remedies to be administered in special cases, these will be fully considered when we come to speak of the treatment of separate diseases. *Strychnia*, however, is a remedy so constantly employed in the treatment of paralyzed muscles, that a brief reference should here be made to its use. It should be administered in doses sufficient only to produce slight twitchings of the muscle. The administration of $\frac{1}{60}$-grain doses three times a day, and the subcutaneous injection of one-sixtieth of a grain into the muscle, once in eight or ten days, will ordinarily be sufficient to produce the desired results, and will also, as a rule, be of much service. Over-fatigue of muscles can be brought about by exciting undue contractions with this remedy, as well as by the application of electricity, or by excessive manipulation. Such fatigue is to be carefully avoided.

Thus, gentlemen, I have given you a general outline of our subject. I have endeavored to lay before you the reasons why you should make it a special study; I have directed your attention to the different varieties of deformities you will meet with, and have mentioned the general principles which are to govern you in their treatment. And I have, also, in a general way directed your attention to the operative treatment, and the mechanical appliances, etc., which are to be used subsequent to the operation. Repetitions of what has already been said will constantly be made throughout the entire course, and for so doing I have no apology to make, but on the contrary shall hope thereby to indelibly impress the principles which I teach upon your minds. We are now ready to commence the study of special deformities, and at my next lecture we will begin the study of *talipes*.

LECTURE VII.

TALIPES.

Definition.—Varieties and Combinations.—Mechanical Construction of the Normal Human Foot.—Talipes Equinus.—Talipes Calcaneus.—Case of Division of Tendo-Achilles by an Accident.—Mechanical Treatment of Talipes Calcaneus.

GENTLEMEN: To-day we commence the study of special deformities; and that which will first engage our attention is commonly known by the name of *club-foot*. The technical name for this class of deformities (for there are several varieties) is *talipes*.

Under the term TALIPES are included all deformities in which there is a permanent deviation from the normal relations of the foot to the leg, or of the parts composing the arch of the foot to each other, whether this deviation consists in flexion, extension, inversion, or eversion. Talipes is usually described under four distinct heads, namely, *talipes equinus*, *talipes calcaneus*, *talipes varus*, and *talipes valgus*.

Typical examples of any of these varieties are rare, for, nearly always the deformity is a combination of two varieties. For example, equinus may be combined with varus or valgus, and the same is true of calcaneus.

When we wish to designate such a deformity, the names of the two component distortions are combined, the more important always being placed first. Thus when we have a combination of equinus and varus, it is styled equino-varus or varo-equinus, according as the equinus or varus is the more prominent, and the same principle of nomenclature is used for calcaneo-varus and valgus.

In addition to the above-mentioned varieties, there is one known as talipes *cavus* or *plantaris*. This is a very frequent complication of other varieties of talipes. When it is present as a complication, it does not, as a rule, enter the name of the deformity. When, however, as occasionally happens, the case presents no other deformity than that caused by the contraction of the plantar fascia, the name talipes cavus or plantaris is used. The deformity known as *flat-foot*, I think, should be considered as a variety of valgus, as the peculiar breaking down of

the arch is the same in both, and the two affections are very generally associated. In order to have a correct understanding of our subject, it is necessary, before proceeding to the definition and description of the different varieties of club-foot, to turn our attention to the study of the mechanical construction of the normal human foot.

The human foot, in its *natural* state, is one of the most beautiful examples of a complicated machine, combining great strength with graceful mobility, that can be found in any part of the human frame: consisting as it does of twelve bones (in addition to those of the toes), joined to each other by regularly-constructed articulations, admitting of motion to a greater or less degree of each individual bone—so that no restraint can be put upon these slight movements between the various bones without destroying the harmony of their combined action in the foot as a whole—and at the same time being so firmly bound together by ligaments, and sustained in position by tendons attached to strong muscles, as to give it an abundant security to bear the superincumbent weight of the body, while it allows of sufficient expansion and extension for ease and elasticity in locomotion. It is connected with the leg at the astragalo-tibial articulation, and prevented from *any lateral* movement by the projecting malleoli on either side, which fit so closely to the sides of the astragalus as to permit of no motion at this joint, except that of flexion and extension, or that of pointing the toes up or down. Turning the toes out or in is produced by rotation of the thigh and leg at the hip-joint, or by the revolving motion of the fibula, produced by the contraction of the biceps and tensor vaginæ femoris, when the knee is flexed.[1]

