Remarks on flat foot : made in the Section of Surgery at the Annual Meeting of the British Medical Association held at Bristol, August, 1894 / by Sir William Stokes.

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REMARKS ON FLAT FOOT.

Made in the Section of Surgery at the Annual Meeting of the British Medical Association held at Bristol, August, 1894.

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IT is only within the last few years that any methodical attempt has been made to place on a scientific basis the etiology, mechanism, and treatment of flat foot. Previously to 1882 all speculations on the subject were based on mere clinical observation. As a very typical example of this deformity has recently come into my possession I have deemed it not unlikely that its exhibition would be attended with interest on the present occasion, and perhaps make some points clear about the condition that were previously involved in obscurity. The only authorities who have dealt with the subject in any exhaustive manner have, so far as I am aware, been Hueter, von Meyer, Trendelenburg, Sir George Humphry, and Professors Symington, Ogston, and Sayre. As the deformity is by no means of infrequent occurrence, the limited amount of research that has been devoted to it is somewhat remarkable.

As regards the etiology of this condition the theories that have been held by those who have specially interested themselves on this subject have been three in number:—

1. That it is due to ligamentous relaxation.
2. To paralysis of certain muscles, notably the tibiales anticus, and posticus.
3. To congenital malformation.

Hueter points out that in the early periods of infant life the foot is first in a position of supination, but that as the power of walking commences this position is changed to one of pronation, and that when this is excessive and the position of the foot becomes one of hyperpronation, changes are apt to occur in the tarsal bones, resulting from the effects of alteration in pressure; but whether the excessive prona-

tion has its origin in an abnormal condition of ligaments or muscles does not appear. The theory which attributes the changes to ligamentous relaxation, more particularly of the inferior calcaneo-scaphoid ligament, is the one generally held, but this I may mention is not only questioned but distinctly disbelieved in by von Meyer.

Professor Sayre is of opinion that an important etiological factor in the production of flat foot is paralysis of the tibialis anticus—a condition which, as I have learned in Professor Symington's classical paper, Mr. Golding-Bird failed to find in any of his cases, which were fifty in number.

In the case from which this specimen was taken—a powerfully built muscular individual—there was no evidence of

