Feature Article

Long-Term Results of Periosteal Transplantation in Osteochondritis Dissecans of the Knee

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ABSTRACT

Between 1986 and 1991, a total of 18 patients (11 men and 7 women) with osteochondritis dissecans of the knee were treated with periosteal transplantation. Median patient age was 19 years (range: 16-45 years). Eight patients were operated up to 8 years postoperatively, due to reduced range of motion, synovitis, or formation of an exostosis in the transplanted area. Of 14 patients who were available for follow-up after 8 years (range: 5-10), 2 were completely pain free. Six patients had reduced range of motion, knee instability, or quadriceps muscle atrophy. The number of reoperations and the presence of continued knee pain in most patients does not justify the extensive procedure of periosteal transplantation.

The treatment of osteochondritis dissecans is controversial.1 Encouraging results after periosteal transplantation have been described,2-5 but little has been published about the long-term outcome of this procedure.

This retrospective study evaluated the results of periosteal transplantation in 14 patients with osteochondritis dissecans of the knee after 8 years of follow-up.

MATERIALS AND METHODS

Eighteen patients (11 men and 7 women) with osteochondritis dissecans of the knee (8 right and 10 left knees) underwent periosteal transplantation between 1986 and 1991. Median patient age was 19 years (range: 16-45 years).

The time between onset of symptoms and surgery was >2 years in 9 patients, 6 months to 2 years in 4 patients, and <6 months in 5 patients. Two patients were manual laborers, 10 patients had sitting or non-weight-bearing occupations, and 6 patients were on sick leave. Four patients were able to participate in recreational sports. Three patients had undergone surgery for osteochondritis between 3 and 12 years prior to the periosteal transplantation.

All patients reported knee pain during weight bearing, 3 patients reported pain at rest, and 2 patients reported night pain. In 7 patients, the pain was constant. Only one of these patients was treated with analgesics, and none were treated with morphine derivatives or corticosteroid injections.

Preoperatively, 2 patients had reduced extension and 1 patient had reduced flexion. Five patients reported locking, 5 reported swelling, and 2 had >2 cm atrophy of the quadriceps muscle. Seven of the 18 patients had normal knee function.

Osteochondritis was verified radiographically in all patients (Figure 1). Computed tomography (CT) and magnetic resonance imaging (MRI) were not performed. Twelve patients underwent diagnostic arthroscopy; arthroscopy was performed in 3 of these patients to remove synovial hypertrophy (1 patient) and to treat patellar subluxation (2 patients).

The periosteal transplantation was performed under general anesthesia in a bloodless field. Arthroscopy was done through a medial parapatellar incision. The osteochondritis was debrided by drilling down to healthy subchondral bone. A periosteal graft, slightly larger than the defect, was taken from the medial surface of the tibia and fixed in the cavity with the cambium layer of the graft toward the subchondral bone. Fib-
rin adhesive (Tisseel, Immuno, Vienna, Austria) was used for fixation.

Postoperatively, continuous passive motion (0°-90°) was started immediately and continued for 7-10 days. Active guided exercises were started after 4-5 days, partial weight bearing was allowed after 6 days, and full weight bearing was permitted after 10 days.

The size and localization of the osteochondral defects and concomitant lesions of the operated knees are presented in Tables 1 and 2.

RESULTS

Postoperatively, 6 patients developed reduced range of motion (5 extension defects and 1 reduced flexion) and had performed brisement of the operated knee. There were no cases of deep or superficial infection.

Eight of 18 patients underwent reoperation up to 8 years after the periosteal transplantation. Eight arthroscopies and 3 arthrotomies were performed. The reoperations revealed hypertrophy or exostosis of the transplanted area (5 patients), synovitis (2 patients), a loose body (1 patient), and chondromalacia patellae (1 patient, formerly transplanted at the medial patellar joint surface). No biopsies were taken from the transplanted area.

Fourteen patients (8 men and 6 women) were reexamined 8 years (range: 5-10 years) after periosteal transplantation. Four patients were not available for follow-up.

Patients’ subjective evaluations of the treatment result are summarized in Table 3. None of the patients had daily knee pain or pain during the night. Twelve patients reported periodic pain during weight bearing, and 1 patient reported pain at rest. Two patients reported no pain. Only three patients used analgesics. Three years postoperatively, 1 patient had consulted a physiotherapist for ultrasound and laser treatment, without improvement.

At follow-up, 4 patients worked as manual laborers, 8 patients had sitting or nonweight-bearing jobs, and 2 patients (1 of whom had been working before surgery) received a pension. Three patients were able to participate in recreational sports.

Postoperative range of motion was normal for 12 patients. One patient had 5° reduced extension of the knee. In this patient, the periosteal transplant had been to the medial patellar joint surface because of former patellar subluxation and chondromalacia. One patient had only 0°-130° of flexion. His transplant was to the medial femoral condyle; follow-up radiographs revealed an exostosis in that area.

Twelve patients had normal stability of the knee, and 1 patient had anterior cruciate ligament insufficiency. Follow-up radiographs of this patient were normal, and the patient evaluated the operation result as very satisfactory. The last patient had a slight medial collateral ligament insufficiency and 3 cm atrophy of the quadriceps muscle; follow-up radiographs showed results of partially healed osteochondritis, and the patient indicated that the treatment outcome was not acceptable.

