

Remarks on the treatment of infantile congenital club-foot / by W.J. Little.

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REMARKS

ON THE TREATMENT OF

INFANTILE CONGENITAL CLUB-FOOT.

BY

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1876.

R E M A R K S

ON THE TREATMENT OF

INFANTILE CONGESTIVE OLD-FOOT.

THE following pages which represent the purport of an Address spoken at the Edinburgh meeting of the British Medical Association in August last, contain in addition some observations which the allotted time did not permit the Author to make.

LONDON, *May* 1876.

ON THE TREATMENT OF
INFANTILE CONGENITAL CLUB-FOOT.

It is proposed to lay before you a sketch of the earlier and more recent experiences in the treatment of Infantile Congenital Club-foot, since the introduction of sub-cutaneous tenotomy by Stromeyer, and especially to point out the practicability and the advantages of conducting the mechanical part of the treatment from beginning to end with padded metal splints instead of more elaborate appliances. Bearing in mind how much has been said and done by others as well as by myself in this department of practice, I trust I shall not be considered a trespasser on your time and patience. Whilst so much of interest is going on elsewhere, you confer an honour on me by assembling to listen to remarks in what may appear to some a hackneyed and a comparatively trivial subject.

As a stranger to Edinburgh I am ignorant, as far as personal observation is concerned, of the state of the treatment here of this important, and if neglected, serious deformity. I am more than satisfied by having Edinburgh as the theatre of my remarks, from the knowledge that nowhere better than in this University can a full investigation of a subject be secured or any practical good to humanity be evolved from it. Whatever degree of perfection the treatment of club-foot may here have reached, I have good reason for saying that in many parts of the United Kingdom from which members of the British Medical Association here assembled have come, there is much to be desired before it can be considered that

prompt and efficient treatment of congenital club-foot is the rule of surgical practice.

If I had had the honour of presenting myself before you forty years ago, I might have heralded here, as I did in London two years later, the discovery of true sub-cutaneous division of tendons by Stromeyer,* an event which took place four years before, and the fact that several adolescents and adults had been cured of different forms of contracture by that subsequently distinguished surgeon. An analysis of the work of Stromeyer, published in 1838 (*Beiträge zur operativen Orthopædik, Hannover*), shows that the average age of his operated patients, including both congenital cases and non-congenital ones, was eighteen and a-half years, that of Duval '*Traité Pratique du Pied-bot*' 1839, was fifteen and a-half years, my '*Treatise on Club-foot and Analogous Distortions: London 1839*,' exhibits an average of seventeen and a-half years, whilst Dieffenbach's book '*Die Durchschneidung der Sehnen, Berlin 1841*,' that is, three years later than Stromeyer, shows an average of thirteen years of age. It was natural during the infancy of division of tendons that parents and adults should have been more willing to present themselves for relief by an operation imagined to be a serious one, than to bring infants and children for that purpose.

As early as 1836, in my Inaugural Dissertation at Berlin '*Symbolæ ad Talipedum Varum Cognoscendum*,' following in this respect the opinion of the physiologist Rudolphi, I pointed out the dependence of varus upon contraction of the anterior and posterior tibial muscles, as well as upon contraction of the gastrocnemii; and in May 1837 (see *Treatise on Club-foot, etc.*, p. 212), added division of anterior and posterior tibial tendons as a necessary preliminary proceeding in well marked congenital varus. At this date I also severed

* Delpech '*L'Orthomorphie*,' vol. ii. p. 330, proposed excellent rules for dividing tendons without exposing them; but in the only case which he operated he transfixed the limb with a scalpel, and made a wound one inch in length on each side of the tendon, and afterwards divided it by means of a convex-edged bistoury. See '*Little on Club-foot, 1839*,' Introduction p. liv. This was not sub cutaneous surgery.

the flexor longus pollicis, the extensor proprius pollicis, peronei, and the ham-strings in other forms of contraction. Stromeyer, who had previously considered the inversion of the foot in congenital varus to be due to the action of the gastrocnemii only, objected to division of the tibial muscles. Twice only did he divide the posterior tibial as an experiment.* Stromeyer has since directed his mind to wider fields of surgery. I believe that if he had continued to labour at distortions, he would long ere this have endorsed my opinion and practice as to this matter. Dieffenbach followed the teaching of Stromeyer, and appears from his work above quoted to have only once severed the posterior tibial tendon. The case was that of a boy twelve and a-half years of age. German and French surgeons have usually followed the example of Stromeyer and Dieffenbach.

At the same time I showed, as others had previously done, that malformation of the bones of the ankle and tarsus was not the cause of the distortion. (See on the Nature of Club-foot and Analogous Distortions and their Treatment, with or without Surgical Operation, 1839. *Introduction*, p. xxix.) I agreed with Scarpa with respect to the anatomical mal-position of the bones, and the conclusion at which he arrived, viz.—‘That of the entire tarsal bones, the astragalus had suffered the smallest degree of displacement, which alone proved the possibility of curing infantile varus.’ I showed that in every instance of infantile or adult varus examined anatomically, however great may have been the state of extension and adduction of the foot, some portion of each of the three articular surfaces of the trochlea of the astragalus was in contact with an equal proportion of the three articular surfaces presented by the tibia and fibula in the ankle-joint, and that the essential peculiar characteristic of varus was the dragging inwardly of the navicular and of the remaining tarsal bones away from the astragalus and os calcis, by the contracted anterior and posterior tibial muscles, aided by the long flexor of the great toe. By this time all the requisite

* See ‘Stromeyer Beiträge,’ 1838, p. 80, and also p. 10 of this paper.

knowledge of the morbid anatomy of congenital club-foot, which was essential for the cure of even severe forms of it, had been obtained.

The sub-cutaneous division of the posterior and anterior tibial tendons previously confined to patients above the age of two and a-half and three years, was extended by me to young infants before 1842. (See Lectures in the *Lancet* on Deformities of the Human Frame of that date, reprinted by me under the title of a 'Treatise on Deformities of the Human Frame, with additions (known by insertion within brackets) in 1853, pp. 283, 292, and 297). Previously to 1839, I had divided the posterior tibial sub-cutaneously in children above the age of two or three, and in adults, by passing the knife beneath the tendon above the malleolus from behind forwards, where it could be *seen* and felt, and be severed with comparative facility. In stout fat infants I was then accustomed to divide the posterior tibial by means of a departure from sub-cutaneous division of tendons, by making a longitudinal wound three-quarters to an inch in length over the tendon above and behind the malleolus. But a death about this time through phlegmonous erysipelas occurring in a fat adult female in whom I had severed the peronei by open wound, led me to a final abandonment of this unfortunate departure from sub-cutaneous tenotomy.

Subsequently (*British and Foreign Medical Review*, 1844, vol. xxi.), I introduced the plan of dividing sub-cutaneously this tendon from before backwards above the malleolus, since which time the operation even in stout infants has been rendered comparatively easy in practised hands, and acknowledged by many to be a necessary one in severe infantile congenital varus. When first introduced this division was effected *à deux temps*, using two knives, one of which was blunt-pointed. Mr Gowlland, in 1853, performed it in a single proceeding, using only one knife.

Gradually these improved methods have made their way, and are now commonly employed. Previously to 1840, division of plantar tissues, although practised by Stromeyer, Dieffenbach, and myself, was more prominently recommended

by Mr Martin Coates, in a valuable pamphlet published at that date.

