Subtalar extra-articular screw arthroereisis for the treatment of flexible flatfoot in children

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Received 8 November 2018
Accepted 10 December 2018

The Egyptian Orthopaedic Journal 2018, 53:115–118

Background
Subtalar arthroereisis has been described as a minimally invasive, effective, and low-risk procedure for the treatment of flatfoot in children.
Purpose
To test the effectiveness of subtalar extra-articular screw arthroereisis procedure as a corrective measure for flexible flatfoot (FFF) in children.
Patients and methods
From 2012 till 2014, 12 feet of eight children with FFF were treated with subtalar extra-articular screw arthroereisis at Banha University and Banha Insurance Hospitals.
With a mean age of 10.5 years and ranges between 5 and 16, five male and three female patients were selected and were required to follow-up every 18 months (range, 15–27 months).
Results
This technique offered worthy results to correct idiopathic flatfoot in children, due to its less invasive and less damaging nature for the structures of the sinus tarsi. On the basis of clinical inspections and radiographic measurements, there was clear improvement of foot function.
Conclusion
Subtalar arthroereisis is an effective procedure for FFF correction as it is simple and can be performed rapidly. Additionally, the screws mechanical and proprioceptive effect result in notable correction of the deformity.

Keywords:
arthroereisis, flatfoot, subtalar

Egypt Orthop J 53:115–118

1110-1148

Introduction

Flatfoot is commonly presented in children. Subtalar joint has some abnormal biomechanics, more specifically a talar planter flexion and medial rotation together with calcaneal eversion. Together this altered biomechanics and collapsed arch, as well as forefoot abduction, are responsible for such a deformity.

Physiological flatfoot, which normally presents itself in infants, is usually asymptomatic and needs no treatment. This physiological type is caused by an undeveloped arch that is usually reconstructed in the first decade of life. The other categories of flatfoot such as the pathological or the symptomatic flatfeet require intervention [1].

Treatment of the symptomatic flexible flatfoot (FFF) starts with conventional treatment, which include braces and shoe modifications.

Surgical intervention is indicated in symptomatic patients in whom the conventional treatment fails to alleviate symptoms.

Surgical procedures are divided into two main categories: soft tissue operations and bone surgeries. These procedures include tendon transfer or lengthening, osteotomies, arthrodesis, or arthroereisis.

Subtalar arthroereisis is an effective procedure for the treatment of symptomatic FFF. Its effectiveness returns to alleviating symptoms either pain, deformity, or stability.

There are a lot of controversies about the optimal technique of subtalar arthroereisis [2].

In this study, we use a simple technique, which is the calcaneal block, to prevent calcaneal eversion and talar medial rotation.

 DOI: 10.4103/eoj.eoj_38_18

Figure 1

Calcaneal pitch angle.

Patients and methods

From 2012 till 2014, 12 feet of eight children with symptomatic FFF were treated with subtalar extra-articular calcaneal block screw arthroereisis at Banha University and Banha Insurance Hospitals. The study was approved by the institutional ethics committee in Department of Orthopedic, Benha University, Benha, Egypt. The patients' mean age was 10.5 years which ranged from 5 to 16 years. Five and three of the patients were men and women, respectively. The average follow-up was 18 months (range, 15–27 months).

The treatment of symptomatic FFF in children with failed conservative procedures for 6 months.

Patient complaints were foot pain when taking long walk, early foot fatigue, shoe wear, and deformity.

Inclusion criteria include marked flexible hindfoot valgus with failed conservative procedures for 6 months. Notably, rigid flatfoot or post-traumatic flatfeet were excluded.

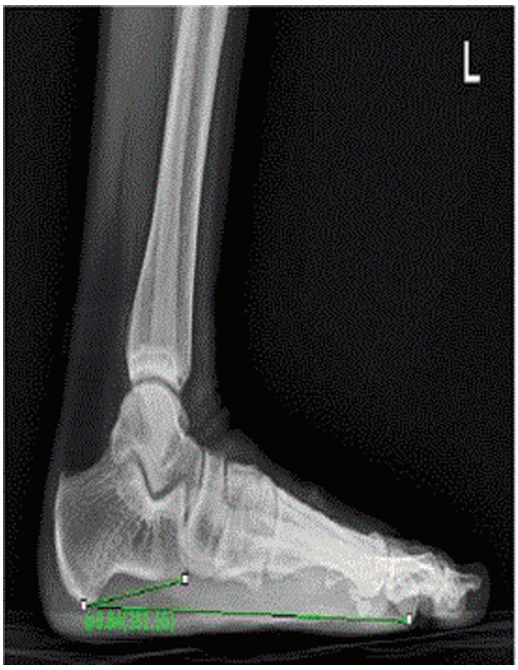
Preoperative and postoperative clinical assessments were done using the American Orthopedic Foot and Ankle Society hindfoot scale together with visual analog of pain scale. Informed consent was obtained for all patients.