None of the 14 patients experienced swelling or locking of the knee. One patient had dysesthesia lateral to the cicatrice. Four patients had 1.5-4.5 cm atrophy of the quadriceps muscle, most pronounced for the patient with reduced knee flexion. In summary, 8 of 14 patients had normal knee function at the clinical follow-up examination.

Standard radiographs were taken of all 14 knees. Results of partially healed osteochondritis were found in all but 1 patient. In 2 patients, there was evidence of knee arthrosis. In 3 patients, an exostosis of the periosteal transplanted area was noted (Figure 2). Neither CT nor MRI was performed.

DISCUSSION

In animal models, it has been shown that free autogenous periosteal grafts transplanted to an articular defect can yield hyaline-like cartilage, originating from the mesenchymal cells of the cambium layer of the periosteal graft. However, the mesenchymal cells also have an osteogenic capacity. The differentiation of the cells is determined by the surrounding environment of the synovial fluid and the stimulation to which the cells are exposed.9-13

The chondrogenic potential of the
mesenchymal cells is stimulated by early mobilization and weight bearing following periosteal transplantation.\textsuperscript{9,11,12,14} For that reason, our patients were mobilized immediately after operation with continuous passive motion and early weight bearing was allowed, in accordance with the postoperative treatment in other clinical materials.\textsuperscript{4-6}

The use of fibrin adhesive in orthopedic surgery is well-documented.\textsuperscript{15} The ability of fibrin adhesive to provide safe fixation of osteochondral fractures and periosteal or periosteal grafts, even during early mobilization, has been reported in a number of trials.\textsuperscript{4-7,16-18}

More authors have reported encouraging results after operation of osteochondritis dissecans using periosteal transplantation.\textsuperscript{2,8} Niedermann et al\textsuperscript{4} used tibial periosteal grafts to fill osteochondral defects of the femoral condyles in four patients with osteochondritis dissecans and one patient with osteonecrosis. Control arthroscopies after 3, 6, and 12 months showed gradual healing of the defects in all patients, so that the transplanted areas completely resembled the surrounding cartilage after 1 year.

Hoikka et al\textsuperscript{5} operated on 13 patients with patellar chondral lesions, caused by trauma or chondromalacia patellae, using tibial periosteal transplantation. After an average of 4 years, a good result was obtained in 8 patients, a fair result in 4, and a poor result in 1. Knee function improved in 12 patients.

Jensen and Bach\textsuperscript{6} treated 3 patients with osteochondritis dissecans of the femoral condyles with fibrin-glued periosteal grafts. A good result was achieved in 2 patients after 6 months to 1 year. The third patient had a loose transplant removed by arthroscopy after 1 year.

In 14 consecutive patients with osteochondritis dissecans of the medial femoral condyle, Angermann and Riegiels-Nielsen\textsuperscript{7} achieved excellent or good results in 86% of the patients 1 year after periosteal transplantation. Patients were evaluated by clinical examination and radiographs. No biopsies were obtained. The authors concluded further follow-up was needed to evaluate the potential production of stable hyaline cartilage in the defects and the long-term results.

Niedermann et al\textsuperscript{8} carried out a prospective randomized investigation of periosteal transplantation in 8 patients versus simple excision of an osteochondral lesion in 10 patients. All patients had an osteochondral lesion of the medial femoral condyle. After 1 year, there was no difference between the two groups evaluated by arthroscopy, biopsy, and Lysholm knee score. In all patients, the cavity of the lesion was filled with mainly fibrocartilaginous tissue.

In most published clinical series of osteochondral defects of the knee treated with periosteal transplantation, the postoperative observation period has been short, often only a year. Consequently, there is a risk that initially good results cannot be reproduced in a longer term. In our series, 3 of 18 patients underwent reoperation within 1 year after periosteal grafting. At the follow-up examination after an average of 8 years, an additional 5 patients had been reoperated due to knee complaints, up to 8 years after the periosteal transplantation. Only 6 of 14 patients reported the results as satisfactory. Two patients were free of pain, 3 were able to participate in sports, and all but 1 patient had abnormal knee radiographs. We have not found any connection between the follow-up results and the size or localization of the osteochondritis.

In evaluating the treatment results, one also must consider the extent of the surgical procedure. In addition to a diagnostic arthroscopy, the periosteal transplantation requires an open access to the knee joint and exposure of a part of the tibia to prepare the periosteal graft. To justify the extent of this procedure, one must demand a better outcome than what can be achieved by arthroscopic surgery, eg, simple excision or drilling of the osteochondral lesion.

Messner and Maletius\textsuperscript{19} have described good or excellent knee function in 22 of 28 athletes 14 years after osteochondral lesion of the knee, treated with diagnostic arthroscopy alone or minimal arthroscopic surgery. These results are better than what we have found after a more extensive operation.
CONCLUSION

In this series, the clinical results 8 years after treatment of osteochondritis dissecans of the knee with periosteal transplantation were unsatisfactory. We have not been able to achieve the good results presented in the literature after shorter follow-up. The number of reoperations and the continuous knee pain in most of these patients does not justify the extensive procedure of periosteal transplantation. Based on these results, this method cannot be recommended for the treatment of osteochondritis dissecans of the knee.

REFERENCES


EDITORIAL COMMENT

This is an important paper that describes the periosteal transplantation of an osteochondritis dissecans defect without chondrocyte grafting. It shows that periosteum alone is unsatisfactory in this defect. The only criticism is that the periosteum was glued on with fibrin; this is probably an unsatisfactory fixation. Nevertheless, the follow-up is long term, and the clinical results were unsatisfactory.