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Case Report

Imaging findings of arthroereisis in planovalgus feet

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ABSTRACT

Arthroereisis is a rare and disputed procedure, where an implant screw is inserted into the sinus tarsi to treat flatfoot deformity. Weight-bearing radiographs are the most essential examinations to assess the correct localization and related measurements. Hardware loosening is the most common complication seen as localized lucency and as dislocation of the implant. Computed tomography yields superior resolution with reconstruction capabilities. On magnetic resonance imaging, the implant appears as a dark signal focus on T1 and T2-weighted images with a hyperintense T2-signal rim. As the data on the imaging of arthroereisis are scarce, we aimed here to review the typical imaging findings.

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Introduction

Flexible flatfoot is a common condition in children and adults [1]. However, since no precise definition for the flexible flatfoot exists, the prevalence has not been documented in the literature [2]. In children, pathologic flexible flatfoot has been shown to have an incidence of 2.7%–4% [3–5]. Typically, flexible flatfoot is characterized by hindfoot valgus, talar adduction with plantar flexion, longitudinal medial-arch collapse, pes planus, and dorsolateral forefoot subluxation [6]. The treatment of symptomatic flatfoot is mainly

conservative, but in some cases, surgical intervention is suggested [1,6]. Arthroereisis (derived from Greek *arthro*-meaning joint and *ereisis* meaning lifting up) is a procedure in which an implant screw is inserted between the posterior and anterior subtalar joints inside the sinus tarsi. The implantation of the screw expands the subtalar joint vertically, elevating the head of the talus which realigns the longitudinal arch of the foot and subsequently reduces the flatfoot deformity [7]. A number of implants have been used including bone, a polyethylene disk, silastic, a vitallium staple, and now more recently a titanium screw with

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soft-threaded design to resist extrusion. No bone drilling is necessary, and no cement is used, thus making arthroereisis a feasible minimally invasive procedure to treat symptomatic flatfoot [7].

Since the literature on the imaging of the arthroereisis is scarce, we propose to introduce to the radiologist the imaging appearances of subtalar arthroereisis in severe flatfoot and cases of complications of the inserted hardware. We recommend obtaining weight-bearing radiographs and vigilance in detecting hardware loosening after arthroereisis surgery.

The imaging findings of arthroereisis on radiographs

Weight-bearing lateral radiographs are essential to illustrate the medial longitudinal arch of the foot. In addition, anteroposterior weight-bearing radiographs allow visualization of the subtalar joint space. Both radiographic techniques are helpful to evaluate and determine the degree of flatfoot deformity, the postsurgical location of the implanted hardware, and the correction of anatomic alignment of the foot. Typical measurements used to evaluate the flatfoot deformity include calcaneal pitch angle, Meary's angle and lateral talocalcaneal angle (on the lateral view), and talonavicular coverage angle and talo-first metatarsal angle (on the anteroposterior view) [8] (Fig. 1).

On lateral radiographs, the radiodense screw can be readily detected in the sinus tarsi. The alignment of the implant should be such that the screw points to the subtalar joint and that the tip of the screw is located within the subtalar joint. On the oblique anteroposterior radiographs, the implant is ideally located on the anterolateral corner of calcaneus pointing slightly posterior into the subtalar joint. The implant should point about 15° off the perpendicular to the sagittal plane going from anterolateral to posteromedial. Furthermore, the implant should not be medial to the midline of the talar neck. The lateral edge of the implant should be at or just medial to the lateral side of the talus. On the anteroposterior view, the leading edge of the implant should bisect the talus or sit within the middle third of the talus. Figure 1 shows examples of optimal localization of the arthroereisis implant on lateral and oblique anteroposterior radiographs.

The most common complication of arthroereisis is the loosening of the hardware, which is seen as lucency surrounding the implant. Also, migration of the implant from the subtalar joint is occasionally observed as a complication of arthroereisis. Figures 2 and 3 depict loosening and migration, respectively, of the subtalar implant as seen on radiographs.

Computed tomography and magnetic resonance imaging appearance of subtalar arthroereisis

A limitation of the computed tomography (CT) and magnetic resonance imaging (MRI) of the foot is that they are acquired in a non-weight-bearing position. In addition to radiographs, CT provides superior detection of the arthroereisis implant.

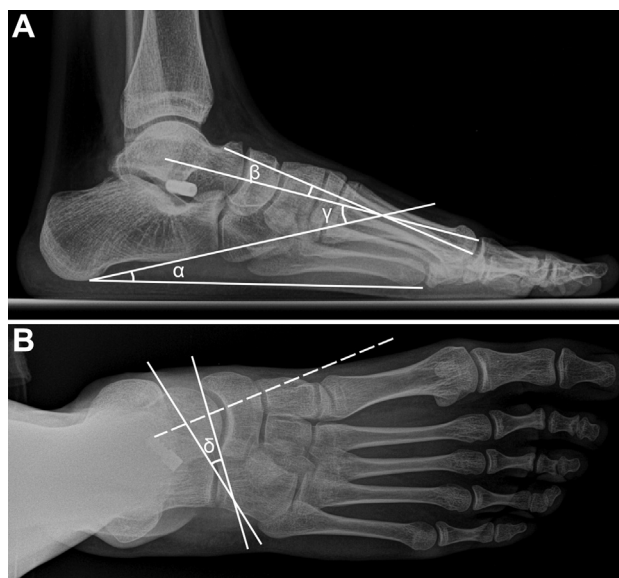


Fig. 1 – Case 1. Lateral (A) and anteroposterior (B) weight-bearing radiographs of a 13-year-old girl after arthroereisis procedure. Lateral (A) and anteroposterior (B) views show the optimal localization of the arthroereisis implant in the sinus tarsi in the subtalar joint between the talus and calcaneus. Measurements used to evaluate the flatfoot deformity include calcaneal pitch angle (α), Meary's angle (β), and lateral talocalcaneal angle (γ) on lateral view (A), and talonavicular coverage angle (δ) and talo-first metatarsal angle (dashed line) on anteroposterior view (B). Calcaneal pitch angle (α) is formed by the horizontal line and a line from the base of heel and inferior cortex of calcaneus, and less than 20° is considered to represent pes planus. Meary's angle (β) is the angle between the lines from the centers of longitudinal axes of the talus and the first metatarsal. More than 4° is considered as pes planus. Lateral talocalcaneal angle (γ) is the angle formed by the intersection of the line bisecting the talus with the line along the lower border of the calcaneus. An angle over 45° indicates hindfoot valgus, a component of pes planus. A line connecting the edges of the articular surface of the talus, and a line connecting the edges of the articular surface of the navicular forms the talonavicular coverage angle (δ), and greater than 7° indicates lateral talar subluxation. Talo-first metatarsal angle (dashed line) is formed by drawing a line through the midaxis of the talus; if this line is angled medial to the first metatarsal, it indicates pes planus.

With thin slices and multiplanar reconstruction capabilities, the localization and possible complications of the arthroereisis can easily be detected. Figure 4 demonstrates an ideally located subtalar implant in the sinus tarsi on CT in axial, coronal, and sagittal planes with 3-dimensional reconstruction.

Compared to CT and radiographs, MRI provides superior resolution of the soft tissues. Also, the anatomy of the sinus tarsi can be evaluated more easily on MRI. Typically, the axial

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