By this time also the application of tenotomy to very young children had been encouraged by the example of Dieffenbach (four days old), 1841, Evory Kennedy of Dublin (four weeks old), 1840, and of myself. In my lectures, printed in 1843-4, I was able to state that I was accustomed to operate on children as early as the age of six or eight weeks, when satisfied that the case was irremediable without it.*

From this period to the present day there has been a progressive disposition to operate at the earliest possible period, on the day of birth (L. S. Little), at two days' old (as by myself), during the first week or month, in suitable cases. No one unaccustomed to treat these cases at the earliest age can realize the enormously increased facilities of cure it presents. To complete this brief historical sketch of the principles successively laid down more than a generation ago for the application of sub-cutaneous division of tendons, combined with mechanical

* Mr Wm. Adams' 'Club-foot; its Causes, Pathology, and Treatment: London 1873,' has erred in having quoted a passage written by me in Lectures in the *Lancet* 1843-4, and reprinted by me in 'Treatise on Deformities of the Human Frame,' 1853, p. 284, on the subject of the time when operative interference is desirable, and against early operation, omitting at the sametime to make any quotations from the same lecture in favour of early operation. Thus, at p. 283, when advising 'that in every case, the treatment of which can be commenced previously to the age of six months, the case should be attempted by the application of mechanical means,' I added a note in 1853, 'the exceptions are like fig. 104, p. 265, which, from the outset, at the age of two or three months, require operation.' Again, at p. 291, I said, 'In this Institution I frequently recommend tenotomy in very young infants, sometimes so early as the age of six or eight weeks;' and I added a note, that Dr E. Kennedy of Dublin, previously to 1840, operated on an infant four weeks old. Mr Adams, in 1873 (*opus cit.*), has also passed over without notice my observations in favour of early operation when unmistakably indicated, contained in 'Holmes's System of Surgery, Article Orthopædic Surgery,' first edition 1862, vol. iii. p. 568, contained also in Holmes's second edition. If an author's opinion be cited and criticised, his latest published recommendations should be quoted.

treatment, to the cure of congenital club-foot, I will add, that in 1839 ('On the Treatment of Club-foot and Analogous Distortions, with and without Surgical Operation,' pp. 209), I published the particulars of restoration to form and function of as severe a degree of congenital club-foot, in a young man aged 17, who was operated on in 1837, as has ever been published before or since, to my knowledge, in any country. In that case division of anterior and posterior tibial tendons and achilles tendon was effected.* Many years before, Continental surgeons who had devoted themselves to the cure of deformities, by instruments only, had laid stress on the importance of endeavouring to correct the inward twist of the foot before attempting to bring down the heel. In 1837, I applied this principle to the severe curable forms of adult varus, by devoting all attention to removal of the inward twist by means of a straight wooden splint, furnished with a steel spring, bandaged on the outside of the leg, until the foot had acquired a position in a straight line with the leg, and indeed until it had assumed a valgoid position. Afterwards depression of the heel was effected, and the foot made to rest with the entire sole on the ground. Up to this time Continental surgeons in general, as far as can be judged from their writings, had not attempted to cure severe cases such as that represented, Case xxiii. p. 209, 'Little, Treatise on Club-foot and Analogous Distortions.' The cases previously operated abroad were mostly cases of non-congenital varus, and the slighter congenital ones. This result was the effect of their insufficient original investigation of the morbid anatomy of congenital varus, and of their belief, following the opinions of Scarpa, Stromeyer, Delpech, and Cruveilhier, in the dependence of congenital varus on primary deformity of the bones, and consequent failure to note the influence exercised in the production of the deformity by the posterior tibial muscle.

In some cases the comparative difficulty of severing the posterior tibial led to disregard of this operation.

* See 'Treatise on Club-foot and Analogous Distortions, 1839, p. 209.

The prominent superficial situation of the achilles tendon sufficiently accounts for the shortening of this tendon, having early, and at first, exclusively attracted the notice of the majority of surgeons, and often of their patients (see 'Little on Club-foot and Analogous Distortions,' 1839, p. 79). For similar reasons the anterior tibial soon attracted notice, and was subjected to division. Next came the turn of the long flexor of the great toe, and of the plantar fascia.

No improvements on these principles of treatment have been effected since that period. Individual surgeons have acquired technical skill, or have introduced modifications in apparatus. Evidence in proof of this assertion is afforded by the cases and illustrations appended to my work of 1839, already quoted.

It was then with justice triumphantly felt that as regards congenital club-foot, a success never before reached in the history of orthopædic surgery had been obtained. *A fortiori* how much more readily and certainly might not in future infantile congenital club-foot be cured! Some tinge of enthusiasm may at that time have been pardonable.

At the periods in question, therefore, *i.e.*, in 1839, and more emphatically in 1842, it was shown, by example and precept, that in order to rectify the form and position of varus or congenital club-foot, whether treated with or without surgical operation, the treatment should be divided into two stages:—

1. That in which the inward twisting of the foot should, in the first instance, be rectified, and the distortion be thus converted from a compound distortion to a more simple one, *i.e.*, from varus to equinus.*

2. That in which the straight-looking but extended and still contracted foot *equinus* should, by the bringing down of the heel and by elevation of the fore part of the foot, become capable of being planted evenly on the sole, and that if the varus was sufficiently severe to require division of the

* See 'Little on Club-foot and Analogous Distortions,' London 1839, Case XVI., p. 164. Remarks on it, p. 168. Also Lectures in the *Lancet*, 1843-4, reprinted in 'Deformities of the Human Frame,' 1853, p. 285, 295, 303.

anterior and posterior tibial tendons, this operation and conversion of the varus into equinus should precede division of the tendo achillis and the bringing down of the heel.*

It was, however, customary for several years after this date to disregard, especially in very young subjects, the subdivision of the operation into two stages, as above described. This course was followed with the view of saving the feelings of parents, by compressing two operations into one, especially at a time when anæsthetics had not been discovered.

The positive evils which, it will presently be shown, may arise through simultaneous division of the tibiales and achilles tendons, or from the division of the achilles only, previously to the correction of the inward tendency of the foot had not been discovered.

Those surgeons who have no experience of the curability of the less severe forms of varus without any operation, and whose practice it is to resort to tenotomy in every case,

* Stromeyer was the first (in 1836) who divided the posterior tibial. His proceeding was by a preliminary incision three-quarters of an inch or one and a-half inches in length. The cases in which he divided this tendon were two non-congenital cases, aged respectively eleven and twenty-eight, and two congenital ones, aged respectively four and five years. In respect of these cases, he departed from his own sub-cutaneous method. These operations were performed between August 1, 1834, and February 1837. He did not afterwards repeat division of the posterior tibial. The following were his reasons for the abandonment of this operation:—('Beiträge,' p. 81) 'The contemplation of these cases appears to indicate that section of the posterior tibial exercises no decided influence in the restoration of the form and function of club-foot; yet, I will not deny, that this subject requires further investigation.' As regards the history of this operation, it may interest to state that in 1836, whilst in Berlin, I was engaged in investigations of the morbid anatomy and treatment of club-foot, I informed Stromeyer by letter, of my conviction that congenital *varus* depended upon contraction of the anterior and posterior tibials, as well as upon the tendo achilles. Stromeyer's reply was to the effect, that the posterior tibial had nothing to do with the production of varus, and dissuaded me from division of it. I was not aware until the appearance of his work, that he had already performed the operation several times. In the work ('Beiträge,' op. cit. p. 29) he gives full reasons for his conduct. It is

appear not to be aware that by mechanical treatment, in many cases the inward inclination can be removed by use of an outside splint, the foot, as I have said, being then converted from a varus form to that of equinus. When this conversion has been effected, and the necessity of severing the anterior and posterior tibials has been removed, the question remains whether or not it be necessary to sever the tendo achillis. Sometimes even this operation is not necessary. More commonly it is needed. Considerations such as are suggested by these facts have always induced me to discountenance early operation except in well-marked or severe grades, of which the surgeon experienced in treatment of varus can easily decide; and to encourage the surgeon practising away from the large centres of population, to try what he can accomplish by simple mechanical means. If, in a few weeks, he succeeds by mechanical means in removing the inward inclination, he may then have to effect the division of the tendo achillis,

