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BY

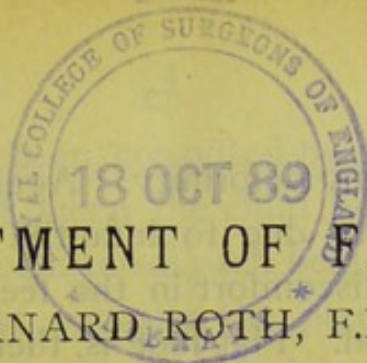
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THE TREATMENT OF FLAT FOOT.

BY BERNARD ROTH, F.R.C.S.

I AM glad to be able to comply with the request of my friend Dr. Gibney, to contribute to a symposium on the treatment of flat-foot, especially as some of my views have materially altered since I wrote the article on this common deformity in "Heath's Dictionary of Practical Surgery," upward of two years ago.

Flat-foot may be defined as a falling down or giving way of the normal arch of the foot, which may be so slight as to escape notice, except from the discomfort it causes, or be so severe that the whole tarsus presents as great a convexity inward as it ought to present a concavity, with the foot so everted that the internal malleolus touches the ground, while the outer border of the foot is raised, with the sole directed outward, as in some cases of infantile paralysis.

Sir James Paget speaks of "the constant pain and weariness of the lower limbs associated with flat-foot. The feet are elongated, flat, low, without insteps; the heels are too little prominent, the plantar arches sunken, the ankles thick; the astralagus, navicular, and inner cuneiform bones are below their right level. The pains complained of are those of the muscles and tendons, which are habitually overworked in the task of keeping the body erect when its proper bearings on its supports are disturbed." I consider this description applies to a severe case not due to infantile paralysis. Pain and much deformity are not always associated together; growing boys and girls approaching puberty are frequently brought to me, complaining of severe pain in the insteps, whose feet

exhibit scarcely any deformity. Again, the severest cases of deformity, those due to infantile paralysis, frequently have no pain or discomfort in the feet, although sensation is perfectly normal. Flat-foot is, therefore, a very general term, and requires some sort of clinical classification if surgeons are to come to any agreement on the proper treatment. I think the best classification is one I proposed some years ago, viz.: (1) Cases in which it is possible to restore the foot completely to the normal shape by passive manipulation, without any force exerted by the surgeon, or by making the patient stand with the heels raised; (2) cases where the tarsal bones have become more or less fixed in their displaced positions by shortened ligaments and tendons, osseous deformity of the articulating surfaces, and fibrous or osseous ankylosis, which require forcible manipulation under anæsthetics to restore more or less of a normal arch; (3) intermediate cases, in which a partial restoration of the tarsal arch is possible without "brisement forcé."

A few words must be devoted to the causation of flat-foot, to enable us to obtain a correct view of the proper treatment. Mr. Le Gros Clark says: "In reviewing the action of the various muscles around the foot, it is obvious that their attachment is designed to preserve the plantar arch; and that such healthy condition must depend in great measure on the evenly balanced action of those muscles upon their several attachments. Thus the peronei and tibial muscles antagonize each other, and the expanded insertions of two of them into the tarsal bones is very instrumental in preserving the transverse as well as the antero-posterior arch."

I find that all infants on commencing to walk are normally flat-footed, without any tarsal arch, whereas after they have stood and run about a few months, and the leg-muscles have become developed, a perfect arch is formed.

I have several times been consulted by an anxious mother about her baby's feet, when the child begins to run alone, the normal absence of a tarsal arch being at first exaggerated by a pad of fat opposite the plantar aspect of the tarsus. I have always been able to reassure her, and to tell her that the feet would become arched in time and the adipose instep-pad disappear, and the result has proved my prognosis to be correct.

Anything that tends to weaken the general muscular system during years of growth will also predispose to flat-foot. Thus I find that out of every three cases of lateral curvature of the spine two suffer from flat-foot, and every other one severely so. Flat-foot is also intimately associated with knock-knee; the one may follow close on the other, or both deformities may arise simultaneously.

Injury or chronic disease of one leg, throwing extra work on the sound limb, is also apt to produce flat-foot in the latter.

