Treatment of Osteochondritis Dissecans of the Knee with Autologous Iliac Bone Graft and Hyaluronic Acid Scaffold

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Osteochondritis dissecans (OCD) is a condition that corresponds to an idiopathic focal lesion affecting the subchondral bone with possible compromise of the stability of the adjacent cartilage. Treatment depends on the size of the lesion, cartilage stability, and the physeal status. The case reported is about an 18-year-old male patient who complained of suffering from knee pain for a period of ten months. Magnetic resonance imaging (MRI) revealed a lesion of 2 cm² in the medial femoral condyle that compromised the subchondral bone, compatible with OCD. He underwent surgery that consisted of filling the subchondral defect with an iliac crest autograft and sealing the defect with a hyaluronic acid scaffold. At the 12-month follow-up, the MRI shows complete healing and the patient has resumed sports activities. Management with autologous iliac crest graft and hyaluronic acid scaffold represents an effective alternative treatment for OCD.

Keywords: Knee, Osteochondritis dissecans, Bone graft, Hyaluronic acid, Tissue scaffold

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Case Report

An 18-year-old patient with no prior trauma history sought a medical consultation after suffering knee pain for ten months. A physical examination revealed medial knee pain, joint effusion, and a full knee range of motion. An MRI was requested, which revealed a lesion in the medial condyle compatible with grade 4 OCD (Fig. 1). The patient-reported outcome before surgery was level 2 on the Tegner scale and 36 points on the Lysholm scale.

The patient underwent surgery under spinal anesthesia and sedation. First, diagnostic arthroscopy was conducted by an anterolateral portal and an anteromedial portal and no other lesions were found. The defect in the medial condyle was confirmed and measured 2 cm in length and 1 cm in width.

Then, the contralateral anterior iliac crest (AIC) was addressed by an open approach performed parallel to the AIC. The anterior-superior iliac spine was identified, and the harvest was performed 2 cm posterior to avoid an injury to the lateral femoral cutaneous nerve. Bone harvesting was performed with the trapdoor technique as described by Cooper and Coughlin.7)

Finally, a medial parapatellar arthrotomy was performed to expose the medial condyle. The knee was flexed and the patella was gently pulled laterally by a retractor to obtain full exposure. Curettage of the lesion was performed with removal of all the de-vitalized tissue under the cartilage defect until healthy tissue was visualized, and then the 1-cm deep defect was noted (Fig. 2). The defect was filled with the cancellous bone graft obtained from the AIC up to the level of the adjacent subchondral bone; then it was sealed with Hyalofast® (Cimed Healthcare, Kuala Lumpur, Malaysia) biodegradable hyaluronic acid scaffold. This scaffold was sutured with four stitches of 2-0 Ethibond® (Ethicon, Somerville, NJ, USA). Full range of motion and no weight bearing were encouraged for six weeks after hospital discharge.

At one-year follow-up, the patient was asymptomatic without

Fig. 1. Magnetic resonance imaging showing a grade 4 osteochondritis in the femoral condyle. (A) Coronal T1 sequence showing the defect in the femoral condyle; the size was 1 cm. (B) Sagittal T2 sequence showing the defect in the medial femoral condyle and mild edema in the surrounding area. (C) Sagittal T2 sequence showing the defect in the medial femoral condyle; the size was 2 cm.

Fig. 2. Intraoperative photograph. (A) Only healthy tissue was left after curettage. (B) The lesion was filled with the iliac crest autograft and sealed with Hyalofast® (Cimed Healthcare) biodegradable hyaluronic acid scaffold.
joint pain and had a full range of motion. An MRI was performed, which showed complete healing of the subchondral bone and a continuous signal of the cartilage in the medial femoral condyle (Fig. 3). The patient was authorized to resume sports. Patient-reported outcomes at one-year follow-up were level 4 on the Tegner scale and 90 points on the Lysholm scale.

Discussion

OCD is a disabling pathology in adolescent athletes, representing an important challenge for the knee surgeon, especially in grade 4 lesions. Standard treatment for grade 4 OCD is to perform an osteochondral autologous transfer (OATS), which consists of obtaining an osteochondral cylinder from a knee region with low contact pressure, most commonly, the lateral trochlea, and to transfer it to the site of the defect. This procedure has the disadvantage of leaving a defect in another area of the knee; nevertheless, reports show a favorable outcome in 82% of patients.

In our case, the size of the lesion was so large that it was at the upper size limit of the traditional OATS indication; two 10 mm plugs would have to be used for OATS in the patient, which means a large donor area in the trochlea. Taking this into account, it was decided to use an iliac crest autograft to fill the defect and seal it with a biodegradable hyaluronic acid membrane. With this, a structural and biological environment for fibrocartilage formation was provided. A disadvantage of this technique is the risk of iliac crest pain and paresthesia of the lateral femoral cutaneous nerve; nevertheless, the patient had no complaints after the first postoperative month.

The size of the lesion is critical in the treatment decision making of OCD. For a large lesion, several techniques are described. Hohmann and Tetsworth described in patients with OCD over 2.5 cm², the use of a fresh-frozen irradiated allograft provided good results; nevertheless, this type of graft is expensive and unavailable worldwide. Zellner et al. reported good outcomes were achieved with use of bone autograft from either the iliac crest or the distal femur, combined with autologous chondrocyte transplantation in large and deep osteochondral defects; however, this also raises costs and is not widely available.

