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E library@wellcomecollection.org
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AT WHAT AGE SHOULD THE FIRST TREATMENT
OF CONGENITAL CLUB-FOOT BE
INSTITUTED?

By H. AUGUSTUS WILSON, M.D.,

*Professor of General and Orthopedic Surgery in the Philadelphia Polyclinic and College
for Graduates in Medicine; Clinical Professor of Orthopedic Surgery in the
Jefferson Medical College and in the Woman's Medical College;
Consulting Orthopedic Surgeon to the Lying-in
Charity and to the Kensington
Hospital for Women.*

THE special feature of this meeting is the discussion of the treatment of club-foot, but such discussion would be incomplete without some consideration being given to the proper time for the first treatment to be instituted in order to be most efficacious. Notwithstanding the absence of any well-authenticated reason, and often in direct opposition to well-established facts, a vast number of cases still go on to maturity with uncorrected, relapsed, or only partially corrected feet. That this is due largely to misconception as to the proper time to begin treatment, as well as to apparent want of knowledge of what that treatment should consist, is clearly understood by all orthopedists.

The general practitioners, however, are often the ones who advise delay or overlook the necessity for appropriate treatment early applied and persistently continued. As accoucheurs, they are often the ones to direct the first treatment and decide as to the age at which it should be applied, and it is important, therefore, that they should be informed of the results of experience. In the table of 101 cases, reported by Dr. E. H. Bradford, in the *Transactions of the American Orthopedic Association*, 1889, vol. i. p. 89, the age at which the cases were first seen by him is given, as follows:

[illegible]

2 AT WHAT AGE SHOULD CLUB-FOOT BE TREATED?

7 cases at	.	.	.	.	.	.	.	.	.	6 months.
1 case "	.	.	.	.	.	.	.	.	.	7 "
3 cases "	.	.	.	.	.	.	.	.	.	8 "
6 " "	.	.	.	.	.	.	.	.	.	1 year.
2 " "	.	.	.	.	.	.	.	.	.	1½ years.
1 case "	.	.	.	.	.	.	.	.	.	20 months.
10 cases "	.	.	.	.	.	.	.	.	.	2 years.
2 " "	.	.	.	.	.	.	.	.	.	2½ "
4 " "	.	.	.	.	.	.	.	.	.	3 "
11 " "	.	.	.	.	.	.	.	.	.	4 "
12 " "	.	.	.	.	.	.	.	.	.	5 "
6 " "	.	.	.	.	.	.	.	.	.	6 "
4 " "	.	.	.	.	.	.	.	.	.	7 "
1 case "	.	.	.	.	.	.	.	.	.	9½ "
1 " "	.	.	.	.	.	.	.	.	.	10 "
3 cases "	.	.	.	.	.	.	.	.	.	11 "
2 " "	.	.	.	.	.	.	.	.	.	12 "
2 " "	.	.	.	.	.	.	.	.	.	15 "
1 case "	.	.	.	.	.	.	.	.	.	18 "

The experience of others is similar to the above, and I have quoted Dr. Bradford instead of referring to my own case-book. An explanation of the delay, shown in the foregoing statement, may be found in the indefinite and often misleading statements of accepted text-books and writers on surgery from a few of which I quote. Ashhurst¹ says: "Mechanical extension should be resorted to in the third to fifth week; not before the third week. The best age for tenotomy is between the second and third month." J. B. Roberts² recommends "immediate correction by force, maintaining the position by gypsum bandage, and tenotomy after two months." Agnew³ advises treatment "at an early period of life, but tenotomy not earlier than the fourth or fifth month." Fisher⁴ thinks that the most favorable time for tenotomy is when the child is six weeks old. Morton⁵ urges manipulation from early babyhood, but condemns tenotomy until the child is able to walk. A. S. Roberts⁶ states that "mechanical appliances should always be granted a fair trial before resorting to operation." Milliken⁷ considers the best

¹ Ashhurst: Prin. and Prac. of Surg., ed. 1885, p. 686.

² Roberts: Modern Surgery, ed. 1890, p. 736.

³ Agnew: Surgery.

⁴ Fisher: Internat. Ency. Surg., ed. 1888, vol. iii. p. 681.

