Arthroscopic Microfracture Treatment for Osteonecrosis of the Knee

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Purpose: This study evaluated the results of arthroscopic subchondral microfracture performed on patients with spontaneous osteonecrosis (ON) (group 1) or secondary ON (group 2) of the knee joint. **Type of Study:** Retrospective clinical study. **Methods:** Group 1 included 26 patients (mean age, 48 years) who had spontaneous ON. Group 2 included 15 patients (mean age, 32 years) with ON secondary to inflammatory disease or steroid therapy. Seventy-six percent of the chondral defects were located in the medial femoral condyle. The average defect sizes in group 1 was 162 mm^2 and in group 2 was 362 mm^2. After debridement of the necrotic tissues, multiple perforations were placed into the subchondral bone to obtain revascularization. **Results:** There was an increase in the average Lysholm scores from 57 to 90 in group 1 after 27 months of mean follow-up ($P < .05$); 71% of patients could participate in strenuous sports with no or minimal limitation. The mean activity level in group 1 according to Cincinnati Knee Rating System was 6 preoperatively and 13.54 postoperatively. For group 2, the average scores showed significant improvement and patient satisfaction after surgery (preoperative and postoperative average Lysholm scores were 41 and 75, respectively, with mean follow-up of 37 months). Average activity level in group 2 increased from 2.67 to 11.73. Control magnetic resonance imaging scans of the cases revealed the continuity of normal cartilage with cartilage-like tissue in the treated areas. However, an increase of the size of ON in the subchondral bone was detected in 27% of the knees. **Conclusions:** The microfracture technique is safe, simple, and cost-effective, and may be an alternative procedure for treatment of ON of the knee, especially in young patients, before possible subsequent replacement surgery. **Level of Evidence:** Level IV. **Key Words:** Osteonecrosis—Knee—Debridement—Articular cartilage—Surgery.

Treatment of osteonecrosis (ON) of the knee, whether it is primary or spontaneous, or secondary to steroid therapy or chronic illness, such as systemic lupus erythematosus, vasculitis, or hemoglobinopathies, is controversial in the literature. Since the initial description of spontaneous ON of the knee as a distinct clinical entity by Ahlback et al. in 1968,[1] many theories of its cause and many treatment modalities have been reported.[2-6] This type of ON of the knee is typically seen with unilateral involvement in elderly patients.[5,7] Conservative treatment and observation is generally accepted in the early stages, although in more advanced cases or after conservative treatment has failed, surgical procedures, such as arthroscopic debridement, core decompression, bone grafting, high tibial osteotomy, and unicompartmental or total knee arthroplasty (TKA), are the treatment options.[3,5,8-10]

As to secondary ON of the knee, the etiology is still unclear. However, associated factors, such as steroid therapy, alcoholism, and some chronic inflammatory diseases, are well known.[11,12] It generally occurs in younger patients and the necrotic areas are larger than the lesions seen in spontaneous ON.[8] Bilateral and multifocal involvement are not uncommon.[7,11,12] Al-

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though the patients are younger, the suggested treatment alternatives are the same as with spontaneous ON.[6,8,10,12-14]

Microfracture of the subchondral bone is a bone marrow–stimulation technique developed by Steadman et al.[15,16] for the treatment of chondral defects. The main indication of this procedure is full-thickness articular cartilage defects caused by acute trauma or chronic repetitive microtrauma.[17] Although microfracture alone has limited indications for degenerative lesions and osteochondritis dissecans, the most significant contraindication of this technique is a malaligned knee.[18]

We hypothesized that debriding the necrosis and making multiple holes in the subchondral bone would result in the filling of the defect with clot that contained mesenchymal stem cells. Formation of type I and II collagen was expected with passive motion, as was seen in the treatment of traumatic defects with microfracture. The purpose of this study was to analyze our patients with ON who had been treated using the microfracture technique and to evaluate the clinical and radiologic results of this treatment. To our knowledge, this is the first report of ON treated with microfracture of subchondral bone.

METHODS

Between March 1996 and August 2002, 438 patients were diagnosed with ON of the knee at the authors' institution. Conservative treatment and observation is recommended for patients who are asymptomatic or at the initial stages, or who have ON without any extension to the cartilage. Nonsteroidal anti-inflammatory medication, cold application, weight-bearing relief, and physical therapy are advised for 4 months. If conservative treatment fails or mechanical complaints existed, surgical intervention takes place.

The decision about the type of surgical treatment depends on the stage and the size of the lesion. The degree of degeneration of the knee, the age of the patient, and alignment of the lower extremity are also important factors in the decision. If a patient has a large necrosis extending to the joint surface (associated with a chondral flap or defect) in multiple compartments, or grade IV degeneration, then TKA is performed. The debridement and microfracture technique, with or without proximal tibial osteotomy on the mechanical axis of the lower extremity, is recommended for lesions involving joint cartilage in 1 compartment of the knee that does not have serious degeneration. Proximal tibial osteotomy alone was not performed in any patient. Unicompartmental knee arthroplasty is not a routine procedure in our clinic. Of the 438 ON patients, 354 were treated conservatively, 18 underwent TKA, and 66 knees underwent surgery using the subchondral microfracture technique with or without tibial osteotomy.

This study included patients with spontaneous and secondary ON treated by arthroscopic subchondral microfracture. Patients who had improvement with conservative treatment modalities or who underwent TKA were excluded. The study was limited to patients who had a minimum of 1 year of follow-up, which eliminated 15 patients. Two ON patients who had chronic anterior cruciate ligament deficiency and who had ligament reconstruction at the same time were also left out of the study (the clinical results of these 2 cases were excellent after 25 and 32 months postoperatively). Follow-up of 8 patients could not be completed. As a result, 41 knees in 41 patients with spontaneous or secondary ON were evaluated.

The patients were divided into 2 groups based on the etiology of the lesion as classified in the literature: primary or spontaneous ON and secondary ON. There were 26 patients classified into group 1 (spontaneous ON) and 15 patients into group 2 (secondary ON).

Group 1 included patients who had no etiological factors such as steroid therapy, systemic disorders, alcoholism, renal transplantation, malignity, or postmeniscectomy problems. All of these cases were examined carefully and we consulted with other clinics, but no etiological factor causing the necrosis was found. In group 2, all patients had at least 1 factor or disorder known to be a possible cause of ON.

The preoperative clinical and radiologic records of the patients, including standing anteroposterior, lateral, and patella tangential radiographs, and magnetic resonance imaging (MRI) scans were collected. The MRI findings for all cases revealed ON in the knee joint. The Lysholm scores[19] and the Activity Level of the Cincinnati Knee Rating System[20] (Table 1) were used for clinical evaluation of the patients just before surgery.

Surgical Technique

All patients were treated with arthroscopic microfracture of subchondral bone performed by the senior author (I.A.). The procedure began by examining all compartments of the knee for possible additional pathologies such as meniscal tears, chondromalacia, or anterior cruciate ligament tear. All other necessary