TREATMENT OF MOBILE FLAT FOOT BY DISPLACEMENT OSTEOTOMY OF THE CALCANEUS

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The purpose of this paper is to advocate simple calcaneal osteotomy as an effective treatment to relieve fatigue, improve shape and prevent abnormal shoe wear in patients with mobile flat foot. It is reserved for those cases in which conservative measures have failed and the symptoms warrant surgical treatment.

The concept of calcaneal osteotomy is an old one. The first description was given by Gleich in 1893 (quoted by Silver, Simon, Spindell, Litchman and Scala 1967). Gleich’s technique involved displacement of the posterior fragment forwards, medially and downwards in an attempt to restore the normal angle between the long axis of the calcaneus and the floor. This was achieved by excision of a medial wedge. In 1923 Lord reported thirteen cases of calcaneal osteotomy for severe flat foot. Only one patient, however, had calcaneal osteotomy alone; the others all required supplementary procedures.

Dwyer (1960) advocated calcaneal osteotomy with insertion of a tibial graft in the outer side. He believed that the basic principles were the same whether the patient suffered from mobile flat foot or from flat foot in cerebral palsy. In many patients with the latter condition he elongated the tendo calcaneus as a supplementary procedure at the same time.

Displacement osteotomy of the calcaneus has been practised in the Bristol clinical area for some years, the operation having been first performed here by the late Mr Pridie.

ANATOMY OF THE FLAT FOOT

In mobile flat foot the calcaneus lies in valgus; its superior articular surface is tilted medially, lying on a lower level than normal. The talus is rotated medially and downwards, its head producing a prominence medially just behind the navicular bone. Hence the alignment of the bones in the medial pillar of the foot is lost, and subluxation is produced between talus and navicular bone, to which is sometimes added a subluxation between the navicular bone and the cuneiform (Fig. 1).
The forefoot is pronated and slightly abducted at the mid-tarsal joints (Fig. 2).

The distorted anatomy produces the well known clinical deformity comprising: 1) flattening at the longitudinal arch (Fig. 3); and 2) valgus deformity of the heel, in consequence of which the tendo calcaneus acquires an evertor action, which may tend to aggravate the condition (Fig. 7). Either the planus or the valgus may predominate or they may be equally represented.

Consequent upon the valgus deformity, the line of weight-bearing transmitted through the talus passes medial to the calcaneus (Figs. 4 and 5).

**THE OPERATION**

The aim of the operation is to displace the posterior part of the calcaneus medially and thus to restore normal weight-bearing (Fig. 6).

**Technique**—A tourniquet is used. The patient lies prone with a sandbag under the lower shin to allow free movement of the ankle. A lateral incision is made, parallel to and a little behind and inferior to the peroneal tendons, care being taken not to damage the sural nerve. The upper end of the incision overlies the lateral margin of the calcaneal tendon and its lower end reaches the inferior margin of the calcaneus. The skin edges are held apart by a self-retaining retractor and two small bone spikes are inserted above and below the calcaneus in order to expose its superior, lateral and inferior surfaces.

The periosteum is incised and elevated in the line of the skin incision to allow subperiosteal osteotomy with a broad osteotome. The osteotomy is prised open and the periosteum is divided along the medial aspect to allow the displacement envisaged. It may be necessary to divide the long plantar ligament to obtain sufficient displacement.

When the osteotomy has been completed the posterior fragment of the calcaneus is displaced medially until its medial border lies in a line with the sustentaculum tali. This usually entails a displacement between a third to a half of the width of the calcaneus. The displacement is held by one or two Kirschner wires, inserted obliquely from the postero-inferior surface of
The weight-bearing line and relation of the talus to the calcaneus seen from a postero-superior viewpoint in a normal foot (Fig. 4) and a flat foot (Fig. 5). The displacement at operation is shown in Figure 6.

Before operation there is valgus of the heels (Fig. 7) but after operation on both heels the position is neutral (Fig. 8).

The arch before operation (Fig. 9) and Afterwards (Fig. 10).
Marked abduction of the forefoot before operation (Fig. 13). After operation (Fig. 14) there is a decrease of the abduction of the forefoot and the mid-talar line approximates to the normal.

the bone, care being taken to ensure that the ends of the wires are buried beneath the skin. Routine closure of the skin only is undertaken and a padded below-knee plaster is applied with the ankle held in neutral position.

Post-operative care—Three weeks after operation the sutures and the wires are removed and a new below-knee plaster is applied. The patient is allowed to bear weight in this for three weeks. Radiographs are then taken, out of plaster, and if union has occurred the limb is left free to mobilise. Occasionally physiotherapy is required.

CLINICAL MATERIAL.

In the Bristol clinical area there was a total of thirty-four feet operated on in nineteen patients. All the patients were traced and examined. The follow-up time ranged from six years to a few months. The age range was nine to fifty-five years but only two patients were over seventeen at the time of operation; one was thirty-nine years and the other was fifty-five years. The mean age was twelve years when these two are excluded. There were eleven females and eight males. All had simple mobile flat foot with a marked valgus element and without neurological abnormalities.
RESULTS

The results were judged on three criteria: the shape of the foot, fatigue and shoe wear. **Shape of the foot.** Heel—Seventeen patients (thirty feet) lost the valgus deformity of the heel and with this the eversion element in the pull of the calcaneal tendon (Figs. 7 and 8). Arch—The longitudinal arch showed some improvement in twenty-five feet (thirteen patients), most of whom had some arch before operation (Figs. 9 and 10). Nine severely deformed flat feet (six patients) failed to show any improvement. **Forefoot abduction**—This was found to run parallel with the improvement of the longitudinal arch. Although the improvement was difficult to demonstrate in the photographs, it was easily apparent on the radiographs. **Fatigue**—This was recorded as definitely improved in seventeen patients. They were very pleased to be able to indulge in normal activities such as walking, running, football and dancing. In addition the spring in the gait was considerably improved. **Shoe wear**—In seventeen patients there was no problem with footwear after the operation. The parents of the young children were particularly appreciative. **Failures**—None of these features improved in the two patients (four feet) with persisting valgus deformity of the heel. These failures were probably due to a tight calcaneal tendon or to inadequate displacement at the osteotomy. In both cases there was inability to dorsiflex to the right angle with the heel in neutral position and the knee straight. **Radiographic appearance**—Standing radiographs before and after operation are essential for a proper assessment of the effect of operation. Improvement in the appearance of the foot was always associated with decrease in the talo-navicular subluxation. This improvement can be divided into components: the longitudinal arch and the forefoot. Figures 11 to 14 illustrate the typical radiographic appearance before and after operation. Only very slight improvement in the elevation of the anterior end of the calcaneus was seen in the lateral radiographs.

**CONCLUSION**

1. Thirty-four cases of calcaneal osteotomy for mobile flat foot in nineteen patients are reviewed.
2. The function was markedly improved in seventeen of the nineteen patients.
3. The operation was successful in correcting the valgus deformity of the heel in thirty of the thirty-four feet. It was less successful in improving the longitudinal arch, especially when the flat foot deformity was severe.

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**REFERENCES**

