

Current Practice

Flat Foot

W. H. GERVIS,* M.B., B.CH., F.R.C.S.

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"If ever the facts about bees are to be fully grasped, then credit must be given rather to observation than to theories, and to theories only if what they affirm agrees with the observed facts."—ARISTOTLE.

This statement written long ago remains as a perfect example of concise scientific thinking. We might do well to consider if some of our theories agree with the observed facts. Take, for example, flat foot. There is a theory that there is an arch to the foot supported by ligaments and muscle tone. Now let us consider the observed facts. In a normal footprint the lateral border of the foot is resting on the ground (Fig. 1). For ease of examining foot and footprint the patient stands on a stool with a glass top and mirror beneath in order that foot and footprint can be seen at the same time.^{1 2 3}

In the earlier stages of flat foot, and this applies to most schoolchildren, the lateral border of the foot is no longer weight-bearing, and the footprint consists of heel and metatarsal heads only (Fig. 2). Thus we have the amusing paradox that a normal footprint is not that of an arch but becomes an arch in the first stage of flat foot. In more severe and old-standing cases the lateral border becomes weight-bearing again, and finally the whole plantar surface becomes weight-bearing, as in the classical flat foot footprint.

If we observe a normal foot from the back, the heel, and therefore the calcaneum, is vertical under the tibia (Fig. 1). In flat foot the heel, and therefore the calcaneum, is no longer vertical but is leaning over to the medial side, thus the foot is out of balance (Fig. 3). Looked at from the front the medial border of the foot in the region of the navicular is unduly prominent (Fig. 2).

If we observe a normal foot from the back the heel, and cases the patellae are not pointing in the direction of the feet but are pointing medially (Fig. 2). Thus if the patient is standing feet parallel the patellae will be pointing medially; if the patient is standing out-toeing the patellae will be pointing forward.

If we now make the patient correct this medial rotation of the legs and stand patellae pointing in the direction of the feet, it will be observed that the flat foot deformity is corrected. The calcaneum is no longer leaning over and the footprint becomes normal, with the lateral border weight-bearing (Figs. 1 and 4).

Thus observation suggests that the flat foot deformity is produced by a medial rotation of the talus, carrying the cuneiforms to the medial side and causing the foot to lean over, for it can be corrected by correcting this rotation. Of course,

old-standing cases with a fixed deformity cannot be corrected in this way.

It was noted that in most cases there is this rotation of the legs and therefore of the talus. There remain a few cases in which the patellae are pointing in the direction of feet but yet there is a flat foot deformity, often severe, with fourth-stage footprint, the whole sole being weight-bearing. If such a case is seen in the early stage before the deformity is fixed—in a toddler or young child—it will be found that the deformity is corrected when the foot is held in the in-toeing position of 30 to 40° while the patella is pointing forward. This suggests that such children are suffering from a medial torsion of the tibiae and are naturally pigeon-toed. Treatment of the medial torsion will correct the flat foot deformity. This again supports the theory that flat foot is due to a medial rotation of the talus.

If a vertical section of a normal foot is made through the base of the fifth metatarsal and tarsus it will be observed that the articular surface on the fifth metatarsal for the cuboid is more on the superior surface than posterior and that the cuboid is resting on it. In like fashion the articular surface on the cuboid for the lateral cuneiform is not on the medial surface, as some books claim, but on the superior surface. It does face slightly to the medial side, but is more nearly horizontal than vertical. Thus the lateral cuneiform rests on the cuboid, the cuboid rests on the base of the fifth metatarsal, and the latter rests on the ground, for in a normal footprint the lateral border of the foot is weight-bearing.

