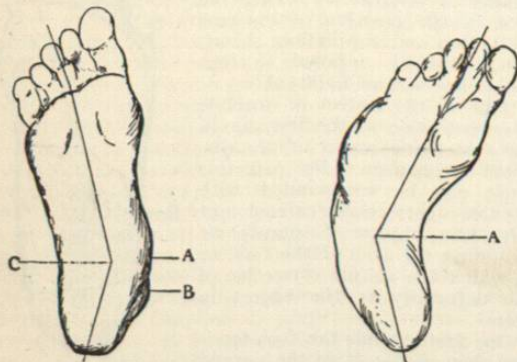


breaking of adhesions, and the complete disappearance of the deformity. In certain instances it will be necessary to divide the tendo Achillis; when, for example, the range of dorsal flexion is limited by resistant accommodative shortening of the calf muscles, or when there have been very great pain and tenderness at the medio-tarsal joint, and it is desired to remove the strain of the calf muscle completely; traumatic cases come especially under this head. In other cases the peronei tendons may be divided if they offer especial resistance to adduction. Tenotomy has one great advantage: it necessitates longer fixation in the plaster bandage, and gives the patient the benefit of rest and the opportunity for prolonged after-treatment. When the passive range of motion has been regained, the foot is turned downward, then inward and upward into the position of extreme varus. By this manipulation the os calcis is drawn under the astragalus and thrown into the supinated position, and the scaphoid is flexed about and under the head of the astragalus, which is then lifted to the limit of normal flexion. The attempt is always made to bring the extreme outer border of the inverted foot up to a right angle with the leg, which is the limit of normal flexion in this attitude. The foot, thickly padded with cotton, especially about and between the toes, is then fixed in this posture of club-foot by a firm plaster-of-Paris bandage extending to the knee. Surprisingly little discomfort, considering the force that it is sometimes necessary to apply, is experienced after the operation. The familiar and often intense pain, from which the patient has suffered so long, is entirely relieved by the correction of the deformity; there is often a sense of tension about the outer side of the ankle and dorsum of the foot, but this is not, as a rule, of long duration.

Functional Use in the Over-Corrected Attitude.—As soon as possible, often on the following day, the patient is encouraged to stand and to walk. Walking serves two purposes: to still further over-correct the deformity, and to accustom the patient to a posture entirely different from that so long assumed. Meantime the contracted tissues on the outer side become thoroughly over-stretched, the weakened ligaments and muscles on the inner side are relaxed, and the local irritation rapidly subsides under the rest from the constant injury to which the foot has been subjected. The patient is not confined to the bed or house, although if both feet are in plaster bandages, crutches are of course necessary. The time that the feet should remain in the over-corrected position depends upon the duration of the deformity and the severity of the symptoms, the usual time being about three weeks. At the end of two weeks, or whenever the patient can



FIGS. 2137 AND 2138.—Illustrating Forcible Correction of the Deformed Foot. C, Medio-tarsal joint; A, the scaphoid bone; B, the internal malleolus.

support the weight upon the plaster bandage without a sensation of discomfort, it is removed; the foot is placed in the normal attitude and a cast is taken for the brace. Immediately after this is done the foot is returned to the club-foot position, and the plaster bandage is re-applied.

When the brace is ready the plaster bandage is finally removed; the foot is now in good position, and in many instances the arch is exaggerated in depth. For the first few days, prolonged soaking in hot water or the use of the hot-air bath, with subsequent massage, at intervals during the day, will be found useful in overcoming the swelling and local tenderness that may persist. It is always insisted that a new shoe of the Waukenphast pattern shall be obtained, the sole and heel of which are raised a quarter of an inch on the inner border, to aid the action of the brace in the balancing of the weak foot. When the shoe is removed at night, the patient is instructed to turn the toes in and to bear the weight on the outer side of the foot until it has regained its strength; in other words, the deformity is never allowed to recur.

Systematic Manipulation.—The systematic treatment is then begun by the surgeon and the patient, the first essential being the attainment of free and painless passive motion in all directions. These motions, which have been so long restrained by deformity, cannot be regained without effort, and during this critical stage treatment must be carried out by the surgeon himself; if he trusts to the patient or to his friends, a cure is out of the question. At least once a day the full range of motion is tested. Three motions, abduction, flexion, and extension, are usually free and painless; but the fourth, that of adduction, is almost invariably resisted by the same quality of muscular rigidity that was present before the operation. By far the most effective method of overcoming this resistance is conducted as follows. The patient being seated in a chair, the surgeon sits or stands before him. Let us suppose that the left foot is to be adducted, or, as the patients express it, twisted. The surgeon places the foot between his knees; his left hand encircles the heel, the fingers grasping the projecting os calcis and tendo Achillis; the ball of the palm lies against the medio-tarsal joint on the inner aspect of the foot; the right hand grasps the outer side of the fore foot and toes; then by steady pressure of the thigh muscles, the fore foot is forced downward and inward (adducted and supinated) over the fulcrum formed by the projecting palm which lies upon the left knee, the fingers holding the heel steadily in place. This inward twisting is at first resisted by a mixed voluntary and involuntary muscular spasm, which gradually gives way under steady pressure. When the limit of adduction has been reached the foot is firmly held until all pain has subsided. Then the patient is instructed to attempt voluntary movements while the foot is guided by the hands; in other words, the patient attempts to adduct the foot while the surgeon supplies the power, which, in all cases of this type, has been completely lost. This passive manipulation to the extreme limit of normal adduction, plantar and dorsal flexion, is continued from day to day until there is no longer a sensation of pain or tension; for as long as there is the slightest spasm or painful restriction, so long is the voluntary motion limited, cure delayed, and relapse of deformity probable. During active treatment the patient, by the use of massage, active and passive motion, is constantly working to one end, namely, to regain the lost power of voluntary adduction.

The time necessary to rest the feet, to overcome the local irritation and muscular spasm, to regain, in part at least, the range of passive motion, and to place the patient in the same position as regards a cure as that of the milder type of deformity, is from three to six weeks. Usually the patients are told that a month will be necessary, and that at the end of that time they may return to work, free from pain and from danger of relapse, and that the feet will constantly grow stronger under the work which before was too great for their strength. The time necessary to re-educate the adductor muscles in their proper function depends, in great degree, upon the intelligence and persistence of the patient. Although in after-treatment massage and special exercises are of benefit, the essentials are very simple; they are, an effective brace, a proper shoe, and the passive manipulation that has been described, until its object has been attained;

the proper walk, the best and easiest of exercises; and finally, one must force into the patient's understanding the method of protecting the weak foot by the alternation of strain and by the proper postures.

OTHER VARIETIES OF RIGID WEAK FOOT.—The foot which is fixed in the abducted position without depression of the longitudinal arch, is simply one variety of the rigid weak foot, and should be treated in the same manner.

It may be stated also that a very large proportion of the so-called chronic sprains of the ankle are of this type, and that the disability will yield very readily to treatment conducted for the purpose of restoring impaired function, in the manner that has been indicated.

There are other cases in which the deformity of flat foot is complicated by rheumatoid arthritis or chronic rheumatism, of which the evidence is seen in various joints, but in which the pain and discomfort seem to be concentrated in the feet, which are absolutely stiff and deformed. In such cases one can hardly expect a complete cure, but although the function of leverage may not be regained, still one may hope, by overcoming the deformity, to hold the weight of the body in its proper relation to the foot, so that the pain of a progressive dislocation may not be added to the pain of disease. In a number of instances, forcible correction has been employed by the writer in cases of this type, and in all the improvement in the general condition, consequently in the resistance to the disease, after the relief of the local pain and discomfort, has been very great.

