomies using a minimally invasive technique with the use of a femoral locking nail with a trochanteric start for subtrochanteric osteotomy and a straight locking plate with a medial location for supramalleolar distal tibial osteotomy, improving pain in the anterior region of both knees.

Case Presentation

This is a 25-year-old female patient, with no significant medical history, who is evaluated for pain in the anterior region of both knees. Once the physical examination was performed using the rotational profile, an intrarotated gait was observed with a bilateral positive 15° gait progression angle, within normality, a mixer gait pattern with internal rotation of the thigh during the swing phase, convergent patellar alignment in the standing position when the feet look forward (bilateral patellar wink sign) (Figure 1).

Figure 1. *Clinical evaluation of tetratorsional malalignment of the lower extremities.*

Figure 2. (A) *Increased femoral anteversion.* ***(B)*** *Excessive external tibial torsion.*

In the stretcher evaluation, a positive patellar kiss was observed in the supine position, poor bilateral patellofemoral tracking, in the sitting position a “W” shape of the lower extremities, in the prone position a positive bilateral thigh-foot angle greater than 30° with a bisecting line of both feet that cuts the second interdigital space, ruling out deformities thereof, increased internal rotation of the hip with decreased external rotation of the same (Figure 2).

Radiographic studies of both hips and pelvis rule out femoral and acetabular dysplasia, while those of the knee in antero-posterior, lateral and Merchant projection identify patellofemoral malalignment and rule out osteoarthritis, while the panoramic view of the lower limbs rules out deformity in the coronal plane and length discrepancy.

You are admitted to our Reconstructive Orthopedic Surgery Unit with the diagnosis of:

1. Idiopathic tetratorsional malalignment syndrome of the lower extremities.

1.1. Bilateral increased femoral anteversion.

1.2. Bilateral excessive external tibial torsion.

1.3. Bilateral patellofemoral malalignment.

Regarding the surgical technique and resolution of the case, the patient was planned in two surgical stages. In the first stage, a percutaneous osteotomy was performed, with a drill and chisel, a subtrochanteric derotator of the right femur and stability with a locked intramedullary nail of trochanteric origin, plus a percutaneous osteotomy, with a drill and a chisel, a supramalleolar derotator of the Ipsilateral tibia and stability with a narrow 4.5mm straight locked plate located medially, under a minimally invasive technique. In the second stage, the same surgical technique is used to correct the torsional deformity of the contralateral limb.

The surgeries were performed with balanced general anesthesia on a radiolucent table. Drilled vents were made at the osteotomy site before femoral reaming to reduce the risk of fat embolism. No fibula osteotomy was performed. It was not necessary, in view of the minimally invasive technique, to place a drain in the surgical wound.

Prophylactic antibiotic therapy was administered intravenously prior to surgery and postoperatively, with no complication of infection and good wound healing. Thromboprophylaxis and the use of antiembolic stockings were established to avoid the risk of fat embolism syndrome, which is a theoretical risk associated with intramedullary fixation.

Physical medicine and rehabilitation were started with isometric and isotonic exercises for muscle strengthening. Assisted walking with crutches in the immediate and total postoperative period at 8 weeks postoperatively. There was a period of 6 months between the two surgical times.

The patient was evaluated by consultation sequentially, requesting control x-rays at 3, 6 and 12 weeks and 6 months postoperatively to monitor the consolidation and effectiveness of the system (Figure 3).

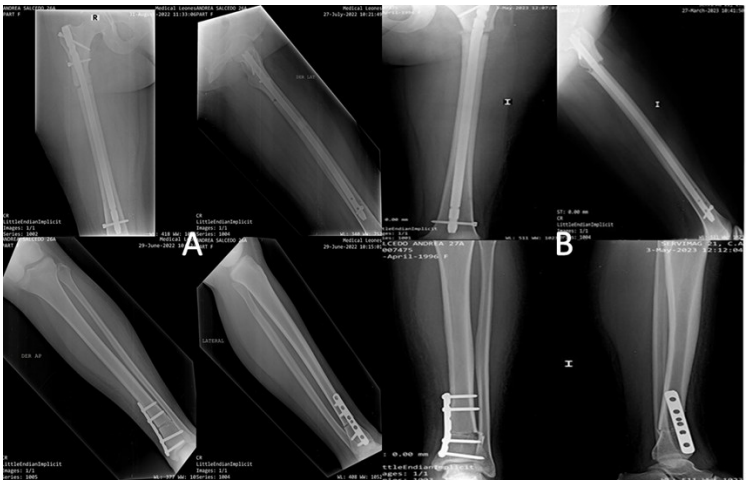

Figure 3. *Postoperative radiographic studies of the lower extremity*
3A. *Right.* ***3B.*** *Left.*

