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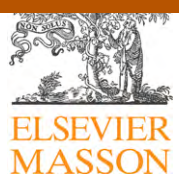

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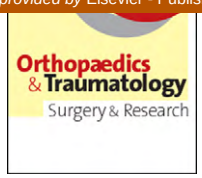

ORIGINAL ARTICLE

Patella osteochondritis dissecans end stage: The osteochondral mosaicplasty option

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KEYWORDS
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Summary
Introduction: Patellar damage during osteochondritis dissecans of the knee is rare.

There were two objectives to this study: evaluate the functional results of surgical treatment by mosaicplasty in this disease as well as evaluate articular surface reconstruction and cylindrical bone plugs incorporation.

Materials and methods: Six consecutive cases of patella osteochondritis dissecans in young athletes were treated using mosaicplasty by the same senior surgeon between 2002 and 2007.

All these cases presented ICRS stage IV osteochondritis dissecans with an empty defect lesion. The average age at diagnosis was 20.5 ± 9.2 years old. The pre- and post-operative clinical evaluation was based on the IKDC subjective knee evaluation, the Lysholm and Tegner scores, CT arthrography and MRI.

Results: Evaluation of the functional results of surgical treatment at a mean follow-up of 26 months showed an average IKDC subjective evaluation score of 66.3, a Lysholm score of 85 and a Tegner score of 5.7 (37.2, 58.3 and 3.5 respectively before surgery). The radiological evaluation showed articular surface reconstruction with satisfying congruency and good incorporation of the graft into the bone at the receptor site, except in one patient in whom a 5 mm diameter cartilage defect and a loose body were identified.

Discussion: Osteochondral grafting with the mosaicplasty technique has been shown to be effective and give satisfying functional results. The problem of the per-operative cylindrical bone plugs choice requires to be addressed during the procedure course itself, according to the patella lesion location.

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Introduction

Osteochondritis dissecans, a term which was first used by Koenig [1], is a limited lesion of subchondral bone necrosis, which progresses slowly towards separation of necrotic osteo-cartilaginous fragments which then move freely in the joint space. The etiology has not been clarified. Most authors [2—5] support the hypothesis that the initial pathogenic event is a combination of ischemic necrosis and trauma. This disease affects twice as many males between the age of 10 and 20 years old (70% of cases) and is often found in a context of the regular practice of sports.

Osteochondritis dissecans of the knee is frequently located in the medial femoral condyle. Location in the patella is rare (approximately 2%) and is predominantly in the lower portion [6]. It was first described by Rombold [7] in 1936. Only isolated cases or small series of patients have been reported in the literature. Based on a register of more than 30000 operated knees, Schwarz et al. [8] showed a surgical incidence of 0.15%.

Numerous surgical procedures have been described to treat lesions associated with osteochondritis [9]: fixation with resorbable pins [10], Herbert screw [11], or fluoroscopy guided procedure [12]. In the presence of necrotic fragments, several approaches have been reported: removal of the necrotic osteocartilaginous fragments then drilling multiple holes in the subchondral bone to stimulate the development of a fibrocartilaginous layer [13—15], chondroplasty [16—19], or chondrocyte grafts [20].

We studied six cases of late stage osteochondritis dissecans of the patella treated by mosaicplasty. Our study had two aims:

- evaluate the functional results of surgical treatment of this disease by mosaicplasty;
- evaluate articular surface reconstruction and the incorporation of cylindrical bone plugs.