Between the two classes of cases, the mild and the severe, one finds every grade of deformity. All cases in which there are marked muscular spasm, local tenderness, and swelling, require temporary rest, in many instances simply rest from functional use combined with massage; in others rest in a plaster bandage in the abducted position. In the milder and ordinary class of cases, the use of a brace and shoe will alone relieve spasm and pain, and the range of motion can usually be regained by manipulation, passive motion, and by the proper use of the foot.

Occasionally, even in childhood, one may encounter marked limitation of normal motion, particularly in dorsal flexion, not due to pain and muscular spasm but to actual shortening of muscle. This may be the accommodative shortening that is characteristic of long-standing deformity; in other instances it would appear to be the result of a slight and unnoticed neuritis or anterior poliomyelitis, which has resulted in muscular inequality. If the contraction does not yield readily to manipulation or to mechanical stretching, forcible correction, and if necessary tenotomy, should be employed in the manner already described; for whatever may be the theory of its causation, it is again emphasized that obstruction to motion in any direction must be overcome before a complete cure is possible.

Adjuncts in Treatment.—It must be apparent that in many instances the cure of the weak foot is out of the question, either because of the want of energy or opportunity on the part of the patient, or because of the local or general conditions, types familiar in out-patient practice. In such cases, raising and strengthening the inner side of the shoe by the wedge-shaped leather sole, as used by Thomas, splints the painful foot and aids in relieving the strain. If the symptoms are more acute the adhesive plaster strapping, as advocated by Cottrell and Gibney for the treatment of sprains, is often of service, although it is applied in a different manner, and with a somewhat different object in view. One end of a strip of adhesive plaster, about fifteen inches long and three inches wide, is applied to the outer side of the ankle just below the external malleolus; the foot is then adducted as far as possible and the band is drawn tightly beneath the sole and up the inner side of the arch and leg, and is stayed in this position by one or two plaster strips about the calf. Narrow plaster straps are then applied about the arch and ankle, in the figure-of-eight manner, and a bandage is applied. The object of the

dressing is to aid in holding the foot in the proper position by the support and suggestiveness of the plaster, and to provide the firm compression about the arch that is always agreeable to the sufferer from weak foot. This treatment combined with the built-up shoe, and with the



FIG. 2139.—The Internal Border of the Shoe Elevated According to Thomas' Method.

corrective manipulation that has been described, is often very effective in overcoming the acute and disabling symptoms of the weak and injured foot, which are, as has been stated, often the result of extra strain or injury, in other words, a sprain of a weak foot. Consequently when these symptoms are relieved, the patient, who has become habituated to the weakness and deformity, considers himself cured.

Operative Treatment.—The various cutting operations for the relief of flat foot do not call for extended comment. The typical operation, the removal of a wedge from the astragalo-scapoid region, aims at removal of deformity simply; functional cure is made impossible by the destruction of the medio-tarsal joint. It would hardly seem possible that adhesion between the astragalus and scaphoid bones could for any length of time withhold a recurrence of deformity of the nature and origin of flat foot, and in all cases that the writer has examined in which this operation has been performed, there were still local tenderness and muscular spasm and even relapse of deformity. The operation of advancement of the posterior extremity of the os calcis, as proposed by Gleich, in order that it may be placed in a relation to the leg somewhat like that of a Pirogoff amputation, offers little hope of ultimate cure, for as the disability is not due to primary depression of the arch, it can hardly be cured by exaggerating its depth in this manner. The most innocent and rational of the operations for flat foot is the supramalleolar osteotomy of Trendelenburg, in which the bones of the leg are divided above the ankle, and the distal fragment is turned inward, with the aim of directing the weight upon the outer border of the foot. In practice, the operation is by no means always successful, while the bow-leg deformity that results, if the object is attained, is an unfortunate accompaniment of the treatment.

It may be mentioned in this connection that fracture at the ankle joint, followed by faulty union in a position of valgus, is a form of traumatic flat foot that may be cured by this operation. In operative treatment, the element of rest, necessary for weeks or months, must be taken into consideration, as explaining in part the immediate

favorable effect of whatever procedure is adopted. An investigation of final results will prove, I believe, as might be predicted from the nature of the deformity and the complex structure of the foot, that there is no short and easy method by which a cure may be attained.

II. THE HOLLOW OR CONTRACTED FOOT. (Synonyms: Talipes cavus; Talipes plantaris.) The hollow foot in which the arch is exaggerated may be considered



FIG. 2140.—The Contracted Foot—An Exaggerated Arch and Slight Limitation of Dorsal Flexion.

as the condition directly opposed to the flat or relaxed foot in which the arch is lessened or lost. In the latter instance the area of bearing surface is increased while in the hollow foot the bearing surface is diminished and the imprint of the sole may show that the entire weight is borne upon the heel and upon the metatarso-phalangeal region.

The contracted foot may be divided into two classes, the simple and the compound. In the first class the arch alone is exaggerated, "Talipes arcuatus." In the second there is a limitation of the range of dorsal flexion at the ankle joint as well, "Talipes plantaris." This latter variety was originally described by Schaffer under the title of "Non-Deforming Clubfoot" (New York Medical Record, May 23d, 1885).

Etiology.—The simple hollow foot may be, and often is, an inherited peculiarity. It may be induced by the habitual use of high heels or possibly by excessive exercise of the calf muscle as by professional dancers.

Compound hollow foot, in which there is limitation of the range of dorsal flexion at the ankle joint, or even slight persistent equinus, may be congenital also, but in most instances it appears to be a remote effect of a temporary weakness of the dorsal flexors of the foot, or of restriction of dorsal flexion from some other cause. This supposition is supported by the fact that the symptoms may date from a period of weakness and awkwardness following scarlet fever, rheumatism, or other infectious disease of childhood, symptoms attracting little attention in early life, but becoming more marked in adolescence or at a later period. In other instances the cause may be more direct, the slight deformity following a sprain or fracture, or it may be a result of an habitual attitude, as in patients who have been treated for disease of the hip joint by the traction appliance.

Symptoms.—The simple contracted foot may not cause symptoms; in fact it often passes as a particularly beautiful member rather than one that is deformed. As a rule, however, the patient complains of inability to buy well-fitting shoes, as the ordinary shoe does not support the

arch while the upper leather presses uncomfortably upon the prominent dorsum. In cases of this type there may be actual exostoses on one or more of the projecting cuneiform bones of the dorsum surmounted by a sensitive bursa.

There is usually, in consequence of the rigidity of the foot, abnormal pressure upon the heel and fore foot, and sensitive corns or callosities at the latter point are often found. Pain beneath the great toe-joint or about the anterior metatarsal arch, which is often depressed, is a common symptom, and as a rule patients complain of discomfort in the hollow of the foot referred to the tense and sensitive plantar fascia. The gait is usually ungraceful, the patient everting the feet and walking heavily upon the heels. In many instances there is a persistent attitude of valgus, "weak ankles," and in cases of this type the most troublesome symptoms may be those characteristic of the weak foot. The symptoms described are usually more marked in the compound variety of the contracted foot than in the simple form.

On examination the nature of the affection is usually apparent. The arch is exaggerated, especially on the inner border, and the tense contracted bands of plantar fascia, usually very sensitive to pressure, can be demonstrated when the foot is dorsiflexed. In many instances there is an obliteration of the anterior metatarsal arch, the normal slight concavity being replaced by a distinct convexity, and at, or about, the head of the third metatarsal bone a sensitive callus is usually present. The prominence of the dorsum of the foot corresponds to the depth of the arch, and at this point, as has been stated, one or more of the cuneiform bones may project sharply beneath the skin. The range of dorsal flexion is often restricted at the right angle with the leg, and in this class there is usually habitual dorsiflexion of the toes, as if the direct result of the action of the accessory dorsal flexors of the foot.

Treatment.—In the mild cases of simple hollow foot the symptoms may be relieved in many instances by the use of a properly fitted shoe with a high "Spanish" arch.