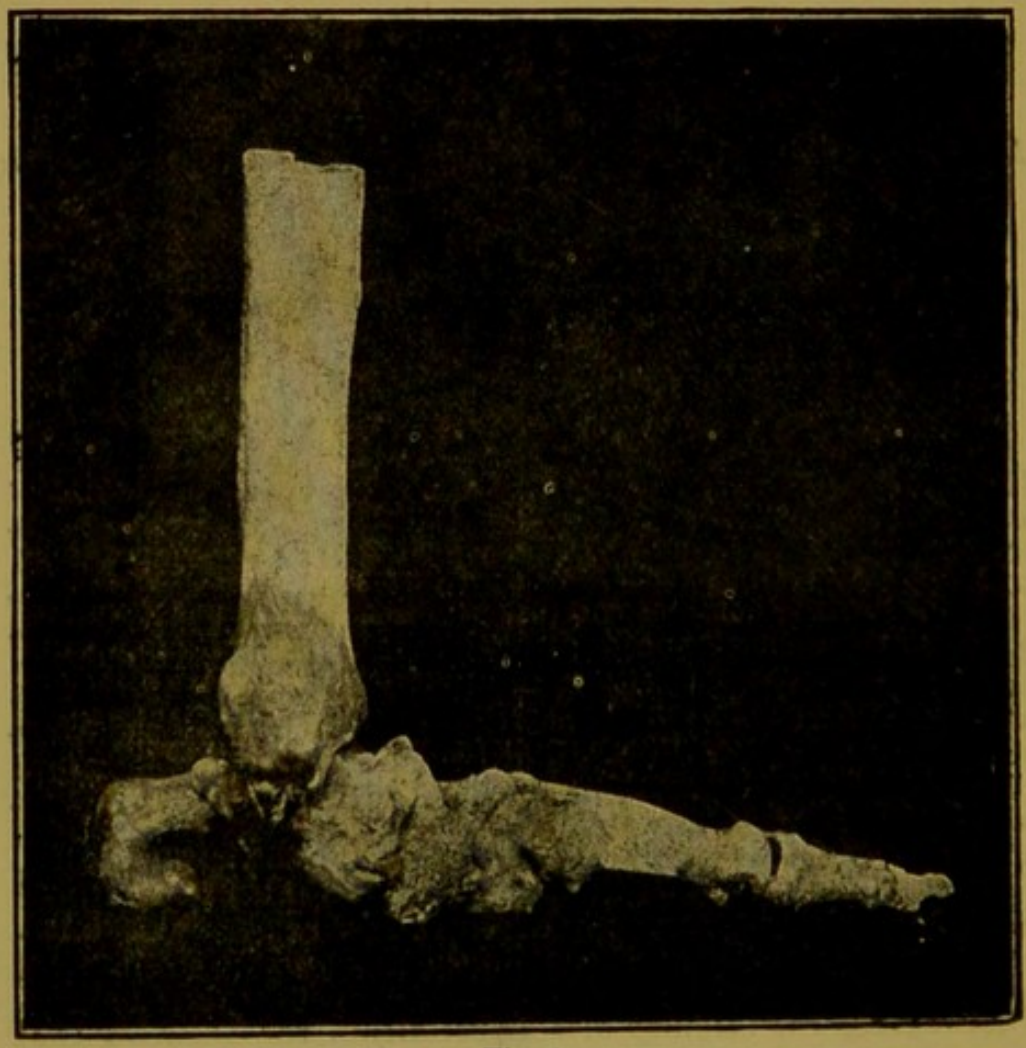

Fig. 1.

any atrophy, at all events of that, or in truth of any other muscle.

The theory based on muscular debility is to a great extent held by Sir George Humphry, who considers that the deformity mainly depends on "a persistent over-extended and incurved condition of the middle and chief joint of the tarsus, and is due to a wearying of the muscles, more particularly of the tibialis posticus and a stretching of the ligaments, more particularly of the inner part of the calcaneo-scaphoid, with the confluent forepart of the deltoid and calcaneo-cuboid."

Lastly, there is the theory of congenital malformation. Tamplin held that the defect was due to or the result of position, presumably a faulty one, of the foot during embryotic existence up to birth; and Eschricht that it was caused by an imperfect unfolding or unrolling of the limb during the fœtal state.

It seems to me that probably all three alleged determining factors in the production of this condition may act either singly or together. Certain it is that it is hard to understand how a mere relaxation of ligaments or weakness of one or more muscles could bring about the remarkable alterations in form of some of the tarsal bones which are observed in so many of these cases—conditions which necessitate so much variation in their operative treatment. The two bones which

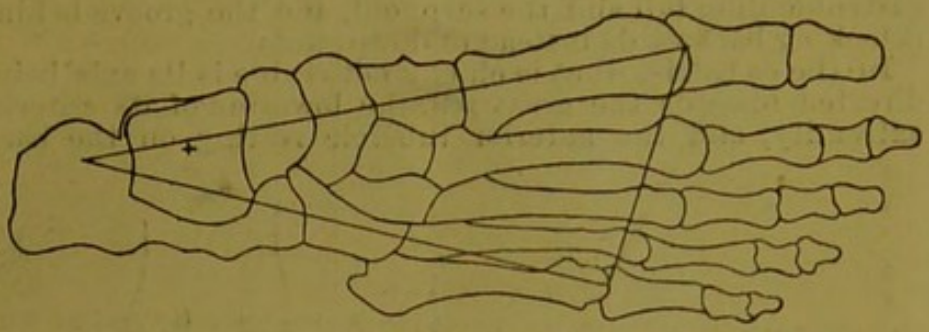

Fig. 2.

