

**A clinical lecture on the mechanical treatment of Pott's disease / by  
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**Publication/Creation**

Chicago : Review Printing Co., 1885.

**Persistent URL**

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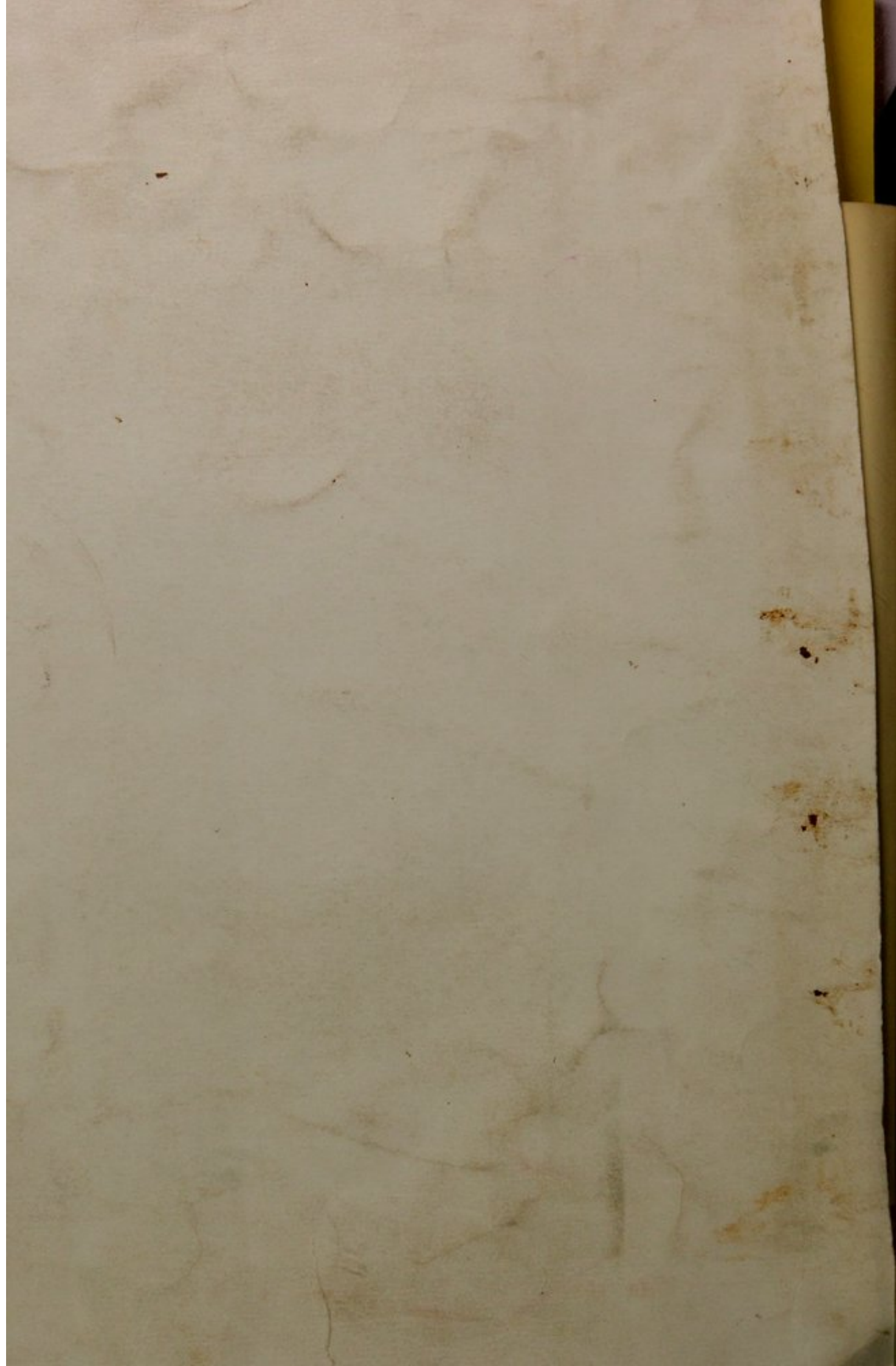
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A CLINICAL LECTURE  
ON THE  
MECHANICAL TREATMENT  
OF  
POTT'S DISEASE.

