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THE USES OF ADHESIVE PLASTER IN ORTHOPÆDIC SURGERY.*

By A. B. JUDSON, M. D.

The earliest record, so far as I am aware, of the use of adhesive plaster in orthopædic practice is found in the fifth edition, published in 1740, of Cheselden's "Anatomy." On pages 37 and 38 he writes as follows: "The first knowledge I had of a cure of this disease (congenital club-foot) was from Mr. Presgrove, a professed bone-setter, then living in Westminster. I recommended the patient to him, not knowing how to cure him myself. His way was by holding the foot as near the natural posture as he could, and then rolling it up with straps of sticking-plaster, which he repeated from time to time as he saw occasion until the limb was restored to a natural position." This method, improved by the application of a strip of adhesive plaster surrounding the foot and extending up the leg, was advocated at a "clinique" held in this city in 1850 by the late Dr. S. D. Gross, who was at that time Professor of Surgery in the University,† and also by Dr. J. N. Quimby in a notable paper read before the Academy in 1867.‡ Plaster ap-

* Read before the Section in Orthopædic Surgery of the New York Academy of Medicine, March 18, 1887.

† "New York Medical Gazette," December 21, 1850, p. 390.

‡ "Bulletin," November 20, 1867, p. 264.

plied in this way will probably continue to be used occasionally in the management of congenital club-foot in its early stage. Combined with other apparatus, it has been quite extensively used in the treatment of all stages of the affection. It is an essential part of the varieties of apparatus described by D. Gilbert,* Jolliffe Tufnell,† L. A. Sayre,‡ C. F. Stillman,# E. Develin,‖ and F. T. Paul.△ It is used in fixing the points of origin and insertion of artificial muscles, as applied by Barwell.◊ It was used in the "extension shoe" described by Dr. Shaffer in 1878,‡ but its use in this apparatus has been discarded by him, as explained in an elaborate and interesting paper recently read before the Academy.↕

I have found it possible to overcome the deformity in several cases of neglected and obstinate varus by "untwisting" the foot by means of a strap of adhesive plaster encircling the foot and buckled by an attached piece of webbing to the outside of the vertical part of the foot-piece of a club-foot shoe, as shown in Fig. 1, which represents schematically a transverse vertical section of the foot and foot-piece, the broken line representing the adhesive plaster,

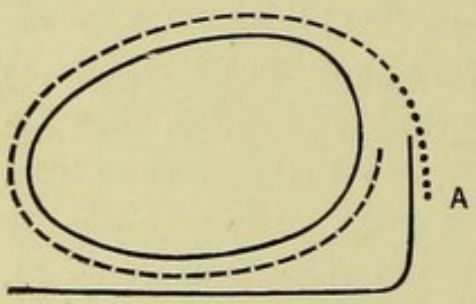

Fig. 1.

* "Philadelphia Med. Examiner," December, 1852, p. 786.

† "Dublin Quart. Jour. of Med. Sci.," November, 1869, pp. 70–72.

‡ "Medical Record," July 15, 1874, p. 363.

"Trans. of the American Med. Assoc.," 1880, pp. 779–792.

‖ "Med. News," August 22, 1885, pp. 205, 206.

△ "British Med. Journal," April 11, 1885, pp. 735, 736.

◊ "Medico-chirurgical Transactions," London, 1862, pp. 25–42.

‡ "Med. Record," November 23, 1878, pp. 401–404.

↕ "N. Y. Medical Journal," March 5, 1887, pp. 253–261; March 12, 1887, pp. 287–292.

the dotted line the webbing, and A the position of the buckle.

