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The Knee



Long-term clinical follow-up of microfracture versus mosaicplasty in articular cartilage defects of medial femoral condyle

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ABSTRACT

Background: The purpose of this study was to evaluate the outcome after cartilage repair surgery in focal defects of the knee by microfracture versus mosaicplasty.

Methods: A cohort of 102 patients undergoing microfracture ($n = 52$) or mosaicplasty ($n = 50$) of a single articular cartilage defect in the medial femoral condyle of $\leq 50 \text{ mm}^2$ was evaluated by Lysholm score before surgery, at six months, 12 months, five years, 10 years, and 15–18 years after surgery.

Results: Median age of patients at the time of surgery was 36 years (range 16–58) and median follow-up time was 16 years (range 14–18). Defects were treated with a median size of three square centimetres (range one to five). A significant increase was seen in the Lysholm score from mean 48 (SD 16) at baseline to 66 (SD 23; $P < 0.001$) at the 15–18 year follow-up. The Lysholm score was higher in the mosaicplasty group at six months, 12 months, five years and 10 years ($P < 0.05$ for all comparisons). These differences were clinically significant at all points (> 10 points). However, at the final follow-up, the difference (eight points) did not reach statistical significance.

Conclusions: In the short-term, medium-term and long-term (10 years), mosaicplasty in a single cartilage defect size one to five square centimetres of the femoral condyle resulted in clinically relevant better outcome than microfracture. However, at 15–18 years after the surgery such a difference could not be found. In the six month to 10–15 year (after surgery) perspective, the mosaicplasty procedure offered a better outcome in this type of lesion.

Level of evidence: Level III.

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1. Introduction

Focal chondral lesions of the knee are debilitating and have been found to impair quality of life to a similar degree as in patients scheduled for knee replacement [1]. These lesions commonly occur, as displayed by the incidence of 19% in a group of 1000 knee arthroscopies in a prospective study by Hjelle et al. [2]. Arøen et al. and Solheim et al. found similar incidences in studies with similar design [3,4]. Chronic articular cartilage lesions have little or no potential for spontaneously healing [5], and their treatment continues to pose a challenge for orthopaedic surgeons [6]. The last decade has seen a range of new treatment

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options, including microfracture [7,8], and auto-transplantation of osteochondral cylinders (often called osteochondral autograft transfer (OAT) or mosaicplasty) from less weight-bearing areas to the defect area [9]. Whereas the short-term outcome after cartilage repair procedures is acceptable in most patients, few regain normal pain-free function [10,11], and the results seem to deteriorate with time [6,12,13]. So far, very few comparative long-term studies on microfracture and OAT have been published. Two studies have reported a follow-up of around ≥ 10 years (median 9.8 years, and nine to 11 years) [14,15].

The current group has previously presented results, separately, for microfracture and mosaicplasty at short-term, mid-term, and long-term after surgery. In the current work, in order to compare the two methods, inclusion criteria were chosen to ensure that the two groups had the same characteristics regarding patient and chondral lesion demographics (e.g., same age group, and same localisation and size of defect). The main purpose of the study was to compare the outcome of the two techniques at short-term (six and 12 months), mid-term (five years) and long-term (10 years and 15–18 years) after surgery. The null-hypothesis was that the outcome was not statistically different between the two methods.

2. Materials and methods

2.1. Experimental protocol

All patients who underwent a cartilage repair procedure at the current institution from 1998 to 2003 were registered prospectively. The data were acquired from standardised forms completed by both the patient and surgeon. The form contained details about pre-operative symptoms and function, perioperative findings and details about the surgery performed, including localisation and size of the articular cartilage defect, which was very similar to the system later recommended by the International Cartilage Repair Society [16]. The data were stored in a local database (Access, Microsoft Corporation, Redmond, USA).

Inclusion criteria were patients: aged ≤ 60 years at the time of surgery; with a single symptomatic focal full-thickness articular chondral defect size ≤ 50 mm² of the medial femoral condyle (verified by arthroscopic examination) treated with microfracture or mosaicplasty; and a minimum 15-year follow-up period. Exclusion criteria (at the time of surgery) were: joint space narrowing (to a space < 4 mm) on standard anteroposterior radiographs; $> 5^\circ$ varus or valgus malalignment; previous or concurrent realignment surgery; ligament instabilities; or the inability to follow the rehabilitation protocol.

Outcome evaluation was performed by the Lysholm score; [17,18] reported as a number from 0 (worst) to 100 (best). Data were prospectively collected before surgery and at six months, 12 months, five years, 10 years and minimum 15 years after surgery. In patients having undergone a knee replacement after the cartilage repair surgery, the most recent Lysholm score prior to the replacement procedure was used.

2.2. Surgical techniques

After arthroscopic evaluation of the knee joint, a microfracture or mosaicplasty procedure was performed. The choice of procedure was based on the surgeon's preference (after discussing the options with the patient) in the current case. The lesion was debrided down to subchondral bone and healthy surrounding cartilage. The area of the lesion was calculated as mm² using a meniscal probe [2]. The microfracture procedure was performed as described by Steadman et al. [8]. Angled awls were used for piercing through the subchondral bone plate, three to four millimetres apart, allowing the flow of marrow elements. The mosaicplasty procedure (Smith and Nephew Inc., Andover, MA, USA) was performed as described by Hangody et al. [9,19]. Grafts were harvested from the periphery of the femoral condyles at the level of the patello-femoral joint and transplanted into burr holes (of the same size) in the defect (in a mosaic fashion in order to repair as much area of the defect as possible). The procedure was performed using an arthroscopic approach or a mini-arthrotomy (allowing both harvesting and transplanting through the same incision).

2.3. Rehabilitation

For both procedures, continuous passive motion was started within a few hours after the operation and was continued for four to seven days (i.e., the duration of the stay in hospital). The patients were instructed in the use of crutches by a physiotherapist and maintained foot-touch weight bearing for six weeks; thereafter, full weight bearing was gradually introduced. Physiotherapy was commenced at the hospital and continued after the discharge. Initial exercises included stretching, straight-leg rises and passive motion, and gradually progressed through active closed-chain exercises, including stationary bicycling, to dynamic weight training [20]. The institution Ethical Committee reviewed and approved the study. All patients gave their informed consent prior to inclusion in the study.

2.4. Statistical analyses

The primary outcome measure was the Lysholm score, and a post-hoc power analysis found that with a total of 102 patients – using a significance level of 0.05 and standard deviation (SD) of 20 – the probability (power) for detecting a treatment difference of 10 points was approximately 95%. The statistical analyses were performed with the Statistical Package for the Social Sciences (SPSS Inc., Chicago, Illinois, USA) on a personal computer.

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