worthy of notice, that acting without knowledge of Stromeyer's previous practice, I kept to the sub-cutaneous method in the five cases in which I divided the posterior tibial between November 1837 and March 1839, related in 'Little on Club-foot,' etc., 1839, Cases XVIII., XXIII., XXIV., XXVIII. The youngest of these cases was two and a-half years. The mode of operation was that described in this address, p. 6. Many others were afterwards operated on by me in the same way. The sub-cutaneous method, as regards this tendon, was very simple, and not difficult, when the tension of it was distinct to eye and touch in their subjects. It was different with young infants, in whom, by the first month after birth, and sometimes at an earlier age, the ankle was surrounded by so much adipose tissue that the posterior tibial was in them never visible and never distinctly felt until after much experience had been acquired. A striking difficulty arose when wishing to apply to infants that sub-cutaneous section of the posterior tibial which I had proved to be so useful in older subjects. I, therefore, after 1839, ventured upon a departure from the sub-cutaneous method, and exposed the posterior tibial by a three-quarter inch incision, and divided it many times, as Stromeyer had done, with impunity. I abandoned it for the reasons already referred to in this address, p. 6; and between 1839 and 1843 laboured at the discovery of a secure method of reaching the tendon sub-cutaneously, even in very fat children which was effected, and which is fully detailed 'Little; Treatise on Deformities,' etc., 1853, p. 297.

which is a simpler operation, or even complete the cure without operation.

By being able to substitute a simpler operation for a more complicated one in suitable cases, the patient becomes in every way a gainer. Unnecessary division of tendons leads to diminished symmetry and strength of limb, whilst on the other hand, a necessary division of tendons, by restoring the functions of the contracted joints, favours the restoration of form and movement.

Enough has been here said to warn against the practice of immediately operating in every case of infant congenital varus which presents itself, and in favour of circumspect, gentle, earnest efforts with mechanical appliances and manipulations in slight cases, or those in which doubt exists as to the absolute need of operation.

A few weeks employed immediately after birth in endeavouring to remedy at least the inversion, will involve no risk of aggravation of distortion, as is the case when any beneficial treatment is purposely postponed to a later period. The surgeon has to take care that the case shall be cured before the age at which a sound child usually walks.

In 1842 I was justified in the sanguine statement that within the lapse of another generation, persons labouring under congenital club-foot would not, as was then too commonly the case, be seen walking in our streets. The hopes of a generation ago have not been entirely realised. Moreover, many incompletely restored cases are common in public places, in hospitals, and in our consulting-rooms. It is a fact that cases frequently present themselves of children and youths who have been operated in one, two, or even three hospitals, or by different private and orthopædic surgeons, and are still far from restoration, indeed, some of them are in a worse position than if they had never been touched, because the operated tendons have been unduly lengthened, secondary deformities have been produced, the retracted bellies of the gastrocnemii, forming, for example, a small wasted mass high up towards the ham, the nutrition of the bones of the leg and of its remaining structures generally much reduced, the

temperature ill maintained, troublesome chilblains adding to the patient's annoyance during winter, the motion in the ankle-joint often less, and the contraction of the plantar tissues greater than when the individual was born.* It is

* I should fail in my duty to the profession and to the public, if I did not unhesitatingly here state, that many of the most able surgeons, as well in the metropolis as in the provinces, have inflicted much injury by heedless tenotomy, that is through having undertaken the treatment of these cases without sufficient previous study of the subject—through insufficient acquaintance with the mechanical aids requisite, or disregard of the teachings of their predecessors, as to the value of manipulations, and the mischief resulting from keeping a part too long *secured* in an apparatus. I will adduce a case in point: a parent lately brought to me a child four years old, who had originally been affected with congenital varus of average severity. The family surgeon had fruitlessly cut the tendo achillis, and used a so-called Scarpa shoe. The distortion being unabated, and the child already walking in the position represented in fig. 1 of this paper, the family surgeon sent the patient, with a letter of introduction, to the senior surgeon of a metropolitan hospital, who admitted the case into his hospital, and, in addition to re-division of the tendo achillis, severed the anterior tibial, kept the patient three months in the hospital, and sent the child home wearing an apparatus similar to that previously employed by the family surgeon, with the foot apparently none the better when examined out of the apparatus.

A few months more elapsed, the deformity and difficulty of walking becoming aggravated, the child was again sent to the metropolitan surgeon, who again took it into his hospital, repeated the operation, ordered an apparatus, again leaving the mechanical treatment to his house-surgeons and dressers. After the second stay in the hospital—this time of four months duration—the parents removed the child and brought it straight from the hospital to my house. The case was as bad as a case of neglected varus of four years old can be, with the aggravation of several large cicatrices above the insertion of the achilles tendon, into the heel, two considerable (by comparison) scars over the insertion of anterior tibial tendon. The posterior tibial tendon did not appear to have been touched.

By this paper I desire to show that such occurrences are not desirable or unavoidable. I do not exaggerate when I say, that I have come across many scores of such cases with the same history. These are not cases of accidental failure of treatment, but cases in which all the principles of treatment, as laid down in this paper, and in many previous writings of my own and of other authors, have not been

possible that exceptional circumstances have led to my becoming consulted as to a larger number of incompletely cured, damaged, or neglected cases. But I am not singular in being placed in a position to observe that relapsed or

followed, and in which the surgeon has neither attended to the details of treatment himself, nor placed the management, after operation, in the hands of competent assistants. They are a discredit to surgery, and it is indisputable that no graver charge can be brought against special hospital (orthopædic) surgeons than that which might be brought against those general hospital surgeons who treat congenital varus in the manner I have instanced.

The profession and the public have derived great benefit from the instruction given, and the relief afforded, at orthopædic hospitals. These special institutions deserve every encouragement by the public and the profession; they are a necessity of the advance of society, and of the endeavour of our profession to bring every form of departure from the normal state of the body thoroughly within the reach of our art, and of relief by the means which it affords. A special orthopædic hospital, in a building exclusively devoted to the purpose, or a special orthopædic department of a general hospital, with a special surgeon, special house-surgeons and dressers and nurses, all specially trained, are alone able, in public hospital practice, to thoroughly treat these cases.

The surgeon who had so greatly mismanaged the case is regarded as one of the ablest in London, and most justly so, I believe, except as regards the two largest specialities, ophthalmic and orthopædic surgery. For many years past, being in full knowledge of the unintentional wrong-doing as regards infantile congenital varus, I have contemplated leaving the fault-finding ideas of this paper for posthumous publication. I have now made them public in consequence of the reiterated entreaty of medical brethren that I would not shrink from the duty of plain and truthful speaking on the subject.

It has been objected to special hospitals, that in them patients receive advice and assistance whose circumstances would permit them to apply to surgeons in private practice, and give an adequate fee for their treatment. It is not undeserving of notice, that in the instance of the patient's case I have described, who was lately brought straight to me from a general hospital, the friends at once offered me, as an inducement to undertake the case, the largest fee I am accustomed to expect. The case has been restored to perfect form and movements, and will, I expect, need the aid of no supports or irons after three or four months.