In passing I may notice that the overlapping of the toes, which is a frequent accompaniment of acquired club-foot, may be easily corrected by the use of adhesive plaster. This affection, though trifling in itself, may give rise to the conditions known as hallux valgus and "hammer-toe," the latter being a dorsal projection of the proximal phalangeal joint of the second or third toe resembling the hammer of a gun. It is a very painful and inconvenient deformity,

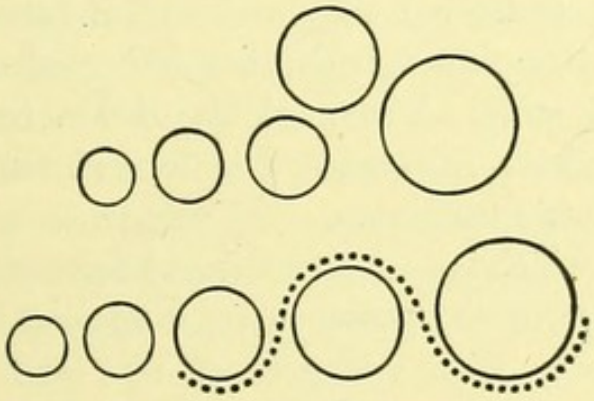

Fig. 2.

and has not infrequently led to amputation and other forms of operative interference.* Overlapping may be arrested by a single narrow strip of adhesive plaster passed over and under and between the toes in such a manner as to reduce them to a straight line, as shown in Fig. 2, which represents the reduction of the overlapping second toe, the plaster being applied with the adhesive surface uppermost. In children this treatment permanently restores the toes to their normal position in a few days.

Adhesive plaster for making prehension of the head has been widely used in the treatment of torticollis. Dr. Gil-

* See Annandale's "Malformations of the Fingers and Toes," 1865, pp. 63–65, Plate vi.

bert,* of Philadelphia, applied a strip passing under the chin from one temple to the other. Dr. W. J. Little,† of London, encircled the forehead and occiput. Dr. A. J. Steele,‡ of St. Louis, encircled the forehead and occiput, and added two strips passing over the top of the head from side to side. Dr. L. A. Sayre# applies a wide strip of plaster from one temple to the other across the forehead, a strip of muslin being attached to the extremities of the plaster and passing around the head. Prehension of the head being secured in one of these ways, a fixed point from which traction may be made is found by Dr. Gilbert and Dr. Sayre in an axillary band on the unaffected side, and by Dr. Little in a waistband of adhesive plaster, which is re-enforced by Dr. Steele by a perineal strap. The methods of Dr. Sayre and Dr. Steele have whatever advantage is derived from the introduction of elastic traction.

Traction, which is such a prominent feature of the orthopædic practice of the present day, is applied by the use of adhesive plaster with a degree of ease and convenience which may be appreciated by recalling the experience of those who treated joint diseases by the application of traction before the introduction of adhesive plaster as a means of making prehension of the limb. So far as I am aware, Brodie was the first who applied traction in the treatment of hip disease. He used the weight and pulley, and said: "A bandage may be placed round the thigh above the condyle with a cord attached to it passing over the pulley."‖ Ducros△

* "Phil. Med. Examiner," December, 1852, pp. 786, 787.

† "Deformities of the Human Frame," London, 1853, pp. 193, 194.

‡ "Trans. of the Med. Assoc. of the State of Missouri," 1876, pp. 37–49.

"Lectures on Orthopædic Surgery," 1876, pp. 454, 455.

‖ "Diseases of the Joints," 3d ed., 1834, p. 55.

△ "Gazette des hôpitaux," June 30, 1835, p. 311.

and William Harris,* working independently, applied traction by the long splint which was in use for treatment of fracture of the thigh. The former probably used a fillet around the ankle, and the latter the laced buckskin gaiter of Hagedorn's splint. Bonnet, in *le grand appareil*, made prehension of the limb by means of the starch bandage,† and Ferdinand Martin ‡ flexed the patient's knee and ingeniously made traction by applying force to the calf of the leg in a line parallel with the axis of the thigh.

It would be interesting, but foreign to our purpose, to trace the gradual substitution of the use of adhesive plaster for these painful methods of grasping the limb in the treatment of fractures. It is enough to say that it was first described in 1830 by the late Dr. S. D. Gross,# who had learned it from Dr. Joseph K. Swift, of Easton, Pa., and, after being advocated by Dr. Josiah Crosby,‖ of New Hampshire, in 1850, it was in a few years generally recognized in this country as a most valuable addition to the therapeutics of fractures.

