

be found that, with very little discomfort to the patient, the foot can be brought nearly, or quite, to its normal position. The manipulations should not be continued so long, or used with so much force, as to excite inflammation or reflex contraction.

Again, the foot should never be retained, by any dressing, any nearer to a normal position than can be done *without* endangering free circulation. When, therefore, you apply the first dressing, you may not be able to restore the foot to its normal position, but must be content with a partial restoration, one which will permit a free and unobstructed circulation in the parts.

At the second dressing, the foot can be restored still nearer to its normal position, and yet permit free circulation; and thus you will go on, step by step, until complete restoration has been obtained.

If the foot is restored at once to its normal position and held there by some apparatus, regardless of a free circulation (indicated by the color of the toes), sloughing will probably supervene, and your treatment will be delayed for a considerable time. The shampooing friction of the muscles should be very thoroughly applied, and, in addition, they should be lightly whipped with the fingers transversely to their fibres. If a muscle be struck so that the blow falls in the direction of the fibres, the contraction produced is far less than if the blow be received transversely; the object being to awaken the paralyzed muscles to action, the latter method is far preferable. These manipulations, by drawing a large supply of blood to the part, very much increase its nutrition. They should be repeated daily if possible, and I consider them of so much importance that I greatly prefer those forms of dressing which do not interfere with these and other kinds of accessory treatment.

LECTURE X.

TALIPES.

Treatment (continued).—Methods of Dressing.—Splints.—Adhesive Plaster.—Barwell's Apparatus.—The Author's Club-Foot Shoe.—Crosby's Substitute for the Shoe.—Neil's Apparatus.—Case.—Talipes Varo-Equinus.

GENTLEMEN: To-day we will continue our study of the treatment of talipes by describing some of the methods of dressing that may be employed for correcting the deformity without having recourse to tenotomy.

To describe in detail the various plans which have been suggested would occupy too much time. I shall mention only the principal ones, which are really valuable, and, as briefly and clearly as possible, point out the indications for, and objections to, each plan.

The simplest of all is the ordinary *roller-bandage*. If the patient be taken while the case is yet recent, by bringing the foot as near its proper position as possible, and carefully bandaging it to retain it there, and by constant observation and readjustment of the dressing, a cure may sometimes be effected. There are very considerable objections to this plan of treatment, viz.: it is applicable to a very limited number of cases; it is very liable to get out of order, and therefore demands constant care; it has, moreover, an objection, in common with all which permanently cover the limbs by bandages, or splints, that it interferes with the necessary application of frictions and galvanism.

The *gypsum bandage* possesses the advantage over the last plan that it does not change its form; the limb is as securely locked as in a vice. In the details of its application, quite a considerable variety exists—some preferring to first bandage the limb, and then to cover the bandage with the gypsum mixed with water; others, to fill the meshes of a loosely-woven cotton roller-bandage with the dry powder, and to moisten it after it has been applied; and others, again, to make from woolen or cotton cloth a covering to fit the leg, and to apply to this the plaster. These varieties are, however, immaterial; the property which gypsum possesses, of "setting" when wetted, is the essential one to bring into operation. The objections to this plan are, the weight of

the dressing, the impossibility of inspecting the limb, and of applying to it friction, electricity, etc., as before mentioned.

Again, *splints of sole-leather* and *gutta-percha* have been recommended as a plan of treatment. A pattern is fitted to the limb held in the position desired. The leather or gutta-percha is softened by immersion in water (if the former is used, cold water is necessary, as hot water shrivels it; if the latter, boiling water is necessary to warm the material); it is then moulded first to the foot, after which the foot is gradually and slowly forced around into its natural position, and firmly held there while the leg-part of the splint is moulded to the limb above and secured by the continuation of the roller, and carefully held in the required position until the splint is hardened. Leather is to be preferred to gutta-percha, owing to its greater cleanliness and accessibility. Both leather and gutta-percha are superior to gypsum, in that they can be daily removed for personal inspection, manipulation, friction, shampooing, and electricity.