I beg it may be remembered that this paper is destined for the perusal of members of the profession only. I have the honour to rank the

imperfectly treated cases abound. Mr Jackson, and the rest of the staff at the National Orthopædic Hospital in Great Portland Street, London, can testify that nearly as many cases of the latter class present themselves as of young previously untouched infants. A friend of mine of long-standing, whose praiseworthy and successful efforts for many years to relieve the mischiefs caused by unsuccessful treatment of congenital club-foot amongst the well-to-do members of the population, and more especially amongst the poor, justify my mentioning his name, Mr Clowes of Windermere, informs me that he continually sees cases lamentably indicative of want of skill in, or ill-luck attendant upon, treatment.

This side of the picture of the results of sub-cutaneous tenotomy after general employment of it for more than a generation, is indeed a sorry one. The other side of the picture is, I rejoice to say, a bright one, and need not, therefore, so long detain us.

I am here to-day to ask you to consider with me for a few minutes whence comes the sorry side of the picture; a picture which, but for the bright side, would be a subject of sincere humiliation to us as a profession. It should in justice be stated, that until the day of Stromeyer, all was dark in the condition and prospects of everybody affected with well-marked, congenital club-foot. Despite writings on the subject by Hippocrates, Scarpa, Delpech, and many others, only those cases of club-foot of the slightest grade, such as can now-a-days, with the improved knowledge at our disposal, be cured more easily without operation, had the smallest chance of being restored,—they trudged on their way in the forlorn deformed state in which we still occasionally meet some of the present generation, the great mass of congenital club-foot

eminent surgeon whose orthopædic treatment I have criticised, as a personal friend. I have instanced this particular case, because it happens to be the latest I have met with. I hope that whoever may recognise it as his own case, as well as the profession at large, will tolerate these remarks from one who has to acknowledge the receipt of so many favours from it.

persons, estimated by me at probably one in 2000 of all born in Western Europe, wearing heavy, clumsy irons, eking out scanty pleasure, if not positive pain, from their indifferent locomotion.

When we contemplate the perfection with which the worst forms of infantile congenital club-foot are, under favourable conditions, remedied at the present day, we may console ourselves for some disappointments, and be reassured that the subcutaneous method of Stromeyer has conferred great blessings on humanity, has increased the usefulness of our profession, and given it an additional claim to the regard of society at large.

What are the causes of the failures or relapses from complete restoration which are met with in public practice, and among even our private patients ?

In the first rank I believe must be placed the omission to operate at a sufficiently early age those cases which appear undoubtedly to require its performance. So long ago as in 1839 and in 1842, as already stated, I endeavoured to lay down rules for determining what cases respectively could be remedied without operation or by its means, and recommended that cure should be accomplished before the age at which sound children usually walk. The fact that the majority of operated patients had been adults, and that section of the achillis alone gave great relief, retarded the extension of tenotomy to other tendons by the profession at large, and tended more to operations on adults than on infants. Each succeeding year has increased the conviction that to restore the part to its proper form and movements as promptly as possible, with or without operation, as the nature and severity of the case indicate, is the certain mode to obviate the tendency of the bones, ligaments, muscles, and fasciæ to become more and more shortened, wasted, deformed, and weakened, in proportion as the limb grows. If the practitioner considers the case to be a favourable one for mechanical treatment, and finds, after due attention to it, that adequate progress be not made, he should at once operate. Delay in the completion of effective restoration of form and movements *before* the age at

which robust children usually walk, is mischievous, but after that period every day's delay does manifold greater injury. The tegumentary structures, the muscles, tendons, fasciæ, and ligaments in all situations around the ankle, and those connecting the tarsal bones, metatarsus, and toes, situated on the contracted side of the member, become daily more shortened, and exhibit greater opposition to restoration, whilst the similar structures situated on the opposite side of the member become daily more elongated and weakened. In the less deformed cases the deeper structures, as well on the back and inside of the leg as on the sole, appear little concerned in the production of the distortion.

Every step made with a foot not capable of being placed evenly on the ground with so much of the entire sole as a sound person applies to it, occasions a certainty of aggravation of the deformity, and augmentation of the difficulty in obtaining perfect restoration.

Another practical point, the neglect of which is apt to entail future trouble is, that gentle, painless, passive exercises and manipulations should be employed *pari passu* with the instrumental treatment, whether or no any operation has preceded it. Long detention in any apparatus in one fixed position, whether it be that of extension or flexion of the foot, causes painful rigidity of structures which are naturally destined to constant daily movements. It is a fact that long retention of a part in one fixed position is a cause of pain when the part is again moved. This is observed by sound persons during many of the avocations in life. In like manner, the child whose foot has been too long held in any retentive apparatus, experiences pain when the part loses its support, or when the surgeon attempts to manipulate it. The young child instinctively offers resistance to the handling, the older child energetically opposes by means of volition the surgeon's efforts to move the parts.* By frequent proper removal of

* The treatment is more rapidly successful in the young infant, because it is comparatively unconscious of the surgeon's or the parent's doings. If the application of splints, or the employment of manipula-

the splint, by winning the confidence of the child through gentle patient usage, the entire treatment of infantile congenital club-foot can be painlessly conducted. Violent manipulation of these cases under anæsthetics is a barbarism. We frequently meet with varus cases in which the foot has been adducted and flexed to a right angle, and has been so long retained in that position that difficulty is experienced in extending it and abducting it. It is true, that undue adduction with heel and sole contraction are characteristics of varus, but it should at the same time be remembered that a moderate degree of congenital varus exhibits a natural position, such as the foot in health is required to assume amongst its numerous actions. I have had cases that, from undue retention in instruments, have never recovered the power of proper depression of the foot, such as is required in standing tip-toe. In some of these cases this condition has been brought about by repeated sections of the tendo achillis. By this means also an artificial talipes calcaneus is often produced. Allied to the necessity of the foot being exercised and manipulated in all natural deviations during infancy, is the necessity for the choice of a good apparatus for those cases which have not been thoroughly cured during infancy. There is no doubt that the ordinary ratchet-screw instruments so largely used in the present day, miscalled Scarpa's instruments, by their fixed condition allowing, when applied, no 'play' in the ankle-joint, are, in that respect, much inferior to the real Scarpa shoe, to Stromeyer's

tions causes crying, the surgeon may suspect that undue tightness of bandage, or too great strain during manipulations is being used. Even after the surgeon has obtained full range of motion, an accidental interruption of treatment or neglect may, in a few weeks, cause considerable relapse. The young infant offers no resistance; each month of age, however, increases resistance. If the child have attained the age of eight or twelve months, the surgeon or parent has to deal with the temper of the child, and its wilful resistance to his efforts. Opposition from these sources can only be overcome by tact—the utmost gentleness combined with firmness, and a steady resolve not to be led into a perceptible struggle with the child. The causing of pain must be sedulously avoided, for the reason, that with patience and perseverance the cure can be effected without it.

modification of it, and to the further modification of it, which is known as my shoe.

Another practical rule, of the necessity of which I am convinced from long experience, is, that the surgeon who treats a case of varus, with or without operation, should, *until the natural range of motion at the ankle and toes* is fully obtained, apply the splints or other apparatus with his own hands, and renew them at least once a-day himself, or only allow it to be done by a well-qualified representative. Most splints or apparatus of the kind need, as a rule, removal once a-day. By no other course can the surgeon keep the thread of the treatment in his own mind and hands, and rarely without it does the case do justice to his wishes. I would lay down as a rule, that no case can be handed over to parental or domestic management, until the joint is fully and freely movable to the full natural extent in all proper directions. Too many surgeons heedlessly sever the achilles tendon, and leave the ultimate and most important part of the after-treatment to an incompetent assistant, to the parent, or to an instrument-maker; practically, the case 'takes its chance.'

