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Treatment of Meniscal Deficiency with Meniscal Allograft Transplantation and Femoral Osteotomy in a Patient with History of Lateral Discoid Meniscus

15-Year Follow-up Case Report

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Investigation performed at Istituto Ortopedico Rizzoli, Bologna, Italy

Abstract

Case: A 15-year-old woman with multiple arthroscopic procedures for left lateral discoid meniscus since the age of 9 presented with pain, swelling, and mechanical symptoms. A meniscal allograft transplantation (MAT) and lateral opening-wedge femoral osteotomy was performed. At the 6-year follow-up, the patient presented a visual analog scale (VAS) score of 0, subjective International Knee Documentation Committee (IKDC) of 88, and Lysholm of 95. At 15-year follow-up, the VAS score was 0, subjective IKDC 85.1, and Lysholm 86.

Conclusions: MAT associated with femoral osteotomy was an effective procedure in this patient with pain and functional limitation after total meniscectomy in the setting of discoid meniscus and valgus malalignment. Good clinical and magnetic resonance imaging-related outcomes were achieved at the intermediate and long-term follow-up.

Discoid meniscus is a congenital, anatomical variant characterized by an alteration in the shape (width and thickness), stability, and structure of the meniscus[1,2]. It usually occurs in the lateral meniscus, and its incidence is difficult to determine because of the large number of asymptomatic cases. In the United States, an incidence of 3% to 5% has been calculated, but in Asian populations, it is described up to 17%[3,4]. Discoid meniscus is susceptible to injuries, and in some cases, the surgical treatment can cause a meniscal deficiency[5]. Allogeneic meniscal transplant has been performed in the past decades for the treatment of postmeniscectomy syndrome, but the literature is scarce of reports evaluating meniscal allograft transplantation (MAT) in the setting of patients with discoid meniscus. The aim of this report was to present the long-term results of a patient treated with MAT and lateral opening-wedge osteotomy of the femur after subtotal meniscectomy of a lateral discoid meniscus.

The patient was informed that data concerning the case would be submitted for publication, and she provided consent.

Case Report

Consent form was signed by the patient at the final follow-up (at 30 years old). At the age of 9, she underwent a first saucerization for a tear of the discoid lateral meniscus (Figs. 1-A, 1-B, and 1-C). At the age of 10, she underwent a partial meniscectomy, and at the age of 14, she underwent a further total lateral meniscectomy after a new tear of the meniscal remnant. She presented to us at the age of 15, with ongoing pain, recurrent swelling, and mechanical symptoms on her lateral knee, which severely affected her ability to participate in her favorite sport (volleyball) and other physical activities. The magnetic resonance imaging (MRI) at that time showed the complete absence of lateral meniscus tissue and bone marrow edema associated with partial-thickness chondral defect in the posterior aspect of lateral femoral condyle (Figs. 1-D, 1-E, and 1-F). The standing anteroposterior (AP) knee x-ray showed 4° of valgus alignment (Fig. 2-A). At this time, the patient had a visual analog scale (VAS) for pain of 8.5, a subjective International Knee Documentation Committee (IKDC) of 32.2, and a Lysholm of 52.

The surgical plan was to restore meniscal tissue and to leave the limb axis in neutral position. This was carried out through a MAT and a femoral osteotomy.

At the time of the surgery, the articular cartilage presented International Cartilage Research Society (ICRS) grade 1 chondromalacia of the lateral tibial plateau, a complete absence of lateral meniscal tissue, and ICRS grade 2 lesion in the posterior area of lateral femoral condyle. An arthroscopic-assisted allograft transplantation of the lateral meniscus was performed, fixing the posterior horn through a transtibial tunnel and the remaining tissue with all-inside sutures as described previously[6].

Disclosure: The **Disclosure of Potential Conflicts of Interest** forms are provided with the online version of the article (http://links.lww.com/JBJSCC/B29).

Fig. 1

Preoperative and postoperative findings in magnetic resonance imaging (MRI) in the 15-year-old female patient. **Figs. 1-A, 1-B, and 1-C** MRI before the first meniscectomy at 9 years old showed a torn lateral discoid meniscus. **Figs. 1-D, 1-E, and 1-F** MRI at 15 years old before the meniscal allograft transplantation showed the complete absence of lateral meniscus with bone marrow edema lesions in the posterior aspect of lateral femoral condyle and loss of articular cartilage. **Figs. 1-G, 1-H, and 1-I** MRI at 21 years old showed in situ lateral meniscal allograft, with a good hypointense signal and a mild extrusion on the coronal plane.