If the symptoms are more persistent, a metal foot plate, modelled upon a plaster cast of the sole, may be employed, the object of the brace being to equalize the pressure on the sole, to remove the strain upon the sensitive fascia, and to lessen the pressure on the sensitive points of the anterior metatarsal arch. If the foot is habitually used in a valgus attitude, the sole of the shoe must be made thicker along the inner border in order to correct the inclination.

In addition to the supporting shoe or brace, daily forcible manipulation, with the object of stretching out the foot and increasing the range of dorsal flexion, if this be limited, is of service. The Schaffer traction brace is a useful appliance for this purpose.

If the deformity is well marked and of long standing it should be corrected by operative means. The patient being anesthetized the fascia is divided subcutaneously and the exaggerated arch is then reduced to the normal depth by forcible manipulation with the hands, or by the use of the Thomas wrench. At the same time the slight limitation of dorsal flexion is overcome and the foot is fixed in a plaster bandage in which a thin wooden foot plate is incorporated. The patient is then encouraged to walk and he thus completes the cure by flattening the sole against the resistant sole plate. In severe cases tenotomy of the tendo Achillis may be required, but this is unusual.

III. PLANTAR NEURALGIA.—Pain referred to the hollow of the foot, combined with sensitiveness to pressure on the plantar fascia, is usually symptomatic of the hollow or contracted foot in which the fascia is subjected to abnormal tension. Occasionally it is present when the arch is weak or broken down. Sensitiveness of the fascia and pain at this point on standing are sometimes present in feet apparently normal. These symptoms may be induced by injury or by irritation or inflammation of the fascia, apparently due to infection, as it may follow influenza, typhoid fever, and the like.

Treatment.—If the foot is fairly normal in appearance,

or if slight weak foot is present, the application of a well-fitting shoe may relieve the symptoms. In most instances, however, a properly fitted light steel foot plate is indicated, in order that the weight may be distributed, thus relieving the fascia from strain. If the foot is markedly contracted the fascia may be stretched or divided. (See Contracted Foot.)

IV. WEAKNESS OF THE ANTERIOR METATARSAL ARCH. (Synonyms: Anterior Metatarsalgia; Morton's Neuralgia.) Pain and discomfort referred to the metatarso-phalangeal articulations of the foot are symptoms that may be explained in most instances by an abnormal condition of the anterior metatarsal arch. Normally the anterior extremities of the metatarsal bones, although each bears its share of weight when pressure is put upon the foot in standing and walking, form an arch when the foot is not in use, the second and third bones being on a somewhat higher level than the others. In other words, there should be a certain resiliency of this part of the foot that lessens the liability to injurious pressure or strain. In many instances this resiliency is lost and one finds on examining the sole of the foot a persistent convexity in place of the normal arch. It may be noted in this connection that plantar flexion of the toes raises the heads of the adjoining metatarsal bones and increases the metatarsal arch. On the other hand, dorsiflexion of the toes lowers the arch, and as this attitude of persistent dorsiflexion of the first phalanges and consequent limitation of plantar flexion is one of the common effects of improper shoes, one recognizes the shoe as the most constant cause of weakness and of depression of the metatarsal arch.

Another type of weak arch is that in which there is, in consequence of weakness and flabbiness of tissue, an abnormal lateral expansion of the fore foot. Or again there may be apparently a local weakness of the muscles or ligaments of one of the component bones of the arch that allows it to assume an abnormal relation to its fellows.

Attention was first called to pain in this region of the foot by Dr. T. G. Morton of Philadelphia, in 1876, under the title of a painful affection of the fourth metatarso-phalangeal articulation, and as far as the symptoms of this type of what may be called anterior metatarsalgia is concerned, his description needs but little amendment. Typical cases of this class are characterized by a sudden cramp-like pain beneath the fore foot in the neighborhood of the fourth toe. It may begin as a burning pain beneath the toe or simply as a sensation of discomfort that gradually increases until it becomes unbearable. From the point of greatest discomfort the pain often radiates to the end of the toe or up the dorsum of the foot to the leg. Except in extreme cases, the pain is never felt except when the shoe is worn, and it may be relieved usually by removing the shoe and rubbing the foot. This need is so urgent that the removal of the shoe is one of the most distinctive signs of the affection. These cramp-like attacks may occur only at infrequent intervals, as for example when a certain shoe is worn, or they may recur so frequently as practically to disable the patient. After an attack of cramp the part may be sensitive for a time, and swelling even may appear, if it has been severe and prolonged. This is, however, rather unusual. The affection is relatively more common among women than among men, and among the well-to-do rather than the poorer classes. It is not infrequently found in several members of the same family, and it may be an inherited peculiarity. It is often bilateral, the second foot becoming affected usually after a considerable interval. The affection is usually chronic in character and not infrequently the patients are of a nervous or possibly neurosthenic type.

As has been stated, pain, although far more common at the fourth articulation, is by no means confined to this point. In some instances the patient is unable to localize the pain accurately, in others it is referred to the three adjoining toes, second, third, and fourth. In certain cases the greatest complaint is of sensitiveness of

the metatarso-phalangeal joints to pressure, either direct or lateral. This complaint is more common when the arch is depressed and fixed in this attitude corresponding to the rigid weak foot. In other instances a painful callus beneath the second or third metatarsal head is the source of discomfort.

It should be stated that typical cases of Morton's neuralgia may be present although the foot is apparently normal in appearance.

Etiology.—As has been stated, the attacks of pain, although favored by "hot pavements," by "the sticking of a damp stocking to the foot," by thin soles, by sudden and unguarded movements, and the like, are practically always induced by the shoe, and it may be assumed that the pressure of the shoe upon a weakened and sensitive part induces the cramp. The influence of the shoe, as the author has suggested elsewhere (New York Medical Record, August 6th, 1898) may be explained as follows. Normally, lateral pressure on the hand or foot compresses it and increases the depth of the arch, as the tight glove does the hand. If, however, this increase of the arch is prevented, the adjoining bones cannot escape direct lateral pressure, a pressure that then becomes extremely painful, as one may demonstrate upon one's self by squeezing the hand suddenly while the metacarpal bones are fixed in the same plane; or if one finger of the hand be dorsiflexed so that the metacarpo-phalangeal joint is forced below the level of its fellows, pain on lateral pressure is always referred to this point. The same manoeuvre causes pain in the foot at the corresponding articulation. It is evident also that in the foot an articulation that is depressed habitually will be constantly subjected to greater weight, or direct pressure as well, when it is in use.

Of all the causes of weakness and deformity of the anterior part of the foot the shoe is by far the most important. The lateral compression of the narrow and ill-shaped sole induces distortion of the toes and atrophy of the muscles that have lost their function. Thus the fore foot, deprived of its accessory supports, is subjected to abnormal pressure. The depression of the metatarsal

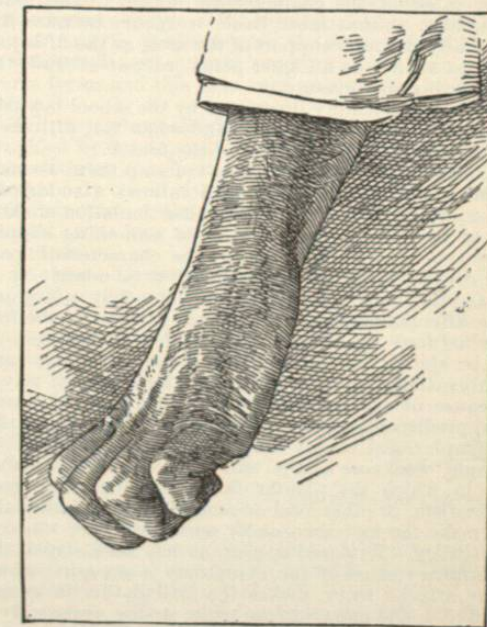


FIG. 2141.—An Attitude in which Lateral Pressure is Painful.

arch is induced by the persistent dorsiflexion of the toes which is the attitude of shoe-wearing people, an attitude favored by direct compression by the rocker shape of the

ordinary shoe and by the slight depression of the sole beneath its centre.