Much has been said about bringing the heel down to a right angle. I would say that nothing is permanently gained until the ankle can be *freely bent, extended, adducted, and everted* to the natural extent. There can be no doubt that the *éclat* which at first attended 'division of the tendo achillis,' and the benefit which promptly follows this operation in many cases in young children, has often been the cause of imperfect cure. The improvement visible immediately, or shortly after this operation, has led the surgeon and parent to be satisfied with the improvement already gained. The patient has been dismissed to the parent and instrument-maker before the bending and eversion of the foot was complete, and before the patient was enabled to tread as well upon the inner margin as upon the outer margin of the foot.

A powerful cause of delayed restoration or non-success of instrumental or operative treatment of congenital club-foot, springs from the innate difficulties attending it. Hence, in these deformities, the surgeon ought to leave nothing to

incompetent persons. In the greater number of cases in which a surgeon performs any other operation than that for a congenital club-foot, he may calculate upon receiving larger assistance from nature. After an ordinary surgical operation, the wound will heal, the original natural parts left intact after the operation will perform their offices, even parts which have been injured will exhibit a tendency to the normal state of things. But in congenital club-foot, unless on the way towards cure, there is often exhibited a tendency to relapse into the original distorted state of things. So strong in many cases is this tendency, that it has suggested the idea that it is not merely the disposition of an elastic, semi-elastic, contractile, or tougher structure, to return to the form and length which it has possessed during the three, four, or five latest months of uterine life, when the distortion may have originated, and during the period that has elapsed since birth, but that there exists a tendency to revert to that state of evil, *nisus formativus*, which was formerly generally believed to be the cause of these affections during the earliest phase of embryonic development. The resistance to cure is naturally greatest in the most severe cases, severity not being measurable from mere external shape of the member, but from the number of the muscles affected. The gastrocnemial layer only, or the deep posterior layer of muscles of the leg also, the anterior tibial muscles, the respective layers of the sole of the foot, including all the ligaments and fasciæ, may also be contracted. We recognize the highest grades by the deep clefts behind the heel and in the sole, and by the tissues being so tense and resistant to the hand as if they were all more or less adherent and fixed together, a supposition anatomy does not justify. In no form of remediable complaint is there greater need of intelligent watchfulness and attention.

Another cause of delayed recovery I take to be the fruit of an insufficient estimate being formed by the surgeon of the difficulties of cure, and of the parent never having been informed of the probable length of time during which the treatment may require to be continued, or at least during which a diligent attitude of watchfulness against the first signs of

relapse should be maintained. It is comparatively easy to rectify the form and movement within a period of two or three months, in the case of a young infant; but the patience of the surgeon or parent is liable to flag during the number of years these cases, if once greatly mismanaged or neglected, cannot safely be left to themselves. When asked by parents how long the treatment or the attention of the parent or doctor will be needed, I now reply, 'Until puberty, or until the child is old enough to take care of itself.' Many medical men are prone to conceal the truth from the parents. I can with satisfaction say in relation to club-foot, that since I have told parents that their attention to prevent relapse will be required until adolescence or until the patient have quite grown up, and have distinctly placed the responsibility as to the final result on the parents' shoulders, I have rarely witnessed a relapse in one of my own private cases. It is an obligation upon the surgeon not to hand over the cured case to the sole management of the parents until he has thoroughly *instructed* them in the duties they will have to perform in order to maintain the cure. If it be possible, the surgeon should not entirely lose sight of the case until the patient is thoroughly competent to perform all the active locomotive acts of civil life.

A great cause of retardation of restoration has been the expense of elaborate instruments, the rapidity of the infant's growth, and the damage done to instruments by the frequent wettings by the child's secretions. Renewal of instruments and their repairs, especially when the child has been permitted to walk before the cure has been completed, place formidable obstacles in the way of early successful treatment, and accounts for many disappointments.

Owing to want of means, the poor—our profession's most numerous clients—are the greatest sufferers by the supposed need of expensive apparatus. Whether in general or special hospital practice, it is practically impossible to keep pace with the demands for instruments.

In most hospitals some provision can be made for one set of instruments, but no known funds are available to meet

the demands of the poor when the protracted use of apparatus becomes necessary, as in half cured cases, hence augmented difficulty of locomotion and suffering. It becomes, therefore, a greater satisfaction to be enabled with confidence to point out the means by which, in at least this particular deformity, the use of expensive apparatus can be with certainty avoided.

Another cause of incomplete cure may arise from the occurrence of and interruption from one or more of the epidemic infantile diseases to which the very young are liable, or to want of breast-milk, severe bowel complaints, convulsions, and so called difficulties of dentition, which I would attribute to the risks incidental to transition from the mother's milk to independent feeding.

Lastly, When cases have not been thoroughly restored in form and natural movements before the time of beginning to walk, ingenious and expensive mechanical contrivances are prescribed, either to help completion of cure, or to assist and correct errors in the act of locomotion. Such contrivances, *vulgo* irons, are often worn for years during the day time, the limbs returning at night into a worse position unless checked by a suitable retentive shoe. Some years ago I classed and wrote of these cases as relapsed ones. With my present experience this term would be a mere euphemism. I consider all such cases to have never been truly cured, the result of either misfortune, inattention or neglect of suitable treatment before or after leaving the surgeon's hands. For such cases, in which many structures have become additionally rigid from age, from undue walking in improper positions of the foot, long retention in unsuitable apparatus, and neglect of manipulations, the sufferer is apt to pass from hospital to hospital, or from private surgeon to private surgeon, to the manipulations of the pretended bone-setter, or the pretended dislocation-reducer, with or without the aid of anæsthetics. Repetition of section of the poor achilles tendon is undergone, as in Phillips's hands even to the twenty-second time.*

* De la Tenotomie sous-cutanée. Le Docteur Ch. Phillips, Paris 1841, p. 54.

Other tendons and fasciæ are sometimes treated in a similar way, and wholesale sub-cutaneous section in the mass of all the plantar tissues included between the integuments and the under surface of the tarsal bones has been again advocated. (See *British Medical Journal*, March 13, 1875, p. 339). Experience shows that the contracted arch of the bones of the tarsus in a young adult case of congenital club-foot can, after division of the superficial band of fasciæ and tendon of long flexor of the great toe be gradually unfolded and elongated by mechanical appliances, by manipulations, and by suitable exercises. I therefore regard the division in mass of all the plantar tissues as an unnecessary operation, and as one presenting peculiar disadvantages and probable future annoyance.*

There has already been too much of the knife in these imperfectly cured cases. I have, with rare exceptions, resorted to a single repetition of tenotomy, and I trust now, even more than ten years ago, to mechanical means and exercise.

The able surgeon who has carried out wholesale division of plantar muscles, tendons, arteries, nerves, and ligaments, remembered, doubtless, Phillips's and Guerin's long since published experiments on men and animals, which were intended to show the fearlessness and safety with which the largest arteries, veins, and nerves, may be sub-cutaneously divided. Operations upon human beings frequently present different results from those observed in animals. The human tissues are equally tolerant of deep and large sub-cutaneous sections with those of animals, as far as regards the risks of bleeding, suppuration, and mortification. An animal may recover promptly from a deep section of vessels and nerves in a lower limb, and walk apparently well after it has recovered from the immediate effects of the operation. But the animal is unable to express his after sensations to us. The human nerves and vessels unite, but the human being can communicate his feelings, and inform us what unpleasantly imperfect

* See also as to the operation of removal of the cuboid bone in *British Medical Journal*, May 13, 1876.

union results even from sub-cutaneous sections. I have been consulted in two cases in which the peroneal nerve had been severed during the operation of dividing the outer ham string, neither patient had recovered after many years from the total paralysis of the muscles on the outside of the leg and foot. I know another gentleman whose *nervus communicans tibiae* was severed over thirty years ago, at the same time as the achilles tendon. He still complains of very unpleasant aberration of sensation along the outer edge of the foot.