The lateral border of the foot is therefore built like a rough wall, with one bone resting on another but leaning slightly to the medial side. The top course of the wall is overhanging in the region of the medial and intermediate cuneiforms and these with the first and second metatarsals produce the appearance of an arch on this side of the foot. As, however, the cuneiforms are firmly bound together and to the navicular, this overhanging top course of the wall cannot collapse vertically down. It can collapse only if the wall falls over. This happens when the talus is rotated medially carrying the navicular and cuneiforms medially, with the result that the whole foot leans over to the medial side. Thus in flat foot an arch does not collapse vertically downwards but the foot leans over to the medial side. These considerations have an important bearing on the diagnosis and treatment of flat foot. The condition can be diagnosed and its severity assessed only by observing and palpating the extent to which the calcaneum is leaning over. Observation of the footprint on the stool described above is helpful but not essential.

Treatment

The treatment of old-standing cases in which the deformity is fixed and therefore cannot be corrected must differ from

* Consultant Orthopaedic Surgeon, Kent and Sussex Hospital, Tunbridge Wells, West Kent Hospital, Maidstone, and Queen Victoria Hospital, East Grinstead.

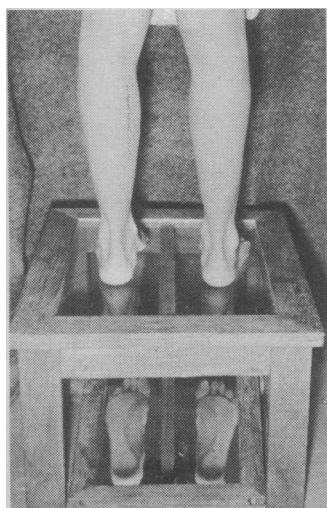


FIG. 1.

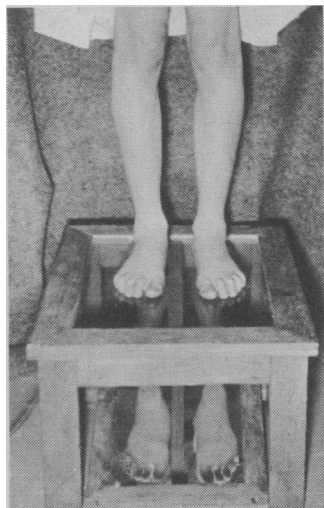


FIG. 2.

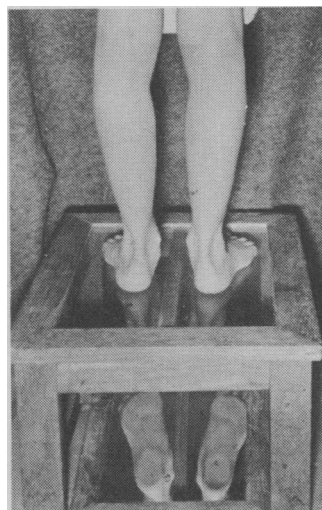


FIG. 3.

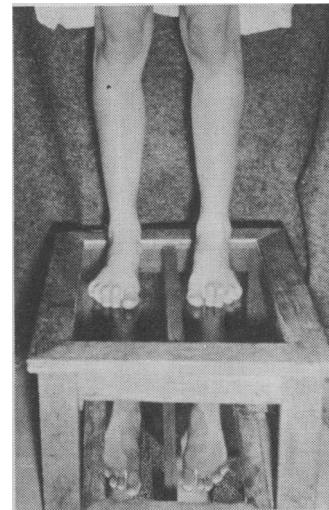


FIG. 4.

that of more recent cases where the deformity can be corrected. The treatment of the latter will be considered first.

Exercises

The usual object of exercises is to develop muscles, and in flat foot the object is to develop those muscles supposed to support the longitudinal arch. Obviously such exercises cannot achieve any direct benefit as there is not an arch supported by muscles. It has been observed, however, that a number of children improve after such exercises. It is more than probable that the improvement was due to training in foot action and balance rather than to the development of those muscles.

In the treatment of flat foot the first essential is to teach the patient to correct the medial rotation of the talus and thus stand in a position of balance. Postural training might be a better term for this form of treatment. It is not easy.