⁵ T. G. Morton: Trans. Amer. Surg. Asso., 1890, vol. viii. pp. 71-77.

⁶ A. S. Roberts: Clinical Lect., Phila Hosp., 1886, Nos. 1 and 11.

⁷ Trans. Amer. Orth. Asso., 1890, vol. iii. p. 50.

time to do tenotomy is when the child begins to walk, but advocates manipulation being instituted at birth. Professor Sayre¹ says: "If prompt treatment were the rule, section of the tendons would rarely be called for, but should be resorted to when necessary." Gross:² "Age is no bar to tenotomy." Druitt:³ "The earlier tenotomy is done after other treatment fails, the better." Ewens:⁴ "No educated surgeon of the present day would, I imagine, allow an infant to reach the age of three months without tenotomizing every contracted tendon or putting on suitable apparatus; but it becomes a serious question how far one would be justified in allowing a child to grow up beyond the age of three years, when it is evident that the bony deformity is so great as to defy rectification by free tenotomy." Bryant⁵ recommends manipulation and strapping a few days after birth, and tenotomy when necessary; has operated at one week. Stephen Smith:⁶ "Treatment as soon after birth as possible." Wyeth:⁷ "All forms should be treated from birth, and tenotomy determined by degrees of resistance." Moullin⁸ urges treatment to begin in infancy; tenotomy, if manipulation, etc., fail. Schrieber:⁹ "As early as possible." Parker:¹⁰ "It may be laid down as a canon that treatment should commence immediately after birth, and that tenotomy is an essential feature of the treatment of many cases." Pye:¹¹ "I believe that it will be found much speedier and a more satisfactory plan to recognize from the first that early tenotomy will give the best results." Bradford:¹² "Treatment should be begun as early in infancy as possible; the amount of time gained by tenotomy is not great." Vance¹³ begins treatment about the tenth day by manipulation and retention

¹ L. A. Sayre: Trans. 9th Internat. Congress.

² S. D. Gross: System of Surg., ed. 1882, vol. ii. p. 1036.

³ Druitt: Modern Surg., ed. 1887, p. 491.

⁴ John Ewens: Brit. Med. Journ., Oct. 17, 1891.

⁵ Bryant: Prac. Surg., ed. 1884, p. 817.

⁶ Stephen Smith: Operative Surg., ed. 1887, p. 824.

⁷ Wyeth: Text-book on Surg., ed. 1890, p. 811.

⁸ Moullin: Treatise on Surg., ed. 1891, p. 355.

⁹ Schrieber: Woods' Med. and Surg. Monographs, vol. ii., No. 3, p. 807.

¹⁰ Parker: Congen. Club-foot, ed. 1887, p. 85.

¹¹ Pye: Surg. Treat. Common Deformities of Children. 1889.

¹² Bradford: "Treat. Club-foot," Trans. Amer. Orth. Asso., 1887, vol. i. p. 89.

¹³ Vance: Discussion, Trans. Amer. Orth. Asso., 1889, vol. i. p. 115.

apparatus, and when that is not satisfactory divides the tendo Achillis.

H. Hodgen¹ believes, in the majority of cases, in cutting the tendon and rectifying at once, not taking time to stretch it. Steele:² "If they can be corrected without cutting, it would be far better." Keen and White:³ "The earlier the deformity is corrected and the foot held in the right position, the better; time may be saved by tenotomy."

A plan of treatment appropriate to one case or class of cases is often inadequate in others, and therefore treatment, when referred to in this paper, will mean the thorough correction of the deformity, its proper maintenance, and the application of measures having for their object the full establishment of the functions of the foot. In whatever degree the deformity may exist, attempt should be made at the earliest possible moment after birth to correct the deformity. The first day is none too soon, in my opinion, and the longer the delay the more difficult will be the recovery. In no case should plaster-of-Paris or fixed and immovable apparatus be kept on for more than one month, for their continuance tends to produce muscular atrophy. In all cases, passive motion, gymnastic exercise, friction, and the encouragement of motion in proper directions should be early instituted and persistently maintained. In all cases the form of apparatus selected should make elastic, in preference to rigid retention, to enable the patient voluntarily to move the foot in the proper direction, but upon the cessation of muscular effort to restore it to its normal position. In cases of first degree, or where the deformity is easily corrected and easily maintained, operative procedure is rarely, if ever, necessary in infancy. In cases of second degree, or where the deformity is corrected with difficulty, and where considerable restraining force is required, it is often desirable to cut, through an open wound, every soft tissue that restrains complete restoration rather than depend upon their possible stretching under force. The first day is none too soon to resort to such operative procedures, but any time during the first month will usually suffice. In cases of third degree, or where correction

