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The Treatment of Club-foot by Continuous Leverage.

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THE TREATMENT OF CLUB-FOOT BY CONTINUOUS LEVERAGE.*

By HENRY LING TAYLOR, M.D.

In a paper written for this association and published in its *Transactions* for 1889, and in the *Medical Record* (March 8, 1890), the writer described and advocated a method of treating pes equino-varus by leverage continuously applied in such a manner as to progressively unfold and remold the deformed foot. The following practical points in the treatment were emphasized:

1. The preservation of the heel cord as an aid in unfolding the foot.

2. The reduction of the varus deformity first, afterward of the equinus.

3. Exact prehension of the foot by means of an apparatus not attached to the shoe, and by adhesive plaster applied to the leg.

4. The application of leverage to the inner side of the foot and leg.

5. Thorough mechanical after-treatment.

* Read before the American Orthopædic Association, New York September 21, 1892.

If in equino-varus the deformed member is viewed from behind, the foot and leg are seen to constitute an irregular curve with the concavity inward. The plan is to efface this curve and throw the foot into the valgus position by applying a lever to the inner side of the foot and leg, where it can act most directly and efficiently. In the case of an infant this can readily be done by means of a wooden splint or light strip of metal, padded, and bent somewhat less than the curve to be acted upon, and securely strapped at the ends to the fore part of the foot and to the leg below the knee, while the ankle is drawn toward this lever by a third strap placed a little above that joint. As the foot yields to the leverage thus applied, the lever is straightened and the process is continued until complete eversion of the foot is obtained. After the original curve formed by the inner border of the limb has been considerably reduced by this process, the anterior part of the foot is turned outward and in place of the single inner concavity we have two—the upper, formed by the os calcis with the tibia; the lower, by the os calcis with the metatarsus. The exaggerated concavity of the sole forms a third abnormal curve. When this stage is reached the splint should be well padded opposite the os calcis, so as to engage it and pry it over into place, since the position of the os calcis is finally the key to the situation. No effort has been made up to this point to correct the equinus element of the deformity. "In equino-varus the tendo Achillis is inserted toward the inner side of the tuberosity of the os calcis, and the inner border of the tendon is shorter than the outer; by forcing the foot out and the os calcis over, it is stretched fiber by fiber, as when we tear a bandage from the tense edge, and when the valgus position is established the resistance is diminished." After overcorrection of the varus element, the tendo Achillis may be divided and the foot

flexed; but in most cases it may preferably be stretched by turning the set screw at the ankle joint of the apparatus soon to be mentioned. Up to this point all ordinary cases can be successfully treated by means of a simple home-made splint, if only the principles above outlined are care-

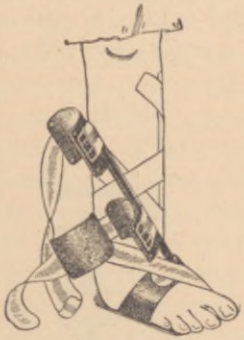

FIG. 1.

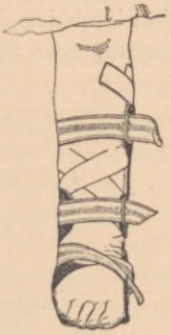

FIG. 2.

fully followed; but so soon as the deformity has been sufficiently reduced to permit the patient to place his sole squarely on the ground, he will need a retentive apparatus which will hold his foot until the tissues are stable in the corrected position and there is no tendency to the return of the deformity.

As a matter of convenience I am in the habit of applying leverage in these cases, both to reduce the deformity and to hold the foot in the corrected position, by means of a steel apparatus, the usual form of which is shown in Figs. 1 and 2, and which has previously been sufficiently described.*

This apparatus is at first adjusted to the deformed position of the foot by bending the steel shank near the ankle. It is worn day and night, is frequently readjusted, and,

* *Loc. cit.*

when necessary, the leverage is increased by straightening at the shank, so that a moderate corrective force is continuously exerted against the abnormal curves. All strapping is carefully guarded from harmful constriction, while precision of action is much increased by the use of a three-tailed adhesive plaster applied to the leg, and ending in a strip of webbing which is buckled to the side plate of the apparatus near the heel (Figs. 3 and 4), and which gives

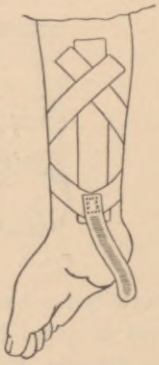

FIG. 3.