[1] Prof. S. D. Gross, after thanking me for a copy of my work on club-foot, which he states is "of great practical value to the profession," adds, in his letter: "I shall still continue to make *lateral* motion at my ankle-joint without rotating my hip or revolving the head of my fibula." So great a difference of opinion from such a distinguished authority made me, of course, exceedingly uneasy to think that I had been such a careless observer, and I therefore dissected a number of feet, both of children and adults, making most careful ligamentous preparations of each, and, after the most critical examination of all these specimens, I was unable to produce the slightest *lateral* movement in any of them. I therefore feel perfectly justified in asserting most positively the correctness of my first statement—that there is no *lateral* motion at the astragalo-tibial articulation. The lateral movement of the foot, which *appears* to take place at this joint, actually occurs at the junction of the os calcis with the astragalus, the latter bone being so firmly embraced by the external and internal malleolus as to permit of no lateral movement whatever.

Having stated that no motion can occur at the tibio-tarsal or ankle joint, except *flexion* and *extension*, and that the pointing of the toes out or in is done by the muscles of the hip, as above described, it follows, as a matter of course, that all the other motions of the foot, such as twisting the sole inward or outward, raising or depressing the arch, etc., must occur between the joints of the other eleven bones of the foot. The toes, being merely attachments, are not considered as having any influence in these motions.

If we carefully examine the foot, as seen in Fig. 16, we shall observe that, between the os calcis and astragalus behind, and the cuboid and scaphoid in front, is the *medio-tarsal* joint, *a*, *b*,

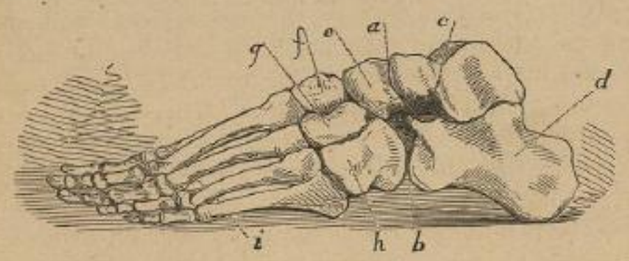

FIG. 16.—*a*, *b*, the medio-tarsal articulation; *c*, the astragalus; *d*, the os calcis; *e*, the scaphoid; *f*, middle cuneiform; *g*, external cuneiform; *h*, cuboid; *i*, the metatarsal bones.

going completely across the foot, dividing it into an anterior and posterior portion, admitting in a limited degree of every variety of motion—flexion, extension, abduction, and adduction, as well as rotation inward and outward upon the long axis of the foot. I desire to call particular attention to this compound articulation in the tarsus, because, by a most remarkable oversight of surgeons, the very important part which it plays in deformities of the feet has until very recently been entirely unnoticed.

The foot, as a means of support, rests upon three buttresses: the heel behind, which is stationary; and the first and fifth metatarso-phalangeal articulations in front, which are slightly movable, capable both of expanding and extending, thereby increasing the base of support, which adds to the security of the body, and by this very expansion and extension of the anterior pillars, or buttresses, gives elasticity in locomotion.

Between these three pillars, or points of base, spring two

arches: one from the heel, reaching to the anterior two pillars, narrow behind, and wider in front, called the antero-posterior arch; and one from the two anterior pillars arching across the foot, called the transverse arch. The antero-posterior arch is higher on the inner than on the outer side, and cannot be brought to the ground in the normal condition of the foot, whereas the outer line of this arch is always brought to the ground whenever the weight of the body is borne upon it.

Let any one dip his naked foot in a pail of water, and then, while wet, stand with it upon a dry board or piece of brown paper, and he will get an exact impression of the parts of the foot which come in contact with the earth in supporting the weight of the body. (*See* Fig. 17.) It will be seen that the outer line

Fig. 17.

