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Operative Techniques in
Orthopaedics

Microfracture Treatment of Osteochondral Lesions of the Talus

Woo Jin Choi, MD, PhD,[*] Masato Takao, MD, DMSc,[†] and Jin Woo Lee, MD, PhD[*]

Microfracture is in widespread clinical use as an intervention for symptomatic cartilage defects. Although effective when used with strict indications for treating smaller talar dome defects, the resultant fibrocartilagenous repair tissue shows degradation over time when this approach is used in larger or uncontained defects. This article reviews the indications, techniques, and results of microfracture in treating osteochondral lesion of the talus.
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The microfracture technique was developed to treat patients with posttraumatic or degenerative osteochondral lesions of the talus (OLTs) that have progressed to a full-thickness chondral defect. This technique is a kind of bone marrow–stimulation techniques and is designed to penetrate the subchondral bone and fill the debrided talar lesion with blood containing precursor cells and cytokines. These components then mediate a healing response by forming a fibrin clot and promoting fibrocartilagenous repair tissue.

Repaired tissues have been studied extensively and are mainly composed of type I collagen, whereas hyaline cartilage consists primarily of type II collagen.[1,2] Although fibrocartilage is advantageous compared with exposed subchondral bone as a weight bearing surface, fibrocartilage has inferior stiffness, resilience, and wear properties compared with normal hyaline cartilage.[3]

Microfracture has been used to treat lesions of all grades and sizes. We have found that arthroscopic microfracture of the subchondral bone is a reliable and repeatable procedure that stimulates biological repair of OLTs in patients for whom nonoperative treatment has failed or in whom acute lesions are encountered during arthroscopy. Here, we review the indications, clinical applications, rehabilitation, and outcomes of the microfracture procedure for treatment of OLTs. In addition, we present an overview of the factors influencing the clinical outcomes of OLT when the arthroscopic microfracture technique is performed, based on current research and our own experiences.

Indications

The following indications for employing microfracture techniques are based on findings from multiple studies, which we discuss in detail in the section Outcomes. Microfracture is primarily indicated for treating full-thickness articular cartilage defects without significant bone loss (Berndt and Harty stage 2-4; International Cartilage Repair System, grade 3) and measuring less than 1.5 cm^2 on the talar domes.[4-6] Extra-articular comorbidities such as malalignment and ligament instability are not contraindications provided they are corrected in a staged or concomitant fashion. Defects larger than 1.5 cm^2, defects located in the talar shoulder without containment, and the presence of accompanying intra-articular lesions are all associated with worse outcomes.[7,8]

Preoperative Planning

In most cases of OLTs, patients complain of chronic ankle pain during or after engaging in sports activities. In advanced cases, swelling and stiffness are accompanied by more constant pain. Occasionally, but not always, mechanical symptoms are present, including catching, locking, and giving way. Symptom severity does not always correlate with lesion severity.

*Department of Orthopaedic Surgery, Yonsei University College of Medicine, Seoul, South Korea.
†Department of Orthopaedic Surgery, Teikyo University, Tokyo, Japan.
Address reprint requests to Jin Woo Lee, MD, PhD, Department of Orthopaedic Surgery, Yonsei University College of Medicine, Seoul 120-752, South Korea. E-mail: ljwos@yuhs.ac

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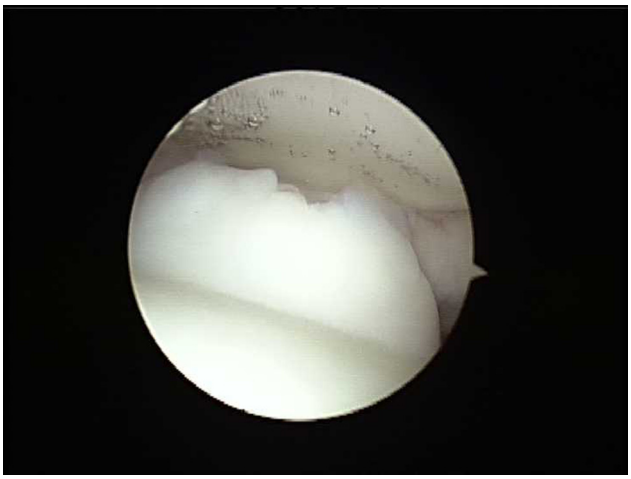

Figure 1 Arthroscopic view of a lateral talar cartilage defect. (Color version of figure is available online.)