The question of more immediate interest is, Who first used adhesive plaster for traction in the treatment of diseases of the joints? I have not found the answer in the literature of the subject. And yet, so far as hip disease is concerned, this improvement in therapeutics is of more value than any of the very numerous inventions for applying traction in the treatment of this affection. The first

* "Phil. Med. Examiner," January 19, 1839, pp. 37–40.

† "Traité des maladies des articulations," 1845, vol. ii, p. 324.

‡ "De la coxalgie," 1865, pp. 488–496.

"Diseases of the Bones and Joints," 1830, p. 5

‖ "Trans. of the Am. Med. Assoc.," 1850, pp. 382, 383. One of Dr. Crosby's patients graphically described the sensation produced by this application in these words: "It feels as if my leg was in the mud, and I was trying to pull it out."—"New Hampshire Journal of Medicine," Oct., 1850, p. 65.

record bearing on this point, so far as I am aware, occurs in the April number of the "American Medical Monthly" for 1860, in which Dr. Henry G. Davis and Dr. L. A. Sayre have each an article advocating the treatment of hip disease by the use of adhesive plaster applied to the limb for the purpose of traction.

It is interesting to notice here that, just as adhesive plaster, applied around the pelvis for counter-extension in the treatment of fracture of the thigh, in order to avoid the inconvenience of a perineal strap, was used by Dr. Gilbert in 1851 * and Dr. J. H. Churchill † in 1877, so it was used for the same object in the treatment of hip disease in 1879 by Dr. C. F. Stillman, ‡ who applied mole-skin adhesive plaster, and covered it with plaster of Paris, which, mixing with the nap of the mole-skin, made a fixed point of remarkable stability. Considering the advantages attending the use of a perineal strap, which not only furnishes a fixed point for counter-traction, but also acts as an ischiadic crutch-head when used with the long hip splint, it does not seem to me probable that it will be supplanted by adhesive plaster.

At this point I would like to call attention to some of the natural limitations of the use of adhesive plaster in the treatment of joint diseases. The first instrument invented for the treatment of hip disease did not extend to the ground, and yet it was designed not only to make constant traction on the limb, but also to prevent the weight of the body from being borne on the articular surfaces in standing. A consideration of the apparatus as applied to a patient will, I think, convince an attentive observer that if it is able to relieve the joint surfaces from the weight of the body in

* "Am. Jour. of the Med. Sciences," January, 1851, pp. 70–72.

† "Med. Record," March 17, 1877, p. 167.

‡ "Med. Record," August 30, 1879, pp. 196–198.

standing, the weight will be held up by the perineal strap and thence transferred to the surface of the limb over which the adhesive plaster is spread. In such a case the natural limits of the adhesiveness of the plaster and the integrity of the skin are speedily reached, and the joint surfaces receive at once the weight of the body.

Furthermore, the usefulness of adhesive plaster in orthopædic practice is seriously limited by the fact that, although we intend by its use to control the action and modify the attitude of the skeleton, we are compelled, from the nature of the case, to apply it to the skin, which is not only elastic but also extremely movable on the bony tissue, which lies at a greater or less depth. This is one of the limitations which make it difficult to accomplish all that seems to be desirable in practice. It is supposed that the circumarticular muscles can be directly and potently affected by traction thus applied. Without denying that in some cases and for a limited time slight effects of this kind may be produced, I believe that, as a general thing, the benefit derived from the use of adhesive plaster in the treatment of joint diseases is due to the fixation which accompanies continued traction.

