

## A MODIFIED APPROACH TO THE DWYER OS CALCIS OSTEOTOMY IN CLUB FOOT

J. E. HANDELSMAN, M.CH. ORTH., F.R.C.S. (LOND.), J. YOUNGLESON, F.R.C.S. (LOND. AND EDIN.), AND C. MALKIN, M.CH. ORTH., F.R.C.S. (EDIN.); *Departments of Orthopaedic and Plastic Surgery, Witwatersrand University and Baragwanath Hospital, Johannesburg*

The opening wedge os calcis osteotomy described by Dwyer in 1963 is a well-recognized and valuable procedure in the treatment of club foot—particularly in relapsed cases where a small inverted and elevated heel predominates.

The purpose of this paper is two-fold: (1) To discuss the use of deproteinized calf bone rather than autogenous bone as the 'inserting prop' in the opening wedge of the os calcis, and (2) to describe methods of overcoming the problem of obtaining soft tissue cover for the bone graft.

Before doing so, however, a brief mention of the underlying principles and indications for the operation, as we see them, is worth discussing for the sake of clarity.

The equinus hind foot and adducted forefoot in talipes equinovarus is inextricably linked with a small varus and elevated heel. The Achilles tendon sweeps down the medial side of this inverted heel, and through its attachments to plantar fascia and other structures on the medial side of the foot, perpetuates forefoot adduction. Re-aligning the heel allows reversal of this deforming pull, converting it instead into a dynamic correcting force.

In performing the os calcis osteotomy, we aim at inserting a large enough wedge into the medial side of the heel to correct fully any varus, erring preferably on the side of over-correction into mild valgus. Concurrent with correcting the tilt of the heel, a considerable increase in size is incidentally achieved. Invariably an elongation of the tendo achillis is carried out in a 'Z' fashion so that medial fibres are completely detached from the os calcis and hence the plantar fascia.

We consider the operation indicated in any relapsed or untreated club foot where a small varus heel predominates. The one prerequisite is that there must be a sufficient degree of ossification of the os calcis for a bone graft to be feasible; which usually makes the procedure impractical under the age of 3.

In the relapsed club foot, where a small varus and posteriorly elevated heel is the major pathology, the osteotomy with elongation of the tendo achillis is usually adequate, since any residual forefoot adduction tends to correct dynamically over a period of time.

However, in the previously untreated club foot or the more severe form of the relapsed club foot—so commonly encountered at Baragwanath Hospital—correction of the

heel alone rarely suffices. In these cases it has been our policy to attain a full correction of the foot by whatever soft tissue release is necessary, and concurrently to osteotomize the heel when varus is a prominent feature.

We feel strongly that in these severe cases a full correction at surgery must be the aim, for our experience indicates that no subsequent improvement will occur with any amount of plaster-of-paris moulding if the surgical release has been inadequate.

It is interesting to learn, in a recent personal communication from Mr. Dwyer, that it is also his practice to use the os calcis osteotomy as part of a more extensive procedure when indicated.

### *The Use of Deproteinized Calf Bone as the Inserting Wedge*

Traditionally autogenous bone is taken from the upper end of the tibia for use as the 'inserting wedge' to maintain the opening in the osteotomized os calcis. This autogenous graft has certain disadvantages. Apart from increasing the extent and morbidity of the procedure, growth disturbances in the upper tibia, notably genu recurvatum, have been recorded.

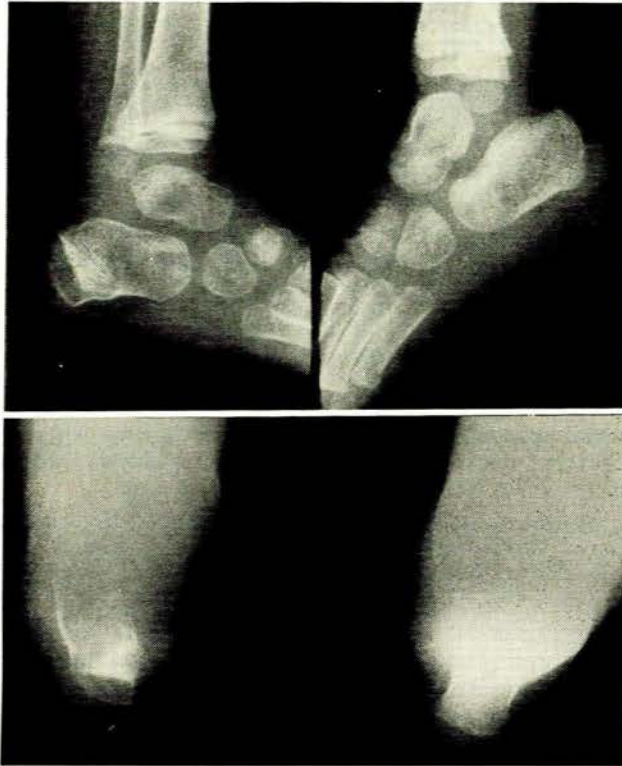
On this account we have now abandoned the use of autogenous tibial grafts and have for some 2 years used deproteinized calf bone made by the Kiel Company of Hamburg. This is supplied as cancellous packs of bone, both wedge-shaped and cuboid, and is easily trimmed to fit the wedge osteotomy produced.

