

CLINICAL RESULTS OF MOSAICPLASTY IN THE OSTEOCARTILAGINOUS LESIONS OF THE KNEE

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Abstract

The aim of this paper is to evaluate the medium term postoperative results of mosaicplasty depending on the location and dimension of the cartilaginous defect. This study used the database of University Emergency Hospital Bucharest, the Department of Orthopedics and Traumatology, which recorded a number of 112 mosaicplasties between 2006 and 2012. Mosaicplasty is a surgical technique of autologous transplantation of some osteocartilaginous cylinders from a non-bearing donor area to the area of the cartilaginous defect in the knee. The postoperative functional evaluation was performed by means of the International Knee Documentation Committee (IKDC) score 6 months after the intervention, compared to the IKDC score prior to surgery and Lysholm and International Cartilage Repair Society (ICRS) score for the evaluation of the cartilage one year after surgery. The greatest rise in the IKDC score 6 months after surgery was recorded for the patients with posttraumatic osteocartilaginous lesions. In terms of the quality of recovery of the articular cartilage, assessed by means of the ICRS score, the best results were obtained for small lesions with traumatic etiology located at the medial femoral condyle. The technique of mosaicplasty represents an outstanding solution for patients with non-degenerative osteocartilaginous lesions. However, the result of surgery depends on the etiology, location and dimension of the osteochondral defect, as well as on the surgeon's experience and patient's compliance with the treatment.

Keywords: mosaicplasty, cartilaginous defect, osteochondral grafts, osteochondritis dissecans

Introduction

Despite the numerous techniques of reconstructing the articular cartilage developed over the past 50 years, a standard treatment for this type of lesion has not been established yet. The previous focus was not only on the reconstruction of the anatomical integrity of the area where the osteochondral defect is found,

but also on the assurance of the development of a tissular neo-formation whose histological characteristics are the closest possible to those of the normal tissue [1]

In this context, mosaicplasty (the transplant of multiple osteocartilaginous auto grafts), initiated and improved by Hangody between 1990 and 1994, became one of the most common techniques for the reconstruction of

limited osteochondral defects [2]. It consists in the transplantation of an amount of osteochondral grafts from non-weight bearing areas of the articular cartilage of the knee to the area where the cartilaginous defect is located.

The purpose of this paper is to evaluate the long term postoperative results of this surgical technique based on the location and dimension of the cartilaginous defect.

Material and Methods

This study used the database of University Emergency Hospital Bucharest, the Department of Orthopedics and Traumatology, which recorded a number of 112 mosaicplasties between 2006 and 2012.

The surgical technique of mosaicplasty [2]. This can be performed by arthrotomy, miniarthrotomy or arthroscopy. The surgical procedures are very similar to one another, since there are only slight differences between the steps of this surgery. Actually, the patient must be prepared for an open procedure - if the area of the lesion is arthroscopically inaccessible due to either a subsequent localization, or the inability to bend the knee adequately. After the arthroscopic approach or, through arthrotomy, the lesion is cleared through the removal of the altered cartilage, as well as any existing detritus (Figure 1). The cartilage adjacent to the lesion is also removed if it is detached from the subchondral bone, movable or of poor quality, such that the obtained groove has flat edges of healthy cartilage. At this stage, measurements are done to determine the amount of grafts needed to cover the defect. At the area of the lesion, with the help of trephines of different sizes, a number of bone cylinders are extracted, while leaving drilled tunnels according to the intra-operative planning (Figure 2). The grafts can be harvested from both edges of the femoral condyles through arthrotomy, but it is especially recommended to use the medial margin of the medial femoral condyle as donor site in the arthroscopic technique, since the joint distension during the procedure pushes the patella laterally and grants perpendicular access on the surface of the medial femoral condyle much easily. The lateral limit of the medial femoral condyle may also be used as a secondary donor site for the arthroscopic

procedure if necessary by all means. The length of the grafts must be 15 mm for superficial cartilaginous defects, and 20-25 mm for those in which the subchondral bone is intersected as well (Figure 3). A distance of at least 3 mm must be kept between the neighboring harvesting areas. The grafts are harvested very carefully in order to avoid the lesion of the adjacent cartilage.

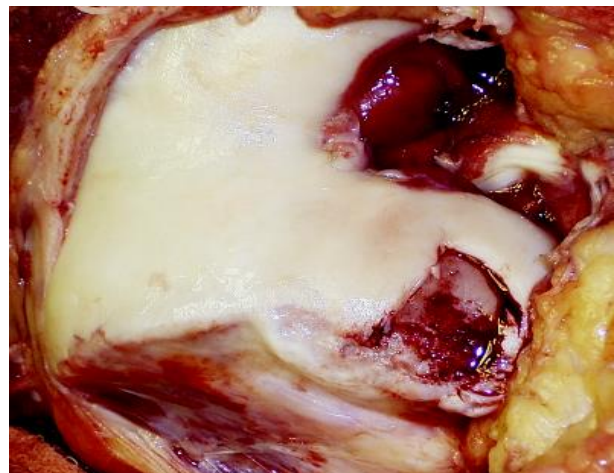


Figure 1 – Cartilaginous defect on the medial femoral condyle of the knee

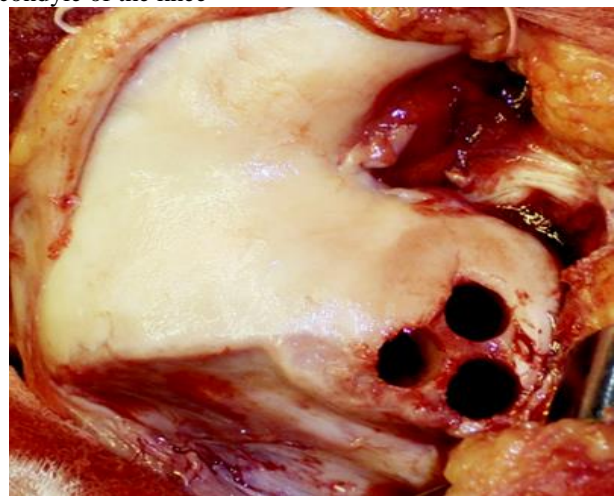


Figure 2 – Tunnels drilled at the level of the cartilaginous defect-same case

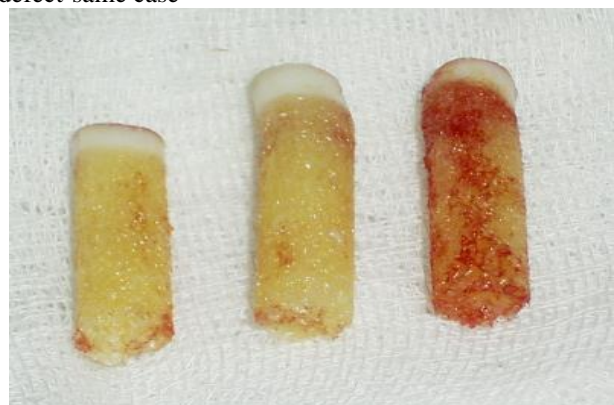


Figure 3 – Osteochondral grafts harvested from the donor area-same case

It is necessary to use grafts of different diameters to best and completely cover the osteochondral defect (at least 80%). The remaining tunnels of the donor area are filled with the bone cylinders which were extracted from the area of the lesion (Figure 4). This can diminish the postoperative hemarthrosis and thus accelerate a functional recovery. The axis of the grafts must be 2-3 mm shorter than the depth of the drilled tunnels. If the height of the grafts is longer than that of the adjacent cartilage, the risk of breaking or decaying is even higher.

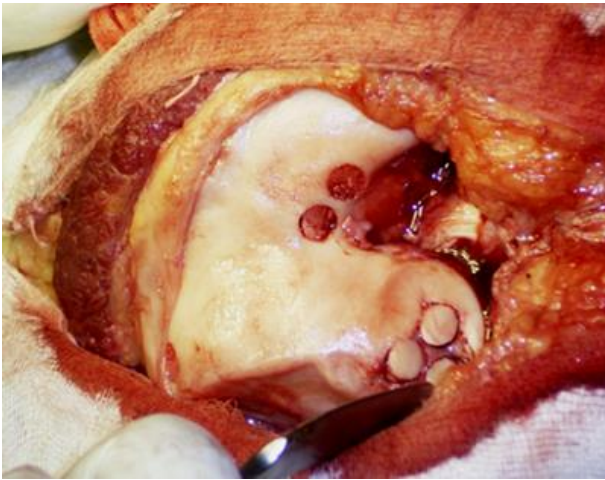


Figure 4 – Grafts implanted at the level of the defect-same case

From the total number of patients (112), 77 (68.75%) were male and 35 (31.25%) were female.

The average age of the patients was 31, with extremes of 20 and 60 respectively. The 20-30 age interval amounted to 26 patients; the 31-40 interval amounted to 39 patients, while 30 patients were included in the 41-50 age group and 17 between the ages of 51 and 60.

The pathologies which led to the occurrence of osteochondral defects were, in order of frequency, *osteochondritis dissecans* (OCD) in 54 cases (48.21%), secondary osteonecrosis (ON II) in 30 cases (26.79%), traumata in 22 cases (19.64%) and last but not least primary osteonecrosis (ON I) in 6 cases (5.36%).

From the patients with OCD, 37 (68.52%) were male and 17 (31.48%) were female.

From the 112 patients, it was found that 94 (83.92%) had single osteochondral lesions and 18 (16.08%) had multiple osteochondral defects.

The location of the lesion in the case of the 94 patients with single osteochondral defect was: the medial femoral condyle (MFC) in 65 cases (69.15%), the lateral femoral condyle (LFC) in 17 cases (18.08%), and the trochlea in 8 cases (8.51%) (Figure 5). Moreover, 4 patients (4.26%) displayed a single lesion on the articular surface of the patella (Figure 6).

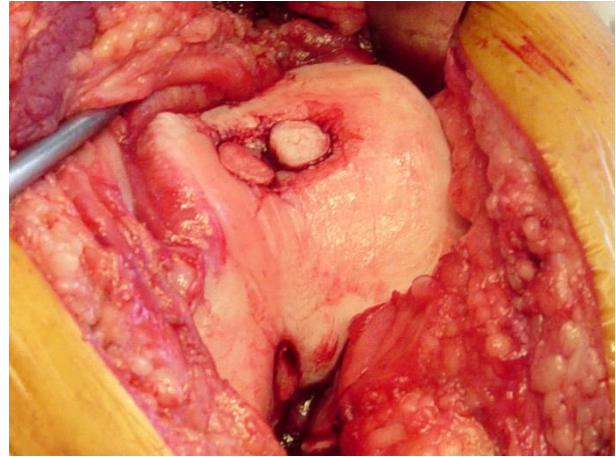


Figure 5 – Mosaicplasty at the level of femoral trochlea

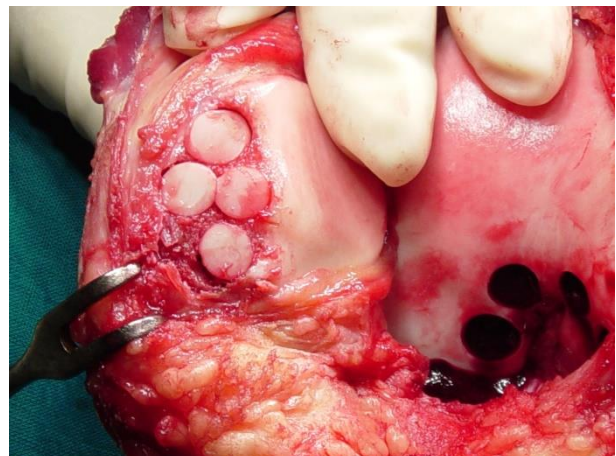


Figure 6 – Mosaicplasty at the level patellar articular surface

According to the dimension of the lesions, the patients with single osteochondral defect were divided into three categories: 41 patients (43.62%) with osteochondral defect between 1 and 2 cm², 35 patients (37.23%) with lesions between 2 and 4 cm² and 18 patients (19.15%) presenting lesions between 4 and 8 cm².

The multiple lesions, found in 18 patients, represented the association of defects of MFC and LFC in 13 cases (72.22%) and of MFC and trochlea in 5 cases (27.78%).

ON II had a bilateral nature in 22 cases (73.33%) and a unilateral one in only 8 cases (36.4%).

The risk factors found in the study which contributed to the emergence of ON II comprised: alcohol consumption for 19 patients (63.33%), dyslipidemic syndrome for 7 patients (23.33%) and autoimmune systemic diseases for 4 patients (13.33%).

A medium term follow-up lasted for 12 months, with extremes of 8-18 months, and the average period between mosaicplasty and „second look” arthroscopy was 6 months long, with extremes of 5-12 months. After surgery, the following examinations were performed:

- MRI in 36 of the cases
- “Second look” arthroscopy in 53 of the cases (Figure 7)
- “Second look” arthroscopy and needle biopsy in 23 of the cases

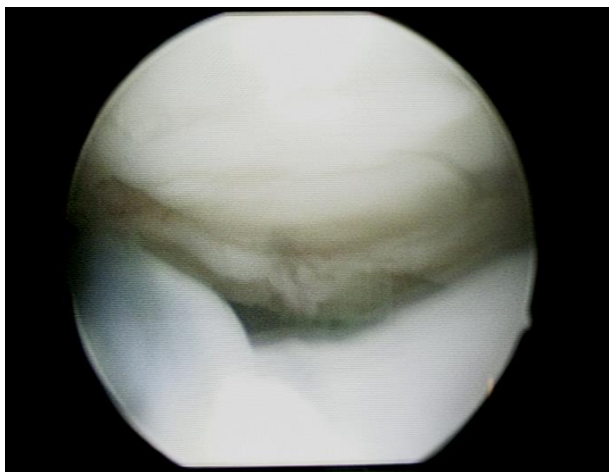


Figure 7 – Second look arthroscopy at 6 months after mosaicplasty

The postoperative functional evaluation was performed by means of the International Knee Documentation Committee (IKDC) score 6 months after the intervention, compared to the preoperative state and Lysholm scores and the International Cartilage Repair Society (ICRS) score for the evaluation of the cartilage one year after surgery.

Results

The initial average IKDC scores and those resulting 6 months after surgery based on the etiology of the lesion were as follows:

- OCD – 37.02, respectively 88.01
- ON I – 36.59, respectively 87.83
- ON II – 35.43, respectively 86.74
- Trauma – 34.73, respectively 89.23

The initial average IKDC scores and those resulting 6 months after surgery based on the location of single lesions were as follows:

- MFC – 36.19, respectively 85.47
- LFC – 34.44, respectively 81.03
- Trochlea – 31.05, respectively 72.75
- Patella – 42.68, respectively 80.78

In case of multiple lesions, the IKDC scores, prior to and after surgery, were lower for the patients with osteochondral defects involving both MFC and trochlea than for those with associated lesions of MFC and LFC.

- MFC+LFC – 34.65, respectively 78.29
- MFC+trochlea – 32.37, respectively 73.68

In terms of the dimension of the osteochondral defects, the pre- and postoperative IKDC scores resulted in lower values for larger areas of the lesion. The lesion area was more difficult to cover for large lesions, as fibro-cartilaginous tissue qualitatively inferior to the physiological one was formed in the area between the grafts.

- 1-2 cm² – 43.56, respectively 89.75
- 2-4 cm² – 39.24, respectively 85.43
- 4-8 cm² – 33.89, respectively 77.21

The ICRS evaluation score for the reconstruction of the articular cartilage was assessed one year after surgery:

- MFC – 10.4
- LFC – 9.5
- Trochlea – 7.3
- Patella – 9.2

In terms of the etiology of the osteochondral defects, the best results were recorded for the patients with posttraumatic lesions caused by OCD, while the least satisfactory results were found among those with ON II.

- OCD – 9.7
- ON I – 8.2
- ONII – 7.9
- Trauma – 10.3

As for the dimensions of lesions, it was noticed, in a similar manner to the evaluation by means of the IKDC score, that there was a higher value of the ICRS score for a smaller lesion areas.

- 1-2 cm² – 10.8
- 2-4 cm² – 9.6
- 4-8 cm² – 8.3

The medium Lysholm score, evaluated for all patients, regardless of the etiology, location or dimensions of the lesions, recorded a spectacular increase one year after surgery.

- Prior to surgery -- 54.18
- 1 year after surgery -- 88.95

Discussions

The indications of mosaicplasty were initially limited to small and medium size osteochondral defects of the surfaces of the femoral condyles of the knee. Next, the initiator of the technique expanded this procedure to be applied for the patellofemoral compartment, as well as the anterior aspect of the femoral condyles and the articular surface of the patella [3]. Eventually, the procedure was also applied to other joints such as to the superior articular surface of the talus, distal extremity of the tibia and recently even of the femoral head.

Ideally, the osteochondral defect should be captured between 1 and 4 cm², despite the fact that mosaicplasty can also be performed, under exceptional circumstances, for lesions up to 8 cm²[4]. The patients must be young, physically and socially active, and their ages must range between 15 and 50.

The application of a single graft which replaces a substantial loss with a diameter of 16 mm (2cm²) at the level of the weight bearing areas of the femoral condyles increases the peripheral stress by 92%. If three grafts of 8 mm diameter each were applied, this rise would only be of 35% [5].

The ideal donor sites should be non-weight bearing and present a convexity and thickness of the articular cartilage very similar to the receptor area [6]. Garretson et al. identified low contact pressures in the medial area of the trochlea and very low in the lateral region. This is why harvesting some grafts of larger dimensions from the lateral area of the trochlea is possible [7].

The reestablishment of the convexity of the femoral condyles is very important for the attainment of an optimal distribution of the contact pressures on the weight bearing areas. Two studies on specimens have shown that the medial and lateral sides of the femoral trochlea

serve as the best donor sites for grafting the femoral condyles defects. On the other side, the margin of the intercondylar notch is flat and can be used for grafting the trochlear defects [8].

Conclusions

The greatest rise in the IKDC score 6 months after surgery was recorded for the patients with posttraumatic osteocartilaginous lesions.

In terms of the quality of recovery of the articular cartilage, assessed by means of the ICRS score, the best results were obtained for small lesions with traumatic etiology located at the medial femoral condyle.

The technique of mosaicplasty represents an outstanding solution for patients with non-degenerative osteocartilaginous lesions. However, the result of surgery depends on the etiology, location and dimension of the osteochondral defect, as well as on the surgeon's experience and patient's compliance with the treatment.

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