

# Osteochondritis dissecans of the femoral condyle treated with periosteal transplantation

Poor outcome in 14 patients followed for 6–9 years

Peter Angermann<sup>1</sup>, Per Riegels-Nielsen<sup>1</sup> and Hans Pedersen<sup>2</sup>

We evaluated 14 consecutive periosteal transplantations to treat osteochondritis dissecans lesions of the femoral condyle. 1 year postoperatively, 9 knees were pain-free, but with 6–9 years follow-up, only 2 knees were pain-free. Formation of hyaline-like carti-

lage, assessed in 12 knees, was documented in 1 patient and assessed as possible in 1 more, but in 10 patients the tissue formed in the defects was not or probably not hyaline cartilage. 6 knees had developed arthrosis.

Departments of <sup>1</sup>Orthopaedic Surgery, Central Hospital, Næstved, Denmark, <sup>2</sup>Radiology, Roskilde County Hospital, Roskilde, Denmark. Correspondence: Dr. P. Angermann, Gildhøj Speciallægeklinik, Brøndbyvester Boulevard 16, DK-2605 Brøndby, Denmark. Tel +45 4343-9292. Fax -9293  
Submitted 98-01-23. Accepted 98-09-22

Adult osteochondritis dissecans of the weight-bearing area of the femoral condyle, with detachment of the fragment, is disabling and carries a high risk of later osteoarthritis (Lindén 1977). When possible, most surgeons prefer fixation of the osteochondral fragment (Lindholm et al. 1977, Anderson et al. 1990, Johnson et al. 1990). When reinsertion of the fragment is impossible, various surgical methods have been described, including debridement and drilling (Hughston et al. 1984), osteochondral autografting (Outerbridge et al. 1995) or allografting (Garrett 1994), autogenous chondrocyte implantation (Brittberg et al. 1994), and perichondrial (Homminga et al. 1990) or periosteal transplantation (Ritsilä et al. 1981, Niedermann et al. 1985, Korkala and Kuokkanen 1991, Jensen and Bach 1992, Angermann and Riegels-Nielsen 1994).

Periosteal transplantation for treatment of osteochondritis dissecans of the femoral condyle has produced good results and formation of hyaline cartilage in animal experiments and was introduced into clinical practice about 15 years ago (Ritsilä et al. 1981, Niedermann et al. 1985). The short-term results were promising but, to date, long-term results have not been published. In 1994, we published good 1-year results (Angermann and Riegels-Nielsen 1994). We now present a 6–9-year follow-up of the same patients.

## Patients and methods

We studied 14 consecutive patients (8 women) with osteochondritis dissecans of the femoral condyle treated during 1987–1990. All cases showed severe degeneration or fragmentation of the loose fragment which prevented reinsertion. In 7 cases, the fragment was completely detached as a loose body. The mean age at surgery was 25 (16–47) years. The mean size of the lesions was 4 (1–8) cm<sup>2</sup>. The lesion was in the lateral part of the medial femoral condyle in 12 knees, the central part of the medial femoral condyle in 1, and the medial part of the lateral femoral condyle in 1 knee. At surgery, the loose fragment was removed and the defect debrided, including removal of the sclerotic base of the lesion. Periosteum obtained from the tibia diaphysis was transplanted to the defect and fixed with fibrin sealant (Tisseel, Immuno, Austria) with the cambium layer facing outward. The patients were followed prospectively (Angermann and Riegels-Nielsen 1994).

We now report the outcome after 8 (6–9) years. Evaluation was done by questionnaire (14 patients), clinical examination (14 patients), radiographic examination (11), MRI (9), and arthroscopy with biopsy (4).

The knee function was evaluated according to the Brittberg Clinical Grading Scale (Brittberg et al. 1994), a modified Cincinnati knee rating system (Noyes et al. 1989), and the Wallgren-Tegner scale (Wallgren et al. 1987). The definitions of the Brittberg Clinical Grading Scale are the following: *poor* – pain

at rest, swelling or locking, *fair* – moderate pain with strenuous activity, or occasional swelling, but no locking, *good* – mild aching with strenuous activity, but no swelling or locking; and *excellent* – no pain, swelling or locking with strenuous activity. Definitions of the modified Cincinnati knee rating system are: *poor* (1–2) – significant limitations in daily activities, *fair* (3–4) – moderate limitations that affect daily activities, no sports possible, *good* (5–6) – some limitations with sports, but can participate by compensating, *very good* (7–8) – only a few limitations with sports, and *excellent* (9–10) – the patients can do whatever they wish, with no problems.

MRI was performed on a Siemens Impact 1 Tesla scanner, using an extremity surface coil. The following sequences were used in all patients: Coronal T 1- and T 2-weighted spin echo sequences, a FLASH sequence in sagittal plane and a sagittal 3 D DESS sequence. With the latter sequence, we could reconstruct in all directions.

