Surgical Technique and Clinical Outcomes of Retrograde Osteochondral Autograft Transfer for Osteochondral Lesions of the Tibial Plateau

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Purpose: To present the surgical technique, clinical outcomes, and poor prognostic factors of arthroscopic retrograde osteochondral autograft transfer of the tibial plateau. **Methods:** Twelve patients (6 men, 6 women; mean age, 38.7 years) with tibial plateau osteochondral lesions underwent surgery. The primary diseases were osteonecrosis in 4 cases, cartilage injuries in 6, and postfractures of the tibial plateau in 2. Clinical outcomes were evaluated preoperatively and postoperatively according to the International Knee Documentation Committee score and the Japanese Orthopaedic Association score. The International Cartilage Repair Society score was recorded in 7 cases who underwent second-look arthroscopies postoperatively. Statistical analyses were performed to identify prognostic factors associated with the clinical outcomes. **Results:** The mean International Knee Documentation Committee and Japanese Orthopaedic Association scores were both significantly improved from 39.0 (range, 13.0-57.1) to 72.4 (range, 33.3-100) ($P = .0022$) and from 65.8 (range, 30.0-85.0) to 85.8 (range, 50.0-100) ($P = .0022 < .05$), respectively. In 2 cases, secondary operations were performed because of knee pain (1 varus osteotomy of the femur and 1 total knee replacement). The mean International Cartilage Repair Society scores were significantly worse in the 2 cases who required a secondary operation (3.5; abnormal) than in the 5 cases who did not (10.6; nearly normal). The secondary operation rate was significantly higher in cases with lesion size $\geq$400 mm^2 than in those $<$400 mm^2 (Fisher's exact test; $P = .046$). **Conclusions:** Most clinical scores improved significantly postoperatively. The results indicate that arthroscopic retrograde osteochondral autograft transfer is an effective procedure to achieve sufficient cartilage congruity for osteochondral lesions of the tibial plateau $<$400 mm^2 in size. **Level of Evidence:** Level IV, therapeutic case series.

Recently, there have been several reports of the use of osteochondral autograft transfer (OAT) for the treatment of moderately sized (100-400 mm^2) osteochondral lesions in the knee,[1-3] and good operative results have been reported in almost all cases. Lynch et al.[4] found that OAT is superior to microfracture, but that the long-term results are not as good as with autologous chondrocyte implantation, and there is some evidence of failure of OAT at between 2 and 4 years. The literature on the surgical treatment of osteochondral lesions of the tibial plateau is relatively limited. Hangody et al.[5] documented the results of OAT as a salvage intervention in 82 athletes with osteoarthritis of the knee, showing good to excellent results in 91% of femoral, 86% of tibial, and 74% of patellofemoral mosaicplasties; 92% of talar mosaicplasties had similar results (Hannover ankle scoring system). The review by Pareek et al.[6] referred to 3 studies that assessed OAT for tibial plateau lesions, including the following study that included 16 patients with tibial plateau lesions. They reported that patellofemoral lesions predispose patients to a poorer outcome than lesions on the femoral condyles, but the outcome was unknown for the tibial plateau lesions. Ueblacker et al.[7] described retrograde OAT performed for 3 patients with tibial plateau lesions. All of their patients were satisfied with the surgery after follow-up of 6-35 months. Although reporting only a small number of patients, the literature has shown that arthroscopic retrograde OAT

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could be performed on a routine basis in clinical practice, because the results were encouraging and showed good incorporation of the graft, a minimal failure rate, and satisfactory functional outcomes.[7-9] However, these prior studies could not identify potential prognostic factors because of their sample size.

The purpose of this retrospective study was to present the surgical technique, clinical outcomes, and poor prognostic factors of arthroscopic retrograde OAT of the tibial plateau. We hypothesized that OAT in a larger series of patients would show satisfactory clinical results at short- to mid-term follow-up independent of lesion size, location, or number of plugs required.