Another article which I have employed of late with great satisfaction is, Ahl's felt-splint. This material is light, has no offensive odor, can be easily moulded to fit any irregularities of surface when softened by being dipped in boiling water, and hardens quickly by being dipped in cold water, and is comparatively inexpensive. For the sake of convenience in its application, I have had made for my own use a wooden model of the foot and leg of a child of medium size. Over this model the felt can be moulded with the greatest ease, and it is sufficiently accurate for any foot within its limits; for these feet are always smaller than normal, and can be easily padded to fit the model.

Before applying any of the bandages or dressings above described, the limb should be enveloped in cotton, or, what is better, wool (the advantage of the wool is its elasticity, which prevents its becoming compressed or irritating to the skin, while it seems to be rendered foul by the perspiration no more quickly than the cotton); this prevents the permanent dressing from exoriating or unduly constricting the limb at any point. Great care should be taken that no foreign matter be entangled in the fibres of the cotton or bandages, as very severe excoriations and ulcerations may be produced by them. I have been obliged to suspend treatment owing to a grain of sand in the cotton. The small

shells found in compressed sponge sometimes cause the same trouble.

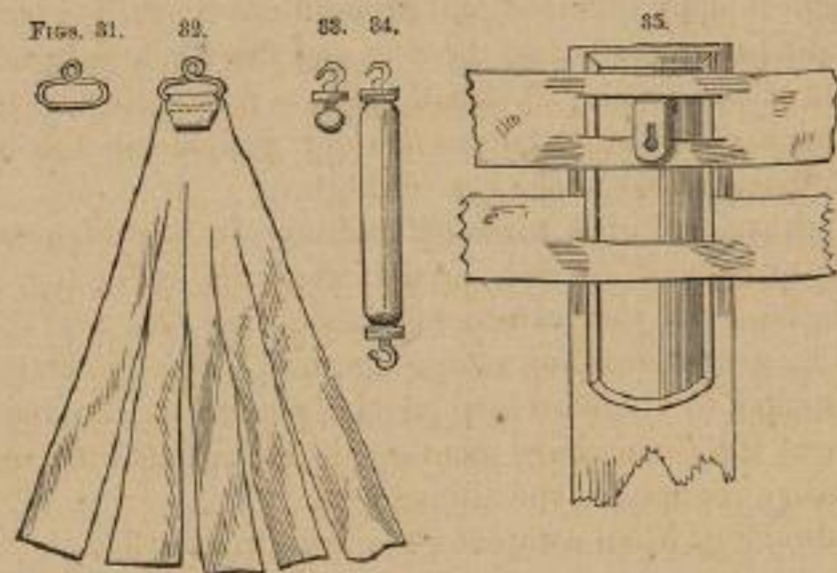
A large majority of congenital deformities, if taken *immediately* after birth, can be easily restored to, and retained in, their normal position by adhesive plaster. This can be applied in the following manner:

Cut a piece of strong adhesive plaster (Maw's moleskin is the best) from two to four inches in width, and of sufficient length to go nearly around the foot and to extend some inches upon the thigh. Commence on the dorsum of the foot with one extremity of the plaster at a slightly oblique angle, and wind it around the sole smoothly in the direction in which the foot is to be drawn; then with the hand draw the foot as nearly as possible into the natural position, and carry the plaster up the leg and secure it by a well-adjusted roller as far as the head of the fibula; as the plaster was cut longer than the leg, the end can then be reversed with the plaster outside, over which the roller is again carried down the limb, and the plaster will thus prevent it from slipping. Care must be taken *not* to have the plaster completely encircle the foot, and a few nicks cut in the edge *nearest* the ankle may be necessary to prevent strangulation of the circulation, when the foot becomes flexed. A second strip of adhesive plaster may be applied in the same manner *over* the first bandage if the foot requires still greater traction than that afforded by the one applied first. The same care, however, must be exercised with respect to completely encircling the foot when applying the plaster *over* the bandage as when applying it to the naked skin.

Such small points, gentlemen, may appear to you as unworthy of mention, but it is the neglect of these little things which has been the cause of many failures in the treatment of deformities; and I think, therefore, that nothing can be so insignificant as to be unworthy of your attention which has proved in practice to be of real value to me.