I know a case also in which, twenty years ago, I divided the posterior tibial tendon, and doubtless the neighbouring artery, veins, and nerve. I am aware that I relaxed more effectually than was intended, many of the distal tissues, and that the arterial and venous trunks on the front of the foot are unpleasantly prominent and distended. These cases have confirmed me in the practice during tenotomy to keep as close to the tendon as possible, to employ no bold surgery, such as unnecessarily sweeping the knife, in the neighbourhood of any, and especially of important parts. In fact, experience shows that with care and patience, with suitable apparatus and manipulations, no necessity exists for wholesale sections in the deeper parts of the sole. If the contracted sole will not yield without such sections, it will not yield because of them.

As so much has been written about suppuration or delayed healing of the wound made in proposed sub-cutaneous tenotomy, it will not be out of place to mention here, that I have never witnessed the smallest particle of pus in the thousands of instances in which I have practised sub-cutaneous division of tendons. This result is attributable to the smallness of the puncture in the skin, and to the care taken immediately to cover the puncture with pledget of lint and bandage. The number of considerable scars which I have seen in consultations respecting incompletely treated cases, shows that the operation has not been accomplished by a mere puncture afterwards nearly invisible. It is probable that suppuration has sometimes resulted from operators having fingered the wound after completing the operation.

A few words more with reference to the employment of elaborate instruments in congenital club-foot. Such are not necessary in cases which come under treatment before the child begins to walk. I am now able to say that, valuable and necessary as they are in the treatment of cases which have been permitted to walk before a perfect restoration of form, movement, and function, has been obtained, that until the age when a child should walk they are totally unnecessary. I may go much further, and say that infantile club-foot can be better cured without Scarpa's, or any other shoe, than with it. All elaborate instruments for infantile cases are simply articles *de luxe*. Indeed they have not even that poor recommendation. From the circumstance that renewals and repairs often cause interruption of instrumental treatment and loss of time, they are mischievous, they act often as a delusion to the attendants, who, regarding the *ignotum* as infallible, expect wonders from it, and are led to neglect other apparently more humble means. The tin splints and tin shoes, introduced by me many years ago, or the improved adjusting tin splint described by me in an article on orthopædic surgery in 'Holmes' Surgery,' second edition, have enabled me to accomplish better results in young infants than ever previously obtained by less simple means. These tin splints and side splints, with a roller bandage, constitute a sufficient armamentarium upon which the surgeon in remote country districts may safely rely, as far as mechanical means go, for the cure of his patient, if he will take as much pains, using his own hands, as if he were treating a bad fracture. A neglected fracture of a leg bone, and a consequent somewhat crooked leg, is a smaller evil as regards subsequent use of the limb, and the ability of the patient to perform the active duties of life, than a neglected imperfectly cured club-foot.

I here summarise the principles of correct treatment of congenital club-foot.

1. Whether the case promises favourably for mechanical treatment only, or needs, as the majority of cases do need, operative interference, commence the treatment as soon after birth as practicable.

2. Reduce the distortion from the state of a compound one (varus) to the simpler form (equinus), by first curing the inversion of the foot, and the tendency to involution of the sole.

3. Avoid the slightest undue pressure upon prominent points of the leg and foot, by careful padding of the hollow parts, and by using only gentle pressure with any bandage. Avoid obstruction of the returning blood from the limb.

4. Remove splint and bandage daily, practice gentle movements of the foot in the desired direction, endeavour to prevent the part remaining for an instant unsupported and liable to fall back into the deformed position, until it is found that the foot, on removal of bandage, retains a perfectly good position and flexibility.

5. Never permit the child to be placed on the feet, or to walk until the form and movements are complete, whatever may be the age of the patient.

Be convinced that by carefully following these recommendations, the robust child will, before the age of thirteen or sixteen months, stand and walk without instrumental aid; that the muscles of the leg will be fairly developed, and a bystander have difficulty in discovering that any distortion formerly existed.

I do not forget that I am addressing members of the Association, many of whom practice in small centres of population, where, from necessity, during a long lifetime, they may not bring into the world or meet with more than three or four cases of congenital varus, which is the commonest form of congenital foot deformity. It is, therefore, practically impossible that all should previously be experts in the management of these cases. I recommend such members of the Association to commence the treatment of infantile club-foot within the first day or two after birth, by means of the splints I offer to their notice, and in the manner I propose to demonstrate, acting upon the principles laid down in this paper. By means of the amount of improvement in form and mobility which may reward their exertions during a period of one or two weeks, they will be enabled to judge of the probability of success without operation. So long as almost daily im-

provement is visible and palpable, they may safely proceed on this method. If the cure do not adequately progress within the first month or two, if the foot, when removed from the splint springs back actively into the inverted position, it is probable that division of one or more tendons and fasciæ is required. If the surgeon be certain on this point, he should

Fig. 1.

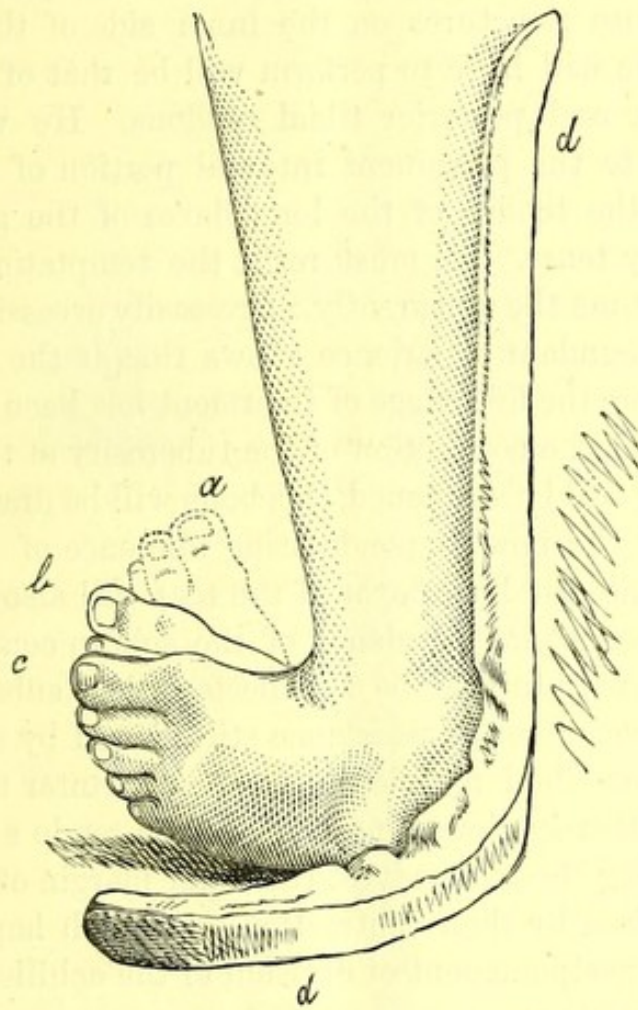


Fig. 1 represents a severe case of congenital varus being gradually conducted to a state of equinus. The dotted outline, *a*, represents the extreme degree of inversion and elevation of the internal margin, to which the foot is occasionally drawn by the anterior and posterior tibial muscles; the position at *b* represents the ordinary quiescent condition; *c*, the position to which a slight touch of the surgeon's hand brings it; *d, d*, represents a flexible, metal, padded splint, bent almost to the shape of the foot as represented at *c*, applied along the outer side of the leg, and as near as can be along the outer margin of the foot, intended to be secured in position by a gently applied roller bandage.