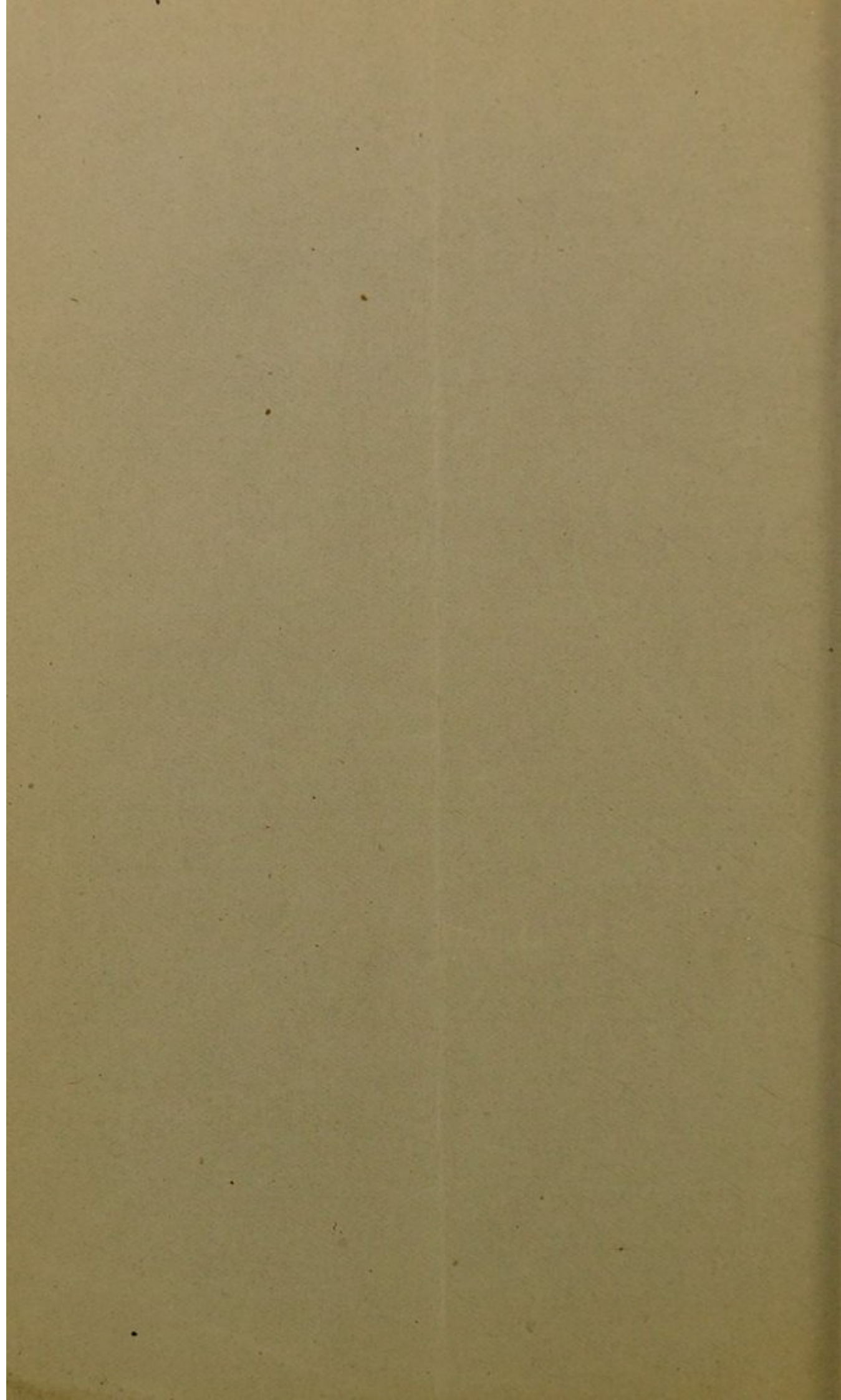
BY CHARLES F. STILLMAN, M.S., M.D.,  
OF NEW YORK,

Clinical Professor of Orthopædic Surgery in the Woman's Medical College of New York; Orthopædic Surgeon to the New York Infant Asylum.

Reprinted from the Journal of the American Medical Association,  
January 31, 1885.



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## A CLINICAL LECTURE ON THE MECHANICAL TREATMENT OF POTT'S DISEASE.

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The first case we will consider to-day is this boy of nine years, who has had spondylitis for two years, and whose mother died of phthisis soon after his birth. There is no history of traumatism so far as it can be elicited, and his step-mother states that her attention was first drawn to his condition by his complaints of pain. He described this pain as passing from his back around the right hip to the front of the abdomen, and that the pain was not constant, but was felt more in the afternoon, after exercise. She also noticed that he afterwards began to carry himself stiffly, and carefully avoided bending the spine, resting often in a stooping posture, with his hands upon his knees, thus transferring the weight of the head and upper extremities to the legs directly. She also noticed, about this time, a protrusion, or "knuckle," as she termed it, in the median line posteriorly, and this became more noticeable if he bent forward. He was then seen by the family physician, who diagnosed disease of the lower dorsal vertebræ, and recommended a plaster jacket, which was applied during partial suspension. This, for a few weeks, caused an amelioration of the symptoms, but as they began to increase it was removed at the expiration of six weeks and another applied. The deformity was, however, not improved, as the kyphos was slightly larger than when the patient was encased in the plaster; and suspension, while it straightened the spine and caused the compensatory curves to disappear, did not seem to appreciably affect the knuckle itself.

At intervals the jackets were removed and renewed, as the indications for change arose, but they did not



effect a cure of the disease. The effect of the jacket was, however, valuable in the sense that it was restrictive; that it afforded a degree of fixation which prevented the vertebral ostitis from proceeding so

rapidly as to form abscess, and as it is thoroughly protective it should be used when better agents are not at hand.

