

## Potential pitfall in the microfracturing technique during the arthroscopic treatment of an osteochondral lesion

Christiaan J. A. van Bergen · Peter A. J. de Leeuw ·  
C. Niek van Dijk

Received: 1 July 2008 / Accepted: 3 July 2008 / Published online: 23 September 2008  
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**Abstract** Debridement and bone marrow stimulation of the subchondral bone is currently considered to be the primary surgical treatment of most osteochondral lesions of the talus. Different methods of bone marrow stimulation are used, including drilling, abrasion, and microfracturing. The latter has gained recent popularity. In this technical note we describe a potential pitfall in the microfracturing technique. The microfracture awl can easily create small bony particles on retrieval of the probe that may stay behind in the joint. It is emphasized that the joint should be carefully inspected and flushed at the end of each procedure, in order to prevent leaving behind any loose bony particles.

**Keywords** Osteochondral lesion · Osteochondral defect · Ankle arthroscopy · Microfracturing · Loose body

### Introduction

Osteochondral defects (ODs) of the talus are often preceded by a trauma [2]. The lesions typically cause deep ankle pain on weight bearing, and may have a major impact on the patient's daily life and (sporting) activities. The diagnosis is frequently delayed, since the complaints may be attributed to the previous trauma [2]. Both conventional

radiographs and additional diagnostics, such as computed tomography (CT) or magnetic resonance imaging (MRI), may reveal the lesion [4].

Various treatment options exist, including nonoperative treatment, debridement with or without bone marrow stimulation, autologous chondrocyte implantation, allograft transplantation, and osteochondral autograft transplantation or mosaicplasty [4, 12]. Despite advancements in some of these options, arthroscopic debridement combined with bone marrow stimulation is still the best currently available treatment [11]. It is considered the treatment of choice for primary lesions not exceeding 15 mm in diameter [1, 6].

Different methods are used to approach the lesion during arthroscopy, e.g. full plantar flexion, distraction, and trans-malleolar or retrograde drilling [5, 7, 8, 10]. Depending on the location of the defect, the arthroscopic approach can be performed from either anterior or posterior [4]. Furthermore, different tools for bone marrow stimulation can be used, i.e. a K-wire, drill or microfracture awl. Bone marrow stimulation by means of the microfracture technique has recently gained popularity [9]. One of the advantages of this approach in the ankle joint is its accessibility due to the curved end of the awl. In this report we describe a potentially important pitfall that is related to this procedure.

### Case report

A 30-year-old female presented to our clinic with an osteochondral defect in the central talar dome of the right ankle. The medical history revealed a bimalleolar ankle fracture which was surgically treated one year earlier. At the time of her visit, the fracture had healed, but the patient had developed deep ankle pain on weight bearing. On examination there was no swelling. The range of motion

**Electronic supplementary material** The online version of this article (doi:10.1007/s00167-008-0594-y) contains supplementary material, which is available to authorized users.

C. J. A. van Bergen (✉) · P. A. J. de Leeuw · C. N. van Dijk  
Department of Orthopaedic Surgery, Amsterdam Medical  
Center, Location G4-262, University of Amsterdam,  
P.O. Box 22660, 1100 DD Amsterdam, The Netherlands  
e-mail: c.j.vanbergen@amc.nl

was slightly diminished, with a dorsiflexion–plantar flexion of 10–0–40°, compared to 15–0–45° on the healthy side. On palpation there was no recognizable tenderness.

Anteroposterior and lateral weight-bearing radiographs revealed an OD located in the central talar dome (Fig. 1). A CT-scan of the ankle confirmed this finding, and showed the exact location and extent of the lesion. Treatment by means of arthroscopic debridement and microfracturing through an anterior approach was scheduled.

#### Surgical technique

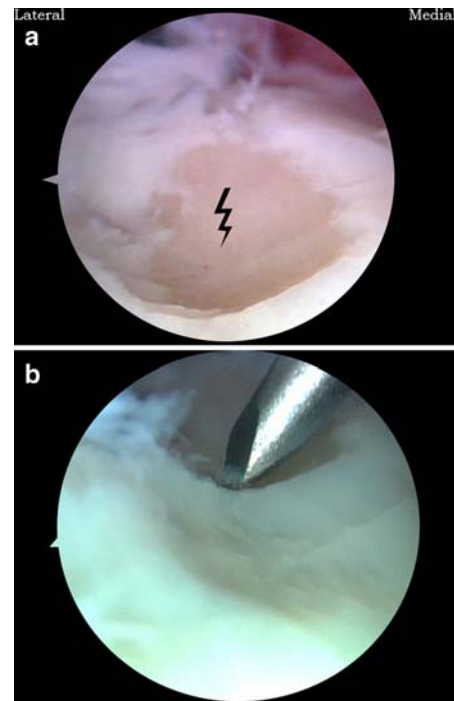
During the procedure the patient was placed in a supine position, with slight elevation of the ipsilateral buttock, and the hip supported. A tourniquet was applied around the involved upper leg and was inflated up to 300 mmHg. For irrigation normal saline was used with gravity flow. The procedure was performed under spinal anaesthesia. The anterior ankle arthroscopic approach was performed by means of routine anteromedial and anterolateral portal placement [4].

With the arthroscope in the anterolateral portal, the ankle was fully plantarflexed until the OD came into view (Fig. 2a). The contours of the defect were defined with a probe, and the edges were sharpened with a curette. Then a shaver system (Bone Cutter Dyonics, Smith & Nephew, Andover, Massachusetts) was used to debride the osteochondral defect and underlying necrotic talar bone (Video).

