CHAPTER **16**

SUBTALAR JOINT DISTRACTION ARTHRODESIS TO CORRECT CALCANEAL VALGUS IN PEDIATRIC TARSAL COALITION PATIENTS

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INTRODUCTION

Subtalar joint (STJ) middle facet coalitions commonly present during the ages of 12-16 years in children presenting with a rigid pes planovalgus foot type (1, 2). Coalition of the middle facet allows for the rearfoot forces to be distributed medially through the coalition, instead of the posterior facet (3). The resulting spherical distribution of pressure forces between the ankle, subtalar, and talonavicular joints is seen radiographically as the C sign or the halo sign. The C sign has been shown to be more sensitive and specific than the other radiographic findings of STJ coalition (absence of STJ facet space, talar beaking, and blunting of the lateral talar process) (7). Uneven medial distribution of forces through the coalesced STJ can result in boney changes, such as arthritis or wedging of the talus between the tibia and the severely everted calcaneus (3). Figure 1 depicts an example of lateral tarsal wedging.

Surgical treatment of the symptomatic STJ middle facet coalition primarily includes coalition resection or arthrodesis. Resection arthroplasty has been successful, generally in younger patients without arthritic adaptation (2, 5). In cases of advanced arthritis involving the entire rearfoot, triple arthrodesis has been recommended. Pain, arthritic changes, and deformity limited to the STJ may be addressed via isolated STJ arthrodesis (6). Often, adjunctive procedures are required to address equinus, an unstable medial column, etc.

Many techniques have been described for STJ arthrodesis for a variety of indications. Glissan's requirements for arthrodesis must be appreciated for any technique to yield successful outcomes. Lateral tarsal wedging, seen with many STJ middle facet coalitions, presents a challenging surgical situation. Wedge resection may be required for correction of the valgus rearfoot, however, there is already a decrease in the talocalcaneal height (TCH) and further tarsal shortening should be avoided. The technique described in this article utilizes distraction arthrodesis with a wedged bone graft to restore TCH and correct the frontal plane position of the rearfoot.

Gallie, in 1943, was the first to introduce STJ distraction bone block arthrodesis. He introduced this technique for management of depressed calcaneal fractures and stated that, "no attempt has been made in this operation to change the relation of the astragalus to the os calcis or to correct any deformity of the foot. If such were necessary, some different operation would be required" (7). In 1988, Carr reported that positional correction could be achieved through Gallie's procedure and specifically noted improvements in heel height, and decreased talar declination and talocalcaneal angles (8). Bednarz demonstrated a mean TCH increase of

Figure 1. Tarsal wedging. An axial magnetic resonance imaging confirms radiographic presence of coalition, indicates its composition, and can assess the frontal plane position of the rearfoot. Wedged resection of the talus could neutralize rearfoot position but this would further shorten the tarsus.

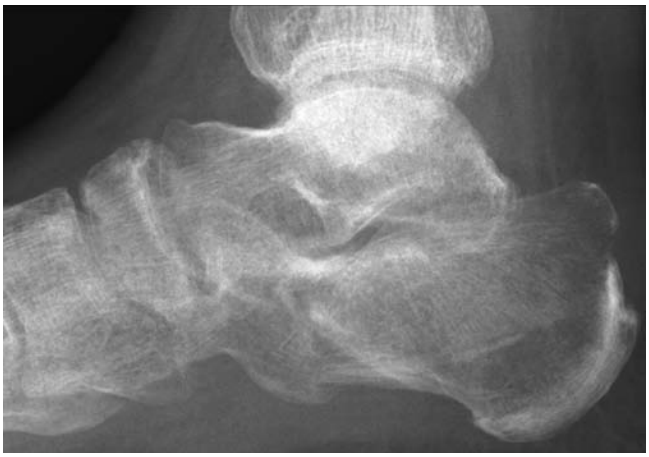

Figure 2A. Example of subtalar joint distraction bone block arthrodesis for calcaneal fracture. Preoperative radiograph showing calcaneal fracture with posterior facet depression.

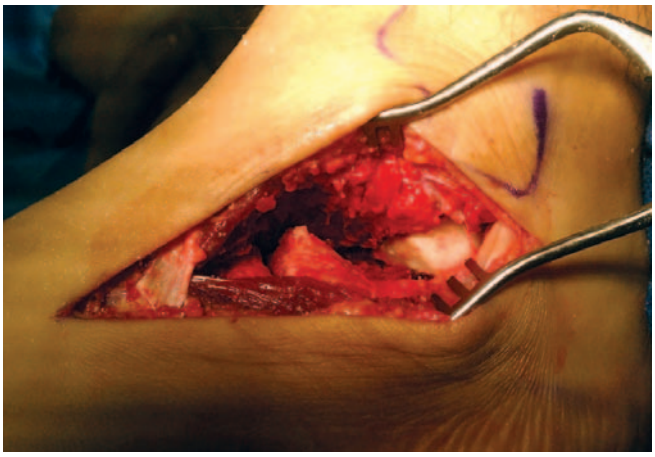

Figure 2B. Intra-operative image of allograft bone block used for subtalar joint distraction arthrodesis.