Although this plan is frequently successful, cases do occur in which the muscular rigidity is too great to yield to manipulation, unless continued for a longer time than can be generally given. A constant tractile force then becomes necessary, and the plan suggested by Mr. Richard Barwell, of London, is by far the best. This consists in cutting from stout adhesive plaster spread on Canton flannel, or the "moleskin plaster," a fan-shaped piece. In

this are cut several slips, converging toward the apex of the piece, for its better adaptation to the part. (See Fig. 32.) The apex of the triangle is passed through a wire loop with a ring in the top (see Figs. 31 and 32), brought back upon itself, and secured



by sewing. The plaster is firmly secured to the foot in such a manner that the wire eye shall be at a point where we wish to imitate the *insertion* of the muscle, and that it shall draw evenly on all parts of the foot when the traction is applied. Secure this by other adhesive straps and a smoothly-adjusted roller.

The artificial *origin* of the muscle is made as follows: Cut a strip of tin or zinc plate, in length about two-thirds that of the tibia, and in width one-quarter the circumference of the limb. (See Fig. 35.) This is shaped to fit the limb as well as can be done conveniently. About an inch from the upper end fasten an eye of wire. Care should be taken not to have this too large, as it would not confine the rubber to a fixed point. The tin is secured upon the limb in the following manner: From the stout plaster above mentioned cut two strips long enough to encircle the limb, and in the middle of each make two slits just large enough to admit the tin, which will prevent any lateral motion; then cut a strip of plaster, rather more than twice as long as the tin, and a little wider; apply this smoothly to the side of the leg on which the traction is to be made, beginning as high up as the tuberosity of the tibia. Lay upon it the tin, placing the upper end level with that of the plaster. (See Fig. 36.) Secure this by

passing the two strips above mentioned around the limb (see Fig. 37), then turn the vertical strip of plaster upward upon the tin. A slit should be made in the plaster where it passes over the eye, in order that the latter may protrude. The roller should then be continued smoothly up the limb to the top of the tin. The plaster is again reversed, and brought down over the bandage, another slit being made for the eye, and the whole secured by a few turns of the roller. A small chain, a few inches in length, containing a dozen or twenty links for graduating the adjustment, is then secured to the eye in the tin.

Into either end of a piece of ordinary India-rubber tubing, about one-quarter of an inch in diameter and two to six inches in length, hooks of the pattern here exhibited (see Fig. 33) are fastened by a wire or other strong ligature. One hook (see Fig. 34) is fastened to the wire loop on the plaster on the foot, and the other to the chain above mentioned, the various links making the necessary changes in the adjustment.

The dressing, when complete, is shown in Fig. 37.