Physical examination is relatively nonspecific in OLTs. By having the patient plantarflex the foot and ankle, the anterior aspects of the talar dome can be palpated at the anteromedial and anterolateral joint spaces. Tenderness in a specific area may indicate an osteochondral lesion. Tenderness that occurs behind the medial malleolus when the patient dorsiflexes the ankle may indicate a posteromedial lesion. Ankle range of motion can be tested with the knee flexed to eliminate restriction by the shortened gastrocnemius muscles, and range of motion is limited only in the case of ankle synovitis and effusion.

Physical examination should also include evaluating any associated pathology, taking into account differential diagnoses. Bony structures, tendons, ligaments, and soft tissue structures should be palpated and tested against resistance to discern tenderness of the specific anatomical part. Ligamentous instability or laxity is assessed with the anterior drawer test and passive varus or valgus stress test. Ankles must be inspected for severe swelling, warmth, or erythema. Based on our experience, any abnormal blood sample results that indicate an acute inflammatory process should be considered a contraindication to surgical intervention for OLT management.

When choosing imaging modalities, plain radiographs should be obtained first. Standard ankle plain radiographs should include anteroposterior, lateral, and mortise views; however, only 50%-66% of osteochondral defects can be visualized by plain radiographs alone.[9] Radiologic findings vary from a small area of subchondral bone compression to a detached osteochondral fragment. The 4-stage classification system by Berndt and Harty[10] is still the gold standard based on radiologic appearance.

Stress-view radiographs are frequently recommended if instability is suspected. However, a thorough clinical examination is more definitive and in most cases is sufficient for assessment. A computed tomography (CT) scan offers more accurate lesion staging and characterization, with a clear definition of the exact dimensions of the osseous portion of the lesion, but this subjects the patient to relatively high radiation levels. Magnetic resonance imaging (MRI) is an ideal tool and, in our opinion, the method of choice for imaging all patients with suspected OLTs, because MRI defines occult injuries of the subchondral bone and cartilage that may not be detected on routine radiographs. Furthermore, MRI is accurate in diagnosing associated pathology, for example, soft tissue impingement.[11,12] Although MRIs may demonstrate associated edema in the subchondral bone, in our experience, accurate sizing of the OLT is feasible.[5] On the basis of the CT scan or MRI, the location and size of the lesion can be determined, which helps plan the surgical approach.

Surgical Technique

The microfracture procedure is performed under spinal or general anesthesia. Preferably, the patient is positioned supine with a sand bag under the upper thigh to flex the knee. Then, noninvasive ankle distraction (6.8 kg) is applied by an ankle harness to widen the joint space. Microfracture is generally performed arthroscopically using standard anteromedial and anterolateral portals. In our experience, OLTs in any location within the ankle can be treated arthroscopically through standard portals. Rarely, accessory portals may become necessary to optimize access. When performed with other intra-articular procedures, such as synovectomy or bony spur excision, microfracture should be performed last to preserve the developing blood clot that could otherwise be irrigated away by the arthroscopic fluid. The use of a tourniquet is optional.

After the entire joint has been carefully evaluated and any articular comorbidities present have been addressed, the cartilage defect can be prepared (Fig. 1). First, all-degenerated cartilage is removed with a sharp curette, including any areas of surrounding cartilage that have delaminated, creating vertical shoulders of stable cartilage. Next, the layer of calcified cartilage is removed with the curette, carefully avoiding excessive force to prevent subchondral plate injury (Fig. 2). Generally, a motorized shaver can assist in removing larger flaps but is inadequate to appropriately prepare the

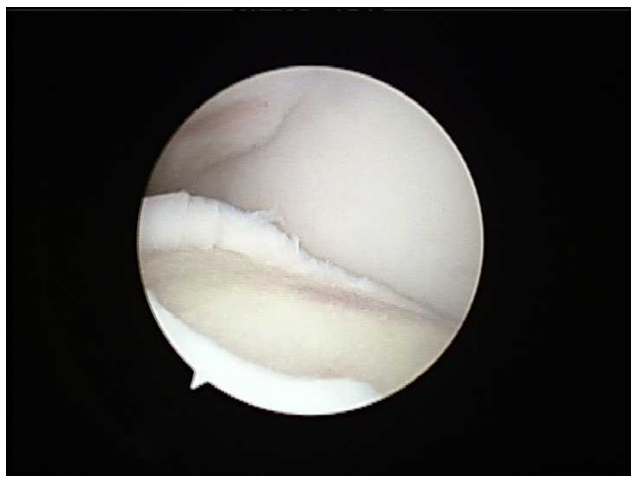

Figure 2 Same defect after debridement of degenerated tissue and the layer of calcified cartilage with creation of stable shoulders. (Color version of figure is available online.)