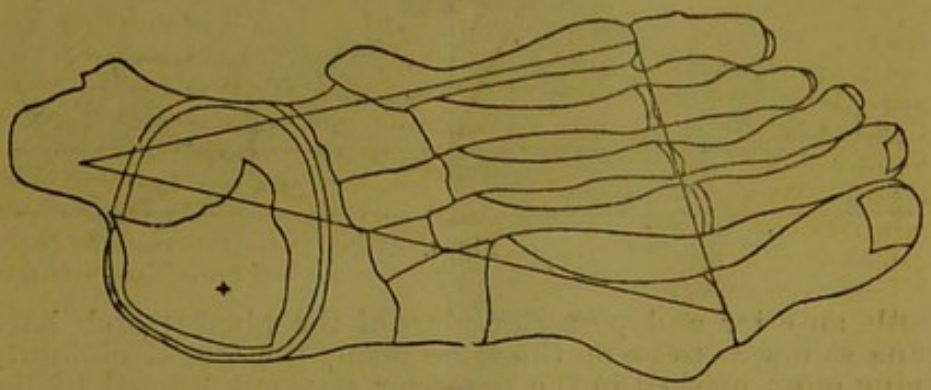

Fig. 3.

more than any others of the tarsus are specially liable to these changes are the astragalus and the os calcis.

The first thing noticeable in the specimen, of which the drawing on previous page, taken from a photograph, gives some idea, illustrates the way in which the astragalus is displaced to the inner side of the foot. This is clearly shown by observing the relation of the trochlear surface of the astragalus to the inner side of von Meyer's triangle. This indicates the sole of the foot, and is made by uniting three points—the centre of the heel and the heads of the first and fifth metatarsal bones. Professor Symington thinks it would be more accurate to make the apex of the triangle correspond to the internal tubercle of the os calcis. He has shown that in the

normal condition the "astragalus point" by which he designates one which represents the centre of gravity of the astragalus, and is the highest spot on the axis of its trochlear surface, lies on the inside and not within the triangle, as it usually does in the normal state. This is of importance to note, as it indicates a condition which should, if possible, be fulfilled in any operative measure that may be undertaken to remedy the deformity.

The changes in the astragalus are chiefly observable in the head, which is much hypertrophied and modified in shape. It has in front and below two facets, the longer articulating with the calcaneo-scaphoid ligament, and the other with the scaphoid. The head is twisted downwards, the axis of curvature passing through the neck, which is directed almost directly inwards. There is no gaping of the astragalo-scaphoid joint. A great distance is to be noted between the sustentaculum tali and the scaphoid, and the groove behind it looking backwards instead of downwards.

In the os calcis, what is chiefly noticeable is its axis being directed towards the great toe, the lowering of its anterior extremity, and the anterior tubercle resting on the base.

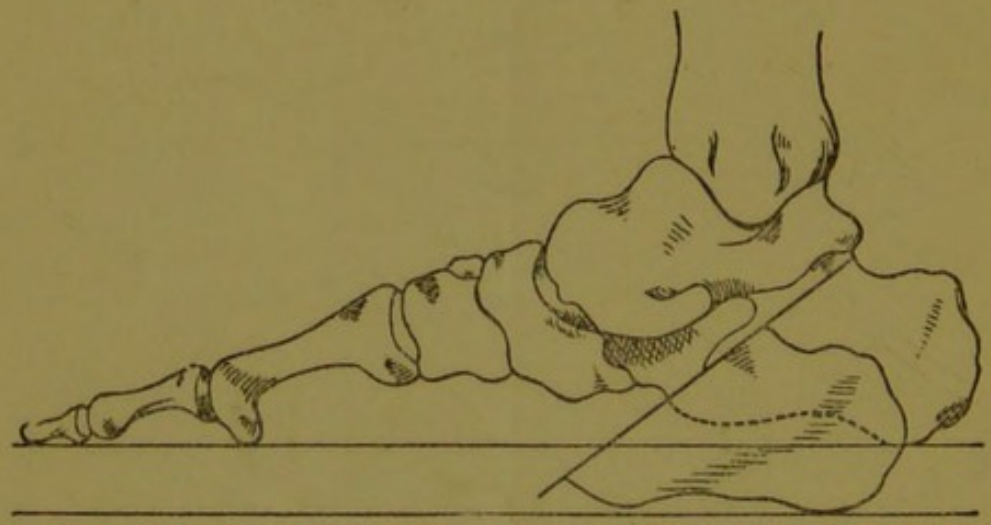

Fig. 4.