In the depressed arch, that metatarso-phalangeal joint that is lowest is subjected to abnormal pressure and it is

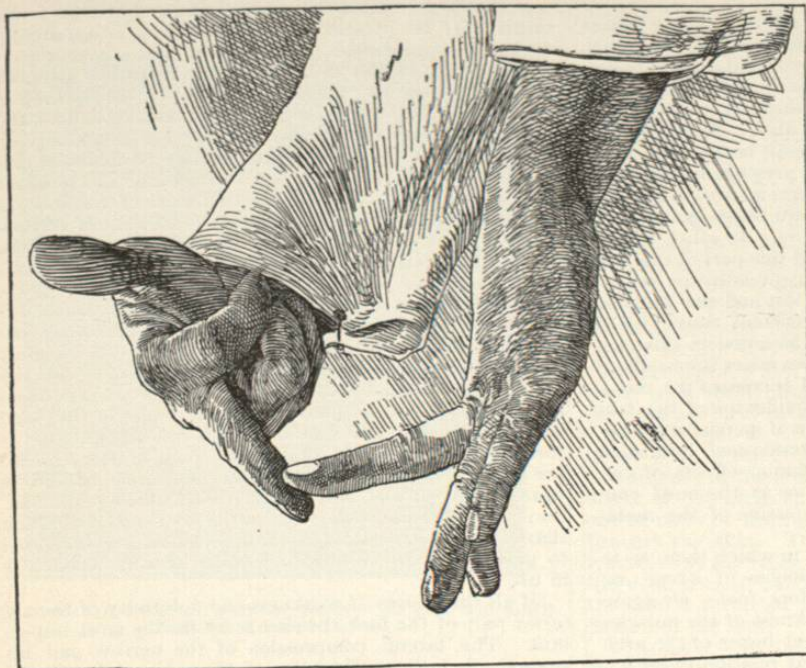


FIG. 2142.—In this Attitude Lateral Pressure Causes Pain at the Depressed Joint.

liable to lateral compression as well, the latter being the direct cause of the characteristic cramp. The fourth articulation is that most liable to injury because it is practically the outer support of the arch, as the fifth joint is almost always on a higher plane or in an attitude that favors injurious pressure.

This may be readily illustrated by the school boy trick of suddenly compressing the hand when the fifth metatarsal bone is above the level of the fourth.

In many instances of Morton's cramp there seems to be simply a laxity of tissues that allows a sudden displacement downward of the fourth articulation or elevation of the fifth, a movement as of something slipping in the bone which is followed by the characteristic pain. This displacement may be induced by a misstep or by overexertion and not infrequently the first appearance of the affection dates from a sprain or twist of the foot, or is induced by extreme dorsiflexion of the toes. It may be stated also that extreme dorsiflexion may cause a subluxation of one of the joints which in itself may be the cause of the peculiar pain. There are, of course, other predisposing or exciting causes of this pain than the simple local causes that have been mentioned: for example, weakness of the longitudinal arch, the hollow foot, in which the plantar fascia is contracted; gout, rheumatism, or other local or constitutional affection that may make the foot abnormally sensitive.

Pathology.—It would appear, as has been stated, that the ordinary cause of the symptoms is pressure, which, as the attacks recur, makes the articulation in general sensitive. The more intense pain is due apparently to injury and pressure on the digital nerve and in certain instances a local neuritis may be present. Other changes in and about the joint are usually those secondary to the abnormal position of the part.

Treatment.—The treatment should be conducted with the aim of removing the direct causes of the discomfort and of restoring the normal condition of the weakened

part. The first essential is therefore to provide the patient with a proper shoe. This must correspond with the outline of an undistorted foot; the sole should be thick and the shank should be arched to give proper support to the sole. A laced shoe that may be drawn tight about the arch usually adds to the comfort of the patient. The sole should be flat and it should be somewhat thicker in the centre so that it may form a slight convexity beneath the metatarsal arch. In fact the object of mechanical treatment is to support this anterior arch in its proper position. For this reason it is well in most instances to provide the patient with a light steel sole plate, fashioned on a plaster cast of the sole of the foot, of which the longitudinal and anterior arches have been somewhat exaggerated. This plate, as is shown in the diagram, usually extends from the centre of the heel to slightly beyond the metatarso-phalangeal joints, but in certain instances it is of advantage to extend it farther forward in order to splint the foot and prevent dorsal flexion of the toes if this motion induces discomfort or if the part is especially sensitive. As an immediate treatment the fore foot from the tarsus to the phalanges may be bound by strips of adhesive plaster, the metatarsal region being compressed somewhat as a tight glove compresses the

hand; the elevation of the arch may be further assured by inserting a pad of felt or leather beneath it. This is a very effective means of relieving the discomfort and preventing the recurrent cramp.

In acute cases or when the part is very sensitive, and particularly in those cases that have resulted directly from injury, a plaster bandage may be applied, the foot being fixed in an attitude of slight dorsiflexion and adduction. The metatarsal arch should be exaggerated and the toes fixed in slight plantar flexion. If the arch is rigidly depressed, as in certain cases complicated by rheumatism and the like, the deformity must be overcome by forcible manipulation under anaesthesia before the bandage is applied.

In all cases the patient should endeavor, in the after-treatment, to regain the power of plantar flexion of the toes by manipulation and by exercise, and by pressing the toes firmly against the sole of the shoe to assist, as far as

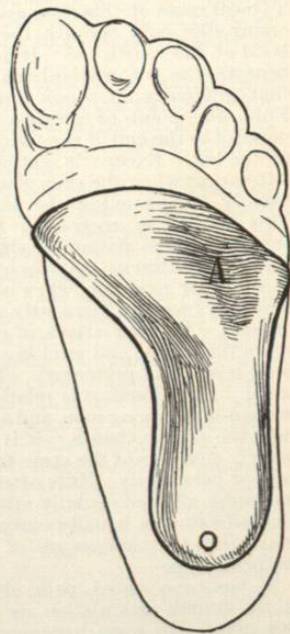


FIG. 2143.—A Brace to Support the Anterior Arch. A. The point of greatest elevation beneath the painful part.

may be, the weakened arch in the performance of its labor.

Operative Treatment.—An effective treatment, and one that may be necessary in the persistent type of this affection, is excision of the head of the metatarsal bones, if, as is usual, the pain is localized at this point. This

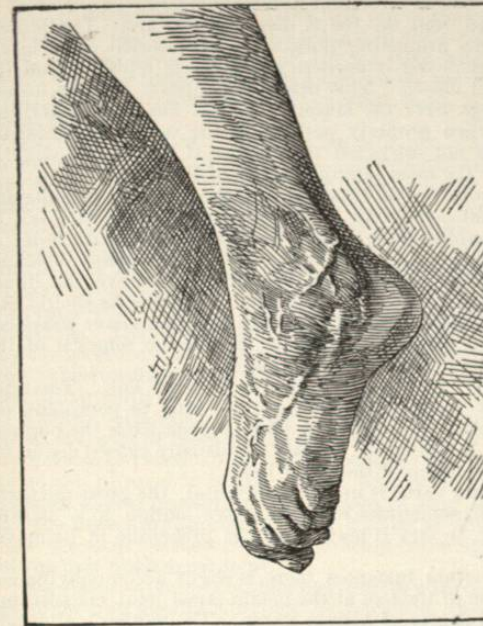


FIG. 2144.—Plantar Flexion of the Toes. An exercise for strengthening the anterior arch and overcoming deformity.

operation, the treatment of routine suggested by Morton, is easy of performance and it usually affords relief. The resulting deformity is but slight. In most instances it is, however, unnecessary.