¹ Hodgen: Discussion, Trans. Amer. Orth. Asso., 1889, vol. i. p. 115.

² Steele: Discussion, Trans. Amer. Orth. Asso., 1889, vol. i. p. 115.

³ Keen and White: Text-book of Surg., ed. 1892, p. 342.

cannot be accomplished without the employment of great force, more extensive operative procedures are necessary, and should be resorted to only after failure of tenotomy. In some cases I believe that early removal of the astragalus will enable the patient to adjust the muscles to the new circumstances and assist in developing them. The earliest age at which this is proper, in my estimation, is between the ages of one and two years. In cases that have been without treatment in infancy, or have relapsed, numerous operations have been recommended and resorted to, the consideration of which is inappropriate in this paper.

I contend that it is not rational to wait until the doubtful assistance of walking can be procured, because I believe that it is clearly proven that the earliest moment at which the deformed foot is thoroughly corrected the more satisfactory will be the ultimate result. During the period of one year or more spent in waiting for the child to walk, the muscles will have adapted themselves in part to their abnormal positions; some will have become inactive, and others overactive. This ultimate result, however, depends upon the completeness of the first correction, and as well upon the efficiency of the maintenance of the corrected position and the establishment of correlation of muscular forces. Relapses are the inevitable result of inefficiency on the part of those having the care or direction of the institution of the first remedial measures employed, and one of the prominent factors in these cases I have found to be delayed early correction. While it is improper to say that in all cases operative procedures should be resorted to or refrained from, I firmly believe that the rule should be adopted, and, without exception, that complete correction should be accomplished at the earliest possible moment—during the first month, if possible—and that this correction should be accomplished by the employment of every rational means—let it be operative, mechanical, manipulative, or gymnastic—but it must be complete to be effective. I believe that the soft bones of the tarsus will alter their shapes as they are squeezed and compressed by force and leave the shortened tendons as much contracted as they were before, because we know that tendons rarely, if ever, yield, except by tearing, while cartilaginous bones, not yet ossified, will yield to pressure. I believe that on making an examination of many feet corrected without opera-

tion, but where operations were indicated, that no elongation of the tendons would be found, but an altered external appearance of the foot, due to the softened condition of the bones, their being squeezed into an external appearance of correction. I believe, therefore, that at the earliest possible moment we should employ any method which will be necessary to correct deformity and which will prevent a return to the deformed condition. In reality, the first correction, no matter by what means accomplished, is but the means to an end. It is not only correcting the appearance of the deformity, but it is the correction of the mechanical defects, so that the mechanical functions may be reëstablished. The production of muscular atrophy, which is so serious an obstacle to correction of club-feet after the period of infancy has passed, is a profoundly interesting subject, and I have but to refer to Chinese ladies' feet for evidence of what is too often done with club-feet. The long-continued use of mechanical correction or restraining apparatus of any kind that does not provide for free ankle motion will accomplish, just as successfully as the foot-binder, a muscle atrophy. This muscle atrophy is in turn followed by atrophy of the bones, not only in their diameter, but in their length as well. The natural tendency of a congenital club-foot is toward atrophy from disuse and increased deformity, and, therefore, we are warranted in resorting to every means to avoid its occurrence. The certainty with which muscle atrophy is corrected by judicious means clearly indicates that if it cannot be entirely prevented in congenital club-feet, it can, at least, be arrested and controlled. The length of time required to accomplish a full and complete correction of a congenital club-foot is the same as that required to form the foot of a normal child, and depends upon the age at which correction was obtained and the efficiency of remedial measures employed. Not until the normally formed child is ten or twelve years old does the foot possess the normal conditions necessary for its full usefulness. All babies are flat-footed, many are pigeon-toed; but all of these conditions pass off as soon as the correlation of muscular forces establishes the mechanical functions. The same may be said of a child born with a club-foot, certainly in the milder forms, that until the age of ten or twelve years the correction must be maintained mechanically, and efforts must be made to develop the muscular system; the

longer the delay in establishing the normal functions the less likely will those functions be normal.