Materials and methods

Description of the series

We performed a retrospective study of a continuous series of six athletic patients (four men and two woman, three right knees) operated by one senior surgeon between 2002 and 2007. The average age at diagnosis was 20.1 ± 9.3 (14—39 years old), and 20.5 ± 9.2 (14—39 years old) at surgery. The average delay between the first symptoms and the first consultation was 42 months (4—180 months). In the pre-operative evaluation, painful patellar crepitation was present in all cases, with functional impairment, especially when climbing stairs and squatting. A hydarthrosis was identified in four cases, an unstable patella in four cases, a positive J-sign in 3. Episodes of joint sticking were found in two patients, a patellar tilt in two cases. None of the patients had signs of anteroposterior or sagittal ligament instability. The average preoperative subjective IKDC score (Fig. 1) was 37.2 (13.8—59.8), the Lysholm score was 58.3 (27—80) and the Tegner score was 3.5 (2—7). All patients underwent standard X-rays and CT arthrography for the preoperative evaluation (Fig. 2), four out of six patients underwent MRI (Fig. 3).

Figure 2 View of the lesion (empty defect) on CT arthrography.

Two patients presented with a type 1 patella according to the Wiberg classification, two with type 2, two with type 3. The trochlear angle measured on CT scan was an average of 143 ± 7.5° with a lateral condylar inclination of 21 ± 3.8°.

The average delay between the first consultation and surgery was five months (1—10). The location of the lesion

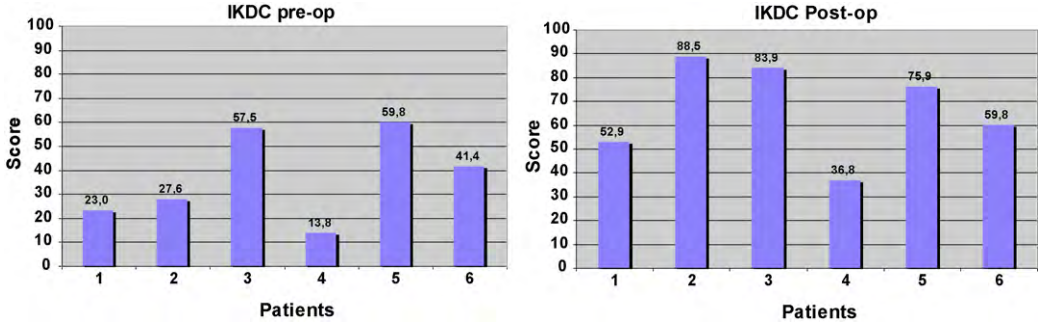

Figure 1 Subjective IKDC score before and after surgery (average follow-up 26 months).

Figure 3 View of the lesion on MRI.

(according to the ICRS classification) was in the superolateral quadrant (2 cases), the mediolateral quadrant (2 cases), in the inferolateral quadrant (1 case) and in the medial quadrant (1 case).

Surgical procedure

Surgery was performed according to the mosaicplasty procedure described by Hangody et al. [21,22] at the beginning of the 1990s for the treatment of cartilaginous lesions of the femoral condyle. The medial parapatellar approach was used, with medial arthrotomy, evaluation of the knee and existing lesions (location, size, depth) (Fig. 4a). After preparation of the cartilaginous lesions (debriding the edges, and reaming the subchondral bone) (Fig. 4b), an initial tunnel was drilled into the bone at the site of the lesion with the help of a tubular chisel (Zimmer GmbH, Sulzer-Allee 8, CH-8404 Winterthur.) (Fig. 4c). The first graft was then harvested from a non-weight-bearing area of the trochlea. The harvested graft was prepared (adjusted for length and slightly compressed) and placed in the recipient tunnel by carefully using the guide tube and the tamp. These steps were repeated as often as necessary to fill the lesion as completely as possible. The grafts were harvested 3 mm apart to avoid weakening the donor site. (Fig. 4d).

All of the patients presented with sequellar lesions of ICRS stage IV osteochondritis dissecans [23] (stage III according to Nagura [24]) corresponding to an empty defect. The average surface of lesions was 88.4 ± 47.6 mm^2. Grafts were harvested in the medial trochlea except in one case (the lateral trochlea). The size and number of cylindrical bone plugs grafted in relation to the size of the lesion are reported in Table 1 (average number of bone plugs per patient 2.2 ± 0.8).