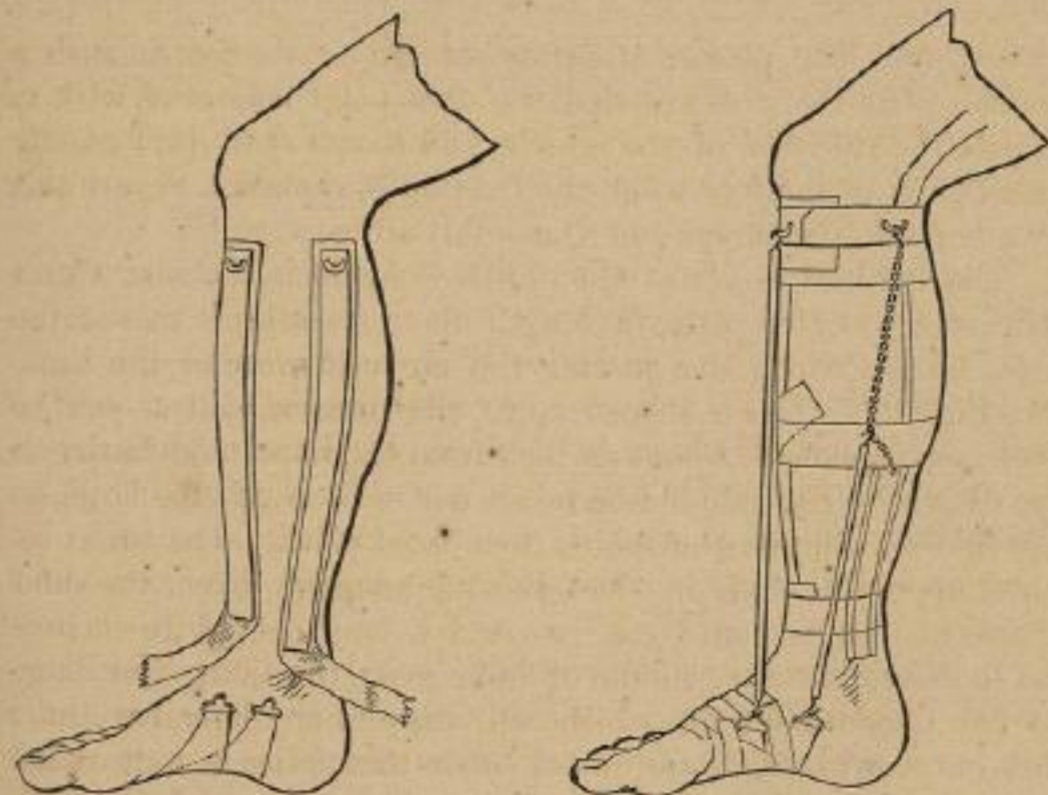


FIG. 36.—From Barwell.

FIG. 37.—From Barwell.

The constant traction of this rubber tubing is sufficient to overcome the strongest muscles, if they have not already under-

gone structural changes,¹ i. e., if they have not become contracted (permanently shortened), or if fasciæ have not become contracted as the result of inflammation.

The advantage of this plan of treatment over any of the others proposed, where the limb is forced into its position, and there securely fixed by the retaining apparatus (whether it be plaster of Paris, or complicated machinery with screws and cogs, and which can only be altered by the key of the attendant), is, that it causes movements in imitation of the natural movements of the parts; permitting and promoting the constant movement of the muscles and joints, thereby increasing the circulation in the same, and necessarily improving their development and power.

The joints and muscles of the human body were designed for active motion, and so far as is possible these natural movements should be retained, stimulated, and strengthened. It is for this reason that I always condemn any apparatus, devised for the cure of this class of deformities, that places the foot in a rigidly-fixed position. The deformity is essentially paralytic in its nature, and treatment of paralytic deformities by retention in a fixed apparatus, is all wrong. Such apparatus, therefore, as plaster of Paris, gutta-percha, or shoes made with a certain set of iron fastenings and screws, by means of which the foot is held in a certain fixed position, are erroneous in principle.

The permanent fixing of any limb or joint in a stationary apparatus, thus preventing even the healthy muscles from contraction and relaxation, will sooner or later cause even these muscles to become atrophied, and undergo fatty degeneration; and certainly this plan of treatment could never have a tendency to develop the latent power of a partially-paralyzed muscle; but, on the contrary, would have a tendency to place it in a condition beyond all hope of ever again being able to perform its normal functions.

I cannot, therefore, too frequently urge the necessity of motion as a means of permanent cure, or too strongly deprecate the use, for any length of time, of any form of appliance which shall prevent or materially limit the proper movements of the foot. Without motion, the muscles cannot be restored to their normal

¹ If the rubber tubing is not stretched beyond six times its length, it will continue to contract to its original length for an indefinite period of time.

degree of development, and consequently the talipes will be cured only in form, and not in reality, and relapse will be the natural sequence of such incomplete treatment. Motion is the essential element of cure; and I think the chief value of galvanism and faradism, as promoters of muscular growth, lies in the muscular contractions which they produce. The growth is the result of action. By the application of the elastic rubber, or contracting force, in just such a degree of strength as shall overcome the distorting muscles only, after a tension on them for a short time, in order to produce fatigue, and as shall not prevent them from contracting by an effort of the will, and thus redistorting the part, a constant motion is produced in the deformed and partially paralyzed limb, similar to that which occurs in the act of walking, which will materially assist the circulation, raise the temperature of the part, and manifestly has a tendency to improve its nutrition and increase its power. The exact amount of force applied can be regulated at will by means of the chain attached to the tubing. The change of the hook from one link to another increases or decreases the power according as the length of the chain and tubing is diminished or increased. A very little practical experience will soon indicate the amount of force required in each case. The only objection that can be urged against this plan of treatment is, that the adhesive plaster will sometimes slide and change its position; will soon become worn out, and require frequent readjustments; and, what is the most annoying, will often, particularly in very young children, and in hot weather, so irritate and excoriate the skin as to compel, for a while, the abandonment of its application.