Figure 2C. Immediate postoperative radiograph showing improved heel height and talocalcaneal relations.

8 mm in 29 patients who had distraction bone block arthrodesis following calcaneal fracture (9, 10) (Figure 2).

Grice's and Chambers' extra-articular procedures for pes planovalgus have similarly been described to restore normal relationships of the talus and calcaneus (11, 12). The Grice procedure involves placing a bone graft within the sinus tarsi to elevate the head and neck of the talus, preventing anterior excursion and adduction of the talus. The Chambers procedure involves utilizing a bone graft wedge to raise the floor of the sinus tarsi. These extraarticular procedures served to avoid disruption of growth plates and prevent excessive pronation in pathologic paralytic flat feet. By improving the relationship of the talus to the calcaneus, excessive STJ pronation is prevented and rearfoot correction is achieved (12).

CASE REPORT

A 12-year-old, healthy boy presented with left foot pain, which rendered him unable to participate in sports. He had progressing pain along the medial and lateral aspects of his arch. The onset of his symptoms was insidious. On physical examination, he was noted to have a rigid rearfoot valgus, collapse of the medial longitudinal arch with a nonreducible stress Hubscher maneuver (3), peroneal muscle spasm, and normal ankle dorsiflexion (Figure 3).

Weightbearing radiographs of his left foot (Figure 4A) demonstrate findings consistent with talocalcaneal coalition including: sclerosis of STJ middle and posterior facets, a halo sign, an anterior break in the cyma line, an increase in talar declination, loss of TCH, and decrease in the talocalcaneal angle. To address his rigid deformity, we chose to perform an STJ arthrodesis. To correct his rearfoot valgus malalignment, our surgical plan incorporated an STJ wedged distraction bone block. This rearfoot procedure was supplemented with a Cotton osteotomy.

The patient was positioned in the supine position. A skin incision commenced at the tip of the fibular malleolus, and extended along the floor of the sinus tarsi out to the calcaneal cuboid joint. The STJ was exposed then distracted. The coalition and STJ surfaces were resected. An iliac crest allograft was fashioned to match the contour of the STJ. A lateral based wedge allowed for neutralization of the rearfoot to a neutral position. The press-fit nature of the distraction arthrodesis afforded stability and eliminated the necessity for internal fixation.

Figure 3A. Preoperative weightbearing presentations. Clinical findings of pes planovalgus are demonstrated. Collapse of the medial longitudinal arch.

Figure 3B. Preoperative view, valgus heel alignment positive Helbing's sign, and too many toes sign.

Figure 3C. Preoperative view, forefoot abduction and loss of arch height.

Figure 3D. Following surgery (1 year postoperative), the arch is restored.

Figure 3E. At 1 year postoperative, the heel is rectus.

Figure 3F. At 1 year postoperative, the forefoot is aligned with the rearfoot.

Figure 4A. Preoperative weightbearing lateral radiograph. Preoperative findings include increased density of the subtalar joint facets, blunting of the lateral talar process and loss of arch height.

Figure 4B. At 1 year postoperative the allograft has incorporated into the subtalar joint and Cotton osteotomy sites. The calcaneal inclination angle is relatively increased, talar declination is reduced, and TCH is restored.

ANALYSIS AND DISCUSSION

Six weeks postoperatively, radiographic incorporation of the bone graft was seen at the STJ and Cotton osteotomy sites. The patient returned to full activity without restrictions after 9 months. At 1 year postoperatively, drastic change in the clinical appearance of his foot was noted (Figure 3). Radiographs (Figure 4) showed full incorporation of allografts at both surgical sites, maintenance of medial longitudinal arch, and increased TCH. The patient continues to function well 16 months following surgery and has an ACFAS rearfoot score of 100.

To our knowledge, this is the first report of distraction arthrodesis for correction of an STJ coalition. This procedure has proven useful in the management of depressed calcaneal fractures. In a foot with an STJ coalition and tarsal wedging, shortening of the tarsas should be avoided. TCH is restored as the rearfoot is realigned in a neutral position. In this case, the TCH increased >5 mm.

This technique has advantages and disadvantages, which should be considered on an individual patient basis. This technique does not require internal fixation; thus, this can reduce the cost of surgery, eliminate the need for hardware removal, and decrease the chance of anterior ankle impingement. This procedure may, however, be technically challenging as it requires a three-dimensional appreciation of the rearfoot shape and alignment. Upon resection of the STJ surfaces, a carefully fashioned bone graft must be customized to match the STJ space contours. It is important that the graft maximizes contact surface area with the talus and calcaneus for healing purposes and to achieve stability provided by its press-fit.

Additional outcomes of this technique for patients with a STJ coalition associated with a severe valgus rearfoot will be presented in the future. This technique appears to be a viable surgical treatment for these patients as it yields successful outcomes.

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