Operative Repair of an Adolescent Knee Dislocation: A Case Report

Introduction
A knee dislocation involves a multiligamentous injury (MLI) that result in disruption of the tibiofemoral articulation. These are an uncommon orthopedic injury with prevalence between < 0.02% and 0.2% of orthopedic injuries. In adults, these injuries can occur in high energy trauma, such as a motor vehicle collision, or through low energy mechanisms, typically related to sports injuries. Low velocity injuries have been reported to be more common, representing up to 75% of MLI knees. Knee dislocations during sports occur with excessive varus or valgus force on a hyperextended knee. The increased size and strength of athletes in today’s contact sports may lead to higher collision forces that are capable of causing a MLIs. In reviewing current literature, there are no examples of MLIs specific to adolescent patients. Musculoskeletal injuries in the immature musculoskeletal system require a different set of considerations than injuries in adult individuals. In this case report, we describe a sports related MLI knee in an adolescent athlete with open physes. Written authorization for this case report was provided by the patient’s family prior to its submission.

Case Information
A 13+0 year-old male football player was tackled in a game, resulting in a lateral femorotibial dislocation (Figure 1). He was reduced and transferred to our facility. Upon arrival, he had a normal neurovascular status, confirmed by ultrasound, but the knee was unstable. He was Tanner III with open growth plates. Magnetic resonance imaging (MRI) study demonstrated complete tear of anterior cruciate ligament (ACL), medial collateral ligament (MCL), and avulsion of the posterior cruciate ligament (PCL) off of the medial femoral condyle, a Schenck Classification KD-IIIM (Figure 2). Fifteen days post-injury, the patient underwent arthroscopic PCL suture repair over a bone bridge and excision of the ACL remnant. The patient’s distal femoral growth plate was open, so intra-operative fluoroscopy was utilized to ensure the physis was not breached during tunneling. Two weeks post-operatively, the patient began a standard PCL physical therapy protocol. At 2 months, repeat MRI demonstrated healing of the MCL and repaired PCL. Four months post-injury, he returned to the operating room for trans-epiphyseal ACL reconstruction with autologous hamstring graft, sparing the femoral physis but traversing the tibial side.

The patient was started on a standard ACL reconstruction physical therapy protocol post-operative day one. He was cleared for moderate sports training, with no cutting, three months after surgery. He began sport-specific training five months post-operatively and returned to all activities, including competitive football, ten months post-injury. Over the following year he excelled as a three sport athlete. Final follow up at 26 months post-injury demonstrated full athletic function, no growth restriction, pain, mal-alignment, ongoing instability, arthrofibrosis or hardware irritation/prominence.

Prior Reports and Relevant Literature
Knee dislocations are uncommon, and are even rarer in the presence of open physes. Existing studies of MLI demonstrate high variability in study sample size, injury severity, concomitant injuries, and treatment techniques. Furthermore, the lack of subjective outcome...
Figure 2. T2 weighted MRI demonstrating complete anterior and posterior ligamentous disruption of the knee.

Figure 3. Postoperative AP (A) and lateral (B) demonstrating final surgical fixation and closed tibial growth plate.

Discussion

Although the treatment approach of isolated ligamentous injuries is accepted, these principles cannot be extrapolated to MLIs. Unfortunately, no prospective study exists comparing surgical with non-surgical management. Non-operative management with prolonged immobilization has been associated with loss of motion, residual instability, and poor knee function.10-12 The goal of surgery is to improve stability, retain motion, and achieve knee function that allows the patient to perform daily activities. However, the timing, graft selection, and surgical technique of MLI reconstruction remains debatable.13-15 Delaying surgery 10-14 days allows for resolution of acute inflammation and soft tissue swelling, and has been shown to reduce the risk of post-operative arthrofibrosis secondary to improved ROM and quadriceps strength.16 In a large systematic review, staged treatment of KDIII or IV was found to yield the highest percentage of excellent and good subjective outcomes and the least number of ROM deficits.15 Repair of the PCL should occur first because PCL deficient knees result in posterior sagging that puts the knee in a state of misalignment, which is detrimental to healing of ligaments and the joint capsule. Open physeal plates complicated operative management of adolescent patients with MLI. In the initial repair of the PCL, the distal femoral physis was spared in order to avoid causing a growth disturbance to the affected leg. The repeat MRI obtained after just prior to the ACL reconstruction demonstrated interval closure of the proximal tibial physis so the tibial physis was not spared and a standard tibial tunnel was created (Figure 3). Post-surgical stiffness and loss of knee motion remain the primary post-operative concern. Rehabilitation protocols emphasize early protection with immobilization and gradual return to activities, but the clinician must balance these against the risks of loss of stability and failure of the reconstructed ligaments.

Conclusions

Given the low incidence of adolescent MLI, high-level evidence on which to base treatment decisions will be difficult. In this case report we have shown successful reconstruction of a knee MLI in a physeal immature patient. While further studies are needed to confirm the beneficence of our treatment plan, we believe this treatment approach can produce a positive outcome.
References