That which in the normal child prevents the foot from becoming deformed, although it may be placed temporarily in a deformed position, is the correlation of muscular forces, and this must and can be established in cases of club-foot that are corrected sufficiently early. The absurdity must be avoided of resorting to gymnastic forms of treatment, and at the same time destroying their efficiency by the use of mechanical restraining apparatus that not only prevents the reproduction of the deformity, but at the same time restrains all motion. Thus I have seen rigid plaster-of-Paris and rigid steel braces in constant use in cases where it was removed every day for half an hour, and during that time developmental methods employed. The trivial gain by manipulation was irrevocably lost by the employment of an apparatus which kept every part of the foot immovable. To accomplish a complete recovery there must be an understanding of the mechanical functions to be recovered, and this is apparently absent in those who postpone the application of rational treatment, or simply cut tendons, and allow the case to relapse by neglect, or who consider braces to be curative.

The diversity of views as to the existence at birth of bone malformations will account in part for the existing differences of opinions as to the propriety of resorting to operative procedures early in infancy. Druitt¹ believes that in some cases the astragalus is quite normal, proving that bone-changes are not necessary to talipes. Erichsen² says very little alteration has taken place in the condition of the bones. Power:³ "I am, therefore, led to suppose that the deformity is due entirely to bone-changes." Ashhurst:⁴ "In most cases bones of the foot are not altered in structure." Adams⁵ maintains that in cases of varus the astragalus is malformed from the moment of birth. Morton:⁶ "Bones, especially the astragalus, are greatly deformed and unrecognizable after excision." Phelps:⁷

¹ Druitt: *Modern Surg.*, ed. 1887, p. 491.

² Erichsen: *Science and Art of Surg.*, ed. 1884, p. 579.

³ Arcey Power: *Trans. Path. Soc.*, London, 1888-89, xl. p. 248.

⁴ Ashhurst: *Prin. and Prac. of Surg.*, ed. 1885, p. 686.

⁵ Adams: *Amer. Surg. Asso.*, 1890, viii. p. 71.

⁶ *Trans. Amer. Surg. Assoc.*, 1890, vol. vii.

⁷ *New England Med. Monthly*, February, 1891.

"Deformity of the soft parts out of all proportion to the deformity of bone."

I am convinced that to a very large extent the changes in the structures of the bones, often described, is due in a large measure to postponement of appropriate treatment. This may be accounted for in either of two ways: First, that observed in uncorrected cases where the process of ossification progresses and the partially dislocated tarsal bones become permanently deformed to suit the abnormal position of the foot; and, secondly, in those cases of more or less marked severity where recourse has been had to mechanical force to stretch shortened tendons. The bones in these cases, whether deformed or not, yield to the pressure exerted and thereby become deformed and become ossified in their altered shape.

In most instances either of these occurrences could and should have been avoided by the early recourse to operative procedures. It is not a question of saving of time, but of perfect correction. In conclusion, I would offer the following:

That full perfect correction should be obtained during the first month.

That where correction is possible without recourse to rigid restraining apparatus, tenotomy should be avoided.

That tenotomy, syndesmotomy, or cutting of fascia, should always be resorted to in the first month, when perfect correction cannot otherwise be maintained without employing undue force.

That tenotomy should never be resorted to in infancy without being followed by developmental as well as restraining treatment.

That it is misapplied mechanics to force a club-foot into a rigid restraining shoe, and that doing so in the first months of infancy will produce ultimate bone deformity.

That all apparatus employed in infancy should facilitate free motion in the proper (*i. e.*, normal) direction, and encourage the development of correlation of muscular force.

All methods which employ undue force in correcting or restraining club-feet should be refrained from until the child reaches the age when the bones are completely ossified. The same period should be awaited before resorting to operations upon the bones.