But in the case of this child the parents became dissatisfied with the effects of the jacket four months ago and requested a change in the method of treatment. Upon placing him on a padded table in the position shown in Fig. 1, and allowing the head and shoulders to hang over the edge, the parts meanwhile being carefully supported while descending, the knuckle itself is seen to decrease perceptibly in size and prominence, and the compensatory curves are reduced.

This effect is due to

gravitation; the head and upper extremities, hanging in space on a lower plane than the kyphos, act as a downward traction force upon it, while the padded

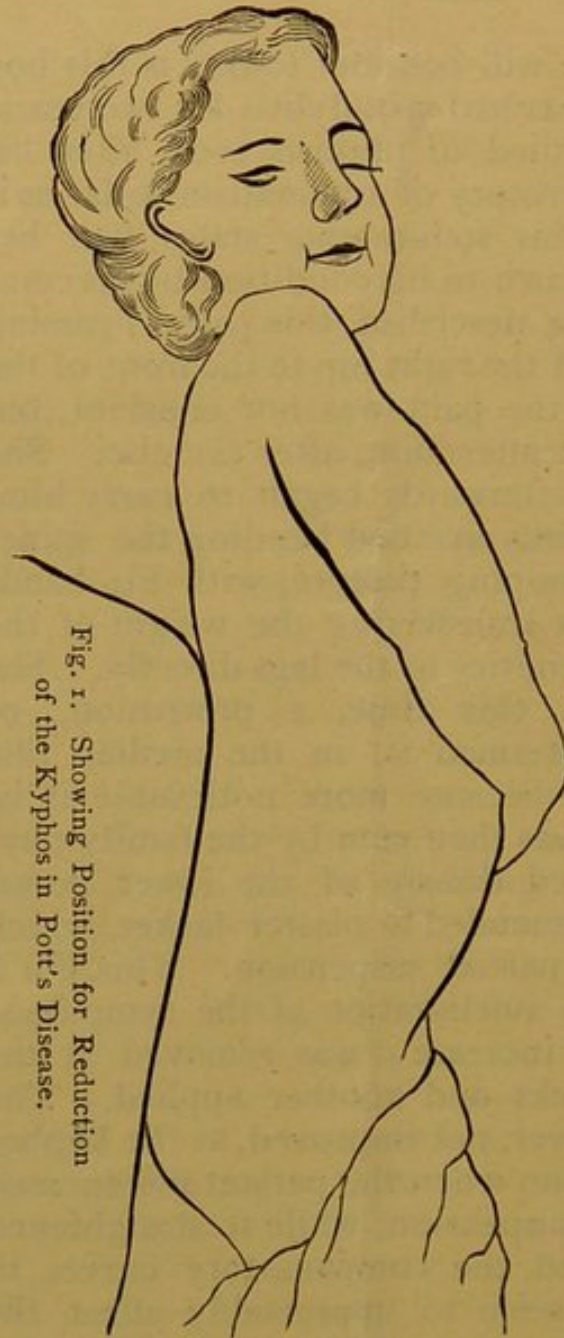


Fig. 1. Showing Position for Reduction of the Kypnos in Pott's Disease.



edge of the table, by opposing resistance to the descent of the rest of the body, exerts a force, in a directly opposite direction, upon the kyphos itself. The first causes an extension of the diseased portion, relieving local pressure and tending to stretch it into the normal curve of the spine, while the second intensifies the direct effect upon the kyphos in diminishing the deformity.

Authorities have so stoutly maintained that a knuckle, when once formed, should be allowed to proceed to complete consolidation, without attempting to mould the parts into better symmetry before the consolidation is effected, that it required considerable courage to first try the effects of this position, which would tend, to a certain extent, to disorganize the consolidation if not yet completed; and I was, therefore, very much pleased in my first case to note that the patient was not only not rendered uncomfortable by the proceeding, that no bad effects were observable, but that a mitigation of the pain at once took place, very much the same as is often observed, and has been referred to by others as resulting from placing a child with Pott's disease on the knees, with the kyphos between them and drawing the knees gradually apart. In the patient before you the same result is obtained, both in regard to pain and disappearance of the compensatory curves; the kyphos, in addition, being also caused to decrease in size.

The attitude assumed by the authorities who urge that consolidation should take place without attempting to previously reduce the deformity, is very similar to that which was formerly maintained in regard to the hip—that ankylosis in the flexed and adducted position was the proper and best result attainable, and should be encouraged. At the present time, however, as we have aimed to show in the consideration of the hip cases treated in our clinic, we are not satisfied with ankylosis and deformity, but try to effect motion and absence of deformity, and grad-



ually restore the joint to a useful condition. To a certain degree this applies to the spine.