Methods

A retrospective review was performed of all surgical procedures performed at our 3 related institutions by a single surgeon (Y.N.). The inclusion criteria in the study were age 12 years or more, any isolated main osteochondral lesion of the tibial plateau at stage 3 or 4 according to the International Cartilage Repair Society (ICRS) classification system,[10] and lesion size of 100 mm^2 or more, with a lesion of only one compartment of the knee. Moreover, only cases who had been treated with conservative measures (such as analgesia, weight loss, modification of activity, and a knee exercise program) for more than 3 months before surgery were included. The exclusion criterion was a lesion with medial or lateral overall tibial cartilage degeneration.

A retrospective chart review was performed to identify patient demographics, mechanism of injury, mechanical alignment, concomitant injuries, lesion variables (size, location), and surgical variable (number of plugs, plug size).

The primary outcome measure was the clinical score improvement rate. Clinical outcomes were evaluated preoperatively and at the final follow-up according to the International Knee Documentation Committee (IKDC) subjective score and the knee scoring system of the Japanese Orthopaedic Association (JOA) score.[11] The JOA scale evaluates 4 items: ability to walk (30 points), ability to climb up and down stairs (25 points), range of motion (35 points), and joint swelling (10 points). Each knee joint can achieve a maximum score of 100 points on the JOA scale. The validation study for the JOA score was reported by Okuda et al.[12] The JOA score was significantly correlated with validated patient-rated outcome measures (the Japanese Knee Osteoarthritis Measure and the Medical Outcome Study Short-Form 36-Item Health Survey), indicating the concurrent validity of the JOA. Domains of the JOA had significant correlations with the Timed Up and Go, showing adequate construct validity. Intra- and interobserver reliability for the JOA showed a moderate to almost perfect agreement, and internal consistency of Cronbach's α indicated that the JOA score was a highly reliable instrument to assess knee osteoarthritis. The ICRS cartilage repair assessment score[10] was recorded in 7 cases who underwent second-look arthroscopies postoperatively. In 5 cases, scheduled second-look arthroscopy was performed. In 1 case, the second-look arthroscopy was performed at the time of surgery for implant removal after high tibial osteotomy, and in another case, it was performed at the time of the secondary operation (varus osteotomy of the femur) for left knee pain. The assessment of donor site morbidity was based on the patella compression test and the complaint of anterior knee pain. Preoperatively, knee radiographs were evaluated, and the extent of the osteochondral lesion was assessed on magnetic resonance imaging (T1- and T2-weighted images), and whether surgery was indicated was finally determined on in arthroscopy. Long-leg weight-bearing alignment radiographic views were included in cases with an obvious abnormal alignment appearance. All procedures were reviewed and approved by the research ethics committee of our hospital.

All operations were performed by the same orthopedic surgeon (Y.N.) using the osteochondral autograft transfer system (OATS) (Arthrex, Naples, FL). Osteochondral transfer was performed by the retrograde approach under arthroscopic vision.

Under general anesthesia, the anterolateral and anteromedial portals were installed, and a 30° oblique arthroscope was inserted. The size of the osteochondral lesion was initially measured by an arthroscopic probe. After the injured cartilage on the tibial plateau was debrided using a curette and abrader until the normal healthy cartilage bordered the debrided defect, the size of the cartilage defect was measured. A 4-cm longitudinal skin incision was made along the lateral border of the tibial tubercle, and the tibialis anterior muscle was reflected laterally from the tibial cortex. A bony window was opened. An ACL guide set (Arthrex) was applied to the window. A 2.4-mm Kirschner wire was introduced into the center of the cartilage lesion from the tibial window using a drill guide (Fig 1). Then, a coring reamer (Arthrex) was applied on a Kirschner wire, and a bony hole was created in the center of the defect through the tibia (Fig 2). Intraoperatively, after a dilator was interpolated into the bony hole, a lateral radiograph was taken to estimate the anteroposterior inclination angle of the dilator to the articular surface of the tibial plateau by a goniometer (Fig 3). According to the angle required, the tube harvester was set to the articular surface of the donor site. An osteochondral plug was harvested obliquely from the proximal lateral margin of the trochlea using the OATS (Fig 4). With the press-fit technique, the osteochondral plug was inserted from the tibial window through the bony hole by a retrograde approach, and its cartilage surface was