Knee Surgery, Sports Traumatology, Arthroscopy

DOI 10.1007/s00167-001-0259-6

Knee

Large osteochondral defects of the femoral condyle: press-fit transplantation of the posterior femoral condyle

Jens D. Agneskirchner · Peter Brucker · Andreas Burkart · Andreas B. Imhoff

J.D. Agneskirchner · P. Brucker · A. Burkart · A.B. Imhoff
Department of Orthopedic Sports Medicine, University of Munich (TUM), Connolly Street 32, 80809 Munich, Germany

E-mail: a.imhoff@lrz.tum.de
Phone: +49-89-28924462
Fax: +49-89-28924484

Received: 1 June 2001 / Accepted: 3 October 2001 / Published online:

Abstract. Background and aims: Large osteochondral defects in the weight-bearing zone of the knee remain a challenging therapeutic problem. Surgical options include drilling, microfracturing, and transplantation of osteochondral plugs but are often insufficient for the treatment of large defects of the femoral condyle. Patients and methods: Large osteochondral defects of the femoral condyle (mean defect size 7.2 cm²; range 3-20) were treated by transplantation of the autologous posterior femoral condyle. Between 1984 and 2000, 29 patients were operated on: in 22 the medial, in 6 the lateral femoral condyle, and in one the trochlear groove was grafted. Thirteen patients underwent simultaneous high tibial valgus osteotomy. In the first series (1984-1999) the graft was temporarily fixed with a screw (n=12), but from 1999 we used a newly developed press-fit technique (n=17) avoiding screw fixation of the graft. The operative technique comprising graft harvest, defect preparation, transplantation, and fixation is described. Patients were clinically evaluated using the Lysholm score, and magnetic resonance imaging with intravenous contrast was performed 6 and 12 weeks after surgery (mean follow-up 17.7 months; range 3-46). Results: Pain and swelling were reduced in 26 patients. Three patients of the first series reported persistent problems and were subjectively not satisfied. The mean Lysholm score rose from preoperatively 52 to 77 points after 3 months, 74 after 6, 88 after 12, and 95 after 18. Magnetic resonance imaging showed good graft viability in all cases. We saw one arthrofibrosis after 6 months but noted no problems related to the loss of the missing posterior condyle. Conclusion: Large osteochondral defects of the femoral condyle can be treated by transplantation of the autologous posterior femoral condyle. The use of only one osteochondral piece renders better approximation of the femoral cartilage curvature and thus joint congruence than in mosaic plasty. However, whether loss of the posterior condyle has a long-term negative impact on the knee joint remains to be elucidated.
Keywords. Osteochondral defect - Autologous osteochondral transplantation - Arthroplasty

Introduction

Several treatment options such as débridement, abrasion arthroplasty, drilling, and microfracturing have been advocated for the treatment of articular cartilage damage in the knee joint. The common principle of all these techniques is the formation of fibrocartilage tissue at the defect with minor mechanical properties other than genuine hyaline cartilage. Moreover, in various studies the long-term results have been discouraging. Autologous chondrocyte implantation is a very new method that is costly and suitable only for a limited number of indications.

Autologous osteochondral plug transplantation (OATS, mosaic plasty) is currently the only technique that delivers genuine hyaline articular cartilage to the defect. A number of clinical studies have shown encouraging results especially when the treated defects were small (<2 cm) and no osteoarthritis was present. However, conventional OATS and mosaic plasty also fail in treating very large osteochondral defects (more than 2 × 3 cm in diameter) in the weight-bearing zone of the knee due to a lack in donor cartilage, which is available only in the femoral trochlea and intercondylar notch. Moreover, in very large defects press-fit fixation of many adjacent osteochondral plugs is infeasible. Unicompartmental or total arthroplasty is therefore often unavoidable in cases of large osteochondral lesions such as in Ahlbaeck’s disease.

The transfer of bone plugs taken from the posterior femoral condyle by a separate posterior arthrotomy was first proposed by Mueller and Wagner in 1964 but was not carried on in the following years. In 1999 we published the initial results of our experience with the posterior condyle transfer operation (PCT) and suggested it as a salvage procedure in very large osteochondral lesions of the knee avoiding total joint replacement. Subsequently we modified the technique of the PCT operation and began using press-fit fixation of the graft. This contribution describes both the operative technique and results in 29 patients treated by PCT.

Materials and methods

The operation described below has been performed in 17 patients since July 1999. In 12 patients (first series) it differed only by the use of an additional screw that was used to attach the graft to the femur from the articular surface.