Fig. 18.

of the arch touches its entire length, which thus gives it a firm and extensive base of support, whereas the inner line only touches the ground at its two extremities, the central part of the arch on the inner side being retained in position by the tibialis-anticus muscle, which is inserted into the inner and under surface of the internal cuneiform and base of the first metatarsal bones. It will, therefore, be seen that the strength and perfection of this arch are greatly dependent upon the condition of the anterior tibial muscle. The importance of understanding the construction and retention of this arch will be more fully seen when we come to study the deformities of the foot, more particularly talipes valgus, or flat-foot.

We are now prepared to go on with the study of the morbid

alterations in the form of the foot, which are more numerous than those affecting any other part of the body. The first variety to which I will direct your attention is that known by the name of talipes equinus.

Talipes equinus receives its name from the position of the foot, simulating the hoof of a horse.

The deformity consists in the raising of the heel and dropping of the anterior portion of the foot, so that the weight of the body is borne upon the metatarso-phalangeal articulation alone, instead of upon the three points above spoken of. (*See* Fig. 18.) The convexity of the arch of the foot is generally very much increased; and the concavity of the arch becomes more and more angular in proportion to the degree of the deformity. The toes are extended upon the foot, and the foot is extended upon the leg. Sometimes the foot is so much extended as to make almost a straight line with the tibia. This peculiarity in the deformity is usually associated with a paralyzed condition of the extensor muscles of the toes. Ordinarily, however, if these muscles possess the power of contraction, they voluntarily contract and elevate the toes sufficiently to enable the patient to walk upon the base of the metatarsal bone of the great-toe, as seen in Fig. 18. When the paralyzed condition referred to is present, there is absence of power for lifting the toes, which necessitates the use of crutches when the patient walks.

Talipes equinus may be either congenital or acquired. The deformity much more frequently occurs under the form of equino-varus, or varo-equinus. These are also by far the most common forms of deformities of the foot. The origin of these varieties is usually congenital. Again, talipes equinus may be paralytic or spastic; or the spastic condition may be developed upon the paralytic. The latter condition may be developed by long-continued walking upon the deformed parts, thereby exciting inflammatory action, and when present will require tenotomy before a cure can be effected. If the deformity is purely paralytic, it can be overcome by the application of mechanical means and elastic force, which shall take the place of the paralyzed muscles, until by the use of electricity, friction, strychnia, etc., they have been restored to the power of proper contraction. The paralytic variety is easily recognized, from the fact that the foot can be easily restored to its normal position;

but, when the force which has restored it is removed, the deformity immediately returns. The muscles chiefly affected in the paralytic variety are those upon the anterior aspect of the leg. On the contrary, when the equinus is spastic, it is due to abnormal contraction of the muscles upon the posterior aspect of the leg.

The next variety of deformity which we shall study is called talipes calcaneus.

Talipes calcaneus is that variety of deformity where the

Fig. 19.

anterior portion of the foot is elevated, and the heel is depressed. (*See* Fig. 19.)

This variety may also be congenital or acquired. It is frequently seen as a congenital deformity, and all the cases which have fallen under my observation have been of a paralytic nature. This deformity is much more liable to occur complicated with varus or valgus, than to present itself uncomplicated. When paralytic, the muscles chiefly affected are the gastrocnemius and soleus; and in the treatment to be adopted the application of artificial muscles to take the place of the paralyzed gastrocnemius and soleus forms an essential element.

Talipes calcaneus is very often acquired. It may result from jumping, wrestling, or the application of any force sufficient to

rupture or cut the tendo-Achillis. It occurs again as the result of injuries received upon the anterior portion of the foot. A very common cause in this connection is the cicatricial contraction following burns. The gradual contraction of the cicatricial tissue overcomes the action of the gastrocnemius and soleus muscles; and, as a consequence, the anterior portion of the foot becomes elevated and the heel depressed. In all such cases, therefore, it is an exceedingly important point in their management to *prevent* this contraction during cicatrization, and thus prevent the deformity. It is important to keep the foot as forcibly extended as possible. By this measure, as a matter of course, you materially delay the cicatrization, but you promote the ultimate usefulness of the limb very essentially.

