

# Triple arthrodesis of the foot with allograft through a lateral incision in planovalgus deformity



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## ABSTRACT

**Background:** Triple arthrodesis may be performed using various surgical approaches, most typically through two incisions and without structural bone graft. We have found that a single lateral incision allows adequate surgical exposure and structural bone graft facilitates lateral column reconstruction. **Methods:** A consecutive series of 30 triple arthrodeses with additive bone graft using a single lateral incision. Outcome measures were SF12 score, Manchester–Oxford Foot Questionnaire index score, visual analogue pain score and satisfaction scores, and radiographic assessment at 3, 6 and 12 months post-operatively.

**Results:** Statistically significant improvements were seen in all measured outcomes, except the SF12 mental component score. The union rate was 100% with no loss of correction at 12 months. Twenty-nine out of 30 patients were satisfied.

**Conclusions:** In this series, triple arthrodesis using structural allograft through a single lateral incision was safe and effective, with restoration and maintenance of surgical deformity correction and foot length.

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## 1. Introduction

Triple arthrodesis is typically indicated in the treatment of the rigid adult acquired flatfoot [1]. The typical pes planovalgus deformity involves several biomechanical abnormalities, including lateral column shortening with midfoot abduction, lateral subluxation of the navicular on the talus, hyperpronation from increased eversion of the subtalar joint, and valgus orientation of the calcaneus [2]. In the first description of the ‘classic’ triple arthrodesis, Ryerson stated that in order to satisfactorily address the various deformities the operation was most easily and accurately performed by two incisions [3] and almost all the published reports of triple arthrodesis have used a two-incision approach [2,4–14] and the technique has been well-described [6,9,14]. Recent series have reported union rates of 83–98%, and even up to 100% in small series [6,15], however wound complications have been a significant problem with infections

rates as high as 9–42% [5–7,9,10,13] using the two-incision approach. Cadaveric studies of both the two-incision and single medial incision approaches to triple arthrodesis have noted a very high incidence of injury to the deltoid artery, artery of the tarsal canal and artery of the tarsal sinus [16]. Furthermore, in the same study difficulties were reported in gaining adequate access to fully prepare the calcaneocuboid joint.

In order to avoid these problems some surgeons have reported on a single lateral incision being used effectively for triple arthrodesis in the adult acquired flatfoot [17–19], however structural allograft was not used routinely. We have found good results using a single lateral incision, structural allograft and a combination of rigid internal fixation and temporary percutaneous fixation and in this study we report the clinical and radiological results of triple arthrodesis in a series of 30 hindfeet using this technique.

## 2. Methods

Following regional ethical committee approval, and having given written consent to participate, 27 patients (23 female, 4 male) who underwent a total of 30 consecutive triple hindfoot arthrodeses were included in this prospective study. Patients were recruited from the senior author’s clinic having been initially

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referred with ankle or midfoot pain and deformity, and a diagnosis of acquired flatfoot made on clinical (stiff planovalgus deformity) and radiological grounds (Meary's angle increased  $> 0^\circ$  apex plantar). The underlying aetiology was rheumatoid arthritis (15 cases), posterior tibial tendon dysfunction (11 cases), osteoarthritis (3 cases) or ankylosing spondylitis (1 case). All patients had failed conservative management and consented to undergo triple arthrodesis. The mean age at operation was 63 (range 17–77) years. Surgery took place between December 2004 and November 2012.

### 2.1. Surgical technique

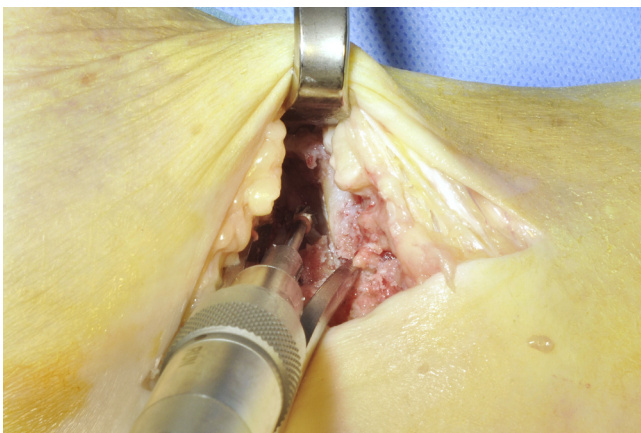
All surgical procedures were carried out by the senior author using a technique described previously [20]. Either spinal or general anaesthesia was used and all patients received a single dose of pre-operative antibiotic prophylaxis. A single lateral 'lazy-S' incision centred over the sinus tarsi was used for all procedures. The calcaneocuboid joint was exposed by elevating the origin of extensor digitorum brevis with a sliver of bone. The subtalar and calcaneocuboid joints were denuded of articular cartilage with sharp osteotomes. Hindfoot retractors and laminar spreaders were used to gain access to the talonavicular joint and a high-speed burr was used to expose bleeding cancellous bone at all fusion sites (Fig. 1). A donated femoral head allograft was used in all cases and correction of the deformity was effected by inserting cortico-cancellous structural bone graft into the prepared bony surfaces. Further bone graft was morselised and packed into the fusion sites. All allograft bone was thoroughly pulse lavaged and impregnated with vancomycin powder. The key to triplanar deformity correction is reduction of the talonavicular joint, i.e. acetabulum pedis, which was transfixed with temporary 2 mm Kirschner wires inserted percutaneously into the medial column of the foot (Fig. 2). Small bone chips were inserted into the posterior facet of the subtalar joint which was typically secured by a staple. After insertion of an 8–10 mm block allograft into the calcaneocuboid joint 2 further temporary 2 mm Kirschner wires inserted percutaneously into the lateral column. An additional staple was used if deemed necessary. Satisfactory correction of the deformity and position of the metalwork was confirmed using intraoperative fluoroscopy (Fig. 3). After fixation of all 3 fusion sites further bone chips or blocks were tightly packed into the sinus tarsi. After wound closure a below knee plaster back slab was applied for a total of 3 months. Patients were reviewed at 2 weeks for removal of sutures and change of cast, at 8 weeks for removal of Kirschner wires (as an outpatient apart from 2 patients who requested removal under general



**Fig. 2.** Intra-operative photograph showing correction of the deformity secured with percutaneous 2 mm K-wires in the medial and lateral columns.

anaesthesia) and change of cast, and at 3 months for cast removal. Patients were required to be strictly non-weightbearing for 6 weeks and partial weightbearing for a further 6 weeks. An orthopaedic leg trolley was provided to aid ambulation. After cast removal patients were provided with a moonboot walker until confidence was restored to wear conventional shoes.

After initial assessment at the pre-admission clinic, all patients were seen at 3, 6 and 12 months post-operatively as part of this



**Fig. 1.** Intra-operative photograph showing access to the talonavicular joint via the single lateral incision and joint preparation using the high-speed burr.



**Fig. 3.** Intraoperative lateral fluoroscopic image showing the position of the Kirschner wires after correction of the three-dimensional deformity. Note the 'empty' sinus tarsi after deformity correction, which is then firmly packed with large bone graft croutons/blocks.

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