

CLINICAL CASE REPORT

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Concomitant Autologous Chondrocyte Implantation with Osteochondral Grafting for Treatment of a Massive Osteochondral Defect in the Bilateral Knees of a Child

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Key words: knee joint; cartilage repair; osteochondral graft; autologous chondrocyte implantation.

Summary. We report the case of a 15-year-old patient who underwent concomitant autologous chondrocyte implantation and osteochondral grafting for the treatment of a massive osteochondritis dissecans defect in the left knee and autologous chondrocyte implantation in the right knee joint. Magnetic resonance imaging showed large osteochondral defects in both the knee joints measuring 8–9 cm². Both defects were located in the weight-bearing areas of the medial femoral condyles. Therefore, simultaneous autologous chondrocyte implantation (ACI) and osteochondral autograft transplantation (OAT) for the left knee defect and ACI for the right knee joint were performed. Osteochondral plugs were harvested from the patellofemoral joint of the same left knee and grafted into the most dorsal regions of the large osteochondral defect of the left knee. The remaining osteochondral defect was covered with ACI using collagen type I and III membrane and chondrocyte cells. The membrane was implanted into more proximal part of the osteochondral defect of the left knee. Time interval between operations of the left and right knee joints was 6 months. Magnetic resonance imaging at 6 months after each knee surgery showed good preservation of the OAT and ACI grafts. The most recent follow-up examination, performed 12 months after surgeries, has shown excellent results with an International Knee Documentation Committee score of 95.59 ± 4.64 and 96.88 ± 4.69 for the right and left knee joints, respectively, and full range of knee motions with no symptoms.

In this clinical case, the combination of ACI and OAT methods in a one-step procedure produced a good reconstruction of the joint surface with excellent clinical outcomes in the both knee joints of the same patient. Autologous osteochondral grafting and autologous chondrocyte implantation can be combined for the treatment of large osteochondral defects of the knee.

Introduction

Although recent studies have shown success of both osteochondral autologous transplantation (OAT) and autologous chondrocyte implantation (ACI) performed separately (1–15), there have been no publications published about the combined procedure on both knee joints of the same patient. Restoring a massive osteochondral defect, ACI procedure may not always allow a complete defect filling. In these cases, an OAT procedure may help to completely repair the entire osteochondral defect. Performed concomitantly, ACI and OAT may result in significant improvements in knee function.

We describe a rare case of massive osteochondritis dissecans defects in the bilateral knee joints that occupied almost all of the weight bearing areas of the medial femoral condyles in the right and left knees in a 15-year-old boy.

Case Report

A 15-year-old boy had a 2-year history of right and left knee pain. He had undergone an arthroscopic débridement and microfracturing of the osteochondral defect of the medial femoral condyle of the right knee. Later, at the age of 16 years, he had undergone partial resection of the medial meniscus in the same knee joint. The osteochondral defect was partially filled with soft fibrocartilage reparative tissue. Thereafter, he experienced pain in the affected and contralateral knees, which gradually worsened despite intracapsular injection of hyaluronic acid. On presentation, he was 188 cm in height and weighed 72 kg. Examination revealed that both knee joints had a full range of motion from 0° to 150°. The patient had tenderness on the medial joint line of the right and left knees. The preoperative International Knee Documenta-

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tion Committee (IKDC) subjective knee evaluation score was 52.8 and 58.9 for the right and left knees, respectively. Magnetic resonance imaging (MRI) revealed loosening of the osteochondral defect fragments in both knee joints. The third arthroscopy of the right knee joint showed an osteochondral defect measuring 42×35 mm, grade IV by the International Cartilage Repair Society classification, occupying all of the weight bearing area of the medial femoral condyles (Fig. 1). There was fibrillation on the medial tibial plateau (grade I). Surgical treatment consisted of 2 steps; initially, the biopsy specimen for the ACI was harvested from the notch area. Cells were cultured at the Genzyme Biosurgery using the Carticel process (Genzyme Biosurgery, Cambridge, Mass). The lesion was accurately shaved, and the pathologic tissue was removed. Postoperative care consisted of early motion with progressive weight bearing as tolerated. The chondrocytes were expanded in the laboratory and then seeded on the scaffold. In the second-step arthroscopy, the lesion was detected and accurately measured again. We made a curved 8-cm incision medial to the patella to expose the medial femoral condyle. The site was prepared by débriding the articular cartilage lesion and removing the layer of calcified cartilage. Five bone plugs, each 6 mm in diameter and 15 mm in depth, were harvested from the recipient site with an osteochondral autograft transfer system (Arthrex, Naples, FL). We harvested osteochondral plugs from the medial aspect of the trochlea of the right knee. All plugs were placed at the same level

