A Clinical Lecture

ON THE

USE OF ELASTIC TRACTION AND ELASTIC PRESSURE IN SURGERY.

Delivered at the Manchester Royal Infirmary.

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Although it is probable that elastic traction had been applied to surgical purposes before the time of Barwell (1861), I am not aware of any systematic attempt to employ it till that date. Barwell's first paper was published in the *Medico-Chirurgical Transactions* for 1861, and a second in 1863.* Lewis Sayre in 1869 writes (*Treatment of Clubfoot*) with approval of Barwell's method of treating clubfoot, and again does so in the later edition of 1874. In 1876, Sayre, in his *Orthopaedic Surgery*, describes the use of elastic traction in cases of facial paralysis. Traction was applied by a wire hooked into the mouth and over the ear with elastic between. The elastic traction was used as an accessory to galvanism.

For torticollis Sayre used plaster strips round the head and a collar round the axilla with elastic fixed on the sound side. He also made use of the jury mast for this purpose. In 1882–3 Golding Bird, in the *Guy's Hospital Reports*, published a paper on the treatment of flat-foot and talipes, and described his method of attaching the elastic or "artificial muscle" to a steel with an encircling band below the knee. The exact details of the method of applying the traction suggested and employed by Barwell and Golding Bird need not be described now.

The use of elastic traction instead of steel springs has of course been employed in various ways, such as in artificial limbs, to produce recoil, and so straightening or flexion as might be desired, but it is of its more direct application to surgical uses that I propose to speak now. Many of these applications of the elastic recoil of rubber are, of course, in constant and familiar use, as, for example, Martin's rubber bandages for varicose veins, the principle here being much the same as that of Brodie's bandage, only employed with more efficient material.

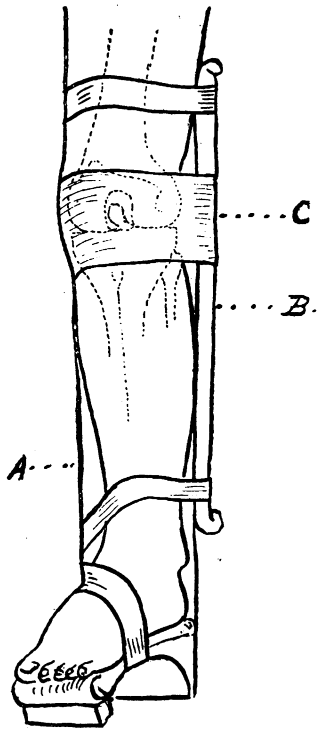

Fig. 1.—The writer's splint for genu valgum The footpiece is rotated inwards on an axis parallel with the back splint A. The outside splint B forms the chord to the arc of the curved limb; C, the broad elastic band drawing the knee against B, and straightening the limb.

So, too, the use of bandages of flannel or other more or less elastic fabrics to reduce oedema and other forms of swelling need only be mentioned. Elastic pressure as directly applied to more local conditions—such as to naevi, and no doubt to many other tumours—would obviously commend itself, probably from very early times; and I well remember my late friend and colleague, James Hardie, advocating and using for some years "sponge pressure" to enlarged glands in the neck (lymphomatous and other) that he did not consider suitable for operation.

Esmarch's bandages and tourniquet for making limbs exsanguine and controlling bleeding before and during operations on the limbs were, if I remember rightly, introduced in the Seventies; and, though simple elevation of the limbs has largely replaced the use of the elastic bandage, it is still frequently employed for such purposes as operations for necrosis, autotransfusion, etc.

With the universal confidence given by modern surgical methods the treatment of aneurysms by elastic as well as by other forms of tourniquet has almost died out, and the method of ligature of the main vessels as a preliminary step in certain amputations has still further restricted the use of tourniquets and allied apparatus of all kinds.

The use of elastic pressure to promote absorption of fluid and other effusions into joints does not differ in principle from its employment in cases of more general oedema. The so-called Biers treatment † may also be mentioned.

Many years ago Lord Lister employed elastic pressure, after a preliminary tapping, as a means of treating hydrocephalus. I well remember trying the method, but experience did not encourage its further use, and it has been superseded by other modes of treatment.