This can be remedied to considerable extent by first carrying a flannel roller over the foot and leg before applying the plaster. Of course, this will require a more frequent application of the dressing, inasmuch as the roller will get loose and slip down the leg.

To permanently overcome or remedy this defect, I constructed a club-foot shoe, on the general plan of the "Scarpa's shoe," with a lateral hinge in the sole, for cases of valgus and varus; the only difference being that the motive power was the rubber tubing in place of the ordinary different kinds of springs which had formerly been used for this purpose.

Just here it may be remarked that the shoe should not be

resorted to until the child is old enough to walk. It is exceedingly difficult to properly adjust a shoe to the foot of a little child, and much more so in a case of club-foot. It is far better to use Barwell's apparatus or the simple strip of adhesive plaster, or alternate them, until the time arrives when the child can walk.

As all distortions of the valgus and varus varieties involve the medio-tarsal articulation, no shoe is applicable for their treatment that has not a joint in the sole opposite this articulation, and any shoe for the treatment of these varieties of club-foot that has a solid or immovable sole is not constructed upon physiological principles, and is, therefore, worse than useless.

This shoe which you see here was constructed in December, 1867, for a little child four years of age, that had been subjected to tenotomy several times, and had worn, almost since birth, heavy instruments of various kinds, only omitting them when the ulcers and excoriations were so great that danger was apprehended from continued pressure. None of the shoes that she had worn had been constructed upon correct principles, viz., that of *imitating natural movements*; and the pair that she had on at the time I first saw her had neither motion in the soles nor at the ankles—in fact, were simple straight bars of steel, bolted at right angles to steel soles; and into these prisons the doctor had endeavored to force and secure the feet by straps and bandages in different directions, but the pain was so great as to require changes every few hours, and frequently he had been compelled to omit the treatment for several days together, in order that the skin might heal. And yet these shoes had been contrived and applied by a gentleman of very great reputation in orthopedic surgery. Even when the bandages were adjusted most carefully, the child could only walk in an awkward manner, on the outer edge of the soles, being unable to balance herself unless held by an assistant, no motion whatever taking place at the ankles or any of the joints of the feet. The father of the child, a very intelligent physician, kindly permitted me to exhibit the case to my class in this room, as I was lecturing on that subject at the time.

The practical working of the shoe is so well described by the editor of the *Medical Gazette*, in the number of December 28,

1867, that I will take the liberty of transcribing his report in that journal:

"AN IMPROVED CLUB-FOOT SHOE.—Dr. Sayre exhibited and applied at his last lecture a pair of club-foot shoes to the little child of Dr. —, of New Jersey, which, in their mechanical construction, ease of application, and efficiency of action, surpassed anything of the kind we have ever seen, and which will doubtless soon replace all the cumbersome machinery hitherto in use in this unfortunate class of deformities.

"Dr. Sayre regards almost all the cases of club-foot as being of a *paralytic* origin, and therefore the necessity arises of supplying some artificial, constantly contracting force, to take the place of the paralyzed muscles, as the only means, in addition to galvanism and friction, that is necessary to restore them to their normal position; and by the proper adjustment of this force almost all of these deformities can be rectified, without resorting to tenotomy. This is certainly a very great improvement in their treatment. The simple yet efficient plan suggested by Mr. Barwell, of applying elastic tubing,

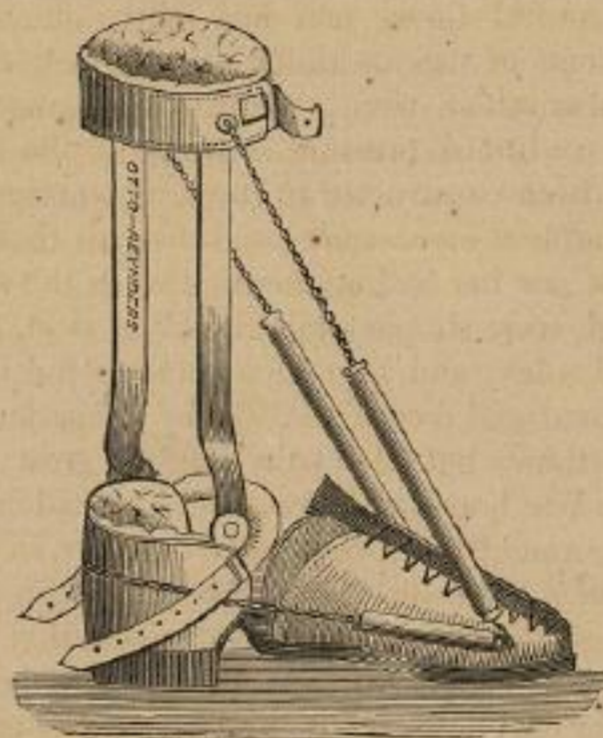


FIG. 38.