The osteotomies consolidated 3 months postoperatively, showing symmetrical correction of the miserable or tetratorsional malalignment of the lower extremities, positive gait progression angle of 15° bilaterally, absence of a mixer gait pattern, bilateral thigh-foot angle of approximately 20°, absence of the patellar wink sign and bilateral patellar kiss, symmetrical rotation of the hips, absence of pain in the anterior region of both knees, without complications (Figure 4 and 5).

Figure 4. *Correction of increased right femoral anteversion and excessive ipsilateral tibial torsion in the first surgical stage.*

Figure 5. *Clinical verification of the correction of tetratorsional malalignment of symmetrical lower extremities.*

Discussion

Various osteotomy sites and fixation methods have been described. Tetratorsional malalignment syndrome is best treated with ipsilateral rotational osteotomies and intramedullary nailing or plate fixation (1).

Percutaneous osteotomies involve minimal periosteal removal and are believed to improve the speed and success of bone healing. This technique is particularly important in adults with less robust periosteum and less healing potential. Percutaneous subtrochanteric derotation osteotomy of the femur is a safe and effective procedure to treat excessive anteversion, which according to Buly et al. Excellent or good results are obtained in 93% of cases (6).

Plate fixation presents serious complications with a reported rate of approximately 15% (5). With the advent of a lateral trochanteric entry nail, intramedullary fixation is the preferred method for correction of rotational deformities. The advantages of intramedullary nails include improved cosmesis, minimal soft tissue dissection, early weight bearing, load distribution, which promotes bone healing, and a decreased risk of complications. Reported complication rates have been low.

For younger patients, the nail can be safely placed through a trochanteric starting point, as was done in this case (7).

With respect to the level of the tibial osteotomy, proximal osteotomies are associated with a higher risk of complications, including peroneal nerve injury and compartment syndrome. Bruce et al. found no differences regarding subjective and clinical outcome when distal or proximal tibial osteotomies were performed to correct miserable malalignment.

Overall, the reported complication rate for tibial osteotomies has ranged from 0% to 43%, with a major adverse event rate of 5% to 10% regardless of fixation method. A supramalleolar osteotomy is recommended to correct the torsion. They used an L-shaped plate for large fragments (blade plate) for medial fixation (1).

Plate fixation requires larger incisions, requires removal of the implant, may result in a decreased union rate due to the presence of rigid fixation, and is associated with higher complication rates, not observed in this case in which medial straight plate fixation was performed using a minimally invasive, undocumented technique. The intact fibula prevented loss of fixation and angulation at the osteotomy site.

The rotational profile and the use of third-dimensional images such as magnetic resonance imaging and computed tomography is the definitive method for diagnosing lower extremity abnormalities. However, a wide range of normal values for femoral anteversion and tibial torsion have been reported, with age, sex, ethnicity, and axial image sections contributing. Ultimately a specialist who can perform a thorough evaluation of the rotational profile and has a good understanding of the normal values for each segment and age, should be able to accurately diagnose torsional deformity, even without the aid of imaging studies (5).

Conclusion

This case report represents the first documented case of correction of idiopathic tetratorsional malalignment through bilateral corrective osteotomy of the femur and tibia using a minimally invasive technique with the use of a femoral locking nail with a trochanteric start for subtrochanteric osteotomy and a narrow 4.5mm straight locking plate with a medial location for supramalleolar distal tibial osteotomy, the latter technique not documented for said pathology. With careful patient selection, it can be expected that the evolution with this technique will have a successful outcome similar to those reported in the literature for patients with idiopathic tetratorsional malalignment of the lower extremities.

Conflicts of Interest

The authors declare no conflicts of interest.

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