Operative technique

The steps of the procedure include arthrotomy and exposure of the osteochondral lesion, harvesting the posterior femoral condyle, preparation of the defect, preparation of the donor graft, and insertion of the donor plug into the defect.

1. The operation is performed with the patient in the supine position and by means of a tourniquet. After arthrotomy that is usually performed by a midline longitudinal skin and - for defects of the medial joint compartment - a medial parapatellar joint incision the osteochondral defect site, typically located in the weight-bearing zone of the femoral condyle, is exposed and usually photo-documented. A first determination of the width and length of the lesion size and a check on the consistency of the defect cartilage is then performed.
2. The procedure continues by harvesting the autologous osteochondral donor graft which requires taking of the medial or lateral posterior femoral condyle (Figs. 1, 2, 3, 4). The osteotomy of the condyle is performed by means of the sharp osteotome with the knee maximally flexed. The intercondylar structures and the posterior joint capsule are protected with two round blunt Hohmann retractors that are inserted medially and laterally around the posterior aspect of the condyle. Ideally the osteotomy level of the condyle is accomplished in direct elongation of the posterior cortical line of the femur (Fig. 2). It is important carefully watch to and, if necessary, fix the graft with a bone clamp as it comes loose from the femur since manipulation with the osteotome may suddenly make the graft uncontrolledly slip away. After taking out the posterior condyle the diameter and thickness are measured determining the maximum transplantable size of the lesion. The graft diameter usually varies 30-35 mm in men, and graft thickness (measured from the vertex of the cartilage surface to the cancellous opposite side) 20-25 mm.
Fig. 1. Schematic of transplantation of the posterior femoral condyle. The osteochondral donor plug is press-fit inserted into the recipient area.
Fig. 2. Schematic of harvesting the posterior femoral condyle. Osteotomy is performed with an osteotome in elongation of the posterior femoral cortex with the knee in flexed position.
Fig. 3. Surgical instruments with workstation (Arthrex) for preparation of the osteochondral donor plug from the posterior condyle
3. The defect site is then prepared starting with a K-wire that is drilled into the center of the lesion precisely perpendicular to the cartilage surface (Figs. 5, 6, 7, 8). Then a hollow chisel and mill (Fig. 7) are used to millcut the cartilage and subchondral bone of the defect. The available diameters of the chisel and the mill are 20, 25, 30, and 35 mm and their use depends on the size of the defect. They are cannulated so that the K-wire serves as a guide ensuring perpendicular preparation of the lesion. Moreover, different milling angles as the instruments are repeatedly inserted and changed can be avoided. The mill is equipped with a millimeter scale (Fig. 7) so that the milling depth determined by the thickness of the graft can be adjusted. The primary milling depth should be approximately 1-2 mm less than the thickness of the condyle graft since impactation of the cancellous bone at the recipient site and thus adjustment to the final size of the graft can easily be accomplished using a tappet after final preparation and measurement of the graft. This tappet is also equipped with a length scaling for exact measurement of the tunnel depth. It is mandatory that the preparation of the defect renders a healthy cancellous bleeding bed (Fig. 8) necessary for good integration of the osteochondral donor plug. In the case of deep necrosis or sclerosis of the subchondral bone that does not yield any healthy cancellous bone at the recipient site it must be further prepared until at least some bleeding is present. If necessary it may then be filled with cancellous bone taken from the iliac crest or the tibial head adjusting the depth of the recipient bed to the donor graft length.
Fig. 5. Preparation of the osteochondral donor from the posterior femoral condyle
Fig. 6. Donor plug (diameter 30 mm)
Fig. 7. Preparation of recipient area in the weight-bearing zone of the medial femoral condyle
4. The next step of the operation is preparing the donor plug from the posterior condyle graft, which for this is inserted into a specially designed work station (Arthrex; Figs. 3, 4). The condyle is placed in the work station with the articular cartilage side facing upwards, and six screws with sharp tips are used for stable fixation. Another hollow mill (Figs. 5, 6) is then utilized for shaping an osteochondral plug precisely matching the size of the recipient tunnel. The diameter of that mill is approximately 0.3 mm larger than the one previously used at the recipient site, thus rendering a slightly larger donor graft than the recipient tunnel to allow the graft press fit into the defect. A guide cannula mounted on top of the work station ensures exactly perpendicular milling of the condyle, which is important for obtaining a symmetrically round donor graft. In the case of osteochondral lesions which are close to the medial or lateral border of the femoral condyle where the preparation of the recipient bed does not produce a symmetrically shaped tunnel the donor plug can be individually prepared with a small offset at the edge of one side that matches the offset of the recipient tunnel. However, at least 75% of the tunnel needs to be surrounded by bone to guarantee stable press fit fixation of the graft.