Extend the ulcerated surface as far as you can, and let it heal as slowly as possible. This is one method of management, and the one ordinarily employed, until another step had been taken. By the old method cicatrization was allowed to go on from circumference to centre until the whole granulating surface had been closed in, which was usually an exceedingly tedious process. Now the surgeon transplants a number of little islands of skin to the granulating surface, and from each of these little islands new skin grows and spreads, and you heal the wound by cicatrization as before; but it is from the new blood-vessels formed, giving us a far different cicatrix from that obtained by the process of granulation. The cicatrix is much more yielding, is softer, and less liable to contract. The same principle is applicable in the treatment of extensive burns about any of the joints, or involving the palmar fascia.

A case, however, may come to you for treatment in which very great contraction has already taken place. The question arises, Shall we undertake to correct such a deformity? In many cases the deformity will be so great, and the destruction of tissues so extensive, that nothing can be done. If, however, you should judge that an operation would be justifiable, never simply cut across the adhesive bands, for no permanent benefit will follow your operation. You must dissect away the entire cicatrix, and then bring the foot into its normal position, and retain it there, leaving the wound open. As soon as granulations have made their appearance, and the wound has taken on a healthy condition, transplanting may be resorted to for the purpose of

hastening and improving cicatrization. If you succeed in restoring the deformed parts to their normal position, some artificial apparatus must be applied, and the application must be kept up until the patient can voluntarily flex and extend the foot in the normal manner.

Prevention of deformity is therefore an essential part in the management of all injuries affecting the anterior portion of the foot, but especially burns. When the tendo-Achillis becomes ruptured from any cause, or is accidentally cut, the foot should be dressed in the position of talipes equinus, and the leg flexed upon the thigh. This position is to be maintained until the tendon is fully healed, when passive movements should be resorted to for the purpose of bringing the foot into its normal position.

The following case, treated by Dr. Yale, is a beautiful illustration of the success that may be obtained by proper treatment:

CASE. *Wound of Ankle, dividing the Tendo-Achillis; Recovery, with Perfect Use of Foot.*—"Mr. R., aged about twenty-eight, September 1, 1872, stood on a chair, and placed his right foot in a stationary wash-basin to bathe it. His weight being great, about two hundred pounds, the bottom of the basin, already cracked, gave way, and the foot and part of the leg passed through the hole thus made. This occurred about 8 A. M. He was seen soon after the accident by one or two medical men, who did not, however, permanently dress the wound. At 11 A. M., three hours after the accident, I saw the patient. The hæmorrhage had been quite profuse but apparently venous, and had then ceased. The line of the incision was transverse directly above the os calcis, its direction was forward and upward, and was an inch and a half deep. The tendo-Achillis was cut off near its insertion, and its short stump was plainly visible. The posterior tibial artery could be seen beating under a thin covering of connective tissue. The joint apparently was not opened. The cut reached on the outer side to the posterior margin of the external malleolus, on the inner side to the anterior surface of the internal malleolus. The anterior, one and a half or two inches, was probably burst rather than cut. From the anterior extremity of the line a V-shaped piece of integument, with its apex at the malleolus, was torn up, the anterior line being about five inches long; the posterior curving around, behind the calf, seven or eight inches. The flap behind was also everted.

"From the wound I cleaned out a number of small chips of the broken porcelain basin, and also some clots. The V was carefully stitched into place. The upper part of the tendo-Achillis was retracted out of sight, and could not be reached. The surfaces of the wound were approximated as accurately as possible, and stitched, a vent for drainage being left on the outside of the stump of the tendo-Achillis. Adhesive plaster, compresses, and bandages, were applied. To keep the foot in a proper position, a thin board was fastened to the sole of the foot, the knee was flexed, the foot extended on the leg, the limb laid upon its outer aspect, and the posterior extremity of the sole-board drawn upward by a cord toward some turns of bandage encircling the lower part of the thigh. This retained the limb in the position best calculated to approximate the separated ends of the tendo-Achillis.