Associated procedures included sectioning of the patellar retinaculum in two cases and distalization-medialization of the anterior tibial tubercle with medial-patellofemoral ligament reconstruction (MPFL) in one patient who presented with a high, hypermobile and unstable patella. In one case, the mosaic graft was stabilized with a resorbable pin.

A removable brace in extension was placed after surgery and weight bearing was allowed on D1. Articular exercises were begun on the first post-operative day (range 0—60°) with a motorised brace and continued for four to six weeks.

Follow-up method

Post-operative clinical and radiological evaluation of patients was performed using the IKDC, Lysholm and Teg-

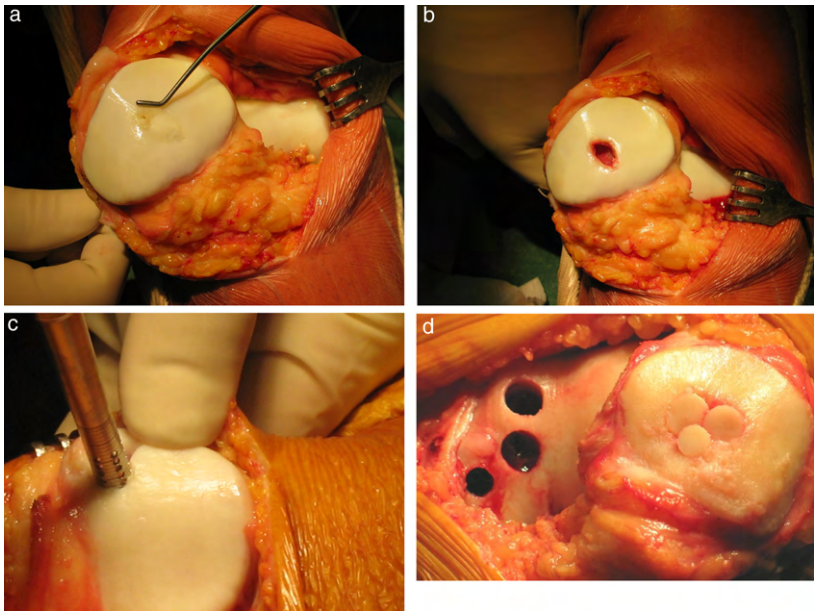

Figure 4 a: view of the lesion during surgery; b: preparation of the lesion after reaming and debridement; c: drilling of the tunnel at the recipient site of the lesion; d: harvesting with a minimum distance of 3 mm to avoid weakening of the donor site.

Table 1 Size and number of cylindrical bone plugs according to the size of the lesion.

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6
Size of the lesion (mm)	10 × 8	6.5 × 6.5	14 × 12	12 × 10	10 × 5	10 × 7
Number of plugs	2	1	3	2	2	3
Diameter of plugs (mm)	7.45/5.5	7.45	7.45/7.45 /5.5	7.45/7.45	5.5/6.4	7.45/7.45/5.5

ner scores. All patients underwent standard X-rays and CT arthroscan. Five out of six patients underwent MRI.

Results

No per- or postopertaive complications occurred requiring surgical revision.

Functional results

The average final follow-up was at 26 months (10—68 months). None of the patients was lost-to-follow-up. Pain was reduced in all cases, three patients had begun athletic activities again (final follow-up at 18, 36 and 68 months). The clinical examination did not show any hydarthrosis, but moderate crepitation of the femoropatellar joint was present in all patients except one. Range of motion on the operated side was the same as the opposite side. The subjective IKDC score (Fig. 1) went from 37.2 (13.8—59.8) pre-operatively to 66.3 (36.8—88.5) post-operatively. The Lysholm score went from 58.3 (27—80) to 85 (69—100) and the Tegner score from 3.5 (2—7) to 5.7 (4—9) (Table 2).