with the healthy cartilage. At the end of the OAT procedure, we moved to the ACI procedure. The defect area was measured, and the template was then used to prepare the appropriately sized and shaped membrane. The scaffold was secured over the defect and implanted OAT plugs, using simple interrupted 6-0 Vicryl sutures (Ethicon Inc, Somerville, NJ) at 3-mm intervals, leaving an opening for cell injection. An injection of sterile saline was performed to ensure a watertight seal, which was then further augmented with fibrin glue. The cultured chondrocytes were then injected under the patch to fill the defect. The injection site opening in the patch was then closed with 6-0 Vicryl suture and sealed with fibrin glue (Fig. 2). Under arthroscopic control, the knee was moved from flexion to extension to check the stability of the OAT and scaffold implants. The patient received prophylactic antibiotics at the time of surgery and at 6 and 12 hours postoperatively. The patient was restricted to non-weight-bearing exercise on the right leg for 4 weeks and partial weight bearing for following 4 weeks. Progressive range of motion (ROM) was allowed 1 week after the operation. After 6 weeks, gradual progression to full weight bearing was allowed if adequate lower extremity strength and control were demonstrated and there was no limp. Full ROM was the goal by 8 weeks. Full release to functional progression to activities was allowed at 9 months.

The same procedure was repeated on the left knee joint (Figs. 3 and 4). At 6 months after surgeries, the patient was free of pain. Twelve months

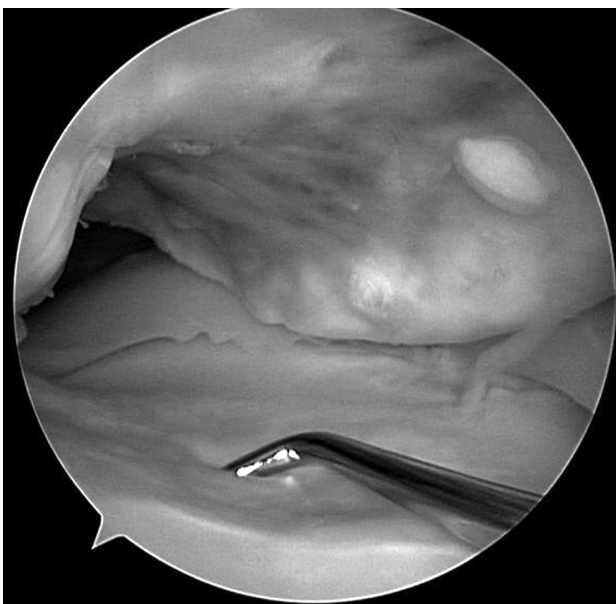


Fig. 1. Osteochondral defect in the medial femoral condyle of the right knee joint

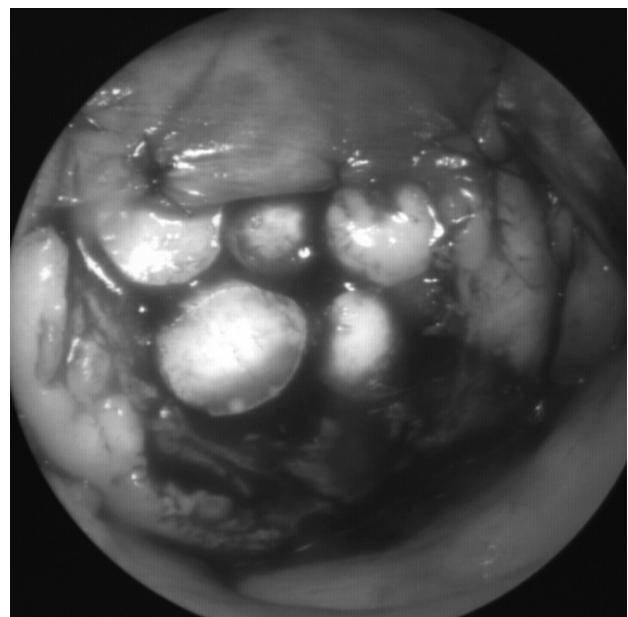


Fig. 2. Osteochondral autologous transplantation with 6-mm osteochondral plugs in diameter simultaneously with autologous chondrocyte implantation procedure for 7.5-cm² osteochondritis dissecans defect in the medial femoral condyle of the right knee joint

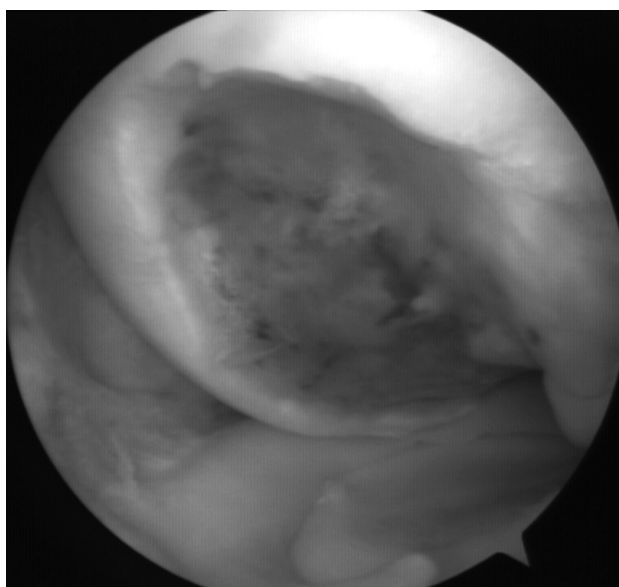


Fig. 3. Osteochondral defect in the medial femoral condyle of the left knee joint