Preoperative and postoperative radiological assessments include calcaneal pitch angle (Fig. 1) and Meary's angle (Fig. 2).

Surgical technique

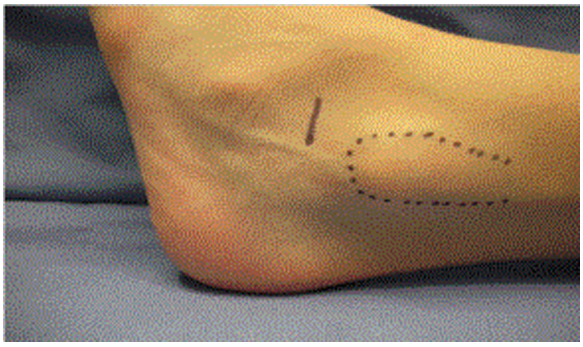
All patients were operated using general anesthesia, in supine position, and thigh tourniquet was used.

Figure 2



Meary's angle.

Figure 3



The minimally invasive skin incision at the level of the sinus tarsi was ~1.5 cm.

Incision was done 3 cm directly over the sinus tarsi. Deep fascia and the capsule covering the sinus tarsi were incised with blunt dissection.

The periostium over the upper surface of the anterior part of calcaneus was elevated. A 2.7 drill hole was done vertically at this anterior part of the calcaneus just posterior to the lateral process of the talus, while a 3.5 mm screw was inserted in a vertical manner with a washer to prevent calcaneal eversion and talar medial rotation.

A mini-invasive incision was done (Fig. 3), former to the reduction of the talocalcaneal derotation, which was done manually and kept in the correct position by insertion of a screw at the sinus tarsi

level, under the talus lateral process. Layered closure was done with application of a compression bandage.

Postoperative bivalved cast is removed within the first 2 weeks in order to exercise. Partial weight bearing started after 2 weeks, full weight bearing after 1 month, and sport activities permitted after 12 weeks.

Results

All patients are followed up at 1, 2 weeks, 1, 3, 6 months, and 1 year. It is noteworthy that the inserted screw is frequently removed by the first year.

All patients are corrected clinically regarding hindfoot valgus immediately postoperatively and improved during the follow-up period (Table 1, Fig. 4).