The pathological progress of ostitis in the head of the femur and in the bodies of the vertebræ is very similar, and if in hip disease we can prevent the deformity from becoming permanent until the ostitis is arrested and the function of the joint restored, we might with reason claim that if the vertebræ can be prevented from being crushed together by the superincumbent weight while they are in the soft and disintegrated condition incident to the ostitis, until the disease is overcome and the process of repair completed, a cure could be effected without deformity. Proceeding still further, it is also reasonable to suppose that while the carious process is still active and consolidation not effected, although a kyphos may be present when the erect position is assumed, owing to the pressure of the superincumbent weight, if this kyphos can be *immediately* reduced, and the reduction maintained by a splint until the active stage of the ostitis has ceased and the process of repair is complete; or if the kyphos can be *gradually* reduced, day by day, by the use of an active force embodied in the splint, which is so constructed as to gradually overcome the deformity, and also to maintain such reduction independently of any position which the body can assume, and at the same time fix the entire spine in a position which tends to keep the bodies of the vertebræ from being pressed together by the superincumbent weight, it would follow as a natural result that a cure without deformity would ensue. Of course, force sufficient to break up consolidation which is actually complete, should never be employed. There is no need for me to point out the dangers or disastrous consequences of such a proceeding, but we are merely referring to the use of the gentle and efficient traction which can be exerted by the weight of the part above the seat of deformity, when exerted as already described.



In the case before you this plan of treatment was strictly followed, but to understand fully the principles upon which the treatment of this case was based, it will be necessary to discuss the subject more in detail.

In our last lecture we considered the various methods of treatment for this disease which were in vogue, and demonstrated the principles upon which they were founded. You will remember that when we considered the mechanical department of the treatment, we divided it into three classes :

1. Simple fixation,
2. Symmetrical traction, and
3. Backward traction,

because all the braces and splints for Pott's disease were based in their action upon one of these three principles.

Bearing in mind, as has been ably pointed out by Heather Bigg, that the spine is a column composed of many segments, which are in apposition when the superincumbent weight is borne upon it, but that this column becomes a chain when force is exerted, or a posture assumed which tends to draw these segments apart, it will be seen that the attempt to produce fixation of such a flexible undulating column is attended with serious mechanical obstacles. You will remember, in describing the different forms of apparatus to produce simple fixation (and among these were the braces of Andrews, Washburne, Knight and others ; the plaster zone of Shaffer, the wire cuirass of Bauer, and the firm jackets of Vance, Steele and others), they were described as attempting to enforce rest for the diseased portion, either by means of long metallic strips placed upon either side of the spine posteriorly and held there by girths and straps, or by enclosing the trunk in splints of leather, plaster-of-paris, felt, or other firm material, which are removable, and are usually laced tightly anteriorly ; or a combination of the metallic frame and plaster-of-paris, as in the



Shaffer brace. But in all the forms of apparatus which embody the principle of fixation, the material strength of the splint is opposed to the flexibility of the spinal column, and if the material were sufficiently strong it would tend to hold the spine firmly, and thus tend to limit the active stage of the ostitis and inaugurate the stage of repair.

The fixation appliances, however, do not attempt to remedy the deformity or produce extension of the diseased part, and their range of usefulness is, therefore, more limited than those of the other classes.

Now, *extension* of the spine may be of two forms: 1st, complete or symmetrical; or, 2d, partial; and both are utilized in the mechanical treatment.

*Symmetrical* extension of the spine is the form in which the bodies and articular surfaces are stretched by the traction force to the same extent, and differs from the *partial* extension produced by backward traction, in which only the bodies of the vertebræ are stretched, the pressure being transferred to the articular *facets*.

Symmetrical extension is produced by traction exerted either *horizontally* or *vertically*.

Upon the principle of *horizontal* traction are founded the various horizontal couches or frames in which the patient lies supinely, and, while the shoulders and head are embraced by one segment of the divided frame, and the pelvis and lower extremities by the other, traction force is exerted horizontally to separate the two attachments.

Upon the principle of *vertical* traction are founded linear traction braces, a notable example being that of Prof. Edmund Andrews, of Chicago, in which the extension is produced by a screw-ratchet; but very much more often a vertical suspension apparatus is employed.

This is best known in connection with the plaster-of-paris jacket advocated so warmly by Prof. Sayre,



and which was exhibited to you in detail at our last clinic, when a jacket was applied.

This suspension apparatus lifts a patient's superincumbent weight from the diseased portion, and utilizes as a vertical traction agent all that portion of the body below the seat of disease. While thus suspended a plaster-of-paris bandage is rapidly and smoothly wound around the trunk and allowed to "set" firmly before the erect position is again assumed, with the object of holding the extension gained by the suspension. But this has been demonstrated by Heather Bigg, Shaffer, and others, to be impossible, and the opinion is expressed by them that the spine, being grasped by the plaster only throughout part of its extent, is not held so as to prevent its segments from pressing upon one another when the vertebral column resumes its normal function of carrying the weight of the head and upper extremities. The extension produced by the suspension is lost when the suspension ceases, unless a jury-mast is added to the jacket, in which case the extension produced by the suspension can be maintained by the apparatus. If, however, the jury-mast is not used, the plaster jacket becomes a fixation splint, but is more effective than the other splints of the fixation class, because it holds the spine in the improved curves produced by the suspension. There is, however, no possibility of adjustment or inspection of the parts, unless the jacket is removed and reapplied, and as there is no active force pressing forward upon the kyphos, there is no corresponding decrease in the actual deformity except such as may be gained at the time of each suspension, and, of course, a certain amount of this is lost, if not all, when the spinal chain again becomes a column by the cessation of the suspension and the resumption of the superincumbent weight, which tends to press the diseased portions together.