secured at the points desired by the means of adhesive plaster, has the very serious objection of irritating the skin, which, in young children, is very annoying, sometimes necessitating omission of its application for several days, and at the same time interfering with the manipulations and frictions which are so essential in their treatment. The simple but ingenious shoe contrived by Dr. Sayre is so constructed that it can be applied and secured accurately to the deformed foot before the elastic force is attached, *instead of adjusting*

the foot to the shoe, while the power is acting, as is the case in all other instruments, and this is the essential difference between it and the ordinary shoe with a jointed sole now in use, after which it is modeled.

"The accompanying drawing (Fig. 38) gives a very correct idea of its construction and mode of action.

"The shoes were applied in this instance with the most satisfactory results, the child in a short time after their adjustment running about the lecture-room with her feet on the floor in a natural position, which had never been accomplished by any of the numerous instruments she had formerly worn."

In January of 1868 I improved this shoe by putting in the sole, opposite the medio-tarsal articulation, a *ball-and-socket*, or universal joint, instead of the hinge-joint, which permitted only lateral movements. This sole and part embracing the heel consists of strong sheet-steel, covered with leather on both sides. Two lateral upright bars, *B*, jointed at the ankle, are fastened near the heel and to the collar-band; *G*, *H*, and *I*, are points for the attachment of artificial muscles, made of rubber tubing, with hooks and chains at their ends. To the inside walls of the shoe near *A*, two flaps of chamois-leather are attached to lace together, which, passing over the front of the ankle-joint, keep the heel firmly in the back part of the shoe. The accompanying figure shows the result of the last effort to make this shoe resemble an ordinary one as much as possible.

MEASUREMENTS REQUIRED.

1. Trace the outlines of the affected foot on a piece of paper.
2. Circumference at *I*, *K*, *A*, *A E*, *L*.
3. Length of foot.
4. Length from sole to below knee.
5. Circumference of leg below knee.

In addition, the shoe has been made more comfortable and convenient by a slight heel, and by making the anterior part of the sole like that of an ordinary shoe, and not so clumsy as that of most club-foot shoes. The upper leather laces neatly over the foot, adapting itself more perfectly than if arranged with straps and buckles. (See Fig. 39.) The shoe as applied is seen in Figs. 60 and 61.

The shoe pictured above is arranged for valgus or varus. There is really no essential difference between the different forms of talipes, and the single principle is to apply the artificial

muscles in such position as shall best supply the place of those paralyzed.

My friend and colleague Prof. A. B. Crosby informs me that he has made a very cheap and serviceable substitute for my shoe, in the following manner: Having procured a pair of stout shoes which fitted the patient well, he cut the sole of the one for the



FIG. 39.

deformed foot quite across, opposite the medio-tarsal junction. The two parts he connected by two links of chain, and made the necessary eversion or inversion by elastics. If to this an upright of tin or sheet-iron were added, for the application of muscles for the elevating of the toe, I doubt not it would serve every purpose in most cases.

Such a device will be of great service to gentlemen who practise at a distance from cities, and who, therefore, find great difficulty in obtaining instruments. Many other succedanea will doubtless suggest themselves, for "necessity is the mother of invention."

Certain things should be borne in mind (to which attention has already been called, but which will bear repetition) in making any dressing: the aim of the dressing or instrument is simply to imitate the action of the surgeon's hand; and that is best which nearest accomplishes this, or which most readily permits the hand actually to be used; accordingly, an apparatus combining elastic force is far superior to any fixed appliance; and,

moreover, of the dressings constructed on this principle, that is to be preferred which is the most readily removable. Shoes, therefore, are better than bandages or splints. A proper shoe must have a joint opposite the main joints of the foot—the ankle and medio-tarsal junction; it must be arranged for the ready application and adjustment of elastic power, and it must not girdle the limb at any point so as to interfere with the circulation.