5. Finally the donor plug is inserted into the recipient site. For this the graft needs to be turned since the curvatures of the posterior condyle (donor) and the weight-bearing zone (recipient) of the femur are usually not exactly identical. Normally the arching of the posterior condyle in the coronal plane more accurately reflects the anatomical surface of the weight-bearing area than the arching in sagittal plane, and in most cases a 90° turn of the graft therefore renders the anatomically best approximation to the femoral surface curvature. The graft plug is first pressed into the tunnel manually and then carefully driven in by means of a tappet. Ideally, if the curvatures of the graft and the femur as well as the respective depths match each other, this yields an excellent reconstruction of the anatomy of the femoral joint surface. It is desirable that no cartilage offsets remain between the graft and the adjacent femoral cartilage to avoid pressure peaks on small cartilage areas. If the graft is excessively prominent above the adjacent cartilage, the graft may be removed by a special retractor and then either the graft be shortened with a chisel or the recipient bed be deepened using the mill or the tappet. If the tunnel is too deep in relation to the graft length, the depth may, as noted, be filled with cancellous bone taken from the tibial head or the iliac crest. We do not recommend using any artificial bone for adjustment of the recipient tunnel depth. No additional screw is required using this technique since the graft is securely press-fit. Finally an intra-articular drain is placed, and the arthrotomy is closed in usual fashion.
Postoperative protocol

Postoperative management includes non-weight-bearing and a 90° flexion limitation for 6 weeks. We recommend immediate continuous passive motion and muscular strengthening exercises starting the day after drain removal. Radiographic supervision including magnetic resonance imaging (MRI) with gadolinium contrast enhancement 6 and 12 weeks after surgery should be performed to determine both the weight-bearing management and viability of the graft.

Patients

A total of 29 patients (Table 1) with large osteochondral defects of the femoral condyle have been treated in two series. In the first series (July 1996 until July 1999) 12 patients (7 men, 5 women) underwent PCT with screw fixation of the graft. Between July 1999 and September 2000 we operated on 17 patients (14 men, 3 women) in the modified technique described above. The patients’ mean age was 36 years (16-60), and the mean defect size was 7.2 cm² (3-20). All patients underwent MRI preoperatively and were diagnosed as having grade 4 osteochondral defects with avital osteochondral fragments. Preoperatively they all had complained for several years of load-dependent pain with reduction in walking distance; 21 patients had been operated on before (1.4 times on average). Previous surgery included mainly meniscectomies, cartilage shaving, and drilling (see Table 1). Mean follow-up time was 17.7 months (3-46).

