SutureBridge Transosseous Fixation of Complete Radial Tears: A Philosophical Approach

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Introduction

While increased participation in organized sports has caused a rise in pediatric anterior cruciate ligament (ACL) injury, the rate of meniscal tears in children is also increasing.[1] Meniscal tears are one of the most common injuries in pediatric athletes, frequently occurring in the setting of ACL injury, with concomitance rates as high as 66% reported.[2] The role that the intact menisci play in knee biomechanics, and the significance of meniscus injuries in the development of knee osteoarthritis (OA) is well documented; thus it is imperative to ensure functioning menisci to prevent long-term morbidity.[3,4] Specifically, radial and root tears pose a greater risk to the function and integrity of the meniscus by disrupting the circumferential fibers that provide resistance to hoop stress. This results in a diminished ability to absorb shock from the tibiofemoral load.[5] Previous studies have shown that a complete radial tear, such as the case below, is functionally equivalent to a total meniscectomy and increases the risk of OA by concentrating high stress on a focal area of the cartilage.[6,7,8]

Controversy exists regarding the best treatment of radial tears, as they are often not amenable to common meniscus repair techniques. Historically, radial tears were treated with partial meniscectomies due to their poor healing capacity. However, it is now known that partial meniscectomies are associated with impaired function and accelerated degenerative changes.[5,9,10] Therefore, it is imperative to determine the optimal techniques which will maintain meniscal integrity and function, and prevent long term degeneration of cartilage. While various techniques have been described in the literature, they have focused on the adult population.[11,12,13] The purpose of this article is to present a complete radial tear of the lateral meniscus in a pediatric patient which was treated with a SutureBridge Single-Tunnel Transosseous Fixation (Arthrex).

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Case report

A 14-year-old female visited our pediatric sports clinic, 18 months post right ACL reconstruction with medial and lateral menisci repairs, due medial right knee pain after playing basketball. On the clinical exam, McMurray's Test elicited trace discomfort at the medial hemijoint and the patient had diffuse tenderness at the medial hemijoint. Given the persistent pain and swelling in the setting of previous ACL reconstruction and meniscus repairs, an magnetic resonance imaging (MRI) study was ordered. The MRI indicated postsurgical changes versus tear of the medial meniscus with an intact lateral meniscus. The patient was reexamined in the office and continued to complain of right knee pain. The decision was made to proceed with surgical arthroscopy of the right knee.

The patient was placed supine on a standard operating table, with the knee flexed to 90 degrees. After evaluation under general anesthesia, the procedure began with a diagnostic arthroscopy with a standard 30 degree arthroscope. The standard anteromedial and anterolateral portals were placed in the usual fashion. We also opted to use an accessory midlateral portal to allow for ease of instrument passage, using three portals instead of two. Diagnostic arthroscopy revealed a lateral meniscus tear not appreciated on the patient's preoperative MRI from an outside institution, in addition to the medial meniscus tear. A full thickness radial tear at the 9 o'clock position of the lateral meniscus was visualized, with friable edges with a poor quality (Figure 1). Due to the chronic, degenerative tear, and the low probability of healing with direct repair, the decision was made to use a SutureBridge Transosseous fixation.

A meniscal Scorpion (Arthrex) was placed to secure the meniscus ends with sutures, and a single tunnel was then drilled slightly anteromedial to the footprint of the meniscus tear. A small amount of exposed bleeding bone was created using a small curette at the precise point where the guidepin was drilled. A retrieving suture was then passed into the joint and was used to bring the meniscus sutures down through the tibial drilling site (Figure 2). The meniscus was then appropriately reduced and probed to confirm stability. Once stable, it was secured using a PushLock anchor (Arthrex) on the medial tibia, drilled and placed as per the manufacturer's protocol. The meniscus was probed again for stability and a shaver was used to remove loose debris (Figure 3).

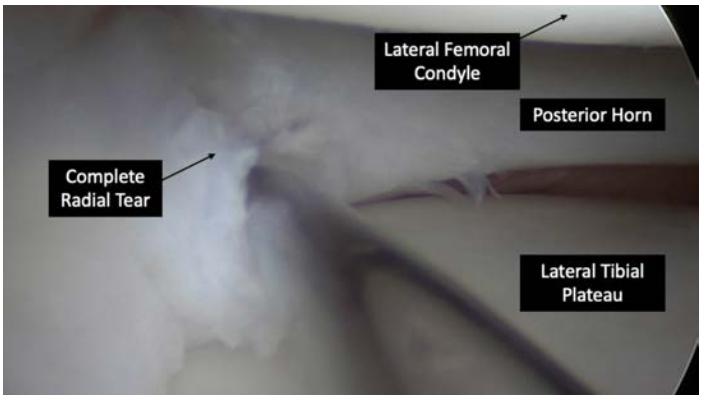

Figure 1. Arthroscopic image of right knee from anterolateral portal demonstrating a full-thickness radial tear of the midbody of the lateral meniscus.