The histologic examination of the biopsies included HE staining, Safranin O staining and collagen typing.

## Outcome

2 patients had an arthroscopy approximately 1 year after the periosteal transplantation because of pain and catching. In both cases, hypertrophic fibrous cartilage in the graft area was shaved.

At the 8-year follow-up, only 3 patients rated excellent on the Brittberg Clinical Grading Scale, compared to 7 patients at the 1-year follow-up (Table 1). Preoperatively, the patients' rating on the modified Cincinnati knee-rating scale was 3 (2–5) and, at the 8-year follow-up, 4 (2–10). The Wallgren-Tegner score was 7 (3–14) before surgery and 8 (5–10) at the 8-year follow-up.

The patients were asked to assess the result of surgery in relation to status before surgery. At the 1-year follow-up, 12 patients had improved and none were worse, but at the 8-year follow-up, only 6 were improved and 5 were worse (Table 2). The main complaint was pain. 9 patients had marked or constant pain and only 2 had painless knees at the 8-year follow-up compared to 9 patients at the 1-year follow-up. Swelling was reported by 5 patients and catching or occasional locking was present in 7 patients.

The status of the transplanted defect was evaluated by MRI in 6 patients, by arthroscopy in 1 patient, and by both methods in 3 patients. On the MRIs, 4 of 9 defects were filled to 75% or more of the depth of the defect, but the tissue filling the defects had a different

**Table 1.** The results of periosteal transplantation according to the Brittberg Clinical Grading Scale (See text for definitions)

	Pre-op	1-year	8-year
Excellent	0	7	3
Good	0	2	4
Fair	9	3	5
Poor	5	2	2

**Table 2.** The patients' assessment 1 and 8 years following periosteal transplantation

	1-year	8-year
Improved	12	6
Unchanged	2	3
Worse	0	5

signal intensity compared to normal cartilage in all but two cases. 4 patients had an arthroscopy with biopsy performed. The specimens showed mixed hyaline cartilage and fibrocartilage in 1 patient, fibrous cartilage in the second, non-chondrocytic cells in the third and erosion to bone in the fourth. The presence of arthrosis was evaluated by arthroscopy in 1 patient, radiographic examination in 2 patients, MRI and radiographic examination in 6, and arthroscopy, MRI and radiographic examination in 3. 6 patients had no signs of arthrosis. 6 had arthrosis of the medial chamber (4 patients) or the medial and lateral chambers (2 patients). The degree of arthrosis was mild in 2 patients, moderate in 3, and severe in 1.

## Discussion

Our study is the first long-term follow-up of periosteal transplantation for osteochondral defects in the knee. The promising clinical outcome after 1 year had deteriorated considerably at the 8 (6–9)-year follow-up. Many patients reported catching or swelling, but the principal complaint was pain. It is interesting that our long-term outcome is inferior to that of simple debridement of osteochondritis dissecans (Hughston et al. 1984), but the patients may not be fully comparable.

We evaluated 9 knees with MRI, and found a normal cartilage signal in the defect in only 2 knees. 1 of these 2 patients had an arthroscopy with biopsy which showed fibrous cartilage. One of the major problems with MRI in evaluation of cartilage lesion is to distinguish cartilage from the surrounding synovial fluid (Stark and Bradley 1992). Fat-suppressed three-di-

mensional spoiled gradient echo MRI has been recommended as the most sensitive technique (Disler et al. 1995). In patients with combined chondral and subchondral defects, as in our series, such a sequence seems less important. In the sequences we used, the normal hyaline cartilage was darker than the synovial fluid. In the FLASH sequence, the cartilage gave a bright signal, while in the other series the signal was grey. In all osteochondral defects where soft-tissue in the defects could be seen, this tissue had a different signal from normal hyaline cartilage, mostly darker. It indicates that this tissue could be fibrous, because in all sequences it was darker than the normal cartilage.

On the basis of animal experiments (Rubak et al. 1982, O'Driscoll and Salter 1984), most investigators (Niedermann et al. 1985, Ritsilä et al. 1994) prefer immediate mobilization following transplantation of periosteal grafts to cartilage defects. In our study, the periosteum was fixed solely with the fibrin sealant and, due to the risk of loosening the periosteum, only 5 patients were allowed immediate mobilization. We found no negative effect of immobilization at the 8-year follow-up.

The purpose of periosteal transplantation for cartilage defects is to facilitate healing of the defect with hyaline cartilage to prevent the development of arthrosis. In our study, we documented formation of hyaline cartilage in only 1 patient and we assessed it as probable in another, but in the remaining assessable 10 patients, the tissue formed in the defect was not or probably not hyaline cartilage. The mechanism of failure of the method may be loosening or necrosis of the periosteal graft or failure of cell differentiation.