Both anterior and posterior piers of the plantar arch have sunk so low as to lie on the same plane, the loss of obliquity being most marked in the posterior segment formed by the os calcis.

As regards the surgical treatment of these cases, everything will, I think, depend on whether the deformity is reducible by manipulation or not; if it is, the probability is that there is no marked alteration in form of the bony structures, and the case will probably be benefited, if not cured, by supporting the arch by mechanical means, by douching, massage, and constitutional tonic treatment. For the more aggravated cases, however, surgical ingenuity has been much exercised in devising means of restoring the arch of the foot by operative measures. First among these I would mention Professor Ogston's ingenious operation, which consists in a resection of the astragalo-scaphoid joint, and, after restoring the arch, bringing about a firm osseous ankylosis between these two bones. Mr. Kendal Franks, in an able paper on this subject which he read some years ago in the Surgical

Section of the Academy of Medicine, discussed the merits of the procedure, and fully endorsed all that was said or written in its favour by Professor Ogston. Trendelenburg has suggested that in order to avoid the risks of involving the tarsal articulations, a supramalleolar osteotomy should be made; the foot being then forcibly adducted, the centre of gravity would be shifted more to a point on the long axis of the foot. It may have the effect of throwing the weight of the body more on the centre and outside of the foot, but cannot to any extent restore the arch. To do this a proposal has

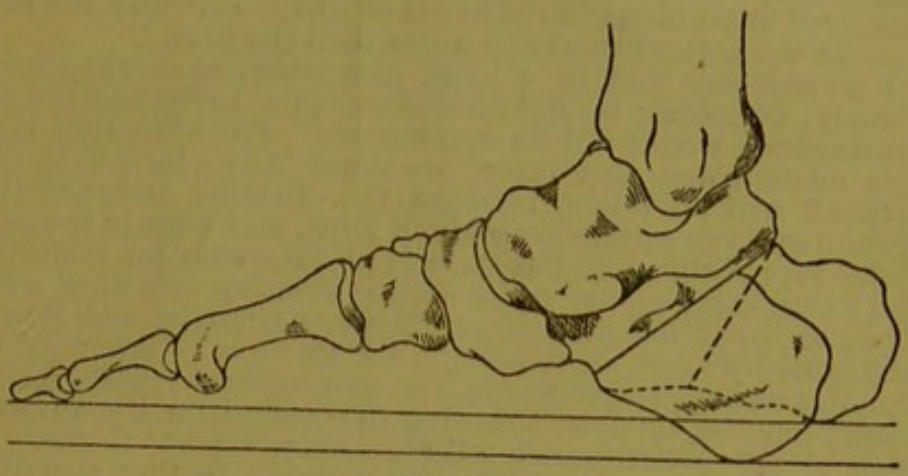

Fig. 5.

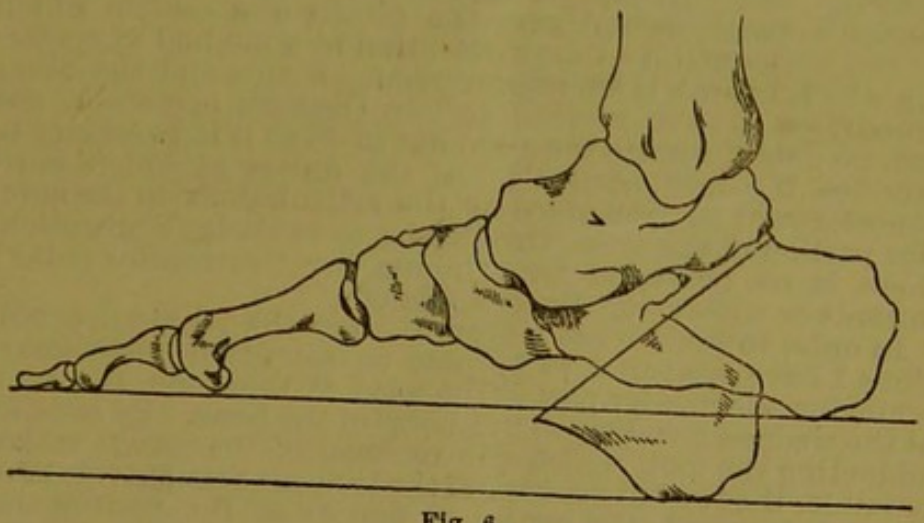

Fig. 6.

recently been made by Gleich which consists in making an oblique section through the heel of the os calcis after tenotomy of the tendo Achillis, and then transplanting the posterior fragment forwards and downwards, and fixing it in that position. The accompanying illustrations, taken from Professor Gleich's paper, explain the principle of his operation.