Few, I suppose, of the present generation have seen the elastic ligature used for the removal of piles or for the cure of fistula, and fewer still can have had any experience of its employment for removal of the tongue or of tumours. Elastic ligatures are, however, occasionally still employed for the purpose of temporarily controlling the circulation in blood vessels and temporarily occluding the gut during operations.

Rubber trusses and belts have been in common use for many years.

With this hurried mention of some of the many uses to which elastic pressure has been adopted, I propose to pass on to a somewhat more detailed consideration of the use of rubber as an orthopaedic agent. In cases of flexion of joints, where no actual ankylosis is present, but immediate straightening by force is undesirable, no more valuable means of rectification exists than elastic tension. At this point it may be well to notice the advantages which rubber possesses over other means of employing tension. First, rubber has the advantage over steel springs in that its tension can be employed through a much wider range, and the strength of the tension is capable of more ready adjustment. It is much easier to apply slighter degrees of traction or pressure, much easier to arrange for the exact line of traction required, and, in addition, any apparatus needed may be readily and cheaply improvised. The appliances are indeed exceedingly cheap, easily managed, and easily replaced. A little ingenuity and some rubber cord is the stock-in-trade, though patience and care are, of course, also necessary, as living tissues cannot, as some surgeons seem to suppose, be dealt with quite as if it was a question of cabinet making or upholstering. Pressure sores are a possible result of mismanagement or neglect, and are easier to make than to repair.

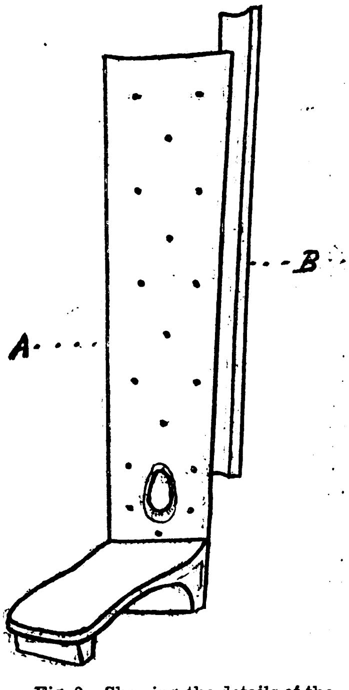

Fig. 2.—Showing the details of the splint and the rotated footpiece. A, Back splint; B, outside splint fixed to A.

For flexed joints that require straightening, all that is necessary in many cases is the application of a straight splint across the angle of flexion secured to the limb above and below the joint, but not so tightly as to prevent the

* In Malgaigne's *Orthopaedics*, 1862, there is no mention of elastic traction.

† A large part of this method is of course simply a revival of the old cupping glasses and cucurbitae.

lower segment from slipping through the bandages as the limb straightens. These bandages may be of any material, but perhaps it is better to use flannel or some slightly elastic material for the distal segment of the limb. The joint is left bare at this stage. Next an elastic bandage is carried over the joint and round the splint so as to exert the desired pressure in the required direction. The exact form of elastic material, its strength, the arrangement of suitable pads to take off or equalize pressure, and other little practical details must be adapted to each individual case.

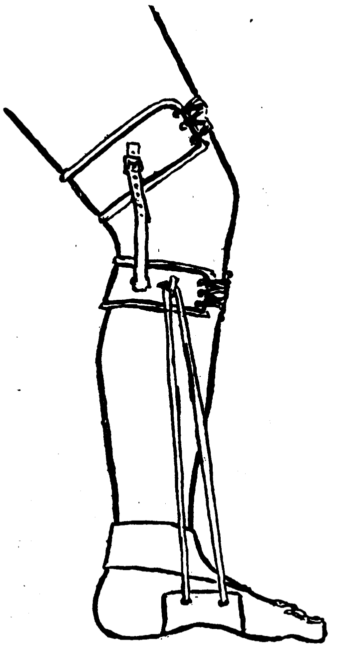

Fig. 3.—"Artificial muscle" applied for flat-foot.

The angle of flexion should be measured before and at short intervals during the treatment, to see what progress is being made, and a daily removal of the elastic is necessary at first to make sure that there is no excessive pressure.

