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

Abstract

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 the subtalar extra-articular screw arthroereisis procedure as a corrective measure for flexible flatfoot (FFF) in children.

Material and methods: From 2012 till 2014, eight children with 12 feet with flexible flatfoot 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 to 16, 5 male and 3 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 flat foot for children, due to its less invasive and less damaging nature for the structures of sinus tarsi. Based on clinical inspections and X-ray measurements, there was clear improvement of foot function.

Conclusion: Subtalar arthroereisis is an effective procedure for flexible flatfoot (FFF) correction as it is simple and can be performed rapidly. Additionally, screws mechanical and proprioceptive effect result in notable correction of the deformity.
Introduction

Flat foot is commonly presented in children. Subtalar joint has some abnormal biomechanics, more specifically a talar planter flexion and medial rotation together with calceneal 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 starts with conventional treatment, which include braces and shoe modifications.

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

Surgical procedures are divided in 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 treatment of symptomatic flexible flatfoot. 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 the calcaneal eversion and talar medial rotation.

Patients and methods

From 2012 till 2014, eight children with 12 feet with symptomatic flexible flatfoot were treated with Subtalar extra-articular calcaneal block screw arthroereisis at Banha University and Banha Insurance Hospitals. The patients mean age was 10.5 years ranged from 5 to 16 years. Five and three of the patients were male and female respectively. The average follow-up was 18 months (range 15-27 months). The treatment of symptomatic flexible flatfoot 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 flatfoot were excluded.
The preoperative and postoperative clinical assessment was done using American Orthopedic Foot and Ankle Society (AOFAS) hind foot scale together with visual analogue of pain scale (VAS). Informed consent was obtained for all patients.

The preoperative and postoperative radiological assessment includes calcaneal pitch angle (Fig. 1) and Meary's angle (Fig. 2).

![Figure 1: Calcaneal Pitch Angle](image1.png)  ![Figure 2: Meary's Angle](image2.png)

**Surgical technique**

All patients were operated using general anesthesia, supine position, and thigh tourniquet was used. Incision was done 3-cm directly over 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 calceneus was elevated. A 2.7 drill hole was done vertically at this anterior part of the calceneus just posterior to the lateral process of the talus; while a 3.5 mm screw was inserted in vertical manner with a washer to prevent calcaneal eversion and talar medial rotation.

The mini-invasive incision was done (Fig. 3), former to the reduction of the talo-calcaneal 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 compression bandage.
Fig. 3 The minimally invasive skin incision at the level of the sinus tarsi was approximately 1.5 cm.

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 patient is followed up at 1 week, 2 weeks, 1 month, 3 months, 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 hind foot valgus immediately postoperative and improved during the follow up period.

Results are classified as (see Tables 1):
– good
– fair
– poor –

Table 1: talocalcaneal arthroerisis: post-surgery results

<table>
<thead>
<tr>
<th>No of feet</th>
<th>results</th>
<th>Valgus hindfoot</th>
<th>Costa-Bartani angle (N.V. 125–120)</th>
<th>Calcaneal pitch angle (N.V. 30–20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Good</td>
<td>Normal or &lt;5°</td>
<td>123°</td>
<td>30°</td>
</tr>
<tr>
<td>3</td>
<td>Fair</td>
<td>but &lt;10° 5°&lt;</td>
<td>132°</td>
<td>18°</td>
</tr>
<tr>
<td>1</td>
<td>Poor</td>
<td>10° &lt;</td>
<td>135°</td>
<td>13°</td>
</tr>
</tbody>
</table>
Discussion

Many surgical procedures for the FFF correction have been used. These include soft tissue plications, transfer or lengthening of muscles or tendons, arthrodesis of one or more joints, osseous excisions, osteotomies, and the interposition of bone or synthetic implants into the sinus tarsi. [3,4,5]

In the 1980s, Pisani et al. [2] started this technique. This technique, also known as “calcaneo-stop”, is an extraarticular arthroereisis of the subtalar joint. It spreaded quickly throughout Italy [6] then more to European areas [7,8,9]. 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 outcome in treatment of symptomatic flexible flatfoot

There were significant improvements in the AOFAS scale and VAS scale postoperatively. This technique is simple, easy and 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 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 screw 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. Results depended 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 flat foot of childhood. 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.
Fig 4: Clinical and x-ray images of bilateral flexible flatfoot of a 11 years old boy
References