The 1-year postoperative radiographs had no sign of arthrosis, but at the 8-year follow-up, half of the knees had arthrosis. This progression agrees with the findings of Lindén (1977), who demonstrated arthrosis in 81% of patients with adult type osteochondritis dissecans after 33 years.

We found a disappointing long-term outcome of periosteal transplantation in the treatment of severe adult osteochondritis dissecans of the femoral condyles. The outcome deteriorated with time and the method failed to produce hyaline cartilage in most of the patients and did not prevent the development of arthrosis.

Anderson A F, Lipscomb A B, Coulam C. Antegrade curettement, bone grafting and pinning of osteochondritis dissecans in the skeletally mature knee. *Am J Sports Med* 1990; 18 (3): 254-61.

Angermann P, Riegels-Nielsen P. Osteochondritis dissecans of the femoral condyles treated with periosteal transplantation: A preliminary clinical study of 14 cases. *Orthopedics Int* 1994; 2 (5): 425-8.

Brittberg M, Lindahl A, Nilsson A, Ohlson C, Isaksson O, Peterson L. Treatment of deep cartilage defects in the knee with autologous chondrocyte transplantation. *N Eng J Med* 1994; 331 (14): 889-95.

Disler D G, McCauley T R, Wirth C R, Fuchs M D. Detection of knee hyaline cartilage defects using fat-suppressed three-dimensional spoiled gradient-echo MR imaging: Comparison with standard MR imaging and correlation with arthroscopy. *AJR* 1995; 165: 377-82.

Garrett J C. Fresh osteochondral allografts for treatment of articular defects in osteochondritis dissecans of the lateral femoral condyle in adults. *Clin Orthop* 1994; 303: 33-7.

Homminga G N, Bulstra S K, Bouwmester P S M, van der Linden A J. Perichondral grafting for cartilage lesions of the knee. *J Bone Joint Surg (Br)* 1990; 72 (6): 1003-7.

Hughston J C, Hergenroeder P T, Courtenay B G. Osteochondritis dissecans of the femoral condyles. *J Bone Joint Surg (Am)* 1984; 66 (9): 1340-8.

Jensen L J, Bach K L. Periosteal transplantation in the treatment of osteochondritis dissecans. *Scand J Med Sci Sports* 1992; 2 (1): 32-6.

Johnson L L, Uitvlugt G, Austin M D, Detrisac D A, Johnson C. Osteochondritis dissecans of the knee: Arthroscopic compression screw fixation. *Arthroscopy* 1990; 6 (3): 179-89.

Korkkala O, Kuokkanen H. Autogenous osteoperiosteal grafts in the reconstruction of full-thickness joint surface defects. *Int Orthop (SICOT)* 1991; 15: 233-7.

Lindén B. Osteochondritis dissecans of the femoral condyles. A long-term follow-up study. *J Bone Joint Surg (Am)* 1977; 59 (6): 769-76.

Lindholm S, Pylkänen P, Österman K. Fixation of osteochondral fragments in the knee joint. A clinical survey. *Clin Orthop* 1977; 126: 256-60.

Niedermann B, Boe S, Lauritzen J, Rubak J M. Glued periosteal grafts in the knee. *Acta Orthop Scand* 1985; 56: 457-60.

Noyes F R, Barber S D, Mooar L A. A rationale for assessing sports activity levels and limitations in knee disorders. *Clin Orthop* 1989; 246: 238-49.

O'Driscoll S W, Salter R B. The induction of neochondrogenesis in free intraarticular periosteal autografts under the influence of continuous passive motion. *J Bone Joint Surg (Am)* 1984; 66 (8): 1248-57.

Outerbridge H K, Outerbridge A R, Outerbridge R E. The use of a lateral patellar autologous graft for the repair of a large osteochondral defect in the knee. *J Bone Joint Surg (Am)* 1995; 77 (1): 65-72.

Ritsilä V, Poussa M, Rubak J, Snellman O, Österman K. Periosteal and perichondrial grafts in reconstruction of joint surfaces. *Acta Orthop Scand* 1981; 52: 447.

Ritsilä V A, Santavirta S, Alhopuro S, Poussa M, Jaroma H, Rubak J M, Eskola A, Hoikka V, Snellman O, Österman K. Periosteal and perichondrial grafting in reconstructive surgery. *Clin Orthop* 1994; 302: 259-65.

Rubak J M, Poussa M, Ritsilä V. Effects of joint motion on the repair of articular cartilage with free periosteal grafts. *Acta Orthop Scand* 1982; 53 (2): 187-91.

Stark D D, Bradley W G. Magnetic resonance imaging. *Mosby Year Book* 1992.

Wallgren K, Norlin R, Gillquist J. Activity score for the evaluation of orthopaedic patients. *Acta Orthop Scand* 1987; 58: 453.