

# Multiple Osteochondral Arthroscopic Grafting (Mosaicplasty) for Cartilage Defects of the Knee: Prospective Study Results at 2-Year Follow-up

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**Purpose:** To prospectively evaluate the mosaicplasty technique for treatment of femoral condyle cartilage lesions (Outerbridge grade IV) less than 2.5 cm<sup>2</sup> in homogeneous group of young active patients. **Type of Study:** Case series. **Methods:** Thirty-seven patients (10 female, 27 male; mean age, 29.5 years) with full-thickness knee chondral lesions were treated by the arthroscopic mosaicplasty technique. All patients practiced sports. There were 12 ACL reconstructions, 11 medial meniscectomies, and 8 lateral meniscectomies associated; 10 meniscectomies, 9 ACL reconstructions, and 5 cartilage reparative operations had been previously performed. All patients were evaluated at a 2-year follow-up. The International Cartilage Repair Society (ICRS) form, return to sports, computed tomography, or magnetic resonance imaging were used for clinical evaluation. In some cases, second-look arthroscopy was performed. **Results:** The ICRS showed 78.3% good and excellent results; 27 patients returned to sports at the same level and 5 at a lower level, but 5 were not able to resume sports. Results in the lateral condyles were significantly better than those in medial condyles, and younger patients had a better clinical outcome than did older patients. Cases with associated surgery had better clinical results; previous surgery did not significantly influence the clinical outcome. **Conclusions:** The results of this technique at medium-term follow-up are encouraging with 78.3% clinically satisfactory results. Better results can be obtained in young patients with associated surgery, with localized grade 4 lesions of the lateral condyles. This arthroscopic 1-step surgery appears to be a valid solution for the treatment of grade III-IV cartilage defects not more than 2.5 cm<sup>2</sup>. **Level of Evidence:** Level IV, Case Series. **Key Words:** Cartilage repair—Osteochondral grafting—Knee.

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Articular cartilage lesions are still one of the most important problems in orthopaedic surgery, especially in young and athletic people. In a retrospective review of 31,516 knee arthroscopies, 63% had cartilage lesions and 19.2% of these were Outerbridge grade IV. In 5% of all arthroscopies, grade IV chondral lesions were found in young patients (<40 years),

which highlights the importance of this problem in orthopaedic practice.<sup>1</sup> It is often unclear which lesions will become symptomatic. Chondral trauma frequently presents in association with other knee diseases, such as anterior cruciate ligament (ACL) or meniscal tears, which makes it difficult to determine which tissue injury is responsible for which symptom and to what extent.

Many surgical options have been proposed in the past decade: methods intended to stimulate formation of new cartilaginous tissue consisting of bringing the new cells that are capable of chondrogenesis and facilitating access to the vascular system (reparative techniques), and methods that reconstruct the defect with chondral or osteochondral allografts or autografts or other materials (reconstructive techniques).

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Partial-thickness chondral lesions (Outerbridge grade I-II) less than 1.5 cm<sup>2</sup> in size are usually not treated surgically because this type of lesion is mostly stable and tends to progress only rarely.<sup>2</sup> Partial-thickness (I-II grade) chondral lesions that involve more than 1.5 cm<sup>2</sup> articular surface and full-thickness articular cartilage defects (Outerbridge grade III-IV) are mostly symptomatic and are very likely to progress to early degenerative wear,<sup>3</sup> and surgical treatment is recommended.<sup>4</sup> Arthroscopic repair or reconstructive techniques can be performed. Various materials, such as allografts, autografts, synthetic polymers, and periosteal and perichondral flaps, have been proposed, but the 2 techniques that have gained widespread use and interest during the last decade are autologous chondrocyte transplantation and osteochondral autografting.

Autologous chondrocyte transplantation, as proposed by Brittberg et al. in 1994,<sup>5</sup> is interesting because it allows the treatment of large defects avoiding donor site morbidity; on the other hand it is an expensive, 2-stage procedure, and maturation of the implanted cartilage takes a very long time.

Because of the limits of hyaline cartilage healing, an osteochondral allograft or autograft unit (with an underlying bone) was proposed, in order to capitalize on bone-to-bone healing, since the cartilaginous cup itself does not bond to the recipient bone or cartilage.

Various ways of using autografts for osteochondral defect reconstruction have been put forward. They differ in donor site change, methods of application, and fixation of the grafts.<sup>6-8</sup> An autologous osteochondral graft can be applied by arthroscopic or open surgery, according to the size of the articular defect and the surgical approach options.<sup>9-12</sup> The integration between the recipient and donor bone just 4 weeks after transplantation was shown in an animal model.<sup>13</sup> Osteochondral graft insertion is a promising procedure because it is single-stage and guarantees an immediate reliable tissue transfer of a viable osteochondral unit.

The results of these new techniques are still preliminary and difficult to analyze because treated groups of patients are often nonhomogenous. In fact, factors such as size of the defect, age, etiology, associated lesions, or previous surgery may significantly influence the results and make it hard to evaluate the influence of the single cartilage treatment procedure. The aim of this study was to evaluate the results of the mosaicplasty technique prospectively in a selected group of patients with the goal of understanding which factors could influence the clinical outcome in order to clarify the correct indication of this treatment option.

## METHODS

### Patient Selection

Thirty-seven active patients younger than 50 years who presented with a cartilage grade IV lesion of the medial or lateral femoral condyle less than 2.5 cm<sup>2</sup>, confirmed by arthroscopic control, were selected for the study. They were treated using the arthroscopic mosaicplasty technique and prospectively evaluated at a 2-year follow-up. Patients with lesions greater than 2.5 cm<sup>2</sup> or less than 1.5 cm<sup>2</sup> were excluded from the study, as were patients with noncorrected axial deviation or knee instability.

The male-to-female ratio was 27:10. All 37 patients reached at least 24 months of follow-up; 18 patients achieved 36 months and 9 patients reached 48 months follow-up. The mean age at surgery was 29.5 years. The age distribution was as follows: 4 patients were younger than 20 years, 21 were from 20 to 30 years, 9 were from 30 to 40 years, and 3 were older than 40 years. All the patients were athletes: 19 were professional or well-trained athletes and 18 were amateurs.

Twenty-three of the chondral lesions were situated on medial and 14 on lateral femoral condyle; the mean size of the defect was 2.1 cm<sup>2</sup> (range, 1.8 to 2.5 cm<sup>2</sup>). In 4 patients, 4 osteochondral plugs were used for reconstruction; in 5 patients, 3 plugs; in 20 patients, 2 plugs; and in 8 patients, 1 plug was used. Twelve chondral lesions were treated acutely; this means that these patients had a traumatic chondral lesion at least 3 weeks before surgery; 25 lesions were chronic.

In 23 patients, associated procedures were performed during the same operation: 12 ACL reconstructions, 11 medial and 8 lateral meniscectomies, and 1 medial collateral ligament repair. Nineteen of 25 chronic lesions had undergone previous surgery more than 12 months before: 10 meniscectomies, 9 ACL reconstructions, and 5 cartilage repair operations, such as shaving and debridement of the chondral lesion.

The clinical outcome of all patients was analyzed using the Cartilage Standard Evaluation Form as proposed by the International Cartilage Repair Society (ICRS).<sup>14</sup> This form considers both subjective symptoms and objective assessment of clinical findings. It is an International Knee Documentation Committee (IKDC) form modified by a task force of the ICRS. According to this questionnaire, the higher the score is, the higher the level of function and the lower the level of symptoms. Therefore, a score of 100 is interpreted as no limitations on activities of daily living or sports and the absence of symptoms. A knee func-

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