<table>
<thead>
<tr>
<th>Patient no.</th>
<th>Age (years)</th>
<th>Defect size (cm²)</th>
<th>Earlier operations</th>
<th>Localization</th>
<th>Additional procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Series 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>40</td>
<td>6</td>
<td>A, D</td>
<td>Med Fc</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>23</td>
<td>10.5</td>
<td>E</td>
<td>Med Fc</td>
<td>F, G</td>
</tr>
<tr>
<td>3</td>
<td>21</td>
<td>7.5</td>
<td>D</td>
<td>Med Fc</td>
<td>F, G</td>
</tr>
<tr>
<td>4</td>
<td>42</td>
<td>4</td>
<td>B</td>
<td>Med Fc</td>
<td>B, H (patella)</td>
</tr>
<tr>
<td>5</td>
<td>22</td>
<td>3</td>
<td>Lat Fc</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>21</td>
<td>8.75</td>
<td>A</td>
<td>Med Fc</td>
<td>F</td>
</tr>
<tr>
<td>7</td>
<td>21</td>
<td>12</td>
<td>E</td>
<td>Med Fc</td>
<td>F</td>
</tr>
<tr>
<td>8</td>
<td>32</td>
<td>8</td>
<td>A, C, D</td>
<td>Med Fc</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>37</td>
<td>12</td>
<td>A, D</td>
<td>Lat Fc</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>36</td>
<td>12</td>
<td>D</td>
<td>Med Fc</td>
<td>H (trochlea), I (lat Fc)</td>
</tr>
<tr>
<td>11</td>
<td>36</td>
<td>20</td>
<td>D</td>
<td>Med Fc</td>
<td>I (lat Fc)</td>
</tr>
<tr>
<td>12</td>
<td>43</td>
<td>6</td>
<td>C, D</td>
<td>Med Fc</td>
<td>B, H (patella)</td>
</tr>
<tr>
<td><strong>Series 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>56</td>
<td>7</td>
<td></td>
<td>Med Fc</td>
<td>A, F</td>
</tr>
<tr>
<td>2</td>
<td>43</td>
<td>7</td>
<td>A, D</td>
<td>Lat Fc</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>47</td>
<td>5</td>
<td></td>
<td>Med Fc</td>
<td>F</td>
</tr>
<tr>
<td>4</td>
<td>18</td>
<td>5</td>
<td>D</td>
<td>Med Fc</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>31</td>
<td>7</td>
<td>D</td>
<td>Med Fc</td>
<td>F</td>
</tr>
<tr>
<td>6</td>
<td>35</td>
<td>5</td>
<td></td>
<td>Lat Fc</td>
<td>G</td>
</tr>
<tr>
<td>7</td>
<td>31</td>
<td>7</td>
<td>D</td>
<td>Med Fc</td>
<td>F</td>
</tr>
<tr>
<td>8</td>
<td>60</td>
<td>3.25</td>
<td></td>
<td>Trochlea</td>
<td>H (trochlea)</td>
</tr>
<tr>
<td>9</td>
<td>60</td>
<td>5</td>
<td></td>
<td>Lat Fc</td>
<td>H (patella)</td>
</tr>
<tr>
<td>10</td>
<td>44</td>
<td>5</td>
<td>A, D</td>
<td>Med Fc</td>
<td>F, H (trochlea)</td>
</tr>
<tr>
<td>11</td>
<td>16</td>
<td>7</td>
<td>D</td>
<td>Med Fc</td>
<td>F</td>
</tr>
<tr>
<td>12</td>
<td>51</td>
<td>3.25</td>
<td></td>
<td>Lat Fc</td>
<td>B, H (trochlea)</td>
</tr>
<tr>
<td>13</td>
<td>57</td>
<td>7</td>
<td>A</td>
<td>Med Fc</td>
<td>F</td>
</tr>
<tr>
<td>14</td>
<td>29</td>
<td>7</td>
<td>D</td>
<td>Med Fc</td>
<td>F</td>
</tr>
<tr>
<td>15</td>
<td>41</td>
<td>5</td>
<td></td>
<td>Med Fc</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>28</td>
<td>7</td>
<td>D</td>
<td>Med Fc</td>
<td>F</td>
</tr>
<tr>
<td>17</td>
<td>20</td>
<td>7</td>
<td>D, E</td>
<td>Med Fc</td>
<td>G</td>
</tr>
</tbody>
</table>
Patients were evaluated preoperatively according to the Lysholm score \[19\], and standard anteroposterior, lateral, and total leg radiographs were performed to determine axial alignment. Moreover, all patients underwent MRI with intravenous gadolinium 6 and 12 weeks postoperatively to determine the size, in particular depth and quality, of the osteochondral defect.

For correction of varus malalignment in 13 patients a high tibial valgus osteotomy (HTO) in closed wedge technique was performed at the same time. Five patients with a deep osteonecrosis of more than 3 cm of subchondral bone received underwent additional spongy plasty which was routinely taken from the tibial head. Seven patients underwent additional osteochondral transplantation in the patella or trochlea. Two patients received a transplantation of autologous chondrocytes at the same time.

**Results**

The average Lysholm score of all patients rose from preoperatively 52 points (12-79) to 77 (52-95) after 3 months, 74 (30-97) after 6 months, 88 (54-100) after 12, and 95 (95-99) after 18. In the first series \(n=12, 1984-1999\) the scores increased from 37 (12-57) preoperatively to 90 (59-100) and 95 (90-99) after 12 and 18 months, respectively. The patients of the second series \(n=17, 1999-2000\) preoperatively had an average Lysholm of 62 (19-79) points which rose to 82 (54-99) and 95 (92-98) after 12 and 18 months, respectively. The results of the patients who had received additional valgus osteotomy and those who had not were similar: the patients with concomitant HTO rose from preoperatively 53 (14-69) to 86 (54-99) after 12 and 98 (97-99) after 18 months, and the values of the patients without osteotomy were slightly lower: 51 (12-79) preoperatively, 89 (59-100) after 12 and 93 (90-96) after 18 months.