Depression or contraction of the longitudinal arch, which in certain instances may predispose to the discomfort, should be relieved if possible.

Massage, the hot-air bath, the application of various liniments are of some service in certain cases as adjuncts. Constitutional treatment is also indicated in those cases in which there is a gouty or rheumatic tendency or other complication.

V. HALLUX RIGIDUS. (Synonym: Hallux flexus.) Hallux rigidus is a painful affection of the great toe joint accompanied by restriction of motion. In well-marked cases the toe may be habitually plantar-flexed to a slight degree; hence the name hallux flexus suggested by Davies-Colley. In this class the motion may be much restricted, particularly in dorsal flexion, thus interfering with proper functional use of the foot. There is usually pain of a burning, throbbing character referred to the joint and increased by use, and a certain degree of congestion is often present.

Etiology.—Hallux rigidus is usually seen in adolescence as a complication of a weak arch which allows the fore foot to be crowded into the narrow part of the shoe, thus subjecting the great toe joint to lateral and longitudinal pressure. In some instances the habitual flexion is the effect of an instinctive effort of the patient to support a weakened arch by downward pressure of the great toe. (Hammer-toe flat foot. Nicoladoni.)

The affection may also be induced directly by injury, as by stubbing the toe or by kicking a hard object, or it may be a complication of rheumatism or gout.

There are no distinctive changes in the joint other than those secondary to long-standing restriction of function and deformity.

Treatment.—If the rigid joint is a secondary effect, as in most instances it is, of the weak or broken-down foot

the first step is the treatment of the exciting cause (see Weak Foot). In any event a properly fitting shoe must be worn, which exerts no pressure on the sensitive part. The sole must be thick, so that movement in the joint may be restricted, and in certain instances it may be necessary to insert a steel brace between the layers of the sole of the shoe in order to prevent all motion for a time. If direct pressure on the toe joint causes discomfort, the sole of the shoe may be made very thick just behind the sensitive part, so that the weight is supported as it were on an anterior heel (Fig. 2145).

If the affection of the toe complicates a rigid flat foot, as is not infrequently the case, the deformities should be over-corrected under anaesthesia (the flexed toe being forcibly extended), and fixed in a plaster bandage in the manner described in the section on Weak Foot. In extreme, and very exceptional, cases of long standing, excision of the joint may be required.

VI. PAINFUL GREAT TOE. Pain, on motion and pressure, at the great toe joint, and symptoms resembling those of hallux rigidus, are not uncommon in older subjects. These symptoms are induced usually by a long walk or by strain or other injury.

The treatment is based upon essentially the same principles as those governing the treatment of the former affection. Thus, for example, splinting may be employed, when necessary, to restrain painful motion, and a proper shoe may be fitted for the relief of pressure.

Pain about the great toe is a common symptom of the weak arch, or of the contracted foot. It may be caused simply by the pressure of a tight shoe. It is often present as a symptom of hallux valgus and of its accompanying bunion. The joint may be directly involved in gout, rheumatism, and the like. The treatment must be directed to the cause.

VII. HALLUX VALGUS. Hallux valgus is a deformity of the foot, in which the first metatarsal bone is adducted and at its anterior extremity separated from its fellows, while the toe is turned outward or abducted to a greater or less degree. Thus although the area of the toes is contracted the fore foot is actually broadened.

In consequence of the distortion there is an actual displacement of the joint surfaces. In marked cases, the first phalanx of the distorted toe articulates only with the external condyle of the metatarsal bone, while the internal condyle, projecting on the inner side of the foot, is subjected to the direct pressure of the shoe. Here a bursa forms and this is in turn surmounted by a corn or callus.

The projecting condyle, sometimes irregular and hypertrophied by the deposit of periosteal bone, the bursa, and the overlying corn make up the enlarged joint or so-called bunion. In cases of this type there is usually more or less abduction of the other toes, and the great toe, often rotated on its long axis, may be displaced above or below its fellows.

Etiology.—By far the most important of the predisposing and exciting causes of the deformity, and of the consequent pain and discomfort, is the shoe. In fact a moderate degree of hallux valgus, shown by the projecting "enlarged" joint, is so common as to pass as the normal condition of shoe-wearing people. The influence of the shoe is increased when the longitudinal arch is weak, as the parts are then subjected to greater pressure. The deformity, or more especially the symptoms, may be increased by gout, rheumatoid arthritis, and the like, and by overstrain and injury as well.

Pathology.—The pathology does not call for extended comment. There are the usual changes in and about the joint that accompany similar subluxations, the cartilage disappears from the exposed parts of the internal condyle, and the ligaments and the muscles contract on the shortened side and oppose the rectification of the deformity.

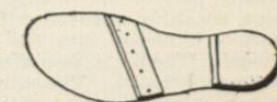


FIG. 2145.—The Anterior Heel.

Symptoms.—The most important sign of hallux valgus is the deformity. The most important symptoms are the pain and sensitiveness induced by the pressure upon the projecting joint. The discomfort is, of course, greatly increased by the inflamed bunion and accompanying corn. There may be pain also beneath and about the joint. Pain in the joint may be in part symptomatic of the irritation and changes secondary to the deformity itself. Pain beneath the joint is usually caused by the greater pressure to which the part is subjected by the outward rotation of the foot, an attitude that is almost always assumed by the patient if there be an accompanying weak foot. In certain instances pain beneath the joint may be due to irritation about one of the displaced sesamoid bones which are sometimes adherent and are sensitive to direct pressure.

Treatment.—In the slighter degrees of deformity the symptoms may be checked by the use of a proper shoe, straight on the inner side and with capacious upper leather. This removes the direct pressure and allows an opportunity for normal movement. Making the sole somewhat thicker on the inner border is of advantage also, as it inclines the weight slightly toward the outer part of the foot. In addition, daily manual correction of deformity, together with alternate voluntary flexion and extension of the toe while it is guided by the fingers in the normal direction, is of advantage from the curative standpoint.

A number of appliances have been devised to hold the toe in normal position while the foot is in use. In most instances, however, the incidental discomfort is sufficient to prevent their use. One of the simplest and most efficient of these devices is the Holden toe post, a thin upright of metal fixed in the front of the sole of the shoe, making a compartment into which the toe is guided and thus held in an improved position. This toe post necessitates a digitated stocking and a special shoe; like other appliances it is very uncomfortable unless it is perfectly adjusted, and until the patient has become accustomed to it.

It must be borne in mind that a part of the deformity of hallux valgus is caused by the adduction of the metatarsal bone. It is well, therefore, to lessen this displacement by the use of a bandage or by adhesive-plaster strapping about the fore foot, so applied as to exercise a certain amount of compression at this point.

It has been stated also that weakness of the arch or flat foot is a common accompaniment of hallux valgus. In such cases a proper support is an essential part of the treatment.

As a rule patients demand treatment rather because of the discomfort than because of the slight degree of deformity. This discomfort is due to the pressure on the sensitive bunion lying on the projecting condyle, and the removal of this projecting bone will practically relieve the symptoms.

A simple and effective operation is conducted as follows. A slightly curved incision is made below the joint, the bunion is dissected from the adherent skin, the joint is opened and the projecting bone, usually the greater part of the internal condyle of the metatarsal bone, smoothly removed with a chisel, after which the capsule is closed with fine catgut as in the external wound. The toe is then straightened by stretching the contracted tissues. The entire foot is slightly adducted, or turned inward, and together with the leg is enclosed in the plaster, the toe being fixed in the corrected position by the same means.

As soon as the weight can be supported without discomfort the patient is allowed to walk about on the foot. Afterward, manipulation, exercises, the use of a proper shoe together with a flat-foot brace, if this is indicated, will complete a practical cure.