Radiological results

CT arthrography results showed articular surface reconstruction with satisfactory congruency (Fig. 5) in all cases except in one patient with a 5 mm diameter cavity in the cartilage and a loose body (probable non-integrated or detached graft). This patient had no particular functional impairment, and surgical revision was not required. CT arthrography showed a reduction in patellar cartilage thickness in one patient.

MRI showed good bone graft incorporation at the receptor site with living grafts in all patients except the patient with the loose body. There were no particular complications of the donor site, just normal signs of healing.

Table 2 Pre- and postoperative clinical scores (average follow-up 26 months).

	Pre-operative	Post-operative
IKDC subj	37.2	66.28
LYSHOLM	58.3	85
TEGNER	3.5	5.7

Figure 5 View of the integrated bone plug with surface cartilage reconstruction.

Discussion

Literature

At present there are no specific prospective or retrospective studies on the treatment of sequella from osteochondritis dissecans of the patella by mosaicplasty. Certain authors have discussed the etiology [25—27] and described the disease [28]. Others have evaluated lesions on MRI [6,29], and even scintigraphy [30]. Finally, other studies have evaluated the management of these lesions as they develop and discuss conservative treatment alone [18,31], surgical treatment by fixation [10—12] or ablation of the articular osteocartilaginous fragment [15,18]. Studies by Edwards et al. [32] and Desai et al. [33] discuss various stages of osteochondritis dissecans of the patella, and present conservative and surgical treatments.

Technical difficulties

Compared to other sites, the patella presents additional technical problems of the orientation of the surface to be treated, its morphology and mobility as well as the problem of cartilage and bone thickness.

Indeed, the patellar surface is irregular. The tip divides it into two parts on the frontal plane, each with bone

that reduces in thickness from the tip to the borders. This presents certain technical difficulties when the lesion is located on the edges requiring cylindrical plugs to be limited in length to avoid drilling through to the anterior side of the patella and to obtain maximum incorporation of subchondral bone. Perfect anatomical reconstruction of a convex surface is not possible with flat surfaced cylindrical bone plugs in case of tip lesions. Moreover, thickness of the patellar cartilage must be taken into account, which is not found at condylar donor sites [34]. This means that a choice must be made between surface reconstruction and bone-cartilage contact of cylindrical bone plugs in the receptor site. In our experience, articular surface reconstruction was given priority.

There is no consensus for the number and size of cylindrical bone plugs to be grafted. Smaller sized grafts result in better incorporation at the site of the lesion, and better graft congruency. On the other hand, the number of surgical acts in the donor site and the number of grafts to be integrated in the receptor site are then increased. We used large sized bone plugs (5.5—7.45 mm in diameter) and sometimes overlapped them to increase congruency and reduce fissures. We chose to reduce the number of surgical acts in the donor site and the injured area as much as possible to reduce the risks associated with harvesting and to replace the empty defect with a single surface of cartilage that was as homogenous and even as possible.

Other therapeutic options

Solheim [19] and Hangody et al. [21] evaluated mosaicplasty for the treatment of cartilage defects of the knee from different etiologies. Isolated chondrocyte grafts are a good option for superficial cartilage defects, with remarkable results in the quality of tissue regeneration [20]. Defects which affect the subchondral bone require associated bone grafts [35]. Condyle lesions from osteochondritis may be treated by arthroscopic matrix induced autologous chondrocyte implantation (MACI). However, this is a difficult and costly technique that requires an in vitro cell culture center [36]. Patellar lesions from osteochondritis dissecans cannot be treated arthroscopically and subchondral bone lesions require an associated graft. This surgical procedure is therefore as invasive as chondrocyte grafts and mosaicplasty.