The osteotomy itself is made obliquely in the os calcis in a line just below the flexor hallucis longus tendon and is opened so that the inferior part of the bone hinges on intact periosteum laterally.

As it is our policy when doing this operation to obtain a full correction, the opening osteotomy is often a very large one. If one block of Kiel bone is inadequate, it is easy to insert a second wedge. We have found that judicious use of a small punch assists in making these grafts seat securely.

Results of the use of Kiel bone have been very gratifying. In all cases our patients have been left free to walk without support at the end of 10 or 12 weeks. Incorporation of the graft can be established by axial X-rays

of the heel. In some patients incorporation has been mature at 3 months (Figs. 1a and b). Only once in the last 20 cases have we seen a delay in incorporation. This



Figs. 1a and b. A mature Kiel bone graft 5 months after right os calcis osteotomy in a 3-year old male. The extent and shape of the opening wedge is well shown.

child was mobile and walking without support to the foot 3 months after operation although X-ray signs of invasion of the graft did not appear for a further 8 months. A second case is worthy of mention. Here skin healing was much delayed, leaving part of the bone graft exposed. A superficial layer of this grafted bone eventually sequestered but left a base of clearly vascularized healthy graft beneath.

It has thus been our experience that autogenous bone graft in the Dwyer wedge is unnecessary, the purpose being served most adequately by Kiel deproteinized calf bone.

#### The Problem of Skin Closure and Healing

Any surgical procedure on the medial side of the foot that adequately corrects a talipes equinovarus deformity must increase the distance between the medial malleolus and point of the heel. The further insertion of a large wedge of bone into the medial aspect of the os calcis widens this gap by a considerable amount, and the surgeon's ingenuity is fully taxed to achieve skin closure without tension.

The problem is more acute when dealing with a case that has previously undergone a medial soft tissue release through a 'J' shaped incision. In our African patients the old scar is frequently hypertrophic, and skin is very short indeed.

In the operation as advocated by Dwyer, the os calcis is exposed by a curved incision starting well above the heel, and, sweeping across the medial aspect of the os calcis, finishes on the inner border of the foot. Regarding skin closure, Dwyer states that this is 'difficult and time-consuming, and is best started at the distal end with oblique sutures tied tightly to pull the widely separated anterior flap backwards and downwards. Even so, there often remains at the apex of the wound an oval gap needing further suturing'.

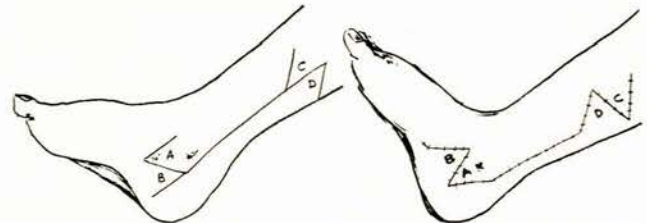
Even when skin apposition has been successfully achieved by this method, subsequent sloughing has occurred to a greater or lesser extent, the total healing time being measured in weeks rather than days, and a hypertrophic contracting and often keloid scar is the common sequel. In some cases these scars have exerted a marked bow-string effect, both at the heel and behind the ankle joint.

It seems clear that a plastic surgical approach to the problem is needed.

#### The 'Z' Plasty

To eliminate a straight contracting scar and provide additional skin length, 'Z' plasties are used: (1) vertically — along the medial aspect of the tendo achillis, and (2) over the os calcis and the medial side of the foot.

A straight vertical incision is made medially down to behind the medial malleolus, and broken over its upper half with 2 oblique limbs at 60°. From the lower point of this incision, 60° triangles are constructed to extend the incision as far forwards along the medial aspect of the foot as required (Fig. 2a). The wound is closed by transposing the triangular flaps so constructed (Fig. 2b).



Figs. 2a and b. (a) 'Z' plasty incision. (b) 'Z' plasty flap transposition.

Advantages of this technique are:

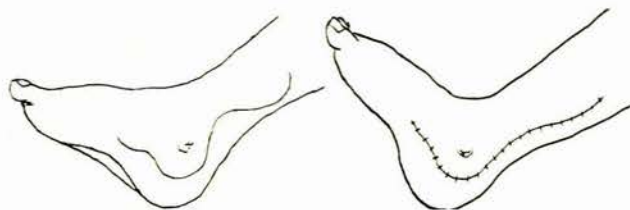
1. A gain of 50% in vertical length may be achieved.
2. A previous vertical or 'J'-shaped scar may be easily excised and replaced by the 'Z' plasty.
3. As the new scar produced has a broken line, subsequent contraction cannot produce a bow-string effect.
4. A good operative exposure is obtained.