either operate without further delay, or obtain the assistance of the most available surgical expert, and with his aid continue the splint treatment until perfect form and mobility are obtained. He should well remember that, unless he has been able, by means of splints and daily gentle manipulations, thoroughly to evert the foot and convert it almost into a valgus, in which case the internal margin of the foot will be presented to the ground, proving entire conquest over the formerly tense structures on the inner side of the limb, the operation he will have to perform will be that of division of the anterior and posterior tibial tendons. He will extend his section to the prominent internal portion of the plantar fascia and the tendon of the long flexor of the great toe, if they be very tense. He must resist the temptation of severing at this time the apparently more easily accessible achilles tendon. Abundant experience shows that if the achilles be divided before the first stage of treatment has been thoroughly accomplished, the connection of the tuberosity of the os calcis with the leg will be weakened, this bone will be drawn towards the toes by the now preponderating influence of the plantar muscles, while the long flexor of the toes will also tend to increase the consequent tendency of the sole to contract. The ankle-joint may further be so affected, that subsequent attempts to overcome the resistance still offered by the anterior and posterior tibial muscles, and of the plantar tissues, will be spent rather in elongating the severed tendo achillis than in overcoming the tendency of the inner margin of the foot to continue raised by their contraction. A much happier result follows the postponement of division of the achilles tendon to a subsequent stage.

As recommended in 1839, the straight splint to be applied to the outside of the limb in varus, may in the case of infants under the age of three or four weeks, be composed of thin card or pasteboard, or of a thin strip of flexible hat-box wood, whalebone, or shaving of a lath. Some material more resisting, gutta-percha, or any thin flexible metal may be used. At two months or upwards, the splint may consist of thin flexible sheet iron. In all cases a soft cushion

should be introduced between the metal and the member, and the splint should be bent before its application, so as to be adapted almost to the full extent of the inward curvature. Every two or three days the splint may be slightly straightened. It may almost be said that the splint should be adapted to the deformed part rather than that the deformed part should be roughly forced outwardly to the splint. Those

Fig. 2.

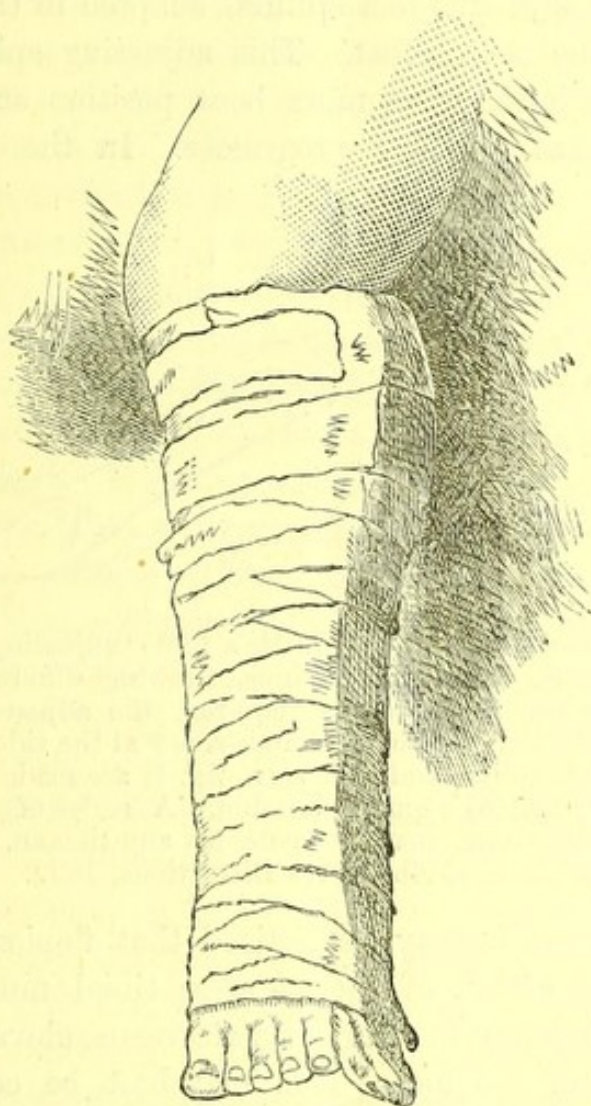


Fig. 2 represents the same foot four weeks after section of the anterior and posterior tibial muscles with plantar fascia, and subsequent gradual bringing of the foot into an equinus position. A few days more would bring it into a valgoid one.

It should be remembered that a foot as distorted as Fig. 1, letter *c*, if capable of being brought by the surgeon's hands, without the use of violence, with a position half-way between Figs. 1 and 2, often needs no section of anterior or posterior tibials and fascia.

unaccustomed to such very gentle usage as I am recommending, will be surprised that no appreciable force is necessary. Before the child is a month old, it may be found that the foot has acquired an everted or valgoid form, and that when the splint and roller bandage are removed, the foot exhibits little or no tendency to revert to the original form. If the directions given have been properly carried out, and no hindrances have occurred, the surgeon may exchange the outside splint for one of 'Dr Little's adjusting foot splints,' adapted to the degree of extension of the actual foot. This adjusting splint may be very gradually raised to a more bent position at the ankle, in proportion as the foot progresses. In the progress of

Fig. 3.

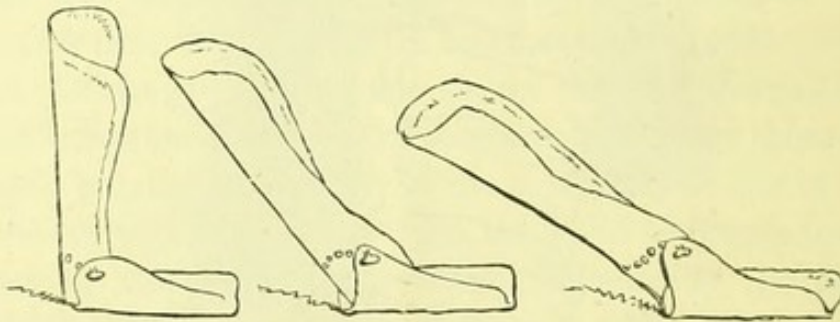


Fig. 3 represents one of Dr Little's foot 'adjusting' splints for treatment of varus, valgus, or equinus, showing different angles at which the ankle can be placed as required, the adjustment to each position being effected by a metal thumb-screw at the side, and a hinge at the back. This splint, and that seen, fig. 1, are made by Ernst, 80 Charlotte Street, Fitzroy Square, London. A series of tin splints in lieu of an adjusting one, may be made by any tinman, as taught in *Treatise on Club-foot and Analogous Distortions*, 1839.

the foot upwards, it may be noticed that flexion favours a preponderating action of the anterior tibial muscle, and a return of a tendency to characteristic varus, elevation of the inner margin of the foot. This may best be combated by daily manipulations in the direction of valgus, and by the application, for a few hours now and then, of the simple straight outside splint, so as to give the foot a renewed equino-valgoid form.

It is almost unnecessary to add, that if when the child is two or three months old, the mechanical treatment having

been diligently and skilfully employed, and the operation for severing the anterior and posterior tibials having been done, the foot, although capable of full eversion whilst in the splint, springs back actively into the varus position, it becomes doubtful whether the anterior and posterior tibials, or the plantar structures, were properly severed. In this case the surgeon should persevere with the mechanical treatment for a month longer. Should the inversion still be active,—not a mere passive falling inwards of the foot owing to want of support, he may then repeat the operation for division of the posterior tibial, the division of which at the first operation may not have been complete. This can, however, rarely happen to the competent surgeon.