Exactly similar appliances may be used to prevent or correct cicatricial contractions in suitable cases. It is a good plan to substitute elastic traction applied to the lower segment of the limb, either as a temporary substitute or an alternative to the elastic pressure, if for any reason direct pressure over the joint is inadvisable. Traction by weight is no doubt efficient and easy to apply in some instances, but is not always so simple and trustworthy as it appears, and it is by no means uncommon to find a weight extension applied to a leg in such a way that a little inspection will make it clear that friction at one point or another is reducing the traction power to nothing or to very little. A good example of the use of elastic traction in this way is seen in Bryant's double splint, with the use of which you are familiar. In fracture of the patella, those who, like myself, do not as a routine resort to immediate wiring, use elastic traction by the "Middlesex" or other method to approximate the fragments by steadying the lower one and drawing the upper downwards towards it. In rickety deformities the use of elastic pressure finds a very wide application. For curvatures of the shafts of the bones of the leg a straight splint applied on the concave side with elastic pressure over the convexity of the curve will straighten a large proportion of these curved limbs. Of course, the more rapidly the deformity is increasing the more likely is the use of elastic pressure to succeed. For the anterior curve of the tibia the tension of the calf muscles makes the use of elastic pressure more tedious, and in some instances nothing but cuneiform osteotomy or a splice section will succeed.

For genu valgum in slight cases an outside splint applied on similar lines is quite efficient, but in severe cases there is great difficulty in maintaining steady pressure by reason of the tendency of the limb to rotate outwards, and so take off the tension. This problem will be familiar to all who have attended at the Children's Hospital; and it was only after various trials many years ago that I found I could get over the difficulty by the use of the splint shown to you in Figs. 1 and 2. It is almost impossible to get a drawing to show the features of this splint, but Mr. Jefferson has made a sketch which is as near as we can get.

You will see that the footpiece is set inwards—that is, rotated on a vertical axis, so that the limb is fixed on the back splint in such a way that it cannot rotate outwards. The outside splint is thus maintained in its proper position, and the elastic tension rendered efficient. You will find this a useful splint if you take the trouble to have it made correctly.

Next we come to the treatment of flat-foot by elastic traction. The modification of the Golding Bird's apparatus, which I show you here, is simple in the extreme, and in my experience much more efficient and comfortable than any of the "insteps" or "socks" or "arches" that are sold. The continuous traction combined with "play" of the muscles by the varying tension not only gradually replaces the collapsed arch, but tends to strengthen the muscles. The mode of application is indicated in Fig. 3. I use this largely and in combination with, not to the exclusion of, tiptoe exercises and thickening of the sole of the boot on the inner side, etc. These means are sufficient for many of the slighter cases, but in the severe ones the "artificial muscle" is much more efficient. Adhesions must, of course, be broken down, and moulding employed by hand under an anaesthetic in some severe cases before the muscle is put on.

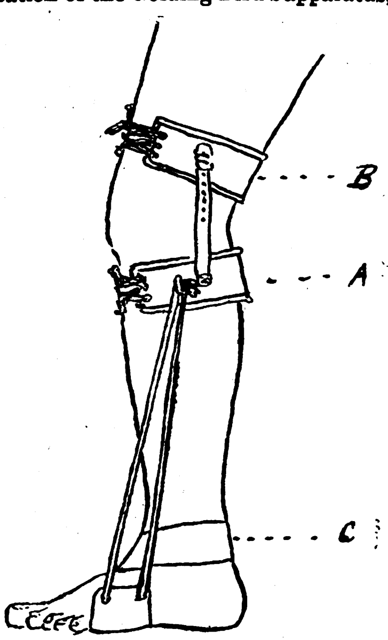

Fig. 4.—"Artificial muscle" applied for talipes equino-varus. A, Leather leg strap with hook; B, leather thigh strap which keeps A from slipping down; C, felt band encircling ankle and foot, to which is attached the elastic.

In the great group of deformities classed as talipes, both congenital and acquired, there is ample scope for the use of elastic traction, and considerable trouble is needed and some ingenuity on the part of the surgeon both to devise the exact method of application, and still more to prevent the instrument maker and the "friends" from foiling his efforts by "improvements" of their own (Fig. 5).