Symmetrical traction can also be exerted locally in the lower dorsal and lumbar regions, by dividing the



jacket and connecting the segments by ratchets ; but the use of such apparatus is unsatisfactory—for while vertical tension is exerted upon the soft parts between the segments, sufficient power cannot be employed to cause a state of extension between the vertebræ, without exciting too much pressure upon the skin and other soft structures—while at the same time no forward pressure is brought to bear upon the kyphos. The action of vertical traction upon a kyphos is well illustrated by a long strip of lead or other flexible material in which a knuckle is formed in the semblance of the deformity of Pott's disease. If linear traction is made to overcome this knuckle it will be seen that no power which can be exerted will take it out entirely ; that although the strip becomes straight on either side of the angle, the angle itself does not disappear, and it will therefore be readily understood that while the curves of the spine are similarly improved by linear traction, and can be held in this improved position by the plaster jacket, or a divided jacket provided with linear ratchets, it is impossible for the deformity itself to be completely overcome, or even appreciably improved by them, or any form of apparatus founded upon the principle of symmetrical traction.

It, therefore, is apparent that although very little permanent improvement can be effected upon the deformity itself, unless it is very recent, yet the fixation in an improved position which they certainly secure, often arrests further progress of the disease and prevents increase of the deformity.

These divided jackets first came into use in 1878, the idea originating with myself, and being published by me at that time, and my apparatus was afterwards improved by Dr. Wyeth, of this city. Still later Dr. Roberts, also of this city, substituted elastic traction ratchets for the fixed traction ratchets of Dr. Wyeth and myself, with the idea of producing a constant linear elastic force, which should admit of



motion, but not otherwise altering the principles involved.

Of more value, however, than symmetrical traction, in Pott's disease, is the *third* principle of mechanical treatment, which you will remember is the partial extension caused by *backward traction*.

This produces extension of the bodies of the vertebræ relieving them from pressure by curving the spine backward, so that the articular processes are caused to assume the superincumbent weight. The origin of this principle is generally ascribed to Dr. H. G. Davis, although the first effective instrument for utilizing the principle was devised by Dr. C. F. Taylor; and this was exhibited to you at the last lecture.

A later instrument for the same purpose was invented and used by Mr. Chance, of London, and has lately been advocated by E. Noble Smith, although the difference between the original brace of Dr. Davis and that of Mr. Chance is so slight as to be hardly appreciable, but the latter is extended upward so as to embrace a greater extent of the spine, which is a point of advantage. Dr. Taylor's brace differs from the others in being provided with a double screw hinge, placed just above and below the kyphos, so that the angle of the upper with the lower portion could be changed by the screws without removal of the brace from the back, while in the others this alteration must be effected by a wrench or the hand before the brace is applied; but the action of each of them on the spine is the same.

In all of these braces for backward traction, and in those for fixation and symmetrical traction beside, the *bending point* of the spine, or the point where the spine most readily gives way if the patient leans forward, is at the *seat of disease*, so that it requires great strength on the part of the apparatus to prevent this.

You have thus seen and had demonstrated to you some of the typical forms of apparatus which are



largely used by the profession for the treatment of spondylitis, and have seen several of them in successful operation, and we now proceed to the discussion and description of another and more recent form of spinal brace which embodies some valuable attributes not possessed by any of those enumerated.

It has already been stated to you that if the patient bent forward while wearing any of the braces or appliances described, the spine was more apt to give way at the seat of disease than at any other portion of its extent, owing to the yielding character of the diseased osseous structure, and that this tendency was only combated by the strength of the material employed in the splints. Now, this bending forward is one of the most important factors for increase of deformity and the retardation of cure, and to meet it successfully I have been obliged to use a lever or spring, which would bring a constant *forward* elastic power to bear directly and automatically upon the kyphos, and after considerable experience I am prepared to advocate a form of spring lever which meets this bending tendency successfully.

If the disease is in the dorsal region, a brace is constructed so as to embody a lever with a short and a long arm; the short arm extending from the site of the disease to the sacrum, and the long arm from the neck to the sacrum, the two being there connected by an adjustable clamp, and together forming a V shaped lever, which automatically acts to press forward the deformity and yet hold the spine firmly in the erect position.

The force is so graduated that if leaning forward is attempted, the shorter arms press firmly over the transverse processes adjacent to the kyphos, and exert a forward pressure which prevents the spine yielding at the seat of disease. In no other brace known is this accomplished, and it thereby secures a greater degree of fixation than either of the braces or splints described. If the lumbar region be involved, the



short arm of the lever passes from the diseased part to the second dorsal vertebra, and the long arm from the sacrum to the same point; and they are there secured together by an adjustable clamp and connected to the front of the chest by straps and a T plate, the latter utilizing the infra-clavicular spaces and sternum as pressure points, thus preventing interference with or constriction of the soft parts. The braces formed upon this lever plan afford fixation in the erect position and exert forward pressure at the seat of disease, and no posture of the patient can influence or derange the action of the instrument, since it is compensatory.