Cases approaching in severity those represented, 'Treatise on Deformities of the Human Frame,' 1853, pp. 264 and 265, require operation as soon as it can conveniently be done.

After tenotomy the foot should, during the three or four weeks' process of union of the tendons, be only gradually everted or flexed. I am aware that some surgeons continue to advocate prompt or rapid elongation of the interval between the ends of severed tendons. Time and space will not permit of my describing the evils of this practice. (See 'Treatise on Deformities of the Human Frame,' p. 305).

When the club-foot infant is only a few weeks or months old, it is necessary to deny the nurse the pleasure of putting it, quite naked, into a bath of the whole body and limbs, for the reason, that unless the foot, whilst in the bath, can be held by the nurse or by a splint in the best possible position, it is harmed by being allowed to revert, even for a few moments, towards its original evil position. But when the foot has been held for some weeks in the position represented, fig. 2, the following test as to the sufficiency of the efforts made to overcome the morbid inversion of congenital varus, or rather a test measure of the progress the child's nervo-muscular system of the foot is making towards *cure* may be resorted to.

The infant is to be held in the sitting position in a bath of lukewarm or cold water. If, during the first moments of

immersion, the limbs are thrust straight out in the water without inversion of the front of the foot, we may conclude that all physical obstacles to natural play of the ankle-joint have been definitely removed—that the shock given to the cutaneous surface of the child has been carried to and reflected from the centre of the nervous system, by a vigorous equal action of the adductors and abductors, so that no trace of varus is visible, as was still the case before the infant was placed in the water, and as may be the case when the child returns to the nurse's lap.

The physician is reminded by this test, of an analogous phenomenon sometimes displayed by the distorted hand in the early stage of hemiplegic paralysis, in which whilst the patient yawns the hand returns to a natural position. The reflex function which follows upon the uneasy or languid condition of the central organs of respiration and circulation preceding the 'yawn' and 'stretching' of full oscillation, excites equally the extensors and supinators as well as the flexors and pronators of the wrist, and temporarily removes the distortion of the hand.

The will of the infant, and the will of the hemiplegic patient, have nothing to do with the temporary improved position excited by the water, or by the languor which excites the yawn.

It is scarcely necessary to remark that when the hemiplegia has long existed, and molecular, *structural*, or adapted shortening of the muscles has taken place, the reflex operation upon the hand during yawning is not observed.

The surgeon who may not be expert as to congenital varus, may use this bath-test in slight cases to determine whether the distortion has existed long enough before and after birth to have produced structural shortening of muscles in addition to dynamic change of them. If the foot inversion, and so-called extension of it, be removed by the shock of the water, he may assume the probability that no section of tendons will be required.

The production of a blister, excoriation, or superficial slough should be considered as a reproach and a proof of

the bandage having been too tightly or too hastily applied. It is thirty years or more since I witnessed such occurrences in a patient treated by my own hands. If prominent parts be injured by over-pressure, the difficulty of future treatment is greatly enhanced.

As a disposition to inversion of the knee sometimes co-exists with varus, it has been recommended that any splint or apparatus should extend above the knee to the upper part of the thigh. I find this inconvenient and unnecessary except where the inversion is strongly marked. As already stated, congenital club-foot, treated in infancy, and thoroughly combated before the age at which children usually walk, needs no irons or supporting instruments to aid walking or turning out of the toes. If such appear requisite, proof is thereby afforded that the cure is incomplete. The surgeon must *rebrousser chemin* in his treatment, and permit no walking, or even attempts at walking, until free motion in all natural directions has been obtained. The child will then be able to stand naturally, and will speedily obtain voluntary power over his movements. It is necessary that the surgeon should insist that the child be not placed on the feet, or be allowed to move upon them before correct form and mobility have been obtained. Disobedience to this injunction has often been a stumbling-block in the cure. The child should, for some months, continue to wear the splint at night time, to correct any morbid direction observable during the day. If the parent or nurse will take pains, whilst the child grows, to watch the occurrence of any tendency to relapse, and educate it by the example of the movements of their own feet how to correct the tendency, it will be overcome.

Whatever be the remote or predisposing causes of ill success attending the treatment of varus, I may lay down as a matter of anatomical and physiological fact, that whatever may be the tendons divided, the apparatus used, the age of the patient, and the general mode of treatment pursued, the full measure of success will not attend the surgeon's efforts, unless the patient be prevented using the member until the

natural form and the full range of natural movement are obtained. Proper use does not come by instinct or intuition, as in those children who were originally well-formed. The patient is not secure from relapse until in addition to proper shape and range of motion of the ankle, fair muscular development has been acquired, and a natural equilibrium on the part of the various muscles has been established. So long as this equilibrium is wanting, it will be readily understood that no guarantee against recurrence of predominant action and shortening of some muscles, and consequent relaxation and weakening of other muscles and ligaments will necessarily result. All walking-irons and instruments being dispensed with, it is not an indifferent matter what kind of shoe the child shall use. In fact, the child of thirteen or fourteen months learning to walk after the thorough rectification of congenital club-foot, acquires a facility of correct walking more rapidly when moving about bare-footed, or with a worsted foot covering, furnished with a soft leather sole of a width quite equal to that of the foot. When the child moves about bare-footed on an even floor, each part of the sole normally touching the ground, is equally supported by the ground, and the foot is not exposed to any extrinsic cause of rolling or yielding to either side, as is to a varying extent the case when the child is raised from the ground by a more or less thick stiff sole, which is, moreover, often less wide than the foot in a boot constructed in the ordinary way. Any anatomist, with strong limbs, remembering his experiences when using ordinary skates, not the modern wheel ones, and the altered leverage to which the ankle-joint then is exposed, will appreciate the correctness of the statement above made, that any increase of the leverage of the ankle caused by a raised sole, may in the case of the weaker foot of the young child learning to walk after varus, be a cause of instability and strain to the muscles, which are then so little subject to the influence of volition. An ordinary plain broad-soled boot without heel is all that is required.

So highly do I appreciate the superiority of the treatment

of infantile varus in all its stages, with the aid of simple splints instead of with more costly and complicated instruments, that I should regard the general employment of these splints as a revolution in practice from the ways of our predecessors, who, previous to the general adoption of Stromeyer's operation, were too much influenced by the known value of elaborate apparatus in the treatment of distortions which had not been cured in infancy, or which had been acquired from various causes after birth.

Further, if I shall have succeeded in conveying to my hearers the experience I have acquired of the *curability* of every degree of ordinary infantile congenital varus, by the means I have here indicated, before the age at which a sound child may be expected to walk, and that no leg irons, steel or india-rubber springs, bandages, supports or peculiar stiffened boots are needed to turn the feet out or assist in walking, my task will be ended on this occasion, and I shall have no reason to regret your attendance here, or the thought and labour I have spent in the development of the treatment of this very important class of cases.

On a future occasion I hope to offer some additional remarks on imperfectly cured, relapsed, and neglected cases, and on the surgical and mechanical measures necessary for their recovery.

THE END.

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ways after failure of the former.
 I think it I shall have succeeded in conveying to you
 the experience I have acquired of the efficacy of
 every degree of ordinary indistinct congenital veins, by the
 means I have here indicated, being the one at which a sound
 may be expected to fail, and that no longer, and
 indistinctly, perhaps, perhaps, perhaps, or perhaps, perhaps
 facts are needed to find the labour or state in which the
 will be called on this occasion, and I shall have no
 need to repeat your observations on the thought and
 about I have spent in the treatment of the treatment of
 the very important class of cases.

On a future occasion I hope to offer some additional re-
 marks on hypertrophy, emphysema, and neglected cases,
 and on the angular and mechanical measures necessary for
 their recovery.