A concomitant lateral opening-wedge femoral osteotomy was performed to leave a neutral alignment and unload the lateral compartment (Fig. 2-B). Almost 2 years after the procedure, the patient underwent hardware removal.

At the age of 21, with 6 years of follow-up, the patient presented a VAS score for pain of 0.5, a subjective IKDC of 90.8, and a Lysholm of 99. She was able to play recreational volleyball. The MRI performed at the 6-year follow-up showed the in situ lateral meniscal allograft, with a good hypointense signal and a mild extrusion on the coronal plane. On the sagittal plane, the graft showed a good coverage of the tibial plateau and the bone marrow edema lesions appeared reduced compared

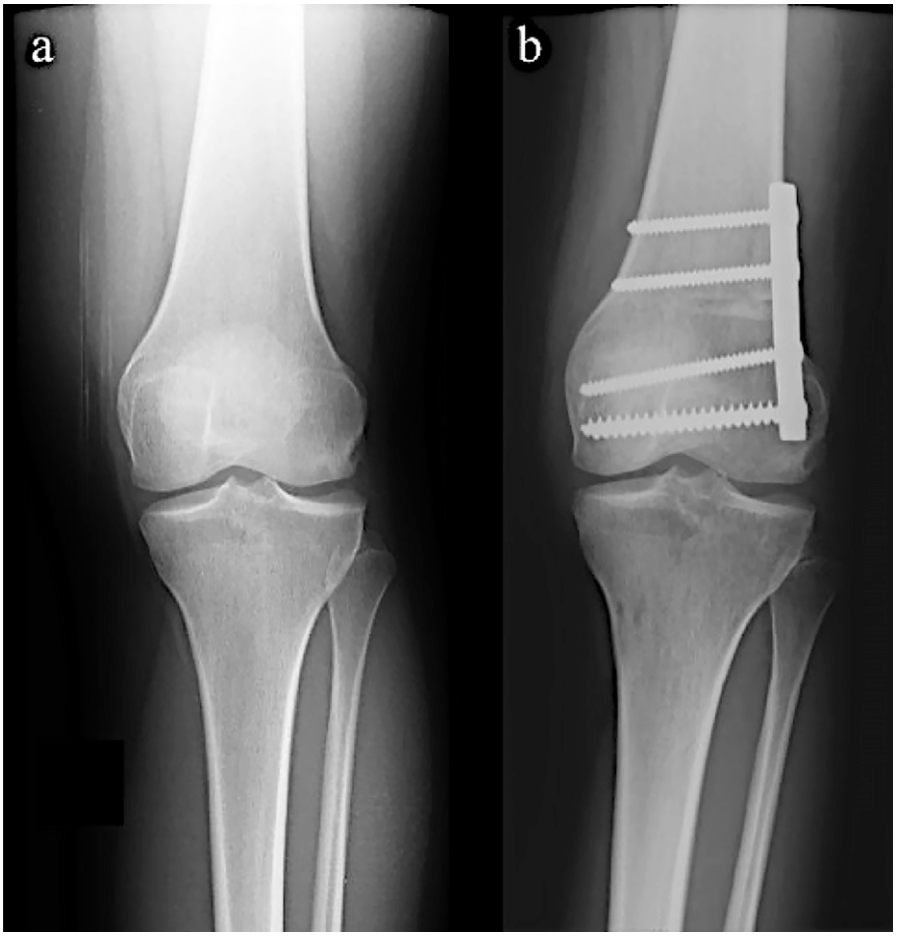

Fig. 2

Preoperative and postoperative anteroposterior (AP) knee x-rays. **Fig. 1-A** Preoperative x-ray showed a 4° of valgus alignment. **Fig. 1-B** The three-month postoperative x-ray showed the associated distal femoral open wedge osteotomy.

with the preoperative status. Cartilage lesions described in the previous MRI remained stable (Figs. 1-G, 1-H, and 1-I). At the 10-year follow-up VAS for pain was 0, subjective IKDC 88, and Lysholm 95.

