TILTING THE SOLES OF THE BOOTS, AND ITS USE AS A MEANS OF TREATMENT IN VARIOUS COMMON CONDITIONS.

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I venture to publish these few notes on this subject chiefly because I feel that it is not as widely known as its merits deserve, and also because the application of the treatment is very simple and yet extremely efficacious.

Alteration of the plane of the sole by tilting or crooking the boot was first practised and brought into prominence by the late Mr. Thomas, and although the actual method of altering the boots has been somewhat modified by Mr. Robert Jones, the original principles remain unchanged.

In the Thomas boot the waist was completely blocked in, and a wedge of leather which extended from the back of the heel to just behind the bend of the sole, a point just posterior to the heads of the metatarsals, was then adjusted (Fig. 1). The leather wedge was not produced along the whole length of the sole as the latter would have been thereby made too stiff; the purpose of blocking in the waist of the boot was simply to afford greater support to the instep in its altered position.

The obvious disadvantages of this boot were its considerable weight and also its rather noticeable appearance. To obviate these two faults and also to allow for play of the muscles of the sole Mr. Robert Jones now applies separate wedges to the heel and sole, raising the whole length of the heel but only applying a small wedge to the sole, so that the flexibility of the tread is not interfered with. Instead of completely filling in the waist where the ordinary short heel does not sufficiently support the foot the heel is lengthened, and, if necessary, at the same time slightly broadened or skewed on the elevated side (Figs. 2 and 3). The sole and waist of the boot should be hammered on an old iron last, and should not be allowed to take a convex shape. With this modified form of boot, without the filled-in waist, it is essential that it shall be made of strong leather, as there is a considerable tendency for it to sag after the heel has been crooked. The thickness of wedge advisable varies in different cases from
\frac{1}{2} \text{ in. to } \frac{1}{3} \text{ in., though a quarter-inch wedge, if properly applied, is sufficient in the majority.}

The method of altering the boots having been thus shortly described, the results of the alterations may now be discussed.

The effect of raising the outer side of the boot is to throw the strain of the body weight somewhat inwards while the patient is standing, and by making him walk, as it does, with the toes turned out, the line of strain in walking is also inclined towards the inner part of the foot. For this same reason—that the patient walks with the toes turned out—the external lateral ligaments of both ankle and knee are relieved of strain and the body weight is largely borne by the outer half of the knee joint.

Where the inner side of the boot is raised we have, of course, just the opposite results to those in the previous case. The body weight is thrown rather to the outer side of the foot in standing, the feet are kept parallel or slightly inturned, so bringing the line of strain in walking through the outer part of the foot, the internal lateral ligaments of ankle and knee are relieved of strain, and the body weight is transmitted mainly through the inner half of the knee joint.

The cases in which the external wedge may be used with advantage are not numerous, but the following two instances may be mentioned:—A small wedge to the outer side of the foot will correct a tendency to intoeing; whether or not it is always a sound line of treatment to correct intoeing will be discussed later. The other instance is in the post-operative treatment of certain talipes equino varus cases. We frequently see patients with this type of club foot who after operation have got quite serviceable feet, but in whom the result is to a large extent marred by the persistence of more or less intoeing. Apart from this intoeing being unsightly it is the position in which a relapse of the varus deformity is most likely to occur. Even though the patient does not actually intoe, a tendency to recurring varus can to a great degree be prevented by tilting the outer side of the boot, for in this way the large part of the body weight is thrown on to the inner side of the foot. I do not for one instant suggest that the intoeing in all these post-operative cases can be cured by an external wedge, for we not seldom see cases where the long axis of the feet lies in an absolutely transverse plane, and in these the statics of the limb are so upset that this line of treatment would have little or no effect. In these cases the deformity must be overcome by an operation, the nature of which will depend on how
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**Fig. 1.**
The original Thomas boot with filled-in waist.

**Fig. 2.**
Modified Thomas boot. Heel crooked and elongated.

**Fig. 3.**
Modified Thomas boot. Heel crooked, elongated and skewed.

Cross-section of heel in Fig. 1 or 2, to illustrate application of wedge.

**Fig. 4.**
Direction of body swing.

**Fig. 5.**
Direction of body swing.
much the intoeing is due to internal rotation at the hip and how
much to twisting of the fibula round the tibia.

Just as the external wedge is used for intoeing so the internal
wedge can be applied for out-toeing. It certainly is an unfor-
tunate fact that the average parent totally neglects out-toeing in
his children, though should they show any tendency to turn their
toes inwards an attempt is at once made to try and correct
it. This is unfortunate because, although intoeing is an ugly
deformity, of the two faults of in and out toeing the former is
much less likely to give rise to secondary troubles later on.