Modifications of the Operation.—In certain instances there may be contraction of the extensor tendon of the toe. Weir has suggested that this may be divided and sewed to the periosteum on the outer border of the first phalanx, thus serving to prevent recurrence of deformity.

In more extreme cases of contraction and deformity, resection of the head of the metatarsal bone may be indicated. Cuneiform osteotomy of the metatarsal bone has been suggested, but this, to be effective, must include the projecting condyle.

Fowler's Operation.—In this procedure the incision is made between the first and second toes, the ligament is divided, and the toe is displaced inward. The bunion and the projecting portion of the internal condyle are then removed if necessary, the toe is replaced, and the wound closed. This operation appears to offer no advantage over the simple one that has been described, for, when properly performed, the scar is insignificant and is not subjected to pressure if it be made slightly below the most prominent part of the joint.

Bunion.—The treatment of the bunion, the inflamed sac and corn, may be summarized as rest with hot or cold applications during the active stage, with relief of pressure by the use of a proper shoe. In many instances a metallic support for the arch to remove the direct pressure on the toe is indicated. Operations should as a rule be deferred until the acute symptoms have subsided. An effective operation must include the removal of the projecting bone as well as the sac.

VIII. HALLUX VARUS AND PIGEON TOE. The term hallux varus is properly applied only to persistent adduction of the great toe, while pigeon toe is the popular name for in-toeing, an attitude usually caused by an inward rotation of the entire limb.

Hallux varus is usually congenital; the great toe turns inward, sometimes when in active motion, to a marked degree, in fact it may be almost prehensile in its movements.

In certain instances there is slight accompanying adduction of the foot at the medio-tarsal joint, constituting a mild degree of talipes varus. The mother's attention is usually attracted to the condition, not by an actual deformity of the toe, but by difficulty in putting on the baby's stocking.

Hallux varus is occasionally seen also as an acquired peculiarity in connection with certain varieties of weak foot (valgus). In such cases there is a marked inward bulging at the medio-tarsal joint which is compensated for by an exaggerated inward twist of the fore foot and adduction of the great toe (Fig. 2130).

Treatment.—Simple hallux varus, as a rule, requires no treatment since it is cured by the use of the shoe when the child begins to walk. In more extreme cases the prehensile movements may be restrained by a narrow band of adhesive plaster passed over the toes and fore foot. If talipes varus is present it should be treated in the ordinary manner (see Talipes).

PIGEON TOE.—Hallux varus is a rather unusual cause of the in-toeing gait, or so-called pigeon toe, which, as has been stated, is caused as a rule by inward rotation of the entire limb rather than by a deformity of the toe or foot. This rotation of the limb may be caused also by bow legs in which there is an accompanying inward twist of the tibiae and occasionally it may be induced by a restriction of the range of outward rotation at the hip joints.

As a rule, however, pigeon toe is a compensatory attitude symptomatic either of weak feet or of knock knees, and it is therefore far more often a secondary than a primary attitude. The proper position of the feet in walking, at least in childhood, is one of parallelism. In fact the exaggerated outward rotation of the feet which is so commonly seen, is more abnormal than a slight degree of in-toeing. As the latter attitude, from the conventional standpoint, passes for deformity it usually attracts the mother's attention before the weakness, of which it is so often a symptom.

Treatment.—The rational treatment must be directed to the cause of the peculiar attitude, viz., the bow leg, the knock knee, or the weak foot. In many instances the in-toeing habit remains for a time, after the removal of its cause, and systematic training in walking with the feet rotated outward may be necessary to overcome it.

If there be actual limitation of the range of outward rotation at the hip joints, as is sometimes the case, this must be overcome by systematic stretching.

In the absence of knock knee or weakness of the arch the tendency to in-toeing may be lessened by making the sole of the shoe somewhat thicker on the outer border.

In the more exaggerated types, the use of elastic tapes attached to the front and outer margin of the soles of the shoe, passing about the back of the leg from without inward over the front of the thigh and across the buttock, to be attached to the middle of the waist band, is an efficient treatment.

IX. HAMMER TOE. Hammer toe is a persistent flexion of a toe, usually of the second. In well-marked cases the first phalanx is dorsiflexed, the second plantar-flexed, and the third may be flexed and extended. The toe is usually compressed between its fellows, while its extremity, lying on a lower level, is flattened out against the sole of the shoe into a club or hammer shape. On the dorsal surface of the flexed joint which is subjected to pressure from above there is usually a sensitive corn or callus. The discomfort of the hammer toe is caused by the pressure of the shoe upon the corn above and upon the hypertrophied extremity below, of which the nail is not infrequently ingrown.

Etiology.—Hammer toe may be congenital, but in the great majority of cases it is an acquired deformity caused by narrow and short shoes. The second toe is more often involved because it is the longest and is subjected to greatest lateral pressure also. In cases of long standing all the tissues are shortened on the plantar or short surface, the most resistant contraction being in the ligaments of the first phalangeal joint.

Treatment.—Congenital hammer toe may be corrected in infancy by manipulation and by retention with a strip of adhesive plaster. The slight degrees of hammer toe in older subjects may be treated in a similar manner by methodical stretching and splinting with some light material such as celluloid. In such cases a digitated stocking is of advantage. In all cases a wide, capacious shoe which exerts no pressure whatever, is the first essential.

Confirmed hammer toe may be treated by division of the resistant parts, particularly of the ligaments of the first interphalangeal joint, and by correction followed by retention for a time with a digital splint of elastic material or a leather inner sole. In most instances, however, patients demand treatment for the relief of the discomfort caused by vertical pressure upon the flexed toe, rather than for the absolute restoration of symmetry. For this class the most efficient procedure is resection of the prominent joint, sufficient bone being cut away from the adjoining phalanges to remove the projection completely. By such a procedure permanent relief may be secured.

X. OVERLAPPING TOES. Irregularity in the line of the toes is sometimes observed in infancy; for example, a congenital hammer toe may be present or the little toe may be set upon a higher level than its fellows.

The irregularities may be treated by methodical manipulation and by retention of the distorted member by strips of adhesive plaster passed above and beneath it, fixing it to its fellows. Irregularities of this character in older subjects are almost always caused by improper foot wear, with the exception of distortions caused by rheumatism or by lesions of the nervous system, and the like. In this class, the use of a proper shoe will usually relieve the symptoms.

XI. ACHILLO-BURSITIS. (Synonym: Achillodynia.) In 1893 Albert* suggested the title Achillodynia to characterize a group of symptoms caused, in most instances, by irritation or inflammation of the bursa lying between the tendo Achillis and the posterior surface of the os calcis.

Etiology.—In certain cases the bursitis may be caused directly by pressure, injury, or overstrain, but in many instances rheumatism, gout, gonorrhœa, and the like, appear to be predisposing or exciting causes of this, as of

similar affections of bursae and tendon sheaths elsewhere. Concretions within the bursa or exostoses beneath it may be mentioned as possible causes, or complications.

Pathology.—In chronic cases the bursa is thickened and enlarged and the lining membrane is fringed and reduplicated. The contents may be serous or semisolid and concretions may be present. Suppuration may occur within the sac or it may be the seat of syphilitic or tuberculous disease. The periosteum in the neighborhood is usually thickened, and the underlying bone may be congested and softened.