"At night it was necessary to nick the bandage around the wound, to accommodate it to the swelling, and to give an opiate.

"The after-history contains no points of especial interest. There were no bad symptoms. The patient suffered from sleeplessness for a few nights. The wound healed quickly, except just near the tendo-Achillis, where, after the first closing, pus to the amount of a half drachm or thereabouts collected several times and required a small incision to evacuate it. The limb was kept in the position above described most of the time for five or six weeks, until the wound seemed securely healed.

"At the end of two months the patient began to go to his business. At first he wore a shoe with an upright support jointed opposite the ankle, and an elastic band behind to supplement the action of the gastrocnemius and relieve that muscle from too great strain. This was discontinued as soon as the disappearance of ice from the streets rendered walking safe.

"*April* 3, 1873.—Has had perfect control of the articulation for some time, and wears no artificial support whatever."

The mechanical apparatus used in the treatment of talipes calcaneus differs somewhat in its construction from that commonly employed in the treatment of the other varieties of talipes, and can be better described here than under the head of general treatment. The objects to be gained are elevation of the heel, and a corresponding depression of the anterior portion of the foot; consequently, your apparatus must be constructed in a manner to

meet these indications. With these objects in view you may construct an apparatus in the following manner:

Take a thin piece of board, a piece of cigar-box or thin shingle, a little longer than the child's foot, cover it with adhesive plaster, and fasten it to the sole of the foot, allowing the board to project somewhat *behind* the heel. When fastened to the anterior portion of the foot, bring the foot into position, and then carry the long piece of adhesive plaster attached to the posterior extremity of the board up along the posterior aspect of the leg, and there secure it by means of a roller-bandage. Such an apparatus should be constantly worn until the child is old enough to walk, when a shoe will be required. For this purpose an ordinary shoe may be used, having a steel sole. From the heel, projecting a trifle behind like a spur, is an eylet. Two upright bars are attached to the sole of the shoe, one upon either side, having a joint opposite the ankle-joint. These bars terminate in a band which goes around the upper portion of the leg. At the posterior portion of this band an artificial muscle is attached and extends to the eylet before mentioned. (*See* Fig. 20.)

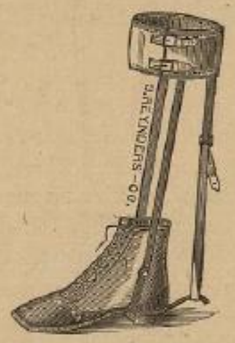

Fig. 20.

One or more artificial muscles are to be used, according to the amount of traction required, and are to take the place of the paralyzed muscles until they are able to perform their functions without artificial aid.

The after-treatment of talipes calcaneus is to be conducted upon the same plan as the other forms of talipes. This will be fully considered when we come to the subject of general treatment.

LECTURE VIII.

TALIPES.

Talipes Varus.—Causes of.—Case.—Complications.—Case.—Talipes Valgus.—Causes of.—Paralytic Variety, with Cases.—Treatment of the same.

Gentlemen: At the close of my last lecture I was speaking to you upon the mechanical treatment of talipes calcaneus; to-day I invite your attention to another variety of talipes which has received the name of talipes varus.

Talipes varus is that variety in which the foot is inverted, and more or less rotated, in such a manner as to bring its inner surface upward, and the outer edge to a greater or less degree upon the ground. (*See* Fig. 21.)

Fig. 21.

The muscles chiefly affected in the paralytic variety are the peroneals.

This variety of talipes may be congenital, and, when combined with equinus, usually is of such origin. Complicated with equinus, it is one of the most common forms of deformity of the foot. Indeed, uncomplicated talipes varus is exceeding rare.

When congenital it is usually of a paralytic nature, but it may be spastic, as the result of some influence exerted upon the fœtus. When the deformity is acquired, it is also most frequently of a paralytic nature. The most common cause, probably, is that form of paralysis known as "infantile." The child may go