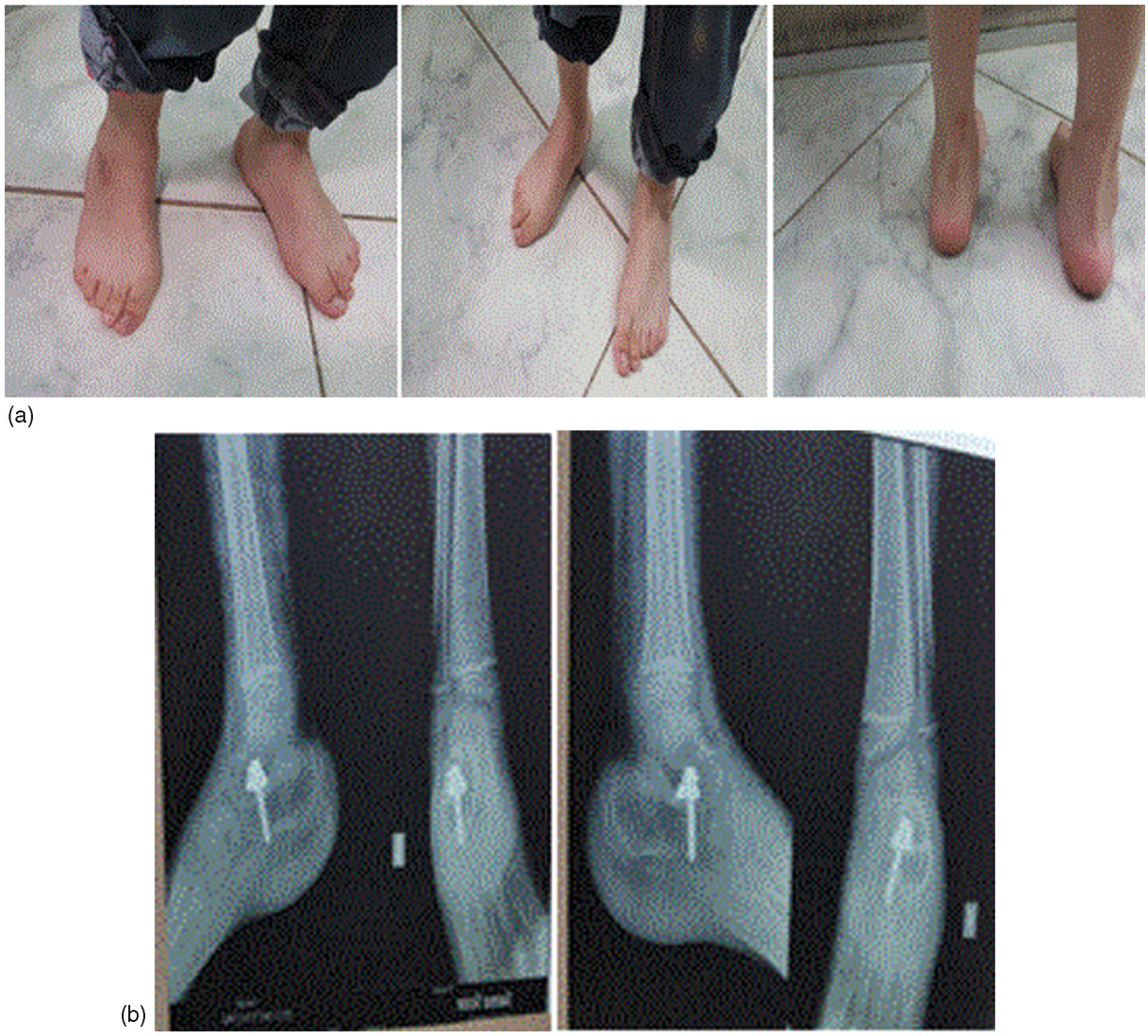
The results are classified as follows:

(1) Good.
(2) Fair.
(3) Poor.

Table 1 Talocalcaneal arthroereisis: postsurgery results

Number of feet	Results	Valgus hindfoot (deg.)	Costa-Bartani angle (N.V. 120_–125_) (deg.)	Calcaneal pitch angle (N.V. 20_–30_) (deg.)
8	Good	Normal or <5	123	30
3	Fair	>5 but <10	132	18
1	Poor	>10	135	13

Figure 4



(a, b) Clinical and radiographic images of bilateral flexible flatfoot of an 11-year old boy.

Discussion

Many surgical procedures for FFF correction have been used. These include soft tissue applications, transfer or lengthening of muscles or tendons, arthrodesis of one or more joint osseous excisions, osteotomies, and the interposition of bone or synthetic implants into the sinus tarsi [3–5].

In the 1980s, Pisani [2] started this technique. This technique, also known as 'calcaneo-stop,' is an extra-articular arthroereisis of the subtalar joint. It spread quickly throughout Italy [6] and then more to the European areas [7–9]. The principles of the correction are still the same with many other different variations of the original technique [10].

Calcaneal block technique in which a calcaneal screw was used to prevent subtalar pronation has clinical and radiological satisfactory outcomes in the treatment of symptomatic FFF.

There were significant improvements in the American Orthopedic Foot and Ankle Society scale and visual analog of pain scale postoperatively. This technique is a simple, easy, and a cheap technique.The correction offered by these techniques is not only mechanical and passive but also mostly active [11,12], and it is helped by the stimulation impressed onto the receptors of sinus tarsi whose action is to activate the muscular and tendon structures and to normalize the pronation of subtalar joint [13].

Both types of screws were used: the cancellous (diameter 4.5/6.5 mm) and cortical (diameter 3.0/4.5 mm) screws. The results and complications (loosening, osteolysis, rupture of the screws) are equal regarding both screw types.

The results depend on the position and mechanical action of the implant not the type of screw itself.

Conclusion

Talocalcaneal arthroereisis is a worthy, valid, important, and secure technique to correct idiopathic flatfoot in children. The results look very promising if we consider the stability over time, the simplicity of the techniques, the short recovery time, and the low occurrence of complications.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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