Symptoms.—In typical cases there is sensitiveness to pressure over the back of the heel, and pain or discomfort exaggerated by functional use, particularly by motions and attitudes that increase the strain upon the tendon. The pain may radiate up the leg or it may be referred to the bottom of the heel. Patients often complain also of a sensation of laxity and insecurity in the subastragaloid articulation. In a large proportion of the cases the symptoms of the weak foot accompany or follow those of achillodynia. In the latter instance this is explained doubtless by the fact that the loss of the leverage function of the calf muscle induces an awkward gait with a strong inclination toward pronation of the foot, an attitude that throws an increased strain upon its inner border and upon the longitudinal arch. In cases of long standing there is marked atrophy of the calf due to disuse of function and in many instances a broadening of the posterior part of the heel caused by the infiltration or irritation of the periosteum about the insertion of the tendon. The enlarged bursa is usually demonstrable on inspection and palpation. The affection may be unilateral or bilateral, the latter being more common in chronic cases. As a rule the symptoms begin in one foot, the second becoming involved after an interval of several months.

When the symptoms have persisted for any length of time, there appears to be little tendency toward spontaneous recovery, a fact that is explained by difficulty in securing relief from pressure and strain in this situation.

Treatment.—In acute cases, particularly those that have followed injury, the treatment should be—functional rest combined with the application of heat or cold, as may be indicated.

When the immediate symptoms have subsided the part may be supported by adhesive plaster so arranged as to relieve the strain upon the sensitive part. A long band of plaster about two and a half inches wide is closely applied to the sole of the foot and calf of the leg, reaching from the toes nearly to the knee, with the foot in slight plantar flexion. This is supported by additional straps about the fore foot and leg, the ankle and heel being completely covered with narrow strips; a bandage is then applied. By this means the direct pull of the muscle on the sensitive part is checked and compression is exerted upon the bursa. The dressing should be renewed when its efficiency is lessened.

If more complete fixation is indicated by the symptoms a light plaster bandage may be applied to hold the foot at a right angle with the leg and slightly adducted. The patient can then use the foot without discomfort. In many instances the application of the cautery seems to hasten the absorption of the effusion. If relief from

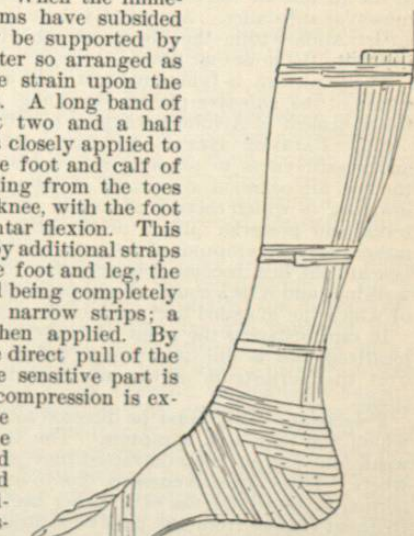


FIG. 2146.—The Manner of Applying Adhesive Plaster.

* Wien. med. Presse, January 8th, 1893.

function is necessary for any length of time, as in the chronic cases, it is well to apply a leg brace to the shoe with a joint at the ankle so arranged as to prevent dorsal flexion beyond a right angle. As patients are usually sensitive to direct jar, a rubber heel should be employed, and an increased height of the heel sufficient to throw the weight forward upon the front of the foot usually lessens the discomfort.

As has been stated, in the chronic cases there is usually an accompanying weakness of the longitudinal arch. This may require the application of a support and further treatment as described in the section on the weak foot.

Operative Treatment.—In persistent cases, particularly those in which the bursa is palpable and in which the adjoining tissues of the os calcis are infiltrated, the removal of the bursa is indicated. This is accomplished by an incision beside the insertion of the tendon where the bursa is most prominent. Irregularities of the underlying bone should be removed at the same time. The wound is then closed and a plaster bandage is applied. This should be worn until the patient can walk without discomfort. Support may or may not be required in the after-treatment. Operative intervention is of course indicated when suppuration of the sac is present or when it is the seat of primary or secondary tuberculous disease. As has been stated, the local disability may be induced or prolonged by systemic disease. In such instances appropriate remedies should be employed.

XII. ACHILLO-BURSITIS POSTERIOR.—A small sensitive bursa over the insertion of the tendon, between it and the skin, sometimes causes symptoms resembling those of the preceding affection. This bursa is usually caused by the pressure of the shoe, and it may be relieved by removing the exciting cause and by strapping with adhesive plaster.

Bursæ or sensitive points elsewhere on the heel are to be treated in a similar manner. Irregular projections on the bone may require removal.

XIII. STRAIN OF THE TENDO ACHILLIS.—Pain on use of the foot referred to the tendo Achillis may follow strain or overuse, the symptoms may resemble those of Achillo-bursitis, but the sensitive point is often localized at the middle of the tendon or at the junction with the muscular substance. Apparently there is, in these cases, an irritation within the fibrous sheath of the tendon or injury to the muscular fibres.

The treatment is functional rest. As a rule the application of the adhesive-plaster strapping, as described in the treatment of Achillo-bursitis, is effective.

XIV. PAINFUL HEEL—CALCANEAL-BURSITIS.—Pain and sensitiveness to pressure referred to the bottom of the heel are common symptoms of the contracted or hollow foot, in which there is abnormal pressure on the anterior and posterior pillars of the arch. It may be in normal feet a symptom of overuse, as when the tissues beneath the heel become sensitive after long standing or walking, and it is a common symptom of the weak foot of which the so-called heel walk is characteristic.

In rare instances the point of tenderness is distinctly localized and is due to a small inflamed bursa lying over the periosteum of the inner tuberosity of the os calcis.

Treatment.—This must be directed to the condition of which the pain is a symptom. The treatment of the weak foot and of the contracted foot is described elsewhere. If the sensitiveness is due to overuse or to abnormal pressure, the use of a rubber heel combined with frequent change from the passive attitude, in which the weight is supported entirely on the sensitive part, may relieve the symptoms. In many instances the use of an arched foot plate, to distribute the pressure along the entire sole, is of service.

Painful bursæ may be protected from direct pressure or removed if necessary. *Royal Whitman.*

FOOT, DISTORTIONS OF.—TALIPES.—In the preceding article, the disabilities of the foot of which the discomfort is of greater importance than the deformity

have been described. One may now consider those of congenital and acquired origin of which deformity is the most noticeable feature. A distortion of the foot of this class is simply an abnormal retention of a normal attitude, or what is an exaggeration of a normal attitude. In other words the centres of motion, at which the foot is deformed, are the centres of normal motion and the different distortions may be simulated by a normal subject. If the foot has been fixed in the abnormal attitude during foetal life, or if it has been used for any length of time in the abnormal position, the deformity becomes exaggerated beyond the possibility of imitation, and secondary variations in its shape, size, and nutrition follow.

The deformities of the foot are grouped under the generic name talipes, derived from talus (ankle) and pes (foot), signifying therefore a form of deformity in which the patient walks upon his ankles. Talipes was therefore originally synonymous with the popular term club foot, but at the present time it is used preferably as a prefix to the descriptive titles of the different distortions, while club foot is usually applied only to the most common of the deformities, equino-varus, in which the distorted foot is club-like in form.

VARIETIES.—There are four simple varieties of the distorted foot or talipes:

1. *Talipes Equinus*, the extended or plantar-flexed foot. In well-marked cases the patient walks upon the heads of the metatarsal bone, an attitude that suggested the name equinus (horse-like).

2. *Talipes Calcaneus*, the dorsi-flexed foot in which the heel is prominent, and which alone bears the weight in walking; hence, calcaneus from calcaneum, the heel bone.

In these forms the centre of motion is at the ankle joint. Under the terms equinus and calcaneus are included not only the cases of marked deformity, but also those in which the range of dorsal or plantar flexion is sufficiently limited to cause a change in the contour of the foot.

3. *Talipes Varus*, the inverted foot. In this deformity the foot is turned in or adducted, and combined with the inward twist, which exaggerates the normal curve of the inner border, there is always a certain amount of supination, or inversion; that is, the inner border of the sole is elevated and the outer border is depressed, so that the weight falls to the outer side of the centre of the foot.

