



Neither significant osteoarthritic changes nor deteriorating subjective outcomes occur after hybrid fixation of osteochondritis dissecans in the young adult

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Abstract

Purpose The goal of the fixation of painful osteochondritis dissecans of the femoral condyles in adults is to integrate the osteochondral fragment and thus achieve a normal hyaline cartilaginous coverage. The addition of a biological process to primary fixation may result in improved fragment integration (hybrid fixation). Osteochondral plugs may fulfil this role. The aim of this study was to evaluate long-term clinical and radiological results after hybrid fixation of unstable osteochondritis dissecans. The hypothesis was that the rate of secondary osteoarthritis would be low.

Methods Nine patients treated by hybrid fixation were retrospectively reviewed at a median follow-up of 10.1 years (range 7–14). The median age at surgery was 21 (range 17–28). Six of them were evaluated as ICRS grade II and three, as ICRS grade III. The mean surface of the lesion was 4.5 cm². All patients were followed up clinically (IKDC, KOOS, Lysholm) and radiologically [Kellgren–Lawrence score (KL)].

Results During arthroscopic assessment at the time of screw removal (3 months after surgery), the fragments were stable, and autograft plugs were all well integrated. At the most recent follow-up visit, the median IKDC score was 85.8 (range 51.72–100), the KOOS score was 87.7 (52.4–100), and the Lysholm scale score was 89.8 (77–100). In 7 out of 9 patients, radiographs showed a joint space KL grade of 0 or 1.

Conclusion Hybrid fixation for treating osteochondritis dissecans lesions of the femoral condyles using mechanical and biological fixation provides healing of the osteochondral fragments with good long-term outcomes. No significant osteoarthritic change was seen with this technique at a mid-term follow-up.

Level of evidence IV—case series.

Keywords Knee · Adult osteochondritis dissecans · Biological fixation · Mosaicplasty · Osteochondral graft

Introduction

Juvenile osteochondritis dissecans (OCD) of the knee condyle is characterized by a lesion of the subchondral bone, which can heal with conservative management [14]. In some cases, the healing process fails, and instability of the osteochondral fragment occurs. Osteochondritis dissecans of the adult (AOCD) has a poor prognosis and might contribute to the development of early osteoarthritis [4, 14]. The surgical treatment of AOCD is based on reconstructive techniques:

mosaicplasty [10], osteochondral allograft [9], autologous chondrocyte transplantation (ACI) [13, 27], and biomimetic osteochondral scaffold [16]. Fixation of the native osteochondral fragment allows restoration of a normal cartilage shape, but this conservative surgical treatment of OCD of the knee requires healing of the osteochondral fragment.

Mechanical fixation provides good primary stability but does not guarantee bone consolidation in adults. 67% of osteochondral fragment fixation attempts are successful [17]. The addition of a biological fixation to the mechanical fixation (as an osteochondral graft) might improve fragment integration (hybrid fixation) [18]. In 2011, we published the preliminary short-term results [18] of a technique combining open fixation with metallic screws and osteochondral bone plugs (mosaicplasty) through the native osteochondral

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fragment, demonstrating an improvement in integration. Nevertheless, results of long-term follow-up are lacking.

The purpose of this study was to assess the long-term clinical outcomes and to evaluate, through radiographic analysis, whether hybrid fixation was successful at preventing joint degeneration in AOCD. The hypothesis was that this technique might offer good results in preventing joint degeneration at long-term follow-up for the treatment of unstable AOCD lesions in adults.

Materials and methods

The series

This retrospective series included nine adults (eight males, one female). The median age at surgery was 21 years (range 17–28). The median follow-up was at 10.1 years (range 7–14). Clinical symptoms included knee pain, crepitus, effusion, and repeated locking. According to the International Cartilage Repair Society (ICRS) classification [3], six of the OCD were grade II, corresponding to partial discontinuity of the cartilage, and three OCD were grade III, corresponding to unstable articular cartilage damage with a pedicle fragment, in a stable, normally aligned and skeletally mature knee. The mean lesion surface area was 4.5 cm² (range 1.5–8). All osteochondral lesions were located in the medial femoral condyle, except one, which was in the lateral femoral condyle.