Development of cell-free scaffolds (chondrocytes) has arisen with the purpose of inducing tissue regeneration through the proliferation and migration of mesenchyme cells. Also, scaffolds would be able to sustain the clot created after microfractures or nano-fractures and increase the success rate in medial condyle lesions. Focusing on patients with OCD, Berruto et al. reported a multicenter study with 2 years of follow-up where good functional outcomes were achieved in large OCD lesions treated with scaffolds without chondrocytes.

The result of the treatment we proposed in this report is comparable to the good results obtained with other types of treatment. It also has the advantage of not requiring an intra-articular donor site and allografts in cases with deep and large defects greater than 2 cm². Besides, the hyaluronic acid scaffold, despite the high cost, is more affordable than autologous chondrocyte transplants and fresh-frozen allografts. Significant clinical and functional improvements were observed in this case, considering that the treated lesion was large, 2 cm² in size and 1 cm in depth.

In conclusion, treatment of large (2 cm²) and deep grade 4 OCD lesions with autologous iliac crest bone grafts and hyaluronic acid scaffolds seems to be a good alternative for this challenging condition. Further studies must be conducted with longer follow-ups.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.
References

1. Jacobs JC Jr, Archibald-Seiffer N, Grimm NL, Carey JL, Shea KG. A review of arthroscopic classification systems for osteochondritis dissecans of the knee. Clin Sports Med. 2014; 33:189-97.

2. Abouassaly M, Peterson D, Salci L, Farrokhyar F, D'Souza J, Bhandari M, Ayeni OR. Surgical management of osteochondritis dissecans of the knee in the paediatric population: a systematic review addressing surgical techniques. Knee Surg Sports Traumatol Arthrosc. 2014;22:1216-24.

3. Bates JT, Jacobs JC Jr, Shea KG, Oxford JT. Emerging genetic basis of osteochondritis dissecans. Clin Sports Med. 2014; 33:199-220.

4. Grimm NL, Weiss JM, Kessler JI, Aoki SK. Osteochondritis dissecans of the knee: pathoanatomy, epidemiology, and diagnosis. Clin Sports Med. 2014;33:181-8.

5. Brittberg M, Winalski CS. Evaluation of cartilage injuries and repair. J Bone Joint Surg Am. 2003;85-A Suppl 2:58-69.

6. Carey JL, Grimm NL. Treatment algorithm for osteochondritis dissecans of the knee. Clin Sports Med. 2014;33:375-82.

7. Cooper MT, Coughlin MJ. Surgical technique: iliac crest corticocancellous bone graft harvest using a trap-door technique. Med Chir Pied. 2009;25:127-32.

8. Heyworth BE, Kocher MS. Osteochondritis dissecans of the knee. JBJS Rev. 2015;3. pii: 01874474-201503070-00003.

9. Dhollander AA, Liekens K, Almqvist KF, Verdonk R, Lambrecht S, Elewaut D, Verbruggen G, Verdonk PC. A pilot study of the use of an osteochondral scaffold plug for cartilage repair in the knee and how to deal with early clinical failures. Arthroscopy. 2012;28:225-33.

10. Lim HC, Bae JH, Song SH, Park YE, Kim SJ. Current treatments of isolated articular cartilage lesions of the knee achieve similar outcomes. Clin Orthop Relat Res. 2012;470:2261-7.

11. Mithoefer K, Williams RJ 3rd, Warren RF, Wickiewicz TL, Marx RG. High-impact athletics after knee articular cartilage repair: a prospective evaluation of the microfracture technique. Am J Sports Med. 2006;34:1413-8.

12. Redondo ML, Beer AJ, Yanke AB. Cartilage restoration: microfracture and osteochondral autograft transplantation. J Knee Surg. 2018;31:231-8.

13. Hohmann E, Tetsworth K. Large osteochondral lesions of the femoral condyles: treatment with fresh frozen and irradiated allograft using the Mega OATS technique. Knee. 2016; 23:436-41.

14. Zellner J, Grechenig S, Pfießer CG, Krutsch W, Koch M, Welsch G, Scherl M, Seitz J, Zeman F, Nerlich M, Angele P. Clinical and radiological regeneration of large and deep osteochondral defects of the knee by bone augmentation combined with matrix-guided autologous chondrocyte transplantation. Am J Sports Med. 2017;45:3069-80.

15. Berruto M, Delcogliano M, de Caro F, Carimati G, Uboldi F, Ferrua P, Ziveri G, De Biase CF. Treatment of large knee osteochondral lesions with a biomimetic scaffold: results of a multicenter study of 49 patients at 2-year follow-up. Am J Sports Med. 2014;42:1607-17.

16. Patrascu JM, Freymann U, Kaps C, Poenaru DV. Repair of a post-traumatic cartilage defect with a cell-free polymer-based cartilage implant: a follow-up at two years by MRI and histological review. J Bone Joint Surg Br. 2010;92:1160-3.

17. Gudas R, Kalesinskas RJ, Kimtys V, Stankevicius E, Toliusis V, Bernotavicius G, Smalys A. A prospective randomized clinical study of mosaic osteochondral autologous transplantation versus microfracture for the treatment of osteochondral defects in the knee joint in young athletes. Arthroscopy. 2005;21:1066-75.

18. Trinh TQ, Harris JD, Flanigan DC. Surgical management of juvenile osteochondritis dissecans of the knee. Knee Surg Sports Traumatol Arthrosc. 2012;20:2419-29.