Advantages and weaknesses to the study. Functional results

Although our study is limited to six cases, it has the advantage of providing an evaluation of a continuous series of a rare disease treated and followed-up by the same surgeon using the same protocol, with an average follow-up of two years, and no patients lost to follow-up. The small size of the study made it impossible to perform a statistical analysis, and is limited to a descriptive analysis of the series. Patellar mosaicplasty provides encouraging biological results, with living grafts found in five out of six cases. The clinical evaluation showed overall improvement in symptoms. This clinical improvement was confirmed by the increase in subjective scores in all patients. It should be noted that the tendency towards functional improvement was less significant in patients whose delay to the final follow-up examination was less that the average. Patients presenting with the best functional scores were those with the longest delay to follow-up. The clinical results showed an overall improvement in symptoms in relation to post-operative delay. This suggests that physical rehabilitation with articular exercises and muscular strengthening is very important to reliably evaluate the final results of treatment.

Conclusion

Considering the poor prognosis of lesions diagnosed in later stages, mosaicplasty with osteochondral grafts seems to be an efficient technique for the surgical management of sequellae of osteochondritis dissecans of the patella in young, athletic patients, with satisfactory functional results.

Patients seen at least one year after surgery and with a longer period of physical rehabilitation had a tendency to have better functional results. Because of the specific shape and thickness of the patellar cartilage, the technical problems of the choice of surgical grafts must still be resolved.

Conflict of interest

None.

References

[1] Koenig F. Ueber Freie Korper in den Gelenken. Deutsh Z Chir 1887;27:90—109.
[2] Mubarak SJ, Carroll NC. Juvenile osteochondritis dissecans of the knee: etiology. Clin Orthop 1981;157:200—11.
[3] Clanton TO, DeLee JC. Osteochondritis dissecans. History, pathophysiology and current treatment concepts. Clin Orthop 1982;167:50—64.
[4] Barrie HJ. Osteochondritis dissecans 1887—1987. A centennial look at König's memorable phrase. J Bone Joint Surg Br 1987;69:693—5.
[5] Bradley J, Dandy DJ. Osteochondritis dissecans and other lesions of the femoral condyles. J Bone Joint Surg Br 1989;71:518—22.
[6] Pfeiffer WH, Gross ML, Seeger LL. Osteochondritis dissecans of the patella. MRI evaluation and a case report. Clin Orthop 1991;271:207—11.
[7] Rombold C. Osteochondritis dissecans of the patella. J Bone Joint Surg 1936;18:230—1.
[8] Schwarz C, Blazina ME, Sisto DJ, Hirsh LC. The results of operative treatment of osteochondritis dissecans of the patella. Am J Sports Med 1988;16:522—9.
[9] Lefort G, Moyen B, Beaufils P, et al. Osteochondritis dissecans of the femoral condyles: report of 92 cases. Rev Chir Orthop 2006;92(Suppl. 5) [2S97—2S141].
[10] Matava MJ, Brown CD. Osteochondritis dissecans of the patella: arthroscopic fixation with bioabsorbable pins. Arthroscopy 1997;13:124—8.
[11] Marandola MS, Prietto CA. Arthroscopic Herbert screw fixation of patellar osteochondritis dissecans. Arthroscopy 1993;9:214—6.
[12] Sekiya LC, Fontbote CA, Harner CD. Arthroscopically assisted retrograde fixation of patellar osteochondritis dissecans using