The other systems of treatment described in the course of our lecture have, with a few exceptions, been before the profession for a sufficiently long period to have their merits generally understood, and have been employed with a varying degree of success; but, on the whole, the mechanical treatment of Pott's disease is considered to be in an unsatisfactory condition. There are two requisites which must enter into the consideration of this mechanical problem, if its treatment is to be attended with success, and these are 1st, arrest of the disease; and 2d, obliteration of the deformity.

Nature herself points out the direction in which force should be applied to relieve the diseased bodies and produce curative results.

Who among us has not noticed the position assumed by a patient with the disease in the stage of invasion? The body is held rigidly, the head and shoulders being thrown back as far as possible, and in stooping to pick up an object from the floor, this position is still maintained, the patient having every muscle exercised to hold the spine perfectly fixed and bent backward, the position being very much that of an equestrian "head and chest up, the shoulders held back, and the small of the loins well knit in." Were it possible for the patient to retain this position indefi-



nately, progress of the disease to the stage of deformity would be almost impossible; but it is a natural tendency in unguarded moments and for the purpose of resting the spine, to bend forward, and bending forward from any cause, removes the weight from the articular processes, and proportionately transfers it to the bodies of the vertebræ and their intervening cartilages. The muscles are unable to continue supporting the spine in its hyper erect position at all times, and consequently the patient bending forward occasionally, causes increased pressure upon the diseased cancellous bodies, hastening absorption of their structure and the formation of deformity.

Nature's indication for the treatment of Pott's disease is to put a splint on the back of the patient which will maintain this erect position, for since the tendency of the disease is to curve the affected portion of the spine forward, the center of this curve being anteriorly, our corrective force should be applied to produce exactly an opposite curve to the diseased one, the centre of such a corrective curve being posterior to the column. In other words, we must follow nature's lead and hold the spine erectly and slightly curved backward, the tendency of the disease being to curve it forward; and to thoroughly understand the principle upon which the new brace for this purpose is constructed, this patient having a well-defined knuckle is again laid on his back upon a table, the padded edges of which come to the apex of the deformity, the shoulders and head being allowed to fall downward. (See Fig. 1.)

You will observe as the patient's head and shoulders descend, that a partial, but physiological and true extension of the spine is effected, the traction force being all that portion of the patient above the seat of disease. This augmented by gravity, produces a backward curve of the spine, most marked at the seat of disease. There is also a tendency to obliterate the knuckle and this is only prevented from tak-



ing place entirely by such consolidation as has become perfected.

We have thus produced by this position the two effects we consider to be necessary to successful treatment and have placed the spine in curves the reverse of those it held before this posture was assumed.

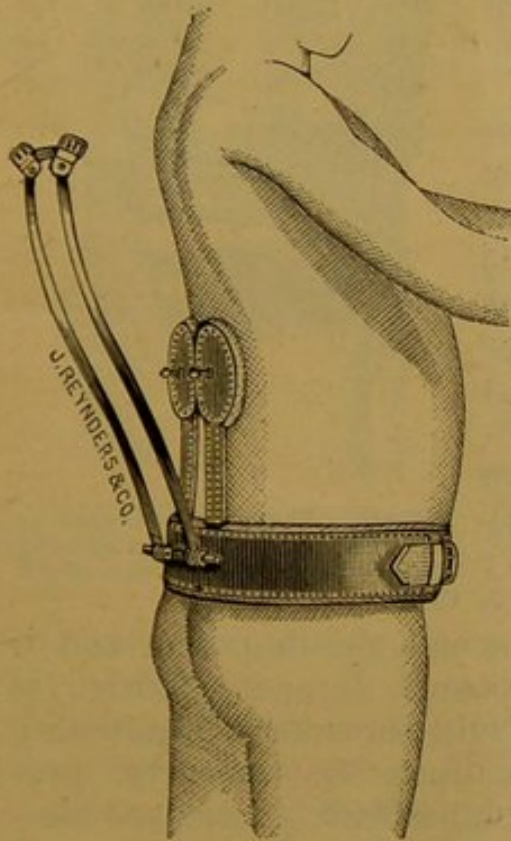


Fig. 2. Showing Lever Brace for lower dorsal region before the long arm is strapped to the body, the backward angle of the long arm being regulated by a clamp inferiorly.

of the median line to the seat of disease (see Fig. 2) and these form the short arm of the lever.

If this position could be maintained indefinitely there would be rapid improvement in the disease ; but as this is obviously impossible we attempt to embody in a brace the forces involved, it being for this purpose constructed in two parts. The "table" portion of the brace (and by this we mean that portion of the brace which is to produce upon the patient an effect identical with the table, as shown in Fig. 1) consists of a firm pelvic band from which strong padded strips pass up on either side



The "backward traction" portion of the brace consists of a back frame secured on the pelvic girth by a ratchet or clamp which allows it to be adjusted at any outward angle, and thus regulates the amount of forward pressure upon the kyphos.