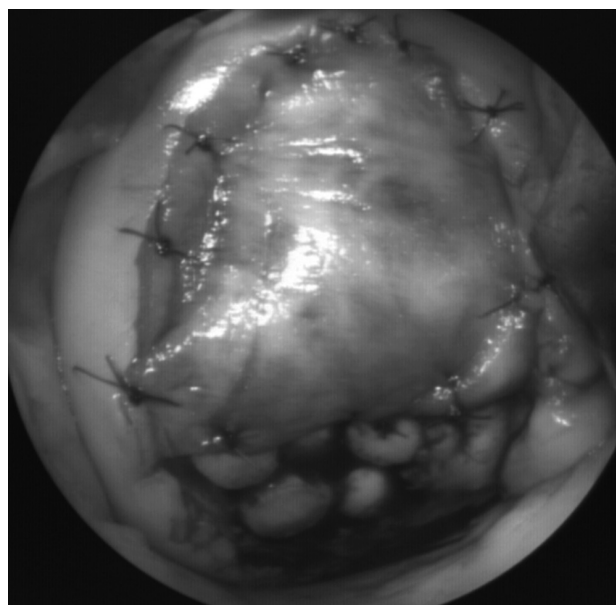


Fig. 4. Osteochondral autologous transplantation with 6-mm osteochondral plugs in diameter simultaneously with autologous chondrocyte implantation procedure for 8.5-cm² osteochondritis dissecans defect in the medial femoral condyle of the left knee joint

after the operations, the IKDC score increased to 95.59 ± 4.64 and 96.88 ± 4.69 for the right and left knee joints, respectively. Within a year, MRI signal intensity of the cartilage repair tissue well approximated to that of the healthy surrounding cartilage. The osteochondral plugs were all well seated within the recipient sites with no MRI evidence of graft loosening or migration.

Discussion

Massive osteochondral defects in the bilateral knee joints are uncommon. Several treatment options involving surgical resurfacing are available for treating these defects, but their clinical outcomes are controversial (2, 5–7). Traditional techniques, such as débridement and subchondral penetration, have been shown to have a limited value because of poor biomechanical characteristics of the ingrown repair tissue. Previous multicenter, prospective studies have showed that mosaicplasty provides a substantially better clinical outcome than the other traditional techniques (6, 10). Donor site morbidity

due to large osteochondral defects is an important limitation of OAT technique. Furthermore, because we believe that appropriate treatment of the underlying cause of a cartilage lesion is essential for the success of any cartilage repair method, we selected a procedure that included concomitant ACI and OAT. We have described a rare case of massive osteochondral defect occupying almost the entire weight-bearing area of the medial femoral condyle of the bilateral knee joints in a teenager. The defect was treated with OAT and ACI. At 6 months after surgeries, the clinical outcomes were good.

Autologous chondrocyte implantation combined with osteochondral autologous grafting may be successfully used in remodeling the joint surface, without causing donor site morbidity within the knee joint.

However, longer-term follow-up will be necessary to determine the efficacy of this concomitant procedure.

Statement of Conflict of Interest

The authors state no conflict of interest.

Vienmomentinė autologinė chondrocitinių ląstelių implantacija ir mozaikinė transplantacija, atlikta vaikui, sergančiam abiejų kelio sąnarių disekuojamuoju osteochondritu

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Raktažodžiai: kelio sąnarys, kremzlės atstatymas, kaulo ir kremzlės transplantacija, autologinė chondrocitų implantacija.

Santrauka. *Klinikinis atvejis.* 15 metų berniukui dėl abipusio kelio sąnarių vidinių šlaunikaulio krumplių disekuojamojo osteochondrito atliktos vienmomentinė autologinių chondrocitinių ląstelių ir mozaikinės transplantacijos operacijos. Atlikus abiejų kelio sąnarių branduolių magnetinį rezonansą ir artroskopijos metu nustatyti abipusiai vidinių šlaunikaulio krumplių 8–9 kvadratinų centimetrų disekuojamieji osteochondritai. Atliktos vienmomentinės autologinės chondrocitinių ląstelių ir mozaikinės transplantacijos operacijos. Kaulo ir kremzlės cilindrai buvo paimti iš girkelinės šlaunikaulio vagos krašto ir užpildytas nugarinis defekto paviršius. Likusi kremzlės defekto dalis buvo padengta I ir III tipo kolageno membrana. Operacijos dešiniajame ir kairiajame kelio sąnariuose atliktos darant 6 mėn. intervalą. Įvertinus chirurginio gydymo rezultatus po 12 mėn., nustatyti puikūs klinikiniai rezultatai, t. y. $95,59 \pm 4,64$ ir $96,88 \pm 4,69$ balai vertinant IKDC sistema.

Autologinė chondrocitinių ląstelių implantacija ir mozaikinė autologinė implantacija gali būti sėkmingai atliekamos vienu metu gydant didelio ploto sąnario kremzlės pažeidimus.

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