The children must be taught to stand feet parallel, patellae pointing in the direction of the feet, and the physiotherapist must make certain that the correction is complete and that the heel is vertical under the tibia. Children have got to be taught to stand like that all day and every day. The monotony can be varied by learning to walk with an active gait, rising up on the toes of the carrying leg as the aftercoming leg comes forward. The feet must be parallel. This gait must not be exaggerated, as in a bouncing type of gait, because the object must be to develop an active gait for use all the time. Walking in this fashion tends to pull the foot into the position of balance; therefore it is more likely to be in balance when they stand. The child stops treatment when it can stand corrected and walk properly, but must be seen again after three months, for a number will relapse and require a refresher course of treatment.

Support

An arch support, as its name implies, might support the vertical thrust of an arch collapsing. In flat foot, however, the foot is leaning over and the thrust is to the medial side, which an arch support cannot counter, nor can it correct the rotation of the talus. Thus arch supports are quite useless in the treatment of flat foot, and observation confirms this. Arch supports, however, are worn extensively, and many claim relief of pain which they attribute to the cure of flat foot. Examination of such cases, however, shows that they are not suffering from flat foot and never were, but were suffering from forefoot pain. Pain under the metatarsal heads or about the metatarsophalangeal joints of the small toes is another subject, the pathology of

which is usually glossed over in such terms as dropped metatarsal arch or metatarsalgia. It is usually forgotten when examining the patient that she was wearing a heel at least $1\frac{1}{2}$ in. (4 cm.) high, hence altering the balance of the foot and throwing an extra 2 stone (12.7 kg.) on to the fore part of the foot in the average case. An increase in weight is also thrown on to the head of the longest metatarsal. An arch support can counteract this effect of a heel by spreading the load under the whole sole of the foot, with consequent relief of pain.

Built-up Shoes

It is rather optimistic to expect that simple wedging of a shoe can prop up the leaning calcaneum and make it vertical, especially as the rotation of the talus is not controlled by the wedging. Thus the results are disappointing. It is popular because it is easy.

Special built-up shoes are much advertised and much used. They correct neither the rotation of the talus nor the deformity. Being stiff and heavy, they encourage a farmer-plod type of gait out-toeing, thus perpetuating the rotation of the talus and often making the condition worse.

Medial Torsion of Tibiae

The ideal time for the treatment of this condition is in the toddler stage. Mothers either complain that the child walks in-toeing or they have noticed that the ankles are leaning over. Diagnosis is facilitated by the stool. There is usually a severe flat foot deformity with fourth-stage flat foot footprint, that of the whole sole, but the patellae are pointing forward. If the foot is then held in the in-toeing position, thus pointing in the direction of the talus, the deformity is corrected and the footprint becomes normal.

At this age these cases are easily treated by means of night splints, the Denis Browne hobble splint, boots on a bar, feet turned out. The bar is bent, however, everting the foot in order that the lateral rotation is exerted on the tibia rather than the foot. By day the child has the opportunity to play barefoot in order to develop foot action and balance.

If the child is a little older and the deformity old-standing, then, after correcting the medial torsion in this fashion, the flat foot deformity remains and the child walks out-toeing. It is then necessary to manipulate the feet into the corrected position and maintain it in plaster-of-Paris casts, with rockers for walking. After two months the child can usually be taught to stand properly.

Footwear

What are the essentials for an ideal shoe? The idea is prevalent that the foot needs support. But as there is not a true arch that is about to collapse, and as no support can correct the rotation of the talus, support can serve no useful purpose. A stiff heavy shoe tends to encourage out-toeing, which is harmful. Playing barefoot tends to encourage foot action, and therefore proper balance, so should be encouraged. The less a shoe interferes with foot action the better. The ideal shoe should therefore be flat and flexible.

Old-standing Cases with Fixed Deformity

Treatment must vary with the age of the patient. In children and young adults it should be possible to manipulate the foot under an anaesthetic and maintain it in the corrected position in a plaster-of-Paris cast (nothing else can hold it in the corrected position). The patient walks in the plaster casts for two months and will then need considerable postural training to maintain the correction.