Surgical technique

The surgical approach was para-patellar medial or lateral. The osteochondral fragment was lifted, maintaining synovial attachment in the notched border of the femoral condyle

(Fig. 1). The bottom of the lesion was debrided and drilled to obtain a bleeding subchondral surface. In the case of bone defect, a filling with a spongy graft from the proximal tibial metaphysis was performed (one case).

The osteochondral fragment was fixed with two metal screws (2 mm) (Fig. 2). The screw head was always buried below the articular surface into the subchondral bone to gain compression and to avoid protrusion that could erode the opposite tibial surface. The osteochondral cylindrical grafts (3.5–8 mm) were harvested in the medial border of the ipsilateral femoral trochlea, and these plugs were then press-fitted through the osteochondral fragment (Fig. 3) [5]. The median size of the plugs used was 5.2 mm. Early rehabilitation started without any limitation of motion recovery. No weight bearing was allowed for 6 weeks. Arthroscopic removal of the screws was performed secondarily at 3 months.

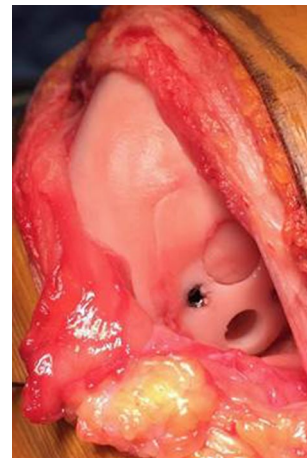


Fig. 2 Osteochondral fragment fixation using two metallic screws (2 mm dia.)

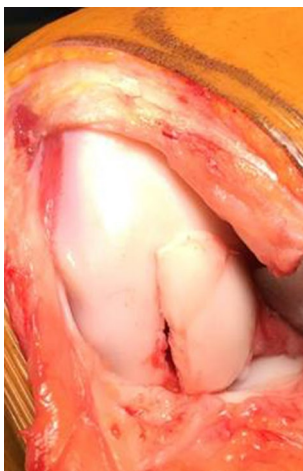


Fig. 1 Osteochondritis dissecans of the medial femoral condyle



Fig. 3 Final aspect of the “hybrid fixation” with osteochondral plugs

Evaluation

Cartilage quality, plug integration and OCD fragment stability were assessed at the time of arthroscopic removal of the hardware.

As a clinical evaluation, the Knee injury and Osteoarthritis Outcome Score (KOOS) [24], the Lysholm knee score and the International Knee Documentation Committee (IKDC) [25] score were assessed at the final follow-up.

The radiological evaluation included a weight-bearing anteroposterior (AP) view of the knee in extension, a weight-bearing posteroanterior (PA) view at 30° of flexion and a lateral view at 30° of flexion. The joint line was assessed according to the Kellgren–Lawrence (KL) classification: Grade 0, no joint space narrowing (JSN) or reactive changes; Grade 1, doubtful JSN, possible osteophytic lipping; Grade 2, definite osteophytes, possible JSN; Grade 3, moderate osteophytes, definite JSN; and Grade 4, large osteophytes, marked JSN [12].

This study was approved by the Institutional Review Board of the hospital and by the scientific committee of the A. Mignot Hospital in Versailles. This study was performed in accordance with the ethical standards outlined in the 1964 Declaration of Helsinki. All patients signed a written informed consent form. All patients were allowed to decline to participate in this study.

Results

No patients declined to participate in this retrospective study.

The OCD fragments were all stable, and autograft plugs were all integrated with the persistence of a superficial peripheral chondral gap between the graft and the native cartilage. Thus, there was not complete integration of the cartilage. To assess the adequacy of bony integration in all patients, we used a hook probe during the removal of arthroscopic hardware.

At the most recent follow-up visit, all patients presented a painless knee with a good trophicity of the thigh and without any joint locking or effusion. At the most recent follow-up visit, the median IKDC score was 85.8 (range 51.72–100), the KOOS score was 87.7 (52.4–100) and the Lysholm scale score was 89.8 (77–100). Radiographs showed a satisfactory joint space. Two patients were graded KL 0, five were KL 1 and two were KL 2.

Two patients needed another surgical procedure: One patient required two arthroscopic revisions. The first was to remove an early shifted screw at 2.5 months after fixation. A linear tibial cartilage lesion was found, caused by the extrusion of a screw head. The second was to resect an extruded plug at 9 months after fixation. At the latest follow-up visit, the IKDC score was 69, the KOOS score was 74.9 and the

Lysholm scale score was 86. The radiograph showed a KL 1 joint space.