fluoroscopic guidance: a case report and technical note. Arthroscopy 2003;19:E1—7.
[13] Smillie IS. Treatment of osteochondritis dissecans. J Bone Joint Surg Br 1957;39-B:248—60.
[14] Pridie KH. A method of resurfacing osteoarthritic knee joint. J Bone Joint Surg Br 1959;41B:618—9.
[15] Modrzewski K, Gaweda K. Osteochondritis dissecans of the patella. Chir Narzadow Ruchu Ortop Pol 1997;62:59—62.
[16] Jakob RP, Franz T, Gautier E, Mainil-Varlet P. Autologous osteochondral grafting in the knee: indication, results, and reflections. Clin Orthop 2002;401:170—84.
[17] Karataglis D, Green MA, Learmonth DJ. Autologous osteochondral transplantation for the treatment of chondral defects of the knee. Knee 2006;13:32—5.
[18] Peters TA, McLean ID. Osteochondritis dissecans of the patellofemoral joint. Am J Sports Med 2000;28:63—7.
[19] Solheim E. Mosaicplasty in articular cartilage injuries of the knee. Tidsskr Nor Laegeforen 1999;119:4022—5.
[20] Gobbi A, Kon E, Berruto M, Francisco R, Filardo G, Marcacci M. Patellofemoral full-thickness chondral defects treated with Hyalograft-C: a clinical, arthroscopic, and histologic review. Am J Sports Med 2006;34:1763—73.
[21] Hangody L, Kish G, Kárpáti Z, Szerb I, Udvarhelyi I. Arthroscopic autogenous osteochondral mosaicplasty for the treatment of femoral condylar articular defects. A preliminary report. Knee Surg Sports Traumatol Arthrosc 1997;5:262—7.
[22] Hangody L, Sükösd L, Szabó Z. Repair of cartilage defects. Technical aspects. Rev Chir Orthop 1999;85:846—57.
[23] Brittberg M, Winalski CS. Evaluation of cartilage injuries and repair. J Bone Joint Surg Am 2003;85-A(Suppl. 2)::58—69.
[24] Nagura JE. The so called-osteochondritis dissecans of König. Clin Orthop 1960;18:100—22.
[25] Bruns J, Luessenhop S, Lehmann L. Etiological aspects in osteochondritis dissecans patellae. Knee Surg Sports Traumatol Arthrosc 1999;7:356—9.
[26] Obedian RS, Grelsamer RP. Osteochondritis dissecans of the distal femur and patella. Clin Sports Med 1997;16: 157—74.
[27] Schenck Jr RC, Goodnight JM. Osteochondritis dissecans. J Bone Joint Surg Am 1996;78:439—56.
[28] Smith JS. Osteochondritis dissecans of the patellofemoral joint. Am J Sports Med 2001;29:112—3.
[29] Choi YS, Cohen NA, Potter HG, Mintz DN. Magnetic resonance imaging in the evaluation of osteochondritis dissecans of the patella. Skeletal Radiol 2007;36:929—35.
[30] Kumar R, Dilip S, Padhy AK, Malhotra R, Malhotra A, Machineni S, Sharma R. Three-phase bone imaging in the early diagnosis of osteochondritis dissecans of the patella. Clin Nucl Med 1998;23:540—1.
[31] Orava S, Weitz H, Holopainen O. Osteochondritis dissecans of the patella. Z Orthop Ihre Grenzgeb 1979;117:906—10.
[32] Edwards DH, Bentley G. Osteochondritis dissecans patellae. J Bone Joint Surg Br 1977;59:58—63.
[33] Desai SS, Patel MR, Michelli LJ, Silver JW, Lidge RT. Osteochondritis dissecans of the patella. J Bone Joint Surg Br 1987;69:320—5.
[34] Thaunat M, Couchon S, Lunn J, Charrois O, Fallet L, Beaufils P. Cartilage thickness matching of selected donor and recipient sites for osteochondral autografting of the medial femoral condyle. Knee Surg Sports Traumatol Arthrosc 2007;15: 381—6.
[35] Bartlett W, Gooding CR, Carrington RW, Skinner JA, Briggs TW, Bentley G. Autologous chondrocyte implantation at the knee using a bilayer collagen membrane with bone graft. A preliminary report. J Bone Joint Surg Br 2005;87: 330—2.
[36] Derrett S, Stokes EA, James M, Bartlett W, Bentley G. Cost and health status analysis after autologous chondrocyte implantation and mosaicplasty: a retrospective comparison. Int J Technol Assess Health Care 2005;21:359—67.