In older adults without symptoms leave well alone. With

slight symptoms forget the deformity, because it cannot be corrected at this stage without operation. Try merely to improve gait and function with physiotherapy. If there are more severe symptoms an osteotomy of the calcaneum is a satisfactory procedure. A wedge is taken from the medial side of the calcaneum which brings it to the vertical instead of leaning over, and this restores the proper balance of leg on foot. In elderly patients some can be helped simply by trying to improve foot action. In many there is an associated splaying of metatarsal heads with forefoot pain, which an arch support might relieve. In a number the pain is in the ankle joint, because the calcaneum is leaning over, and also in the talus, with resulting abnormal wear and tear on the ankle joint. Wedging sole and heel can often alleviate this to some extent.

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TODAY'S DRUGS**Drugs used in Vomiting**

With the help of expert contributors we print in this section notes on drugs in current use.

Numerous remedies are available for the control of nausea and vomiting, but few are of proved efficacy. Prescribers need only use these few—which are the basis of this account. The choice of drug depends upon the aetiology and mechanism of the vomiting. There are obvious instances, such as when it is in response to the ingestion of toxic or irritating substances, when vomiting is in the best interest of the patient and should be encouraged rather than suppressed. In other circumstances, such as digoxin toxicity, the symptomatic treatment of the nausea and vomiting may allow an undesirable situation to get worse by suppressing its most striking manifestation. Serious mistakes can be made when nausea and vomiting are treated uncritically as if they were primary disease processes rather than signs and symptoms.

Mechanism of Vomiting

A brief discussion of the mechanism of vomiting is essential to an understanding of drug action upon it. There are two centres in the brain stem concerned with vomiting, the more important of which is the *emetic centre*, which mediates all vomiting and is situated in the lateral reticular formation. This centre is activated directly by gastrointestinal afference and by fibres from higher centres and near-by brain-stem nuclei. A further vomiting centre is situated on the surface of the medulla and is known as the *chemoreceptor trigger zone* (C.T.Z.). This zone, which, as its name implies, is stimulated directly by centrally acting emetics such as digoxin and morphine, cannot directly induce vomiting but does so indirectly via the emetic centre, which is therefore the final common pathway. The vomiting of uraemia, of diabetic ketoacidosis, and of endocrine origin is probably mediated by the C.T.Z. Drugs such as atropine and its derivatives and certain anti-

histamines inhibit the emetic centre and can therefore prevent all vomiting, irrespective of origin. Drugs such as phenothiazines, which inhibit the C.T.Z., suppress only vomiting that is mediated by the C.T.Z., and they are therefore valueless in conditions in which the vomiting is due to direct stimulation of the emetic centre.

There is some value in dividing the causes of vomiting into two groups: (1) responses to afferent stimuli in the gastrointestinal tract—*peripheral vomiting*, (2) responses to various mechanisms operating in the brain stem and from higher centres—*central vomiting*. Nausea, an unpleasant autonomic syndrome characterized by sweating, salivation, and tachycardia, is usually more severe in vomiting of central origin.

Central Vomiting**Emotional**

A wide variety of assaults upon the senses, such as unpleasant smells or tastes and repulsive or frightening sights, cause vomiting. This is not subcortically mediated—if it were, all medical students would have to cut short their first visit to the dissecting rooms. Certain psychologically disturbed patients, usually with anxiety states, often with hypochondria, steadfastly vomit in the absence of an organic cause. Specific drug therapy or psychotherapy might be of avail in such patients.

Organic Brain Disease

Vomiting almost always occurs when there is raised intracranial pressure. It is thus a feature in hypertensive encephalopathy, cerebral tumour, and certain other conditions, such as encephalitis, meningitis, and subarachnoid and cerebral haemorrhage, where medullary irritation may also play a part. The symptomatic treatment of vomiting in such conditions is important, prochlorperazine or cyclizine being ideal drugs, but such drugs can alleviate the symptoms of some of the above conditions and so obscure a diagnosis. In appro-