Accessibility of the Talar Dome—Anatomic Comparison of Plantarflexion Versus Noninvasive Distraction in Arthroscopy

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Purpose: The purpose of this study was to evaluate the difference in accessibility of the talar dome during ankle arthroscopy between noninvasive distraction and maximum plantar flexion without distraction. **Methods:** For this study, 20 matched pairs (n = 40) of anatomic ankle specimens were used. Two groups (distraction or maximum plantar flexion) were defined. Through the use of chondral picks, the accessibility of each technique was tested arthroscopically. Afterward, the ankle joint was dissected and the reach achieved was measured and compared between the 2 groups. **Results:** Through noninvasive distraction, 13.1 ± 4.4 mm of the talar dome was reached laterally and 16.7 ± 3.7 mm medially. Through plantar flexion, 18.1 ± 3.4 mm of the talar dome was reached laterally and 18.1 ± 3.4 mm medially. Statistical comparison revealed a significantly better reach in plantar flexion on the lateral side of the talar dome ($P = .007$). There was no significant difference medially. **Conclusions:** Plantar flexion significantly improves reachability of the dome on the lateral side and it is equal to noninvasive distraction medially. Results of this study may allow for better access to the lesion of the talus. **Clinical Relevance:** Results of this study allow for a better planning of interventions in OCD of the talus.

Osteochondral defects (OCDs) of the talus are a typical pathology of the ankle joint, occurring most often in younger individuals. Their location is often described as posteromedial or anterolateral and may occur most frequently on the middle third of the medial or lateral talar dome.[1-4] The surgical treatment of OCDs most frequently administered consists of their arthroscopic debridement and a bone marrow stimulation.[2,5-8]

Arthroscopy in talar OCDs represents a minimally invasive surgical procedure. However there exist some drawbacks, especially because of reach-restricting structures, that is, the tibial plafond, and the high congruency of the tibiotalar joint.[9]

Three main work-arounds have been described for better reachability depending on the localization of the OCD: distraction of the joint, maximum plantar flexion of the joint, and location of the portal.

Distraction (Fig 1A) has been used to improve the accessibility of the ankle joint in arthroscopy, first invasive and more recently noninvasive because of a lower complication rate.[10-16]

The basic concept of plantar flexion (Fig 1B) in ankle arthroscopy is not new,[17] but its usefulness in the treatment of OCDs of the talus is the topic of recent discussion, especially in comparison to joint distraction. As only 15.8% of the talar dome articular surface is uncovered by the tibial plafond in the plantigrade position, Van Bergen et al.[18,19] proposed better accessibility of OCDs through using maximum plantar flexion. They were able to show that almost half of the articular surface of the talar dome moves out of the cover of the tibia in full plantar flexion, permitting access to an OCD via anterior ankle arthroscopy if its anterior border is located in the anterior half of the articular surface.[9,18]

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The results of this paper have been presented as poster at the annual meeting of the German association of foot surgery (DAF) 2017 and has won the third place poster award.

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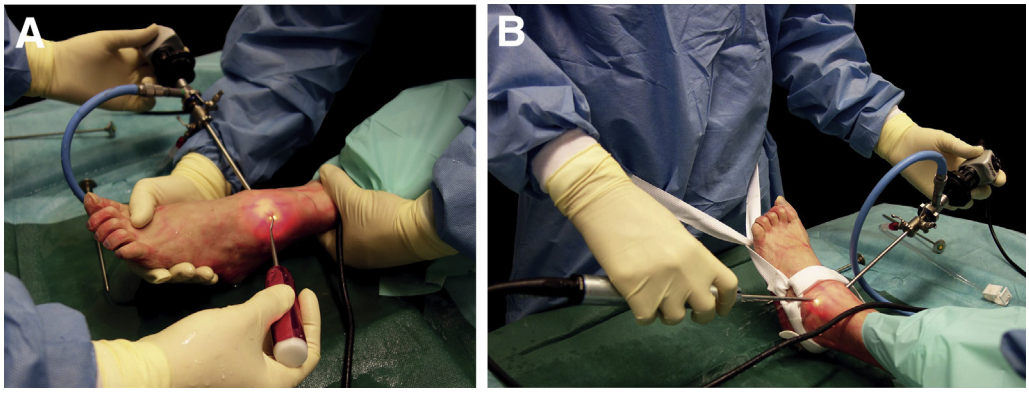

Fig 1. Intraoperative setting during ankle arthroscopy with the specimen simulating a patient's prone position during surgery using maximum plantar flexion performed by a surgical assistant (A) and noninvasive distraction with an Ankle Distraction Strap (B).

Apart from the mainly used anterior portals, several posterior portals—mainly the posteromedial, posterolateral, and trans-Achilles—have been introduced to access pathologies that are more dorsally positioned and therefore sometimes are quite difficult to reach from the anterior.[20-24] However, these posterior portals are more prone to operative complications because of their close position to the posterior neurovascular structures.[21-29]

The purpose of this study was to evaluate the difference in accessibility of the talar dome during ankle arthroscopy between noninvasive distraction and maximum plantar flexion without distraction. The hypothesis was that maximum plantar flexion provides better accessibility of the talar dome through the anterior portals compared with noninvasive traction of the talus.

Methods

For this study, 20 matched pairs (n = 40) of fresh-frozen anatomic ankle specimens were used. They were obtained from voluntary body donations to the Department of Anatomy. The study was approved by the institutional ethical review board of the Medical University of Vienna (No. 1486/2016).

Inclusion criteria for the specimens were their availability. Exclusion criteria were insufficient quality of the soft tissue, evidence of previous surgery or trauma in the area of interest, signs of vascular or neural problems of the extremity, and moderate or severe osteoarthritis of the ankle. The specimens were divided randomly into 2 groups (group 1: maximum plantar flexion; group 2: noninvasive distraction). All specimens were stored at −20°C and thawed at 4°C for 48 hours.

Passive range of motion was evaluated and documented. To investigate the ligamentous status of each specimen, a manual test (anterior drawer stress, lateral tilt) was performed.

Arthroscopic Setting

The ankles were mounted in a stable vice customized for arthroscopic procedures similar to devices used in recent literature.[30-32] The serrated jaws of the vice allowed for reliable fixation of the specimens. Anterior ankle arthroscopy of the ankle was performed through the anteromedial (arthroscope) and anterolateral (instrumentation) portals using a 4-mm 30° scope. All arthroscopic procedures were performed by the same experienced orthopaedic surgeon with concluded foot and ankle fellowship.

Accessibility of the talar dome was tested using a concave pick with a 90° tip. Plantar flexion was performed by a surgical assistant (Fig 1A), and distraction was performed by using a noninvasive arthroscopic Ankle Distraction Strap (Arthrex, Naples, FL) with an average force applied of 115N[10] (Fig 1B).

Arthroscopic Procedure

First, a diagnostic inspection of the ankle joint was performed. After an arthroscopic confirmation of the ligamentous integrity and the absence of severe osteoarthritic changes, accessibility was determined in each group. This was carried out with the use of the pick. The most posterior position in plantar flexion (Fig 2A) and distraction (Fig 2B) was marked.

Evaluation

After the arthroscopic procedure, the joint was dissected. First, the anterior capsule of the joint was opened and the position of the anterior rim of the tibia in maximum plantar flexion was marked with a lateral- and a medial-positioned guide wire. Then the talus was extracted (Fig 3).

The following parameters were evaluated (Fig 4):

- morphology of the talar dome: anterior width, posterior width including the interomedial facet, lateral circumference, and medial circumference
- distal tibial morphology: width and length of the distal tibial articular surface