4. *Talipes Valgus*, the everted foot. This deformity is the reverse of varus. The foot is abducted, that is, the foot is twisted outward at the centre and pronated, so that in use the weight falls on the inner border.

In these forms of lateral deformity the centres of motion are at the mediotarsal and subastragaloid joints.

These simple deformities in which the foot is persistently extended or flexed, or twisted in or out, are comparatively uncommon.

Compound Deformities.—As a rule, the deformities are combined in varying degree; thus, the over-extended or the over-flexed foot is usually twisted inward or outward, making four varieties of compound deformity. 1. *Talipes equino-varus*—downward and inward. 2. *Talipes equino-valgus*—downward and outward. 3. *Talipes calcaneo-varus*—upward and inward. 4. *Talipes calcaneo-valgus*—upward and outward.

In the simple and compound varieties of talipes the arch of the foot may be increased or diminished in depth. It is, for example, usually increased in calcaneus and equinus, and it is usually diminished in valgus; but this secondary or subordinate deformity is not recognized in the ordinary classification. If the arch of the foot is exaggerated, the condition is sometimes called *talipes cavus*; if it is lessened or lost, *talipes planus*. These slight degrees of distortion, in which the functional disability is far more important than the deformity, are rarely classed as forms of talipes. Simple cavus, the hollow or contracted foot; and planus, one of the forms of the common weak or flat foot, have been described already.

ETIOLOGY.—From the remedial standpoint, the cause

of the deformity is of far greater importance than its form. Thus the distortions of the foot fall primarily into two groups: 1. *The congenital form*, in which the foot has become deformed in process of formation. 2. *The acquired form*, in which the foot, perfect at birth, has at a later time become distorted.

Congenital Talipes is simply a twisted foot, of which the component parts, although malformed to a greater or less degree, are capable of regaining perfect form and function. This is practically true of the great majority of cases, although there are exceptional instances in which congenital deformity is complicated by defective formation of the foot or leg, or in which the deformity is caused by, or at least accompanied by, paralysis, as, for example, in certain forms of spina bifida or other congenital defect or disease of the nervous apparatus.

Acquired Talipes is almost always a consequence of paralysis of spinal origin (anterior poliomyelitis) in early childhood. Certain muscles or groups of muscles being paralyzed, the muscular force is unbalanced and the foot is drawn into a distorted position by the action of the unopposed muscles, and by the influence of gravity. This distortion is confirmed and increased by the accommodative changes that accompany functional use and growth in the abnormal attitude.

Far less often acquired talipes may be the result of paralysis of cerebral origin, of other forms of spinal disease, of local paralysis following neuritis or injury to a nerve trunk. It may be caused by scar contraction, as after a severe burn, or by direct injury to the bone, or by disease that may interfere with subsequent growth. Such are, however, extremely uncommon causes, and the statement holds good that congenital talipes is a simple distortion capable of perfect cure, while the acquired talipes is a deformity and disability usually secondary to disease of the spinal cord. It is therefore capable only of rectification, not of perfect cure unless recovery from the original disease, of which it is a result, has taken place.

CONGENITAL TALIPES.

ETIOLOGY.—The etiology of congenital talipes as of other congenital deformities is somewhat conjectural. In some instances the influence of inheritance is apparent, and again two or more children with club foot may be born of the same mother, but, as a rule, there is nothing in the family or personal history that can in any manner explain the deformity. The most reasonable explanation applied to the majority of cases is that the foot has from some cause remained for a longer or shorter time in a constrained or fixed position, and has thus grown into deformity.

It has been claimed by Eschricht, and by Berg (Berg, *Archives of Medicine*, New York, December 1st, 1882) that at about the third month of intra-uterine life the thighs of the embryo are abducted, flexed, and rotated outward, the legs are crossed, and the feet are plantar-flexed and adducted so that the inner surfaces of the thighs, the tibial borders of the legs, and the plantar surfaces of the feet are held in close apposition to the abdomen and to the pelvis of the foetus. Later there is an inward rotation of the legs so that the feet are turned gradually outward until the soles are brought into contact with the uterine wall, the feet then being in the attitude of abduction and dorsal flexion. According to this theory there is a regular succession of attitudes during intra-uterine life. If the inward rotation of the lower extremity is prevented, or if it is incomplete, the foot remaining in the original position becomes deformed. Thus, equino-varus being the normal attitude of the early and middle period of intra-uterine life, is the most common and the most intractable of the congenital deformities. If the constraint or pressure is not exerted until a later period, after rotation has taken place, when the foot has attained or nearly attained its normal size and shape, it will then induce the less common and comparatively slight grades of deformity such as calcaneus or valgus.

This theory which seems interesting and reasonable,

appears to rest on an insecure basis. Bessel Hagen states that in embryos of 30 mm. in length, the foot is in extreme plantar flexion; in those of 90 to 100 mm., the foot is at a right angle to the leg; and from this size to that at full term, the foot may be found in any position, abducted, adducted, or dorsiflexed. He states also that supination is not the usual attitude at an early period, but is more common near the termination of intra-uterine life, and that when it is present it is more often combined with dorsiflexion. In other words, there is no time when the foot regularly and normally assumes the attitude of club foot, from which it is changed by the rotation of the legs. Scudder (*Boston Medical and Surgical Journal*, October 27th, 1887), after similar investigations, arrived at

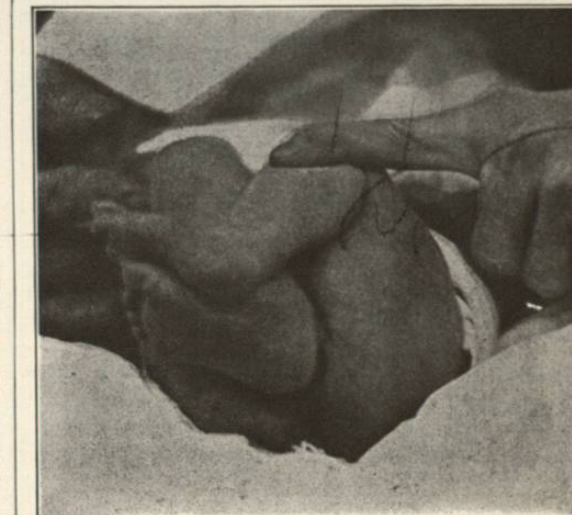


FIG. 2147.—Congenital Talipes Illustrating the Attitude of the Limbs at Birth.

practically the same conclusions. He states that there is no necessary relation between the age, the rotation of the legs, and the position of the feet.

It would appear, however, that there is during the process of development a normal alternation of attitudes and postures. If the feet for any reason are fixed in one position during this period of rapid growth, distortion must follow; if the constraint is slight, and if its influence is exerted at a late period, the deformity will be slight; if it occurs at an early period, the deformity will be more resistant.

One of the causes of constraint, and thus of ultimate deformity, appears to be the interlocking of the feet. Many museum specimens show this, and in some of the cases of talipes seen during the first weeks of life, the feet may be replaced in the attitude in which they had been fixed before birth. Intra-uterine pressure, although not necessarily direct pressure, undoubtedly has an influence in aggravating the deformity. The effect of pressure is not infrequently shown in atrophic areas of skin, and bursæ even are sometimes found over prominent bones. Entanglement in the umbilical cord, the direct pressure of extra- or intra-uterine tumors, and the like, may be mentioned also as possible causes of restraint or fixation of the foot that induces deformity. Further evidence of restraint of normal movements and of abnormal attitudes of the limbs is seen not infrequently in connection with club foot. For example, there may be hyperextension or fixed flexion of the knees, and in cases of extreme deformity the foot is often smaller than normal or otherwise asymmetrical. In certain instances the distorted foot may be imperfect in structure; toes may be absent ("spontaneous amputation"), or constricting bands about the leg or foot may be present. Such ab-