Although the bones of the tarsus are apparently so well supported by their ligaments, and the tendinous prolongation of the muscles inserted in the sole, yet, as soon as these muscles shirk their work, from weakness or paralysis, undue strain is thrown upon the tarsal ligaments and they gradually yield, accompanied by more or less aching and pain, or none at all according to the idiosyncrasy of the sufferer. At first there is no osseous malformation, and, so long as this is so, more or less complete restoration to the normal is possible; but in time the articulating surfaces become altered in shape, the bones distorted, and the ligaments so shortened and thickened that, even with extreme "brisement forcé," under anæsthetics, only a partial improvement is brought about. Indeed, the production of osseous deformity of the feet is caused in exactly the same way as is that of knock-knee. Flat-foot is therefore directly due to

the weakness of the leg-muscles which are attached to the bones of the feet.

In the *treatment* of flat-foot we have to aim at the restoration and maintenance of the previously depressed plantar arch and the strengthening of the leg-muscles which tend to produce and preserve the normal arch of the foot. We have therefore to discuss (*A*) mechanical means for replacing and keeping up the plantar arch, and (*B*) therapeutic methods for strengthening the weak tibial muscles.

(*A*) In groups (1) and (3) a boot or shoe should be worn broad enough across the metatarso-phalangeal articulations, best made from a tracing of the stockinged foot; and, if the toes are much deformed or displaced, the stocking should be digitated and the toes well spread out on the ground. The heel of the boot should be low and broad, not more than double the thickness of the sole in front. For raising the depressed arch I have employed for many years a pad made of superimposed layers of felt, and this, combined with treatment for improving the muscular power, has had good results; every now and then, however, a case proved very obstinate. For the last eighteen months I have discarded pads altogether, and I no longer insist upon laced-up boots being worn; indeed, the more freedom left to the movements of the ankle the better, and I therefore allow shoes to be worn when desired. Instead of a pad which, if efficient, tends to bruise and irritate the already tender tarsus, I employ an increased thickening of the sole opposite the ball of the great toe and on the inner margin of the heel, according to the method of my friend Mr. H. O. Thomas, of Liverpool. His theory of the mechanical production of flat-foot appears to me to be the most rational; it is that in the normally constructed foot the lower end of the tibia is placed too much toward the inner border of the foot, so that the tendency of the tarsal arch is to give way under the pressure of the weight of the

body, and has to be constantly combated by the efforts of the strong leg-muscles inserted into the foot. If we had to create a new foot and leg, simply with the view of preventing flat-foot, we should plant the lower end of the tibia rather more toward the outer margin of the foot. The device of the wedge-shaped sole, with the base inside and the apex outside, tilts or rotates the foot on its longitudinal or antero-posterior axis and carries the lower end of the tibia toward the outer margin of the foot, and thus removes all or most of the pressure of the weight of the body as transmitted through the lower end of the tibia from over the tarsal arch, in the same way as in the imaginary newly created foot and leg. The increased thickness of sole is from one-fourth to one-half inch, according to the severity of the case ; an addition of a corresponding one-fourth or one-half inch is added to the inner margin of the heel, and this thickness gradually diminishes to nothing at the outer margin, which should be protected by a thin plate of iron or steel studs to prevent further differences of level of the two halves of the heel from wear. The same remarks apply to the increased thickness of the sole, which gradually tapers to nothing at the tip of the sole, as well as at its outer margin. This wedge-sole can be applied to boots already worn, and is equally efficacious applied to shoes. I believe that the benefit obtained by valgus-pads under the depressed instep is really due to the patient being forced to walk on the outer border of the foot to avoid the discomfort and annoyance of the pad pressing against the tarsal arch. Boots made, and so much advertised, with movable or spring-like waists are useless, and even injurious if the spring is prolonged to the outer margin of the sole, where the foot ought to rest entirely on the ground. As the chief movement in walking is at the metatarso-phalangeal articulations, it would be an advantage if this portion of the sole could be made of a more yielding leather.