The mode of application is best demonstrated on a patient, but Fig. 4 will show the ordinary mode of application in talipes equino-varus. I had this arrangement for using the elastic made many years ago at the Children's Hospital, and have found it answer all purposes in one form or another. A good deal of skill is, however, called for in getting the most out of the apparatus. The exact line of traction and the point of fixation of the elastic may be varied so as to exert a rotating pull, as well as a direct drag, where such rotation is desirable. In some instances, especially of pes cavus, it is necessary to mould steel sole-plates and exert traction on these to get over difficulties due to slipping of

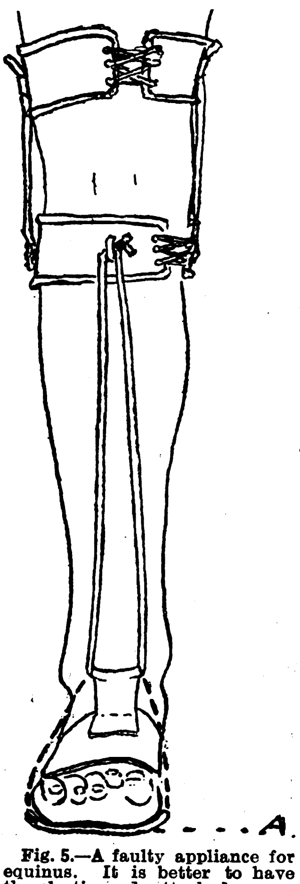

Fig. 5.—A faulty appliance for equinus. It is better to have the elastic cords attached one on each side of the steel sole-plate A, as indicated by the dotted lines.

the felt foot-sling. Other adaptations have been devised, one of which is to put a bandage over the foot first so as to increase friction and allow the sling to be fixed to this. This modification was suggested by the late Mr. Collier at Pendlebury many years ago.

The method of application shown in the sketch (Fig. 5) of an "artificial muscle" applied for talipes equinus is an example of an instrument maker's "improvement" which I do not recommend. It is much better to bring up a cord on each side, as shown in the dotted lines. Varying tension on either side can thus be arranged and much more accurate correction got. The use of "artificial muscles" does not, of course, do away with the need for tenotomy, tenoplasty, tarsectomy, and the various other operations needed in certain cases, but it is a valuable supplement to some of these, and in many cases it prevents the deformity from becoming "inveterate."

For paralytic conditions the elastic traction is a most useful adjunct to, or, in some circumstances, substitute for, tendon grafting. I will only mention the use of

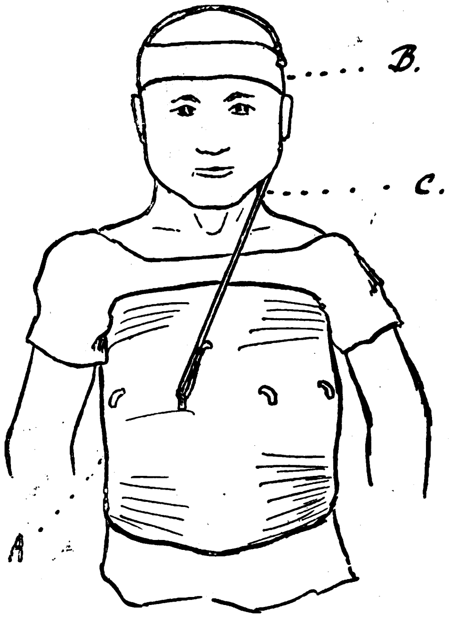

Fig. 6.—Elastic traction applied for torticollis after division of the sterno-mastoid of the opposite side. A, Plaster-of-Paris jacket with hooks; B, head band or felt cap, also with hooks; C, the "artificial muscle." Another elastic is usually necessary at the back to prevent flexion of the head.

the artificial muscle in wryneck. It is usually employed, after tenotomy, with a jacket and some sort of cap (Fig. 6). Traction is made parallel with the unaffected muscle.

There is room for the useful employment of elastic traction and pressure in many more ways in surgery than those I have mentioned, and I strongly recommend you to think out and adapt the plan to any suitable case you may have in charge. These "artificial muscles" have been ignored or decried in some of the orthopaedic and surgical text-books, but they are none the less most efficient and valuable implements, and may with advantage be used in very many cases in preference to the costly, heavy, and complicated apparatus usually recommended. As compared with the use of plaster-of-Paris, the elastic has the advantage of being more readily adjustable and safer, as well as that of giving a varying and active power.