The angle at which this back frame, or long arm of the lever, is thrown out from the body (see Fig. 2) determines whether the brace shall act as a lever or as a simple fixation brace, and the angle between the long and short arms determines the degree of power employed; and when the back frame is set outward at an angle with the short arm and is drawn down to the body and fastened firmly (as shown is Figs. 3 and 4) the short arms terminating in the pads press forward upon the transverse processes of the diseased vertebræ with a constant elastic force.

There are also other features of this brace which deserve mention. It will be observed that if the angle between the short and long arms of the lever is considerable when the long arm is fastened firmly to the body, the bending tendency forward of the upper part of the trunk does not cause the spine to give way at the seat of disease, for in proportion as the patient leans forward the short arms press forward upon the kyphos, and oppose a resistance to the bending at that point, so that by the brace a cura-

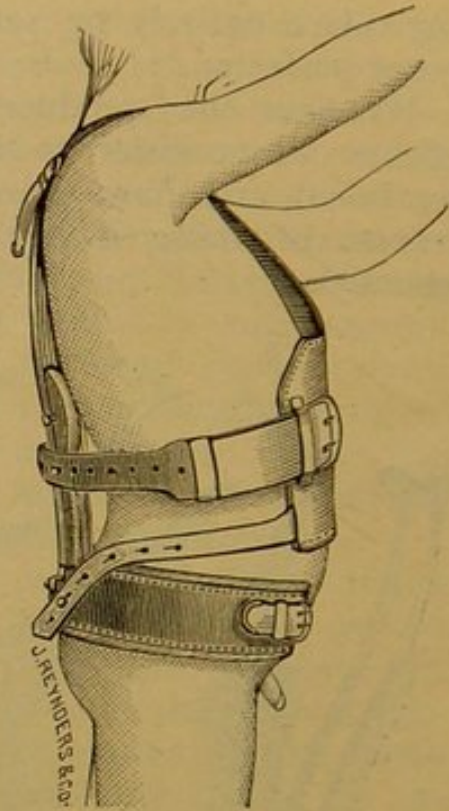


Fig. 3. The same, strapped to the body, the pads there exerting forward pressure at the seat of disease.



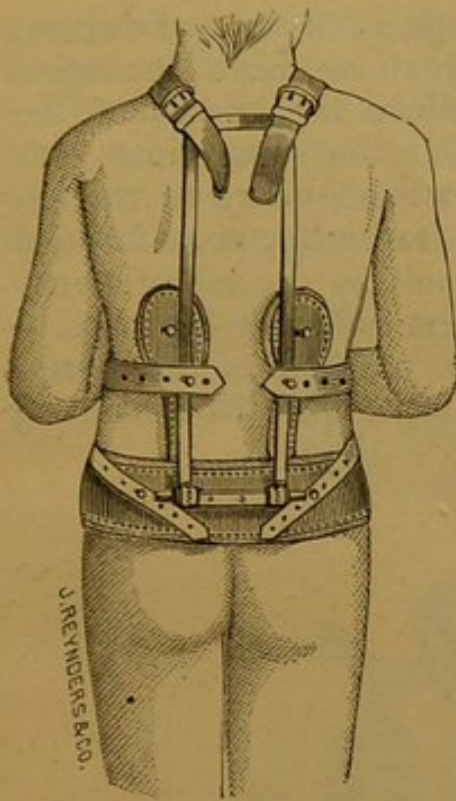


Fig. 4. The same (posterior view). The position of the kyphos, if shown, would be between the two pads.

tive automatic effect is produced to keep the body erect, and at the same time prevent further deformity while tending to improve that which already exists. Also that the *spring* effect, produced by the setting off of the traction frame, and drawing it forward against the body which is thus held erectly when properly strapped, causes the brace to be held more tightly against the back and ensures a higher degree of fixation than any form of apparatus in use.

In the beginning of the treatment it is well to have the traction frame set off at such an angle as to cause

considerable pressure upon the transverse processes of the kyphos, and produce thorough extension of the diseased portion; but this angle may be lessened week by week as the case improves, until finally the traction frame lies directly upon the pads, and the brace becomes a mere fixation brace without any leverage whatever.

To further illustrate the action of this brace, if a bent lead strip is taken and one extremity held firmly by one hand, with the thumb pressed against the knuckle, it will be found that a force comparatively slight (when contrasted with that used in linear traction to produce not so perfect a result) with the other hand will serve to straighten the rod into its original position, knuckle and all. This is precisely what is accomplished by this brace. We grasp firmly the



lower part of the spine as high as the seat of disease, and then, by force applied above, bend the spine backward sufficiently to relieve the bodies of the vertebræ from pressure, and at the same time with the short arm of the lever, corresponding to the action of the thumb upon the lead strip, press forward upon the deformity, and thus, by the use of a very light frame-work, we can exert sufficient leverage to retain the spine in the erect position of the equestrian; and as this *backward* force is distributed along



Fig. 5. Showing Lever Brace for middle dorsal region, with straps removed.

the entire dorsal and lumbar spine, while the *forward* pressure is exerted only along the spine from the seat of disease downward, decreasing from the kyphos to the sacrum, it will be found that no injurious press-

ure is exerted at any one point, as is the case in the Taylor or Chance braces.

