

Midterm results of biologic fixation or mosaicplasty and drilling in osteochondritis dissecans

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ABSTRACT

Background: Osteochondritis dissecans (OCD) primarily affects subchondral bone. Multiple drilling, fixation implant or autogenous osteochondral grafts are reported as treatment options. We present the midterm results of cases in which an OCD lesion was treated by osteochondral autograft transfer and drilling.

Materials and Methods: Between 2002 and 2006, 14 knees with International Cartilage Repair Society (ICRS-OCD) type II and III lesions were treated in our clinic using osteochondral autograft transfer and drilling by arthroscopic or open surgery. The average age of our patients was 22.14 years (range 17-29 years) and average followup was of 24.3 months (range 11-40 months). Lesion type was ICRS type II in five patients (35.7%) and ICRS type III in nine patients (64.3%). In cases with ICRS-OCD type II lesions, *in situ* fixation was applied following circumferential multiple drilling, while mosaicplasty was done following debridement and multiple drilling in cases with ICRS-OCD type III lesion. Mosaicplasty was performed in the lesion area by an average of 2.5 (range 1-3) cylindrical osteochondral autografts. Patients were not allowed to perform loading activities for 3 weeks in the postoperative period; movement was initiated by using CPM device in the early phase; full range of motion was achieved in third week, and full weight bearing was permitted in 6 to 8 weeks.

Results: While 6 and 8 patients were classified preoperatively as fair and poor, respectively, according to Hughston scale, excellent and good results were obtained postoperatively in 10 and 4 patients, respectively. During the followup, no problems were detected in any of the patients in the regions where osteochondral graft was harvested.

Conclusion: Biologic fixation or mosaicplasty and drilling as a technique to treatment of the lesion in OCD by osteochondral autograft transfer has resulted in good and excellent clinical outcomes in our patients and it is considered that providing blood flow to subchondral bone by circumferential drilling leads to an increase in the robustness of biological internal fixation and shortens the duration of recovery.

Key words: Osteochondritis dissecans, Hughston scale, knee, mosaicplasty

INTRODUCTION

Osteochondritis dissecans (OCD) primarily affects subchondral bone, whose etiology has not been fully established yet. Different surgical treatment options may be utilized, such as drilling which may increase the blood supply to the fragment thus in turn increases the recovery potential of osteochondral fragment; fixation by

bioabsorbable screw or Herbert bone screw; autologous chondrocyte transplantation and nowadays osteochondral autograft transplantation (mosaicplasty).

OCD is commonly seen in knee joint and mostly observed in the lateral surface of medial femoral condyle.¹ It may cause serious problems, such a loose body inside the joint. Although its etiology is not fully understood; trauma, ischemic reasons, genetic factors and primary defects occurring during ossification are generally considered among the causes.²⁻⁶ There is a consensus that it occurs by a disorder during the blood flow to the fragment.⁷ Its incidence is low and its frequency is higher in men.

OCD lesions should be repaired whenever possible, although stable lesions can manage nonoperatively in adolescent. Choosing surgical intervention for OCD, and selecting a strategy for repair versus reconstruction or removal of osteochondral lesions, essentially depend on the stability of the inciting lesion and the integrity of the overlying cartilage.^{8,9}

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Multiple drilling, fixation implant, or autologous osteochondral grafts are used in the treatment of ICRS-OCD II and III. ICRS-OCD IV is classified as a lesion with a completely dislocated fragment forming a loose body within the bed and it appears like a crater at the point of dislocation. Autologous chondrocyte transplantation or osteochondral transplantation may be done for its treatment.¹⁰

In our study, we aimed to present our midterm results of OCD lesions at the knee treated with biologic fixation or mosaicplasty by osteochondral autograft transfer and circumferential drilling.

MATERIALS AND METHODS

Between 2002 and 2006, 14 knees with ICRS-OCD type II and III lesions were treated in our clinic with osteochondral autograft transfer by arthroscopic or open surgery in fourteen patients 2 women, 12 men with a mean age of 22.14 years (range 17-29 years). All the patients had complaints of knee pain, sensation of burning inside the knee, difficulty in stair climbing and descending, and difficulty in performing daily activities. Although all patients were evaluated preoperatively with direct radiography and MRI, the decision of applying biologic fixation or mosaicplasty was made intraoperatively. Knee arthroscopy was done in all patients under regional anesthesia. Osteochondral autograft transfer was performed by open surgery ($n=10$) and by arthroscopic surgery in ($n=4$).