The angle made by the axis of the bone and the ground, which is almost lost in an aggravated case of flat foot, can be

materially increased, more particularly when, in addition to the oblique section already mentioned, a wedge-shaped piece of the bone is removed, which enables you to rotate the fragment still more forwards and downwards, and increase the angle already spoken of.

The incision made for reaching the os calcis is similar to that made in Pirogoff's amputation. I have tested the operation on the dead subject, and although the *techniqae* of the procedure does not present any elements of exceptional difficulty, yet I would apprehend great difficulty in maintaining in its new position the displaced fragment of the bone, and unless that were effectually done there would be considerable danger of non-union; in the event of which calamity the last state of the patient would be worse than the first.

I should say that in a large proportion of cases—those, namely, occurring in debilitated anæmic individuals—this contingency would not be improbable. But assuming that this mishap does not occur, we must then admit that the method will no doubt increase the distance between the ground and the astragalo-scaphoid joint, and elevate the posterior pier of the arch, but there is no provision for restoring the "astragalus point" to its normal position within or even close to the inner side of von Meyer's triangle, and it will undoubtedly have an effect similar to what is produced by the high-heeled boots which are patronised by fashionable young females, namely, throwing the weight on the anterior part of the arch; under which circumstances, if there be much ligamentous relaxation, a collapse in that situation might confidently be anticipated.

On the occasion to which I have already alluded—when, namely, Mr. Franks discussed the merits of Professor Ogston's operation, and gave the details of a case in which he had performed it—I drew attention to a method of operating which I think is an improvement on this and the other procedures I have alluded to. In Ogston's operation, one can, no doubt, restore the arch, but to do so it is necessary to sacrifice the medio-tarsal joint, the duties of which must henceforward be discharged by the articulations in the anterior portion of the arch. Then again, as in Gleich's operation, there is no provision for bringing the "astragalus point" towards or within von Meyer's triangle.

In order to fulfil what I deemed were the required conditions I have ventured to propose an astragaloid osteotomy, removing the greater part of the head of the bone, the apex of the wedge extending to the body of the bone. By forcibly adducting the foot, which the removal of the wedge makes possible, the two cut surfaces of the bone are brought together, the arch is raised, the centre of gravity at the "astragalus point" is made to approximate the inner side of the von Meyer triangle, and the medio-tarsal joint remains intact. The effects of removing the wedge-shaped piece of bone from the hypertrophied head and neck of the astragalus can well be appreciated by reference to the annexed drawings of an ingenious diagram or model, designed, made, and kindly furnished to me by Mr. Tenison Lyons, of the Meath Hospital. The first (Fig. 7) shows the situation of the "astragalus point" lying outside von Meyer's triangle; the second (Fig. 8) the foot after removal of the wedge-shaped piece of bone; and the third (Fig. 9) the foot adducted and the astragalus point on the inner side of von Meyer's triangle. The accompanying