In the case of those joints which are found at the point of contact between the extremities of two long bones, as at the knee between the femur and tibia, the leverage furnished by the length of the bones enables us to obtain, by the use of retentive splints and without adhesive plaster or traction, a degree of fixation sufficient to allay pain and promote recovery, which it is impossible, from the nature of the case, to obtain by retentive splints in the case of the hip. I am not unmindful, however, of the fact that traction with adhesive plaster has been widely advocated in the treatment of disease of other joints than the hip, and especially in the treatment of chronic osteitis of the knee,

by Dr. L. A. Sayre,* Dr. C. Fayette Taylor,† Dr. Edmund Andrews,‡ Dr. N. M. Shaffer,# Dr. C. F. Stillman,‖ Dr. Simeon A. Foster,^ and Dr. Sydney Roberts.◊ The results of their treatment have doubtless been excellent, but no better, I think, than the results which follow fixation by retentive apparatus so constructed as to apply the principle of the lever which is so naturally applied to the femur and tibia. Having discussed this question at some length on other occasions, I bespeak a reconsideration of the opinion, which may have been formed or expressed by some of the eminent authorities above named, that counteraction of the muscles, and not fixation of the joint, is the curative agent in the treatment of joint diseases by traction.

In passing it may be noticed that not infrequently in the practice of mechanical surgery adhesive plaster is useful in holding an apparatus in place, although it may not be directly essential to the efficiency of the apparatus. In a convalescent case of hip disease, for instance, when traction is no longer required or maintained, the adhesive plaster previously applied to the limb for the purpose of traction may be useful in keeping the splint from falling off. In such a case the splint is simply an ischiadic crutch, converting the limb into a pendent member, and thus preventing an injurious amount of the weight of the body from descending on the heel of the affected side.

Since traction has helped us to a certain amount of fixation in the difficult hip joint, it is not unreasonable to resort

* "Trans. of the Am. Med. Assoc.," 1865, pp. 383–390.

† "N. Y. Med. Journal," July, 1873, p. 46.

‡ "Archives of Clinical Surgery," New York, April 15, 1877, pp. 3–6.

"Archives of Clinical Surgery," June 15, 1877, pp. 90–93.

‖ "Trans. of the Am. Med. Assoc.," 1881, pp. 453–464.

^ "Annals of Anat. and Surgery," January, 1882, pp. 22–26.

◊ "Med. News," July 26, 1884, pp. 90, 91.

to it in the case of the carious vertebral joint, where there is, above and below the seat of disease, a flexible column which almost nullifies any attempt at fixation, by taking advantage of the principle of the lever. Difficult though the task appears, the application of traction to the vertebral column by the use of adhesive plaster was advocated by Dr. Andrews * in 1863 and Dr. George A. Berry † in 1879. I think it will generally be considered that, except in certain urgent cases, the difficulty which attends this application will more than counterbalance whatever special advantages may attend this plan of treatment. Dr. H. O. Marcy ‡ and Dr. J. J. Reid # used adhesive plaster for the suspension of patients during the application of the plaster-of-Paris jacket, the former applying it to the back of the neck and head, and the latter to the back and front of the chest. The remarkably simple and ingenious device of Dr. Reid is well worthy of study.

In the practical remarks which follow, reference is had to plasters which owe their adhesiveness chiefly to the presence of tropical gums, and not to the resin plaster which is sometimes called lead plaster or diachylon. In 1848 Mr. D. F. Eyre, of Derby, England, proposed India-rubber dissolved in naphtha as a material for the manufacture of adhesive plaster. He wrote as follows: "If liquid India-rubber, spread upon calico or other material by a stiff brush or by a knife, be used as adhesive plaster, it will be found to answer far better, in almost every case, than any other adhesive material, as it sticks firmly, is pliant, produces no irritation to the skin, and will bear lotions or washing over it." ‖

* "Chicago Med. Examiner," September, 1863, pp. 419–421.

† "Edinburgh Med. Journal," July, 1879, pp. 45–47.

‡ "Boston Med. and Surg. Journal," Nov. 30, 1876, p. 654.

"New York Med. Journal," July, 1878, pp. 37–42.

‖ "Lancet," Feb. 19, 1848, p. 210.