Altogether 26 patients (89.7\%) were subjectively satisfied with the outcome of surgery. Sixteen patients (55.2\%) were able to return to their preoperative level of sports activities. Three patients (10.3\%) of the first series complained about persistent pain at follow and were not satisfied. Apart from one arthrofibrosis after 6 months that was treated arthroscopically we did not see any operative or postoperative complication during follow-up. Loss of the posterior femoral condyle did not produce any (clinical or radiographic) problems that could be clearly attributed to it. Follow-up arthroscopy (in two patients) did not show secondary lesions at the menisci or the opposite tibial cartilage. On the contrary, in both cases it revealed a smooth and intact chondral surface of the graft. Small gaps between the transplanted graft and the surrounding cartilage were filled by fibrous cartilage, and the donor site at the posterior condyle was covered with white fibrous tissue.

MRI examination with intravenous gadolinium at 6 and 12 weeks postoperatively showed contrast enhancement of the graft similar to the surrounding bone in all cases suggesting good graft viability (Figs. 9\[10\][11][12][13][14].
Fig. 9. Anteroposterior radiograph of large osteochondral defect at the medial femoral condyle (56-year-old man, varus malalignment 4°)
Fig. 10. Magnetic resonance imaging (a coronal, b sagittal plane) of large osteochondral defect at the medial femoral condyle (same patient as in Fig. 9)
Fig. 11. Operative field of large osteochondral defect at the medial femoral condyle (same patient as in Fig. 9)
Fig. 12. Anteroposterior and lateral radiograph 6 weeks after transplantation of the medial posterior femoral condyle condyle, valgus osteotomy of $6^\circ$ was performed simultaneously (same patient as in Fig. 9)
Fig. 13. Magnetic resonance imaging with intravenous gadolinium contrast enhancement (a coronal, b sagittal plane) 3 months after transplantation of the medial posterior femoral condyle condyle, partial medial meniscectomy was performed simultaneously (same patient as in Fig. 9). Arrows Good integration of the osteochondral transplant
Fig. 14. Operative field after transplantation of the posterior femoral condyle (graft diameter 30 mm, same patient as in Fig. 9). Arrow "Deficient" posterior femoral condyle

Discussion

Transplantation of osteochondral autografts in the OATS, or mosaic plasty, technique is a widely accepted method for the treatment of osteochondral lesions in the weight-bearing zone of the knee. Especially in young and active patients with confined chondral damage and no osteoarthritis it is a suitable and effective treatment option [9]. Moreover, in contrast to other arthroscopic techniques such as lavage, débridement, abrasion arthroplasty, drilling, and microfracturing which produce only fibrocartilage and render at best satisfactory short-term results [18, 21, 22], genuine hyaline cartilage is brought to the defect. Autologous chondrocyte transplantation is a new and costly therapy and, additionally, is not recommended for lesions involving subchondral bone such as in osteonecrosis. Furthermore, compared to OATS or mosaic plasty, patient numbers are still small, and only few data exist about the long-term results [10, 11].

Transmission of viral or other pathogens or immunological reactions is impossible using the OATS technique due to the autologous acquisition of the cartilage. Beaver et al. [2] and Gross et al. [12] treated more than 100 patients (follow-up 20 years) with fresh osteochondral allografts for osteochondral damage in the knee and found a success rate of 95% after 5 years, 71% after 10 years, and 60% after 20 years. Bobic [3] and Bobic and Noble [7] published of a large number of patients treated by autologous osteochondral plug transplantation in the knee and found more than 90% improved in clinical and radiographic signs. Hangody et al. [14, 15] introduced osteochondral plug transplantation as "mosaic plasty" and suggested it as appropriate treatment in circumscribed chondral lesions of the knee joint.

However, osteochondral plug transplantation in OATS or mosaic plasty technique fails in the therapy of large lesions measuring more than 20-25 mms in diameter, for example, in Ahlbaeck’s disease and osteochondritis dissecans. This is due not only to a lack in donor cartilage but also because stable press-fit fixation of many small adjacent osteochondral plugs in large lesions is not possible. Therefore unicondylar or total knee replacement often remains the only therapy option in these cases - certainly not satisfactory for active patients with sportive demands.
In 1999 Imhoff et al. [16] published the first results of their clinical experience with the femoral PCT [16] and suggested it as a salvage procedure in young patients with osteochondral lesions that are too extensive for conventional OATS treatment. The problem of limited availability of transplantable donor cartilage is solved by harvesting the posterior femoral condyle that serves as one large osteochondral graft covering the defect in the recipient area. In the first series of our patients the transferred posterior condyle donor was put on top of the prepared recipient area with a central screw ensuring fixation to the femur. However, in this technique femoral joint surface anatomy sometimes could only be insufficiently assimilated and a small cartilage damage of the graft was caused by the head of the screw. Moreover removal of the screw made a second operation necessary. Due to these disadvantages we developed a new technique in which the graft is - similarly as in the OATS technique - press-fit fixed in the individually matching recipient area without any additional hardware. Therefore hardware removal is unnecessary, and a smooth donor cartilage surface is maintained.