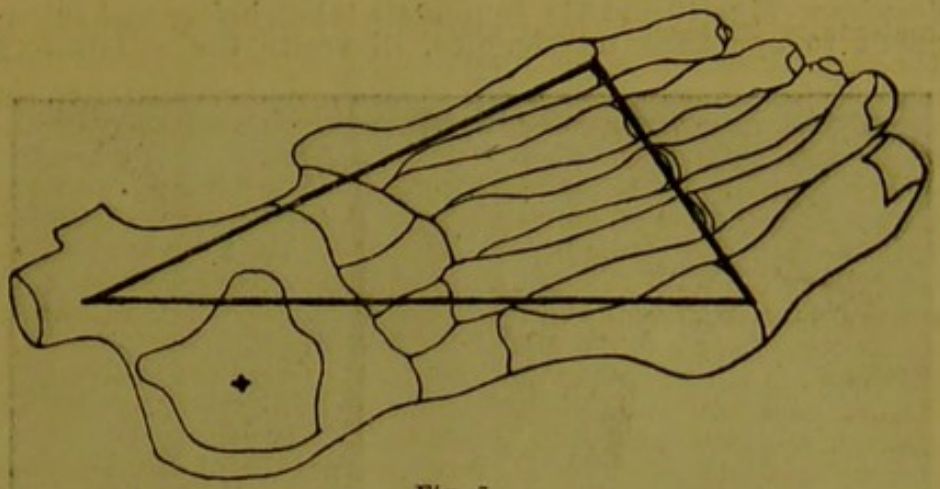

Fig. 7.

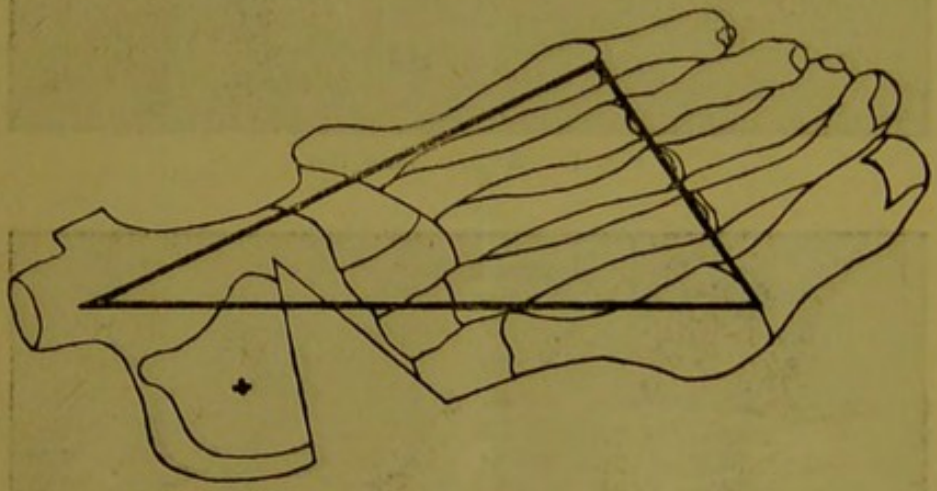

Fig. 8.

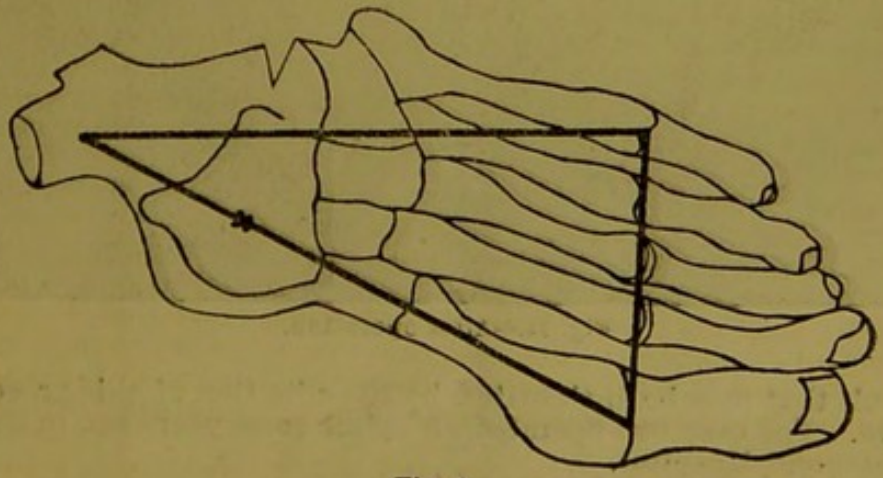

Fig. 9.

drawings (Figs. 10 and 11). from casts taken before and subsequent to operative interference, illustrate the satisfactory

Fig. 10.—Before operation.

Fig. 11.—After operation.

result that may be anticipated by the adoption of this procedure. The case was operated on by me some years ago in the Richmond Hospital.

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