The patient was further assessed at the 15-year follow-up, at 30 years old. No other surgical procedure to the left knee was performed during this time. At this follow-up, the patient had abandoned volleyball for personal reasons and rather was involved mostly in low-impact activities such as swimming and cycling. She had a VAS for pain of 0, a subjective IKDC of 85.1, and a Lysholm of 86.

Discussion

The treatment of meniscal deficiency because of discoid meniscus is a challenge because there are several factors that must be considered to obtain an optimal result. In this case, a MAT associated with a femoral osteotomy proved to obtain good clinical and MRI-related outcomes. As far as we know, the case described in this study represents the longest follow-up available for a patient treated with MAT after discoid lateral meniscus meniscectomy.

In the past decades, the treatment of discoid meniscus consisted in total or subtotal meniscectomy; however, degenerative changes are developed within time[7,8]. Räber et al.[9] reviewed 17 total meniscectomies in 14 patients with discoid meniscus. At a mean of 19.8 years (range, 12.5-26.0 years), 10 of 17 knees had clinical and radiological signs of osteoarthritis. Currently, the treatment of choice is arthroscopic saucerization with preservation of meniscal rim. A recent systematic review that included 422 discoid lateral meniscus treated surgically reported good clinical results and low rate of moderate/advanced degenerative changes with a long-term follow-up[10]. However, in the largest series on discoid meniscus by Kim et al. showed a statistical difference in the radiological changes over 5 years of follow-up between patients treated with total and partial meniscectomies[11]. For this reason, patients who previously have undergone total or subtotal meniscectomy for discoid meniscus may be candidates for MAT. The indications of MAT in this population are in fact the same as those in the general population, that is, patients with meniscal deficit secondary to total or subtotal meniscectomies and those who present with pain in the affected compartment of the knee

without signs of advanced joint degeneration. The role of prophylactic MAT in the acute setting of discoid meniscus lesion is still debated, and no strong evidences are available on MAT chondroprotection. Therefore, considering the possible morbidity of MAT, especially in young patients with open physes, MAT should be reserved to symptomatic patients after total/subtotal meniscectomy.

In relation to the role of the femoral osteotomy, an uncorrected lower extremity malalignment has been considered as a contraindication for a MAT[12]. This could be explained because, as has been reported[13,14], valgus alignment of the knee is an important cause of progression of degenerative damage in the lateral compartment. Although in the reported case the valgus was 4°, it was decided to perform the femoral osteotomy to protect both the meniscal graft and the lateral compartment and to leave the limb axis as close to a neutral.

During the preoperative study and planning, it is important to know the skeletal maturity of these patients because the surgical technique of the MAT must respect the physis if it is still open[15]. On the other hand, it is important to recognize and treat other factors that may be present in these patients, such as instability, the state of the cartilage, and the axis of the lower extremities. In our case, we perform a femoral osteotomy at the same time as the MAT, and in the review of the literature, in approximately one-third of the cases, an associated procedure is described.

Despite the lack of high-quality evidence, MAT can be considered as chondroprotective procedure in young people with meniscal deficiency[16,17]. At the short and intermediate follow ups, reported clinical results are good to excellent regarding pain and function levels[18]. In fact, in a recent pilot randomized controlled trial, the authors demonstrated that MAT provided superior patient reported outcomes compared with personalized physiotherapy[19]. Smith et al.[18], in a systematic review evaluating clinical outcomes of 1,374 MAT in a general population showed an average Lysholm score of 81.3 points, a subjective IKDC of 70 points, and Tegner activity score to 4.7 points at a mean final follow-up of 5.1 years. However, it is not clear if MAT has the same results in patients with a history of discoid meniscus. To this regard, Yoon et al.[20] reviewed a series of 36 patients who underwent MAT with a previous meniscectomy, comparing the clinical results of 16 with discoid meniscus versus 20 with nondiscoid meniscus. They did not report significant differences in the Lysholm, VAS, and subjective IKDC scales; they only observed a small decrease in the postoperative range of motion in patients with discoid meniscus (132.8 ± 15.7 vs. 140.0 ± 6.6, $p < 0.05$). Similarly, no differences in extrusion at the MRI evaluation were observed between groups.

In summary, this case report showed that MAT with femoral osteotomy can be an effective and safe procedure to treat patients with pain and functional limitation after total or subtotal meniscectomy in the setting of discoid meniscus. These results should be confirmed with further series. ■

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