To avoid pressure peaks on small cartilage areas either on the donor or on the recipient side it is desirable to restore a joint surface that is curved as anatomically as possible. For this, as in conventional OATS, the depth of the recipient tunnel must be exactly identical to the donor plug length; this allows precise measurement of both and, if needed, readjustment, which is crucial for an adequate result. Furthermore, 90° rotation of the donor plug before insertion renders better surface congruence since the curvature of the posterior condyle in the coronal plane more accurately reflects the anatomical curvature in the sagittal plane at the weight-bearing zone.

However, on the other hand, it is still unclear whether loss of the posterior femoral condyle in this technique is tolerable and does not itself produce damage on menisci or cartilage. Even in conventional OATS, where compared to PCT relatively little osteochondral material from intact joint areas is taken, some - although transitory - donor site morbidity is caused. Therefore it is hard to imagine that the absence of an osteochondral piece measuring 3 × 3 cm in diameter can be sustained without major negative consequences. However, a biomechanical study of our own [8] analyzing the pressure distribution in knees in which the posterior femoral condyle had been removed showed that pressure peaks onto the tibial plateau as well as the posterior aspect of the meniscus occur only at flexion angles greater than 60°, while at 0-60° of flexion - the range of normal daily knee function - almost no difference was found in cartilage pressure distribution compared to normal knees. Moreover, full weight bearing with the knee flexed more than 60° hardly ever occurs in daily living. However, in fact only long-term results will be able finally to elucidate potential negative consequences of the posterior condyle removal.

Large osteochondral defects in the knee requiring large osteochondral transplants are frequently associated with additional joint pathologies, in particular malalignment and instability. It has been clearly shown that significant varus deformity causes elevated peak pressures in the medial joint compartment, therefore putting increased stress on the articular cartilage which may result in the development of unicompartmental osteoarthritis. Therefore in order not only to eliminate the reason of osteochondral damage but also to mediate a successful integration and long-term graft survival it is mandatory to correct significant malalignment, namely varus deformity, by osteotomy at the same time. Furthermore, in the case of chronic instability caused by insufficient cruciate ligaments, which has also been shown to result in articular cartilage damage or even osteoarthritis after years [13, 20, 24], cruciate ligament plasty at the time of cartilage transplantation is another important factor in long-term graft survival and delay of the progression of osteoarthritis. Although patient numbers operated on in the technique described are still too small to show any difference in clinical outcome of patients with or without additional procedures such as osteotomy or ACL-plasty, we strongly believe that a successful osteochondral transplantation, in particular in the case of large graft transfers such as in PCT, is heavily dependent on concomitant correction of malalignment and/or stabilization.
One key for success after transplantation of the posterior femoral condyle is a defined postoperative rehabilitation protocol. Compliance in non-weight-bearing or touch-down weight bearing is compulsory especially in overweight patients to achieve a good outcome.

Visualization of graft survival and cartilage integration is easy by MRI performed with intravenous gadolinium contrast enhancement, which in our opinion should be performed 6 and 12 weeks after surgery. This can be used for modulation of the early postoperative weight-bearing protocol as well as for follow-up evaluation of chondral viability.

Between 1984 and 2000 a total of 29 patients in our hospital underwent transfer operation of the posterior femoral condyle for large osteochondral defects. Of these, 26 were improved in their preoperative symptoms. The persistent pain and swelling in three patients of the first series could not be attributed to graft failure or operative complications. In all patients MRI follow-up showed excellent graft viability and congruence of the chondral surfaces of the graft and its neighborhood. This may be due to the rising learning curve and to improvement in the operative technique in the second series since similar problems did not arise in the second series of 17 patients. Particularly in young patients (<50 years) in whom symptoms and radiographic findings often strongly advocate total joint replacement arthroplasty can be avoided with this salvage operation. Larger patient numbers and longer follow-up times will of course be necessary to determine the exact aptitude of this technique.

References