The plan of treatment devised and practised by Dr. Henry Neil, of Philadelphia, in 1825, and which was so well described by Dr. John L. Atlee, of Lancaster, Pennsylvania, when discussing my report at the meeting of the American Medical Association in Washington, May, 1868, is so correct in theory—viz., compelling action in the partially-paralyzed muscles in order to remove the deformity—that I give the substance of Dr. Atlee's remarks, in order to claim for American surgery the credit of having first proposed the correct or physiological plan of treatment. Dr. Neil, although a gentleman of high professional standing and of great practical ingenuity, was not much of an author, and I can find no account of his treatment, although it may have been published in some of the medical journals of that date. None of the medical gentlemen present at the meeting had ever heard of the plan before; and it is due to the memory of Dr. Neil that it should be permanently recorded to his credit. The plan of treatment is simply to fasten the child's feet to a board made to fit the soles of the feet, and joined together opposite the ankle-joints. The restraint is, of course, irksome to the child, and, in his efforts to kick himself out of the bandages, he brings into action all the muscles of the legs—accomplishing the very object desired—and, in the graphic language of Dr. Atlee, "kicks himself straight."

To make an apparatus of this kind to fit the child, you place his foot on a piece of folded paper, about one inch and a half or two inches from its folded edge; mark with a pencil the size of the child's foot, commencing at his inner ankle, and going round the heel, the outside of the foot and toes, and back to within one-half inch of the starting-point. From these two points draw lines at right angles to the folded edge of the paper, and then with scissors cut the double paper, and when unfolded you have the pattern from which any carpenter can make, in a few min-

utes, the necessary board out of light but strong wood. (See Fig. 40.)

A strip of leather is folded into a loop and nailed at either heel, through which a strip of adhesive plaster is passed, and car-

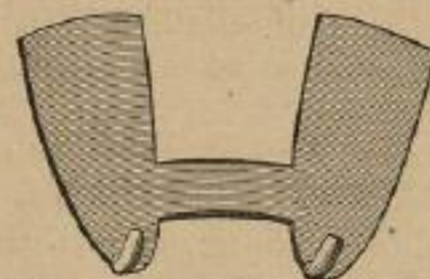


FIG. 40.

ried in a "figure of 8" over the instep and around the foot-board. Such other bandages as are needed to secure the foot in position are of course applied in the proper manner.

I have tried this plan in several cases, and have been well pleased with the result, but do not find it as satisfactory as the adhesive plaster and India-rubber spring, as it gives the child considerable uneasiness, and few mothers will submit to the continuance of a plan of treatment which causes such distress to "the baby."

CASE. Paralytic Talipes Varo-Equinus.—The case now before you, gentlemen, is a very good illustration of the paralytic variety of talipes, and also shows you how easily it can be overcome by an elastic force to take the place of the paralyzed muscles.

This boy, now eight years old, was paralyzed when twenty-one months of age. He recovered from his paralysis—with the exception of the muscles of his right leg—more particularly the peroneals.

He has worn stiff braces almost constantly since he was large enough to walk; only laying them by when the pressure had become unbearable, to be resumed again as soon as the points of inflammation would permit the application of the torturing instruments.

He was sent to our clinic last week, you will remember, to have tenotomy performed. Of course, I did not do it, as the operation would only have increased his difficulty.

Mr. Reynders has made for him one of my club-foot shoes, and Mr. Mason has this morning taken a photograph of his foot

—without the shoe—and another with it on. Both of these pictures were taken within a few minutes of each other, and beautifully illustrate the advantages of this plan of treatment; as you now see, this boy walks perfectly well, with his foot in natural