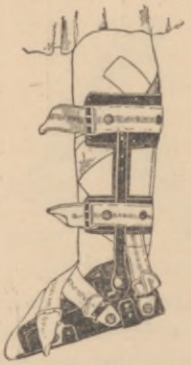

FIG. 4.

perfect control of the foot by keeping the heel in contact with the sole plate of the apparatus. It will be seen from the foregoing analysis of the abnormal curves in this affection and an inspection of the apparatus and model shown, that each abnormal curve is continuously acted upon by a corrective leverage controllable by the operator. The proximal curve formed by the os calcis with the tibia is counteracted by the lever formed by the leg bar and heel end of the side plate, and completed by the strap above the ankle. The distal curve formed by the os calcis with the metatarsus at the inner side of the foot is counteracted by the ends of the side plate, whose leverage is completed

by the band passing over the cuboid and top of the arch of the foot, while the plantar curve is corrected by the same band acting with the sole plate of the apparatus.

When the deformity has been so far overcome as to enable the patient to place the sole squarely on the ground, walking with the splint properly applied will help the patient, since the weight of the body under these circumstances will assist the corrective leverage. It is just at this point that so many failures have occurred in the treatment of congenital equino-varus. The original deformity has been wholly or partially corrected by mechanical means or operative procedures, and the patient is soon permitted to walk about. But as the muscles and ligaments on the long or convex side of the limb have not yet had time to shorten and grow firm, they are not able to oppose so much resistance to the forces which act upon the foot in walking and other movements as the tissues on the inner or concave side. In addition to this, the bones of the foot are imperfectly adapted to their new position, since their relations were developed in quite a different one—namely, the equino-varus position. So, there being no adequate force to oppose it, the foot gradually slips back toward the original faulty position. Repeated operations on the concave side and the adaptation of apparatus which imperfectly grasps the foot and allows it to slip and turn will not meet the difficulty. The deficient forces must be supplied by the exact prehension of the foot, and the continuous application of leverage in such a manner that the foot shall always be held in a slightly overcorrected position until the previously overstretched and elongated tissues are solidified. It will thus be seen that it is quite as important to have complete command of the corrected foot as it is to effect the reduction of the deformity, and any operation or process which only aims to reduce the deformity

must be regarded as but an incident in the treatment. In most cases under six or eight years of age, and in many older subjects, the deformity can be reduced within a few weeks* by the method of continuous leverage, which, besides rendering operative procedures unnecessary, presents the additional advantage of molding the tissues of the foot into normal relations by a proper distribution of pressure. The foot is then to be held in its corrected position from one to several years, while the patient is seen only occasionally by the physician, has full liberty and goes about independently in his brace, which is concealed by his shoe and stocking.

The form of the apparatus must be modified to meet special indications in particular cases. Inversion at the knee may be controlled by an apparatus reaching to the hip, and if necessary the addition of a hip-band will regulate hip rotation.

In secondary cases following poliomyelitis the same principle of treatment is employed, with proper provision for protecting weak muscles by limiting motion at the ankle joint. Such cases can often be successfully treated even after full growth is attained, and tenotomy is seldom necessary. In the deformities following the cerebral palsies and associated with a spastic condition of the muscles, tenotomy is positively indicated in addition to mechanical

* Within a fortnight I began the treatment by continuous leverage of the right foot of a boy of two years, born with an equino-varus, which had resisted doctors and braces, including a "Taylor" brace; the boy continued to walk on the outer side of the foot. In one week's time, with four office visits, and without violence or discomfort, the foot was in the valgus position and the child walking on his sole, to his mother's infinite astonishment. Such results can be accomplished with certainty, though not always so rapidly, when correct principles of treatment are carried out with painstaking precision of detail.

treatment, since the spasm is seldom or never permanently overcome by stretching.

The treatment of the valgus deformity, which is usually more difficult than that of varus, is analogous in principle. Leverage is applied to the outer side of the foot and leg by means of an apparatus similar to that employed in varus, but reversed in its action.

The simple equinus deformity may often be reduced by stretching, but very severe cases are more appropriate for tenotomy of the heel-cord than other deformities, since the relations of the small bones of the foot are not seriously disturbed. The mechanical after-treatment must be attended to to prevent relapse or overcorrection.

In calcaneus, ankle flexion is prevented by a stop at the ankle joint of the apparatus, while the weight of the body in standing and walking is transmitted from the anterior end of the sole plate through the apparatus to a broad band passing in front of the head of the tibia.

In concluding, I would draw special attention to the fact that the cases of congenital deformity which have been discussed are readily curable in early childhood by mechanical means alone, while the foot deformities due to poliomyelitis, the commonest cause of secondary club-foot, are preventable by correct mechanical treatment, applied early in the affection, so that recourse to operative procedures at a later stage is evidence of neglect of simpler and more perfect means at an earlier period.

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