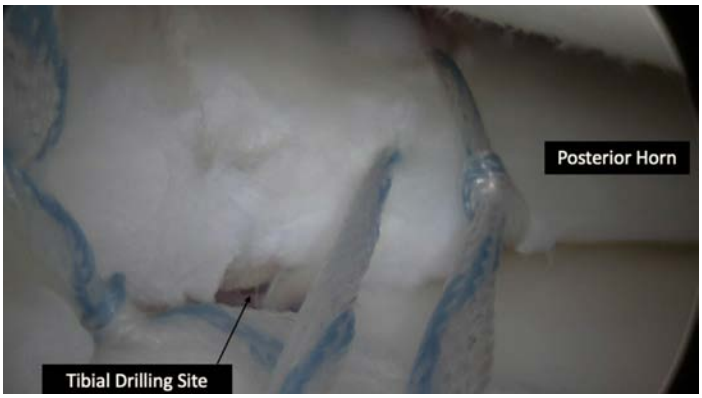

Figure 2: Sutures anchoring lateral meniscus through tibial drilling site.

Postoperative Management

Following surgery, the patient was placed into a range of motion control brace locked in extension and restricted to toe-touch weightbearing. Knee flexion was restricted to 90 degrees until week 2 and 110 degrees until week 4. After 3 weeks, the patient weaned out of the brace as appropriate quadriceps strength was noted by physical therapy. Toe-touch weight bearing was maintained until 6 weeks postoperative. At 3 months, the patient was given clearance to initiate straight line running and plyometric exercises, given the acceptable isokinetic strength and functional testing results. Gradual return to unrestricted activity was allowed at 6 months postoperative when she met all goals outlined by our meniscus repair protocol. Progressive return to sports was allowed at 4 months postoperative.

Discussion

Meniscus injuries are increasing in children and adolescents, especially with the rise in their activity level, year-round sports participation, and early specialization. Due to the significance of the menisci in maintaining the normal biomechanics of the knee, diagnosis and management of these injuries are of utmost importance.[3]

Physical examination of the meniscus is difficult in children and is less reliable in lateral meniscus tears. In fact, physical examination only has a 50% sensitivity in the diagnosis of

Figure 3: Stable SutureBridge transseous repair of lateral meniscus.

lateral meniscus tears in the pediatric population. MRI is the preferred imaging modality in the diagnosis of meniscal tears, which can also characterize the tear and also provide details on associated injuries. However, MRI has lower diagnostic performance in the evaluation of meniscus in skeletally immature patients. Additionally, radial tears can be especially difficult to detect.[14,15,16] As with the case presented here, the initial radiology report failed to appreciate the meniscus tear, although in retrospect, the tear was visualized by the fellowship-trained radiologist at our institution.

Given the importance and vascularity of the immature skeleton's menisci, repair of the torn meniscus is usually the preferred treatment in children. Whereas degenerative tears are common in adults and might not be amenable to repair, most tears in children are of sufficient quality to undergo a repair.

The most common meniscus tear in children is a longitudinal tear in the red-red zone, and thus is the best candidate for surgical repair. The outcomes of arthroscopic repair of meniscus tears in children are generally excellent and will most commonly result in normal or near-normal knee biomechanics.[1,4,17] All techniques used in adults can be applied to the pediatric population, including inside-out, outside-in, and all-inside repairs, depending on the location of the tear, quality of the tissue, and surgeon's preferences. In the less-common lateral meniscus root tears, fixation of the detached root to the tibial cortex through an intra-osseous tunnel provides a rigid, stable fixation with excellent results.[18]

When incomplete, radial tears can successfully be debrided to normal tissue. However, complete radial tears disrupt the normal meniscus function through the circumferential fibers and are challenging to treat. Even with repair, the fibrous tissue replacing the normal meniscus might not be of the same biomechanical properties, and therefore, might not be able to convert the longitudinal forces into circumferential hoop stresses as well.[19] The situation is even worse when facing a degenerative radial tear, as in the case presented here. In such cases, considering the poor results of a partial meniscectomy, the treating surgeon might opt to perform a total meniscectomy, followed by a meniscal allograft transplant in a second surgical stage, with favorable results.

However, in this case, the patient had an otherwise healthy meniscus despite the poor quality of the tear edges. Therefore, we decided against a meniscectomy. Instead, the SutureBridge transosseous technique was used to fix the tear ends to the tibia through an intraosseous tunnel. While this technique is commonly utilized in root tears, we have found it applicable to complete radial tears and is currently our treatment of choice in similar cases. With this technique, the meniscus is practically divided into two functioning segments, each acting as one full meniscus and withstanding longitudinal forces applied to the knee. However, due to the trimmed edges being brought through the same tunnel, the potential for the primary healing of the tear edges is also present. While the biomechanical properties of this technique have not been evaluated, our preliminary clinical results are promising and show excellent function and return to sports.

Conclusion

In conclusion, we have presented the case of a 14-year-old female who presented with a degenerative radial tear of the lateral meniscus which we treated with a transosseous bridge technique. The patient has regained knee motion and has returned to sports with no pain. We believe that this technique is a viable option in cases where the only other option would be a total meniscectomy and meniscal allograft transplant.

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