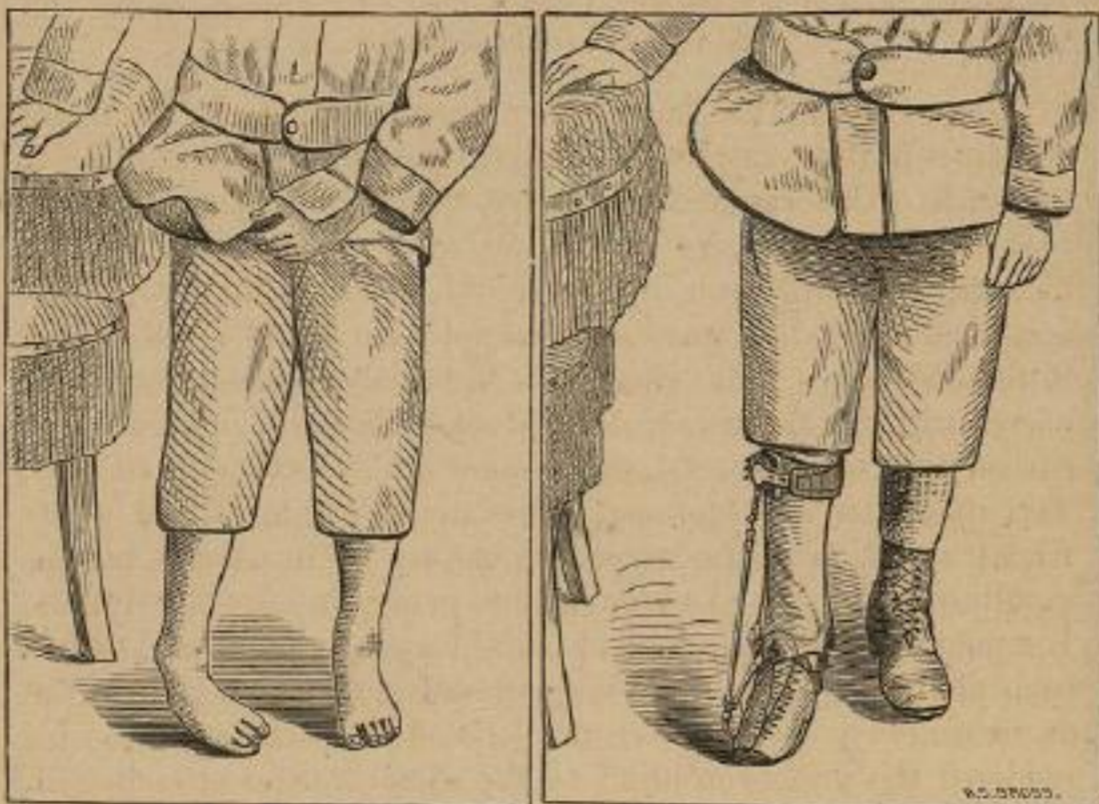


FIG. 41.

FIG. 42.

position when the rubber elastics are properly adjusted. (See Figs. 41 and 42.)

So much, gentlemen, for the management of that class of cases of club-foot that can be rationally and successfully treated without resorting to any operation.

LECTURE XI.

TALIPES.

Treatment (continued).—Tenotomy.—Indications for same.—Dressing applied after the Operation.—After-Treatment.

GENTLEMEN: Thus far we have been studying the treatment of talipes in those cases which may be cured without resorting to the knife. Unfortunately, however, the great majority of cases that fall under our care require *tenotomy*; and almost without exception require such operative interference, simply because a rational method of treatment has not been put in practice early in their history. This brings us to the study of tenotomy as connected with the treatment of club-foot. From the publication of Stromeyer's work, in 1831, dates a new era in orthopedic surgery. The operation of tenotomy, advocated by him, found many friends; and, from the surprising nature of its results, became rapidly popular. It was brought into general use by Dr. William Detmold, of this city, who had himself been a pupil of Dieffenbach and Stromeyer. The immense advantages which this plan of treatment possessed over the let-alone method for some time rendered the profession blind to the disadvantages attending it. After a time, however, surgeons noticed that all cases of club-foot were not cured by tenotomy, and many that had appeared to be cured afterward relapsed.

This failure was due in some cases to the neglect of proper after-treatment, but generally to the fact that the operation of tenotomy was based in many cases upon a false pathological theory, namely, that the deformity was due to a spastic contraction or abnormal shortening of the muscle, the tendon of which was to be cut.

If what I have told you regarding the paralytic origin of most cases of club-foot is true, then the severing of the tendons of muscles still remaining sound is entirely irrational. The very best result that could be expected from the operation would be, that the muscular support of the foot being removed on all sides, gravity would throw it into a normal position. The disease which underlies the distortion, namely, the paralysis, has been untouched. And, if the tendon becomes firmly reunited, there