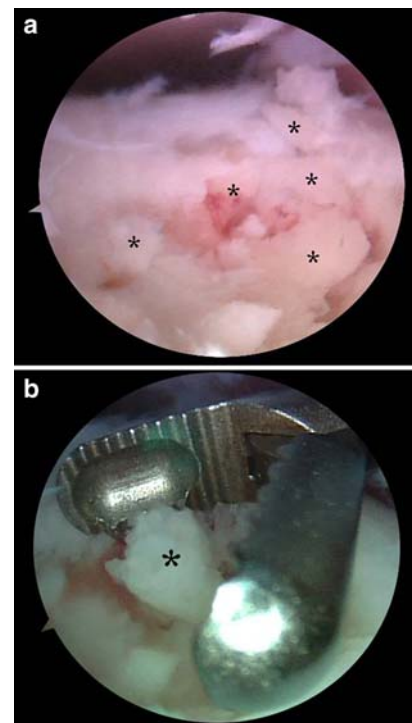
Next, a microfracture awl, angled 45°, was introduced through the anteromedial portal and the subchondral plate was punctured several times at intervals of approximately 3 mm (Fig. 2b) [9]. On inspection it was noted that multiple loose bony fragments were created during retrieval of the awl (Fig. 3a). The fragments were carefully identified,



**Fig. 1** Preoperative anteroposterior (*left*) and lateral (*right*) weight-bearing radiographs of the right ankle of a 30-year-old female with persistent deep ankle pain after a successfully treated bimalleolar ankle fracture. The X-rays reveal an osteochondral lesion located in the central talar dome (↑). The osteosynthesis material is also seen



**Fig. 2** **a** Intra-operative view of the untreated lesion (⚡) of the same patient as in Fig. 1. The arthroscope is located in the anterolateral portal. **b** After debridement of the defect, the subchondral bone is pierced with the microfracture awl



**Fig. 3** **a** Arthroscopic view of the same lesion as in Figs. 1 and 2, after microfracturing. Multiple loose fragments (\*) are seen. **b** All fragments are removed with a grasper, the lesion is again debrided, and the ankle joint is flushed

and were removed with a grasper (Fig. 3b). At the end of the procedure the joint was extensively flushed to wash out all possible remaining bony particles. After removal of the instruments the incisions were sutured with 3.0 Ethilon sutures.

#### Postoperative course

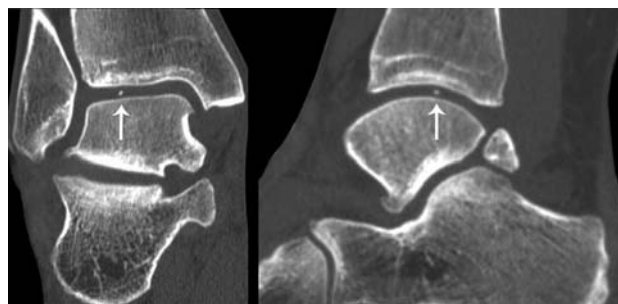
Postoperatively the patient was prescribed partial weight bearing for 6 weeks. She had an uneventful recovery.

#### Discussion

Arthroscopic debridement and bone marrow stimulation is the primary treatment for most osteochondral lesions of the talus, with 87% good or excellent results [11]. The objective of the technique is firstly to remove all unstable cartilage, including the underlying necrotic bone, and secondly to stimulate healing of the defect by opening the subchondral bone. The latter is achieved by creating several defects into the calcified zone that usually covers the defect. Irrespective of the technique used, the aim of the procedure is to stimulate the formation of a fibrin clot into the defect. Pluripotential stem cells are recruited from the bone marrow, and the formation of fibrocartilaginous tissue is initiated [9]. This can be accomplished by using a 2 mm drill, a 1.4–2.0 mm K-wire, or a microfracture awl.

The different instruments which can be used to open the subchondral bone each have specific advantages and disadvantages. Small diameter drills and K-wires have been successfully used in routine ankle arthroscopy [3, 8]. Eventual necrosis, due to heat caused by the drilling, can be minimized by using low speed and sufficient flushing, which also improves visualization. Compared to a drill, the K-wire has the advantage of flexibility and thus less risk of breakage. The use of either a drill or a K-wire also allows a transmalleolar or retrograde approach to the lesion [7, 10]. A drawback of the transmalleolar approach is the iatrogenic damage of the opposing tibial articular cartilage. Moreover, it has been associated with persistent pain and oedema, and even a stress fracture may occur [7].

The bone marrow stimulation technique with a microfracture awl is based on the theory that the use of an awl results in microfractures of the trabeculae rather than destruction of the bone, thereby inducing a healing response [9]. An advantage is that lesions can be treated “around the corner”, because the end of the awl is curved [12]. This makes constant distraction unnecessary, which may lead to fewer complications [4]. Furthermore, possible heat necrosis in the case of drilling without cooling is avoided.



**Fig. 4** CT-scan of a right ankle that shows a loose body which is situated in the talar cartilage (↑). Coronal (*left*) and sagittal (*right*) reconstructions are shown

We describe an important drawback of the procedure. With the microfracture technique loose bony particles are created, which easily become detached upon withdrawal of the awl. If the particles are not removed properly, they may act as loose bodies. These might subsequently give rise to locking and cartilage damage (Fig. 4).

Until better alternatives have been sufficiently investigated, debridement and bone marrow stimulation remains the treatment of choice for primary ODs of the talus. The technique is reliable and reproducible, and is associated with a high percentage of good or excellent outcome [11]. However, when using the microfracture awl, one must be alert for the creation of intra-articular loose bodies, especially when the microfracturing awl is retrieved. The joint should be inspected carefully, any loose bodies should be removed, and we recommend extensive flushing at the end of each procedure.

**Conflict of interest** This research was not supported by outside funding or grants. None of the researchers or an affiliated institute has received (or agreed to receive) from a commercial entity something of value related in any way to this manuscript.

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