For the middle dorsal region the short arms of the lever are longer than in the lower dorsal, so as to be opposite the seat of disease, and the brace may be attached by straps, as shown in Figs. 5 and 6.

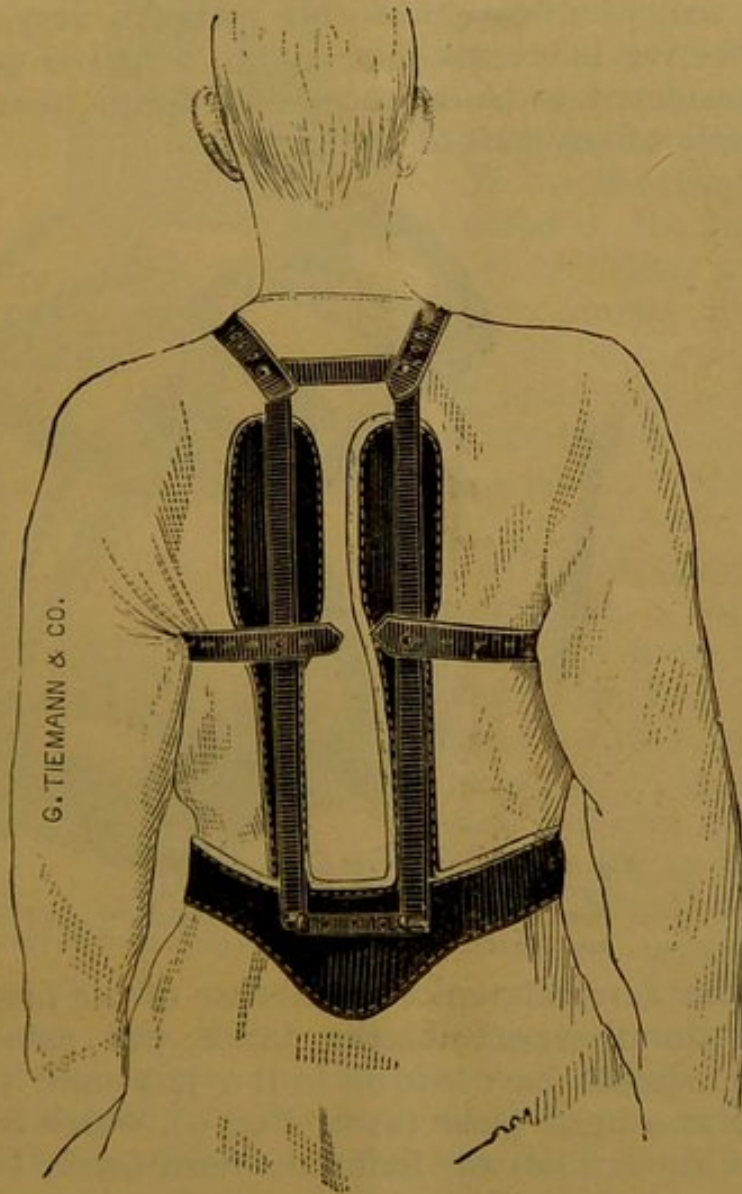


Fig. 6. The same (posterior view), after attachment to the body.



For the upper dorsal region the straps in front are dispensed with, the attachment of the long arm of the lever superiorly being effected by padded strips, curved so as to pass under the axillæ and terminating in infra-clavicular pads, which are still better retained in place by straps over the shoulder (as shown in Fig. 7). As in the other braces, the short arms pass to the seat of disease, and this makes a very light and effective brace for this region, which is generally considered to be the most difficult to treat mechanically of any part of the spine.

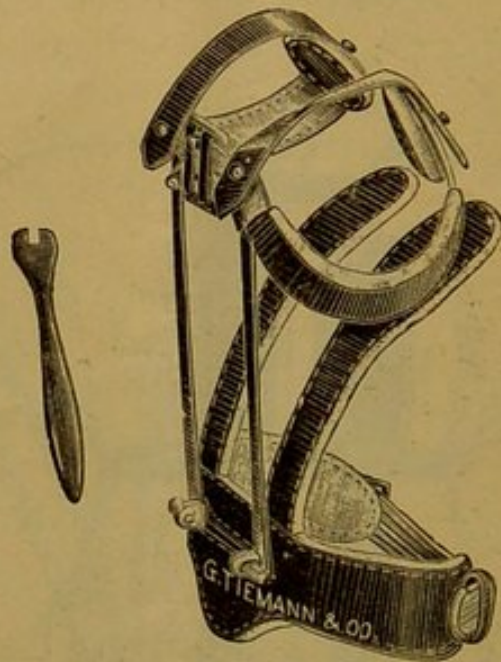


Fig