With a large correction, however, even with this technique, wound closure may produce tension over the heel. If this occurs a further triangular transposition flap is lifted from the medial aspect of the instep, and moved towards the heel. The raw donar area of the instep is covered by a thick split-thickness graft held in position by a tie-over dressing.

In spite of these techniques, however, some cases did not heal by first intention. This problem has now been overcome by a less ambitious initial correction of the foot as the plaster was applied. As long as full correction of the foot could be achieved, the position was only corrected as far as possible without putting strain on the skin flaps. It is our policy to leave the foot in a partly-deformed position in the plaster — usually by leaving some equinus, and to achieve full correction at the first change of plaster under a general anaesthetic 14 days after the operation. Skin healing has usually been sound at this stage and not embarrassed by the tension of complete correction.

### The Lazy 'S' Incision

The 'Z' plasty, while obviously valuable, does require expertise in its execution, handling and resuturing, and can be time-consuming. A simpler method for the average case was then sought, providing no previous scar was present. By replacing the original straight-limbed 'J' incision with a very sharply waved serpentine or lazy 'S' type, an easily executed way of gaining skin was found. This incision is best started with a downwardly convex cut situated between the medial malleolus and the point of the heel. From here the long vertical and short horizontal limbs of the exposure are broken up with sharp 'S' inflections, as far in either direction as is required (Fig. 3a).



Figs. 3a and b. (a) Serpentine appearance of lazy 'S' incision. (b) With skin gain, closed 'S' incision straightens to a 'J' shape.

The shape of the skin incision alone, however, achieves but a small skin gain. The essential feature is to undermine the superior flap sufficiently so that in effect a very wide-based triangle of skin may be induced to slide downwards and backwards to a considerable extent. In the thin patient this flap of skin lifts off the deep layer of superficial fascia with no difficulty, and the thickness of the flap is thus more or less predetermined. In the fat child, however, it has been our policy to leave the edge of this flap thin and deepen the incision progressively until by the time the medial malleolus is reached, there is a tapering layer of fat attached to the skin flap. Undermining of this flap must be ruthless and carried out to well beyond the medial malleolus—or a gain in skin will not be achieved.

Resuturing of this flap is perfectly straightforward, and it is interesting to note that an incision that commenced as a very wavy 'S' indeed, closes in the form of a 'J'—an indication of skin gain (Fig. 3b).

If additional length is required in the vertical limb over the tendo achillis, or should this close in a straight line that would be better broken, a small 'Z' plasty may be carried out at the upper end of the incision.

Skin healing with the lazy 'S' incision initially followed the same pattern as with the 'Z' plasty. Where full correction of

the foot was forced and maintained at the time of operation, some edge sloughing of this incision always occurred, whereas if full correction was delayed until the first plaster change at 2 weeks, healing by first intention was the usual result.

Haematoma formation has been observed under the large anterior flap in 2 recent cases. Since then we have taken the added precaution of removing the tourniquet and compressing the wound until haemostasis is complete, before applying the plaster-of-paris cast.

### EVALUATION OF THE SKIN INCISIONS

The management of skin closure in the Dwyer osteotomy falls into 2 distinct categories:

1. Where the heel is unscarred by previous surgery.
2. When a previous soft tissue release or tendo achillis lengthening has left a contracted scar.

In the case with no previous operation, it is now our policy to use the lazy 'S' incision, because it is easier to plan and quicker to close. Even when considerable corrections have been achieved, skin closure is relatively easy by this method, and as long as full correction is not held at the time of operation, healing is seldom a problem.

Where, however, previous scars exist on the medial side of the ankle, the 'Z' plasty comes into its own. The usually encountered scar is either 'J'-shaped or vertical along the medial aspect of the tendo achillis; and either may be easily excised and incorporated into the 'Z' plasty. Particularly where a 'J'-shaped scar is present, the 'Z' plasty is the only incision we know that will give an adequate exposure, allow excision of the old scar, and still permit skin closure over a lengthened and everted heel.

### CONCLUSION

The use of Kiel deproteinized calf bone in place of autogenous graft in Dwyer opening medial os calcis osteotomy is simple and entirely satisfactory.

Following previous surgery, a 'Z' plasty; and in the unscarred foot, a lazy 'S' incision, have given the most satisfactory results in this operation.

### REFERENCE

1. Dwyer, F. C. (1963): *J. Bone Jt Surg.*, **45B**, 67.