Notwithstanding this early reference and the occasional experimental use of India-rubber in this way, we are largely indebted for the introduction of gum plaster to Dr. H. A. Martin,* who zealously advocated it in 1877. The article now manufactured has all the merits which were alleged by Mr. Eyre. It is sticky, pliant, non-irritative, water-proof, and, in addition, cheap and convenient. The softness and pliancy of this plaster when applied to the skin distinguish it from the lead plaster which composed "Scott's dressing," † one of the objects of which was to prevent the motion of a diseased joint by the application of adhesive plaster in layers around the joint and to some distance above and below.

In practice I have found that the lighter kinds of plaster can be used, even where great strength is required, by stitching a piece of tape on the back of the plaster before the webbing or buckle is sewed on. When the sewing-machine refuses to work from the collection of gum on the needle, a drop of oil may be applied to the shuttle. If the stitches are in parallel lines, they will not interfere with the easy removal of the facing of thin muslin with which the adhesive surface of the plaster is protected.

The extreme adhesiveness of gum makes it possible to apply very powerful traction with two vertical strips of considerable width, extending to the upper part of the thigh. The ordinary roller bandage may also be dispensed with, its place being conveniently and cheaply taken by a laced muslin legging. The excellence of this device—first used, I believe, in the practice of Dr. C. Fayette Taylor—becomes evident when the patient's joint is in a painful condition, acutely resenting the disturbance which necessarily attends

* "Boston Med. and Surg. Journal," Oct. 11, 1877, pp. 407–411.

† Brodie on "Diseases of the Joints," 1821, p. 243. "Diseases of the Joints," John Scott, London, 1828, p. 134.

passing the roller under the limb and tightening the turns and reverses. In such a case the legging may be applied painlessly. Besides, it may be washed and reapplied by unskilled hands.

If a high degree of traction is employed during hot weather or while the patient's room or bed is overheated, the plaster will gradually slip down, making it necessary to buckle shorter the leather straps which proceed to the foot-piece, and in time the plaster will have to be renewed. Its removal from a very hairy surface may be facilitated by the free use of benzine or naphtha, either of which is dangerously inflammable.

The occurrence of eczema under adhesive plaster, no matter what kind of plaster is used, is an occasional inconvenient incident. It is apparently caused by the retention of moisture. The same condition follows a continued poultice or "wet-pack." It is said that its appearance in water-cure establishments is sometimes pointed to as an evidence that morbid material is being expelled from the body. In my experience this form of eczema rapidly disappears on the removal of the plaster if the patient will consent not to scratch the affected surface. I have found it convenient to apply one of the vertical strips of plaster on the inner and anterior surface of the limb, as shown at A, Fig. 3, and the

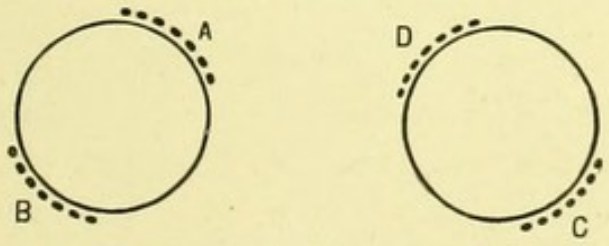

Fig. 3.

other on the outer and posterior surface, B; and when they are renewed, one on the inner and posterior, C, and the

other on the outer and anterior surface, D. By following this plan no portion of the skin is kept too long covered by the plaster. The long distance between the foot-piece and the lowest point of attachment of the plaster prevents the twisting of the splint on the limb, which might at the first glance seem likely to follow this arrangement.

I will close by referring to the use of adhesive plaster as a covering for all kinds of surgical apparatus that are exposed to rust from contact with the body or otherwise. Club-foot shoes may be lined with it in several layers if desirable. A strip of plaster wound around a piece of steel retains its place for an indefinite time, saves the expense of polishing and electro-plating, and may be covered at will with chamois leather or spirally with a strip of Canton flannel or silk.

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