The second patient required an arthroscopic revision because of a loose body in the joint space after a trauma involving torsion of the knee that occurred 13 months after the surgery. At the most recent follow-up visit, the IKDC score was 86.8, the KOOS score was 77 and the Lysholm scale score was 91. The radiograph showed a KL 2 joint space.

Discussion

The most important finding of this study was that hybrid fixation provided good long-term radiographic and clinical outcomes for treating unstable AOCD in skeletally mature patients. To date, and to our knowledge, no study reporting long-term follow-up of the treatment of AOCD by hybrid fixation has been published.

Fixation of the osteochondral fragment using screws or pins theoretically allows us to restore the shape of the condyle, whatever the surface of the fragment. It also maintains the hyaline structure of the cartilage, since in OCD, the cartilage structure itself is not damaged. However, isolated fixation of the native OCD does not guarantee osteochondral integration. In a study of 43 cases with more than 10 years of follow-up, Lefort et al. reported a failure rate of 53% with isolated screw fixation in AOCD [17] (while this failure rate decreased to 23% in skeletally immature patients with juvenile osteochondritis dissecans [J OCD]).

Adding a biological step, such as a graft through the junction between the native condyle and the fragment, improves the healing process. Our results support this theory, showing good functional outcomes and no significant osteoarthritic change. Miura et al. [21] and Berlet et al. [2] obtained similar results utilizing osteochondral autografts press-fitted through the OCD fragment (4.5-year follow-up). These encouraging mid-term results were moderated by the report of loose bone plugs due to insufficient primary mechanical fixation [23, 28].

Simple debridement and excision of loose bodies [1, 22, 31] do not prevent late osteoarthritis. They imply a high rate of knee arthroplasty at long-term follow-up [26]. This should be avoided. Mosaicplasty alone allows biological integration with good results in 90% of cases but is an invasive procedure [11]. This procedure causes technical difficulties in reconstructing the anatomical joint surface with a limited surface coverage and a non-congruent condyle reconstitution.

Filardo et al. showed a significant worsening in the Kellgren–Lawrence score of the osteochondral lesion treated by mosaicplasty. The degenerative process occurred to a greater extent in knees implanted with three or four plugs compared

to those treated with one or two plugs [8]. This technique should be reserved for cases, where the OCD fragment cannot be reimplanted (e.g., ICRS grade IV).

Unfortunately, few data on the long-term outcomes of biomimetic osteochondral scaffolds are available. Clinically significant improvements were observed at short-term follow-up [16, 20, 29, 30], but there are concerns over integration of the subchondral repair tissue of the biomimetic osteochondral scaffold [6]. With the use of a nano-composite scaffold (collagen I—hydroxyapatite) at 2-year follow-up, complete integration evaluated by MRI (MOCART score) was observed by Kon et al. [15] in 70.0% of their patients and by Delcogliano et al. [7] in 80% of their patients. Verdonk et al. observed a complete integration on MRI in only 9 of their 36 patients (25%) 24 months after surgery [30]. These results raise serious concerns about the biological repair potential of the nano-composite scaffold (collagen I—hydroxyapatite).

Furthermore, all studies about biomimetic osteochondral scaffolds thus far have been on knee chondral or osteochondral lesions but not specifically on OCD. Further studies with longer term results on AOCD lesions are needed to evaluate articular degenerative processes. The results of autologous chondrocyte implantation, which produces cartilage similar to hyaline cartilage, was reported in a study [19]. The incidence of radiographic OA in the OCD subgroup was 17% (2 patients out of 12 showed a Kellgren and Lawrence score of ≥ 2). This procedure is costly and requires a specialized centre for in vitro cell culture. Furthermore, it needs two surgeries and a long rehabilitation period.

The limits of this study are the retrospective design and the small number of patients. The small size of the sample made statistical analysis inappropriate and limited us to a descriptive analysis of the series. Nevertheless, this surgery is rare, and the long-term-results are scarce.

Conclusion

The hybrid fixation technique enables preservation of the native fragment in adult knee condylar OCD lesions using mechanical and biological fixations, with good long-term radiological and clinical results. It is an acceptable and reliable option to treat unstable OCD lesions and prevent joint degeneration.

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Compliance with ethical standards

Conflict of interest All authors declared that they have no conflict of interest.

Ethical approval Local committee approval according to national rules.

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