In group (2), where the displaced arch cannot be replaced except by "brisement forcé," I would recommend this being effected by Mr. H. O. Thomas' club-foot wrench, under anæsthetics, and the foot kept in a suitable splint in the improved position till all symptoms of the traumatism have disappeared, and the patient then treated as in groups (1) and (3).

(B) Therapeutical methods for strengthening the weak tibial muscles; I know of no better exercise than walking on the toes with the heels raised an inch or so, taking care that they are not raised too much, for when the longitudinal or long axis of the foot behind the metatarso-phalangeal articulation is raised too vertically there is less work for the muscles, as much of the weight of the body is transmitted directly through the bones of the tarsus and metatarsus standing on end.

It is a good plan to order the patient to walk fifty steps on the toes before and after each meal.

The chief "medical gymnastic" exercises I employ are the two following: (a) is "sitting, foot inward circumduction, repeated forty times." The patient, sitting on the floor or couch, with the back supported and the knees extended, circumducts the foot down, in, up, and out, while the toes are directed inward the whole time; the knee and hip should be kept perfectly still. The leg should rest on a small pad just above the tendo Achillis, to leave the foot free. (b) is "sitting, foot adduction (surgeon resisting) and abduction (patient resisting)," repeated twenty times. The patient is placed in the same position as before; the surgeon fixes the leg just above the ankle with one hand while the palm of the other exerts a gradually yielding resistance to the patient's effort to adduct and invert the foot. On the completion of the adduction the patient strives to maintain this position of the foot while gradually yielding to the

pressure of the surgeon's hand gently pushing the foot back to the commencing position.

I sometimes employ another exercise, viz., walking on the outside edges of the feet with the soles directed inward and forward. Patients with flat feet will frequently assume this last position instinctively, to give relief to the overstrained ligaments of a displaced tarsus.

In cases of extreme weakness of the leg-muscles, rubbing (massage) of the leg-muscles for half-an-hour, once or twice daily, should be employed ; for the technique, I can only refer those interested to my article " Massage " in " Heath's Dictionary of Practical Surgery."

Necessarily in cases of infantile paralysis, where the muscles have completely wasted, only the mechanical portion of the above treatment can be carried out, with the addition of an elevating spiral steel spring to lift up the foot, for clearing the ground during walking, if there is foot-drop.

In all cases due attention should be paid to the general health, and to the removal of all debilitating causes.

Such severe treatment as the removal of a wedge-shaped piece of bone from the tarsal arch, under antiseptics, does not appear justifiable, and I have not yet seen a case which offered any reasonable probability of this treatment being of permanent benefit to the mutilated patient.

The effects of the treatment I advocate begin to be felt within a week or two by the patient, and I seldom see cases where all pain and discomfort have not disappeared within three or four weeks, some even within a few days. For the cure of the deformity, even slight cases require several months, and for severe cases I generally find that a year or more of perseverance with the boots and treatment are necessary.

I append a typical case, illustrating the treatment above described.

Mrs. —, wife of a member of the British Parliament, consulted me, July 7, 1884, with the following history : Two years ago she began to have discomfort in the feet after walking—"a feeling as if the ankles were too soft." The discomfort increased for six months, when she became a vegetarian, and, for a time, the pain in the feet was less. Since then the pain has become gradually worse up to the present. The patient is an active, extremely intellectual woman, fairly well nourished ; menses still quite regular, but inclined to be rather profuse; she can only walk up and down stairs, or a few yards out of doors, and that with considerable discomfort. I found both feet severely flat, (intermediate, or group (3)), with the pain and aching just under the arch of the instep, and described as "a dull, aching soreness" which becomes acute pain at times ; standing causes even more pain than walking. On August 25th, viz., *six weeks* later, patient wrote : "I am following your prescription as far as I can, and feel much better." Again, on November 18th, four months later : "I am a great deal better. . . . I have worn the boots, and, though painful at first [I employed pads at that time], I find now that they give me the greatest support. . . . I must thank you most heartily. . . . When I was in London I was trying to school my impatience to resignation to a walk of not more than a hundred yards at a time ; now I can walk two miles without much fatigue, and am astonished at the elasticity and youthfulness of my movements. I consider myself a walking advertisement of your surgical capacity !" This lady has continued well up to the present time.

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