It was determined that lesions were in medial and lateral femoral condyle in 11 (78.6%) and 3 (21.4%) patients, respectively, and that the average size of the lesion was 3.16 (range 2.1 – 4.0) cm². According to the classification of OCD lesions by the International Cartilage Repair Society (ICRS), ICRS-OCD I is a stable lesion with a continuous but softened area covered by intact articular cartilage. In the treatment of ICRS-OCD I, anterograde

or retrograde drilling is regularly done in lesions that we consider as stable. ICRS-OCD II is classified as a stable lesion with partial cartilage discontinuity when probed, and ICRS-OCD III is classified as an unstable lesion with complete cartilage discontinuity, but without dislocated fragment. Type lesion was ICRS type II in 5 patients (35.7%) and ICRS type III in 9 patients (64.3%). In ICRS-OCD type II lesions ($n=5$), *in situ* fixation by osteochondral autograft plug was done followed by circumferential multiple drilling, while mosaicplasty by multiple osteochondral autograft was done followed by debridement and multiple drilling in cases with ICRS-OCD type III lesion. Multiple drilling was done by K wire and changed to the width of lesion, usually 10 mm depth, 1 mm wide, and the space between each drill was 3 mm. Mosaicplasty was performed in the lesion area by osteochondral autograft plugs an average of 2.5 (range 1-3). Osteochondral plug diameter was 6-8 mm and depth was 18-25 mm which varied with the lesions. In biologic fixation, plug diameter was chosen according to lesion size. Patients were not allowed to perform loading activities for 3 weeks in the postoperative period, movement was initiated by using CPM device in the early phase, full range of motion was achieved in 3rd week, and full loading was permitted in 6-8 weeks. Braces or orthoses were not used in patients in postoperative period. Patients were evaluated preoperatively by using the Hughston scale, and magnetic resonance imaging was performed for an average of 3.2 months (range 2-4 months) during followup. Patients were followed up for an average of 24.3 months (range 11-40 months) [Figures 1-3].

RESULTS

A distinctive reduction was reported in the complaints of all patients after surgery operation. While 6 (42.8%) and 8 patients (57.2%) were classified preoperatively as



Figure 1: (a) X-ray anteroposterior view and (b,c) T2W MRI of knee joint showing osteochondral defect

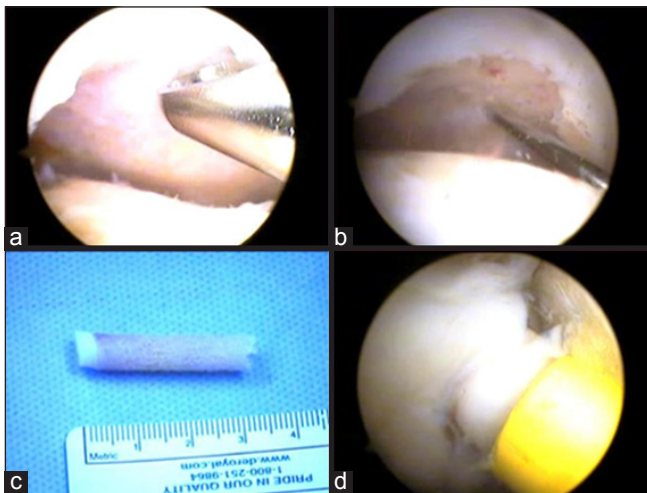


Figure 2: Arthroscopic picture of the lesion (a,b), graft (c) and arthroscopic picture after mosaicplasty (d)

fair and poor, respectively, according to Hughston scale, excellent and good results were obtained postoperatively in 10 (71.4%) and 4 patients (28.6%), respectively. During the followup in the clinic, no problems were detected in any of the patients in the regions where osteochondral graft was harvested. No local site problems, superficial or deep infections, and movement restrictions were observed that would require additional treatment, which might be associated with surgical procedure.

Moreover, followup MRIs did not reveal any developing intra-articular problems except the treated pathology. Although osteochondral graft integration was almost complete in last followup MRIs of the all patients, it was observed that the gap between the fixated fragment and subchondral bone was not completely filled, but the integrity of the joint surface was adequate. In addition, it was found that the regions, where osteochondral grafts had been harvested, were filled with bone.

DISCUSSION

Surgical treatment of OCD lesions of the knee is still controversial.¹² Treatment options differ according to the fragment type and age of the patient. Drilling alone was also another treatment technique in stage III OCD, and resulted in 50% improvement rate in adult form.^{7,13} Smilie *et al.* (1957) introduced the fixation method using wires,¹⁴ which was followed by other fixation methods like screws,¹⁵ Herbert screw¹⁶, or Wagner procedure.¹⁷ The results were reported to be very good in adult patients.¹⁸ The mosaicplasty technique used in the treatment of OCD lesions has gained great popularity in recent years. This technique is a cartilage transfer method, which increases subchondral bone vascularization that helps the recovery of OCD fragment.¹⁹ In addition, this technique has an