To understand what is the ideal position for the feet in
walking we have to realise the following points:—The foot is a
sort of compound lever made up of a number of parts connected
together by what are practically hinge joints whose axis of move-
ment is, roughly speaking, in the long axis of the foot. To preserve
the full action of these hinge joints it is obvious that the line of
strain, or, in other words, the direction of forward movement of
the body, must correspond fairly nearly with the line of the long
axis of the foot; any marked deviation between these two lines
will throw some of these joints more or less out of action, and
will put an untoward strain on those still left in use. If the
deviation is great the gait will become stiff owing to the fact that
the hinge action of most parts of the foot is in abeyance. Apart
from the effect the position of the foot has on its movement, it
must be remembered that all parts of the arch of the foot are
not equally adapted for strain, for the inner side is mechanically
less able to bear weight than the outer. As the results of
experiments it has been found that, taking into consideration
the movements of the parts and the capabilities of the different
parts of the arch to bear strain, the ideal line of strain should
pass from the centre of the heel approximately through the head
of the third metatarsal. Though progression is, in sum, directly
forwards, the body actually swings slightly from side to side as
the weight is thrown successively on to each foot, so that the line
of strain or direction of swing is somewhat divergent in the two
feet. It will be seen from Fig. 4 that if the line of strain is to
pass through that part of the foot mentioned above it is necessary
for the inner borders of the feet to be kept parallel. Fig. 5 shows
how even in a case of moderate out-toeing the strain is thrown
quite obliquely across the foot to its inner side. Figs. 6, 7, and 8
are impressions of a normal foot taken in walking, and demon-
strate well the effect the position of the long axis of the foot has
in changing the weight distribution. In Fig. 6 the feet are parallel, and it will be noticed that the pressure, the degree of which is indicated by the intensity of the print, is distributed fairly evenly along the heads of all the metatarsals, while all the toes have been brought into use. In Fig. 7 the foot is turned outwards, with the effect that nearly all the weight is thrown on the head of the first metatarsal, and with the further result that the four outer toes are scarcely used at all. In Fig. 8 the toes are turned inwards, and in this case we have the stress on the outer part of the foot, while all the outer toes have been brought into action even more strongly than when the feet are parallel.

Having thus endeavoured to show what the best position of the feet is, treatment of in and out toeing may now be discussed. As was indicated earlier in this paper, we can overcome intoeing by the application of an external wedge, and out-toeing by an internal wedge. I would suggest that any marked degree of out-toeing, especially in children, should be treated on account of its predisposing effect to flat-foot and certain other troubles.

Before making an attempt to cure intoeing in children we must first make certain that the intoeing is not really an attempt on the part of nature to overcome a co-existing deformity such as knock-knee, flat or everted feet. In such cases as these just mentioned it is clear that if we overcome the intoeing we are really assisting in the aggravation of the more serious deformity. In this type of case we should not be in any hurry to cure the intoeing, but should first tackle the real cause of the intoeing, say the knock-knee for instance, and when it is cured, or when it has reached a stage at which it is unlikely to progress further, the intoeing is easily overcome as above indicated. Where the intoeing is not associated with any other deformity it may be thought advisable to treat it on account of its somewhat unsightly appearance, or because the child is liable to trip. The effect of the treatment must be closely watched, as if it is overdone it will probably give rise to symptoms of strain on the inner side of the foot.

The internal wedge is of the greatest assistance in the treatment of nearly all forms of flat-foot. Almost the only type of flat-foot where it is not applicable is the spastic type, for in these cases the condition is not due to faulty weight-bearing but to muscular spasm, and any attempt to invert the foot causes great discomfort, nor is it likely to be curative. At present the only satisfactory line of treatment in these cases seems to be resection
of portions of the tendons of both peroneus longus and brevis. The operation may be followed by the application of an internal wedge when the patient starts to walk again to diminish the chance of a recurrence, but, as before remarked, its use is in no sense curative.

From what has been said before it will be easy to see how the internal wedge assists in flat-foot cases, for while muscular weakness is the primary cause of flat-foot, faulty distribution of weight and strain is the strongest predisposing factor. From this it follows that probably the most important part the internally crooked boot plays is in the cure of the out-toeing which is so common in flat-footed persons, and which is bound by the strain it throws on the inner side of the foot to markedly predispose to the collapse of the arch of the foot.

Many medical men are firm believers in some form of instep pad or spring for the treatment of flat-foot, and may object to this crooking of the boots as being unnecessary. The arguments in favour of the Thomas boot or its modifications as against springs or instep pads are as follows:—Firstly, while there are many of the rather more acute forms of flat-foot who are absolutely unable to bear any direct pressure, such as is exerted by a spring, to their arch as it causes so much pain, the great majority of these patients can from the first wear the tilted boots not only without discomfort but with immediate relief from the flat-foot symptoms. Secondly, springs and pads do nothing to correct the faulty position of the feet for weight-bearing and for walking which, as has already been explained, the internal wedge does. Thirdly, footplates, springs, etc., keep constant pressure on the muscles of the sole which, of course, weakens them, and, though they may prevent further collapse, it can hardly be believed that they are able, without being extremely uncomfortable to the patient, to bring about the reconstruction of an arch which has given way. By the application of the internal wedge the foot is kept in a slight but constant varus position which alone, and apart from the fact that the tendons and ligaments on the inner side are so enabled to tighten up, will tend to the reproduction of the natural arch to some extent.

It is impossible to lay down any hard-and-fast rule as to how long a patient should continue to wear the modified boots, for no two cases are exactly alike. Perhaps the best test as to whether the wedges may be discarded or not is to let the patient go back to his ordinary boots for a time and see if he has any recurrence.
of the flat-foot symptoms. I notice, however, that patients get such a feeling of support and comfort from the crooked boots that they are in no hurry to discard them, and often prefer to go on wearing them even though the flat-foot symptoms have completely disappeared. A very small wedge will be sufficient to make a patient walk with the feet parallel once the progressive stage of the flat-foot is passed, and should be applied to the walking boots as a merely preventive line of treatment.

The cutting and fixing of the wedges costs very little indeed, and need not necessarily be performed by a surgical bootmaker, both of which points enhance the value of this line of treatment, especially in the case of poor hospital patients.

I need hardly add before dismissing this subject that flat-foot exercises should play an important part in the treatment, as the proper tonicity of the muscles is an essential factor in the cure of the condition.

The internally crooked boots are of distinct value in certain cases of derangement of the internal semilunar cartilage. Displacement and subsequent nipping of the cartilage is said by some authorities on the subject to be almost necessarily dependent on a stretching or rupture of the internal lateral ligament to which the cartilage is normally firmly adherent. (One's clinical experience bears out this point in that first displacements occur either as a result of some degree of violence—when it is associated with pain on pressure over or when strain is thrown on this ligament—or else in patients such as miners, whose habitual working posture tends to stretch this ligament.) Besides the part played by the internal lateral ligament it is common knowledge that external rotation of the tibia on the femur is another almost essential factor in the nipping of the cartilage. Now the internal wedge makes the patient walk with the feet parallel or even intoed, and so both renders the leg less likely to be externally rotated if the toes catch on any object, and also avoids all strain on the internal lateral ligament of the knee, so giving it a chance to either reunite again firmly or to tighten up to its normal healthy state. For these reasons one applies the internal wedge for a time in cases of first displacement, where one expects to get a permanent cure without operation when the patient starts to walk again after having kept the part at rest for the appointed period. Again for the same reasons mentioned above one uses it in cases of what may be called the chronic recurrent type, where for any reason an operation is contra-indicated. In these latter cases one
should usually prescribe what is called a cage splint (a form of hinge splint) for the knee, to limit movement to some extent and to prevent lateral deviation at this joint.

I would in conclusion like to mention the use of the internally crooked boots in early knock-knee cases in which there is not a very aggravated deformity. Slight cases of knock-knee in children up to about the age of three or three and a half may be materially improved by this treatment, unless, as is sometimes the case, nature is already attempting a cure by making the child walk with the toes inturned. More marked cases, early cases where the child is already intoeing, and cases between the age of 3 or 4 and 6 or 7 years are best treated by a knock-knee iron, which is a rigid metal splint extending from the heel to the trochanter, in addition to the internally crooked boots. After the age of 6 or 7 years an operation is nearly always necessary for the correction of the deformity, except in so far as it is due to laxity of the ligaments. The explanation of the treatment is that as the majority of knock-knee patients turn their toes outwards the internal wedge is applied to counteract this fault and so to transfer the weight from the external half of the knee joint to its inner half, and at the same time to relieve the internal lateral ligament of strain. The obvious effect of these changes is to permit of more free and rapid growth of the bony structures on the outer half of the joint. As was mentioned above, the crooked boots and splints avail little after the age of 6 or 7 years, but provided this limit is not passed they are retained till the deformity is overcome and until the lateral ligaments have completely tightened up.

These principles of the treatment of the above conditions by this method of tilting the boots have been entirely gathered during my visits to the clinic of Mr. Robert Jones of Liverpool, and I am deeply indebted to him for being able to publish these notes.