[I am indebted to my present senior house-surgeon, G. Jefferson, M.B., and to my former house-surgeon, Hamilton Irving, F.R.C.S., for the sketches for this lecture and for some of the corresponding ones in the chapter on this subject in *Diseases of Children* (Ashby and Wright).]

THE next Congress of Diseases of Occupation will take place at Vienna in 1914. The following are the questions proposed for discussion: (1) Fatigue, its physiology and pathology; influence of professional occupation on the nervous system; night work. (2) Work in hot air and in moist air. (3) Anthrax. (4) Pneumoconioses (diseases caused by the inhalation of dust). (5) Accidents caused by electricity. (6) Industrial poisoning, by aniline, mercury, lead, etc. The general secretary of the Congress is Privatdocent Dr. Teleky, IX Türkenstrasse, 23, Vienna.

An Address

ON

HIGH BLOOD PRESSURE IN ARTERIO-SCLEROSIS.

DELIVERED AT THE ACADEMY OF MEDICINE, TORONTO.

BY

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THE occurrence of high blood pressure in arterio-sclerosis has been a much-discussed subject in recent years, since the clinical estimation of this pressure was made possible by von Basch in 1876.

At first high blood pressure was described as a constant symptom in arterial thickening, and even as a measure of the degree of this thickening,[1] so that, although it was admitted that a high pressure might exist without arterio-sclerosis, it was greatly doubted if any considerable degree of arterial disease could be present if the pressure were not raised.

But soon observers began to record cases of even well-marked arterial sclerosis in which the pressure was not raised, and even read below the normal, throughout the illness. Thus Groedel of Nauheim recorded a series of 500 cases of arterio-sclerosis, in 35 per cent. of which there was no rise in pressure, and in 18 per cent. only a slight one.[1] Several years ago Drs. Arthur Ellis and Bruce Robertson investigated the matter with me in St. Michael's and the General Hospitals, and found that in only about 50 per cent. of well-marked cases of arterial thickening was the blood pressure above normal, and since then I have seen several fatal cases of the disease in which the pressure was not raised.

The next view that became prevalent was that arterio-sclerosis only produced a high blood pressure when the splanchnic system of arteries was involved. A high blood pressure means a hypertrophied left heart, and Hasenfeld and Hirsch showed by very accurate weighments[2] that an enlargement of the left ventricle only occurred in arterial sclerosis when the disease involved the splanchnic vessels or the aorta above the diaphragm. But rise in blood pressure may occur from many other causes than arterial thickening, and because an individual happens to be arterio-sclerotic he is not exempt from such other causes. Probably one may say without much fear of contradiction that when in a case of arterial thickening a raised blood pressure is detected, such a rise may be due to one or more of the following causes:

1. Toxaemia; such toxaemia being at the same time the direct cause of the arterial disease by directly poisoning the vessel walls. A good example of such a poison is nicotine, which directly raises the blood pressure, and according to many authorities also acts directly upon the vessel wall as a poison. Probably there are very many such toxins manufactured in the alimentary tract or in the tissues of the body.

2. Some toxin which has nothing to do with the associated arterio-sclerosis, but is directly raising the pressure. One might theorize that in an arterio-sclerotic patient the adrenal tissues might be from time to time overactive, and might thus produce periodic rises in pressure, as might occur in individuals not arterio-sclerotic.

3. Compensatory. It is well known that if some vital tissues, such as those in the medulla, be rendered anaemic—say, by the pressure of a new growth—the blood pressure rises enormously, seemingly with the object of forcing blood at all hazards into the part. If such a part of the brain be supplied by a vessel the lumen of which is much narrowed by disease, it is likely that the blood pressure will rise from the same cause.

4. Simple nervousness. It is very common to find the pressure high from nervousness, and if an arterio-sclerotic happens to be also a neurasthenic, his pressure may be high from this cause alone.

5. Lastly, the raised pressure may be due to the arterial disease alone, and in this case probably the splanchnic vessels, or the aorta leading to them, are extensively diseased.