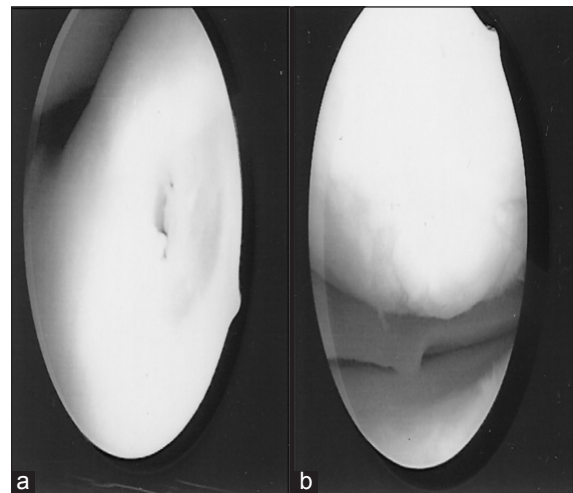


Figure 3: Second look arthroscopy of the defect area after 6 months of mosaicplasty

advantage that the internal fixation material is not to be removed afterward. Another advantage of this method is the compatible joint surface provided by the reconstruction of the patient's own original cartilage. Kazumoto *et al.* obtained excellent and good results in 11 of 12 patients whom they treated with the same technique.²⁰

Berlet *et al.* describe a technique in which the OCD lesion is essentially fixed *in situ* by osteochondral autograft plugs. Yoshizumi *et al.* used this technique in three cases of adult OCD, and delineated successful union within 6 months.²¹

Osteochondral transfer procedures, termed the mosaicplasty or osteochondral autologous transplantation (OATS) procedure, have been developed to replace surface defects with more durable hyaline cartilage. These procedures involve transplanting portions of autologous bone and articular cartilage from minimal weight-bearing regions to the defect site.

Conglutination of pluripotent cell fragments, which come from multiple drilling between the fragment and subchondral bone, and the fixation of the lesion in OCD by mosaicplasty, has resulted in good and excellent clinical outcomes in our patients.

Providing blood flow to subchondral bone by circumferential drilling is thought to increase the robustness of biological fixation and shorten the duration of recovery. Consequently, we are of the opinion that fixation of OCD by osteochondral autograft plug is a successful technique and it has a considerable advantage in the sense that it does not use any metallic implants that may have to be removed in later periods.

Osteochondral allografts can be used for any patient with

a large chondral or osteochondral defect. The ideal patient for osteochondral allograft is young, healthy patient, with an isolated osteochondral defect secondary to trauma or osteochondritis dissecans. Allograft tissue is typically indicated in particular for treatment of lesions more than 2 cm in diameter and/or in the setting of bone loss. Mosaicplasty demonstrates a 90% good to excellent clinical outcome and more rapid improvement than autologous chondrocyte implantation.²² Although ICRS type II lesions are considered to be stable and amenable to fixation, sometimes nonunion and increasing the severity of grade may ensue.²³ So, primary treatment with osteochondral autograft transfer and drilling might be done in these joints with high weight-bearing capacity in daily living despite, donor site morbidity with the OATS technique.²⁴

The maximum age for which osteochondral allografting should be performed is controversial. Many surgeons recommend a maximum age of 40 to 45 years. The minimum size of the defect is also somewhat controversial. Although osteochondral allografts can be applied to defects as small as 1 cm², most surgeons limit the use to lesions greater than 2 cm². Clinical results after osteochondral allograft transplantation have become generally provided good outcome and success rates have changed from 65% to 95%.²⁵ Other factors that are important in determining the most appropriate procedure are the physiologic age of the patient; the etiology of the lesions; social factors such as job status; workman's compensation; and smoking history; the cost of the procedure; and patient compliance. As alluded to previously, associated pathologies such as mechanical malalignment, associated ligament or meniscal injuries, skeletal maturity, and depth of subchondral bone involvement are all important considerations.

Gene therapy, synthetic scaffolds, tissue engineering, and use of stimulatory factors such as bone morphogenic protein are some of the future directions that will be investigated in the treatment of articular surface injuries. Steadman *et al.* reported the results of microfracture with an average followup of 11 years. They performed this procedure on 72 patients aged 45 years or younger with isolated full-thickness chondral defects. A statistically good functional outcome was reported.²⁶

The small number of operated patients without a control group were weak points in our study. We think that circumferential microfracture applied before OATS application might increase graft integration and increase the healing potential, but further experimental studies and pathological specimen examinations which were undertaken during second look arthroscopy is needed. Kocher *et al.* treated 30 knees by arthroscopic anterograde

drilling, and reported radiographic healing in all. Our experience has been the same, that drilling works better in OCD treatment.^{8,11}

Management of the lesion in OCD *in situ* fixation or mosaicplasty by osteochondral autograft transfer and drilling has resulted in good and excellent clinical outcome in our patients, and it is considered that providing blood flow to site of the lesion by circumferential drilling leads to an increase in the robustness of biological fixation and shortens the duration of recovery. Consequently, we are of the opinion that treatment of OCD by a *in situ* fixation or mosaicplasty technique is a successful technique that has a considerable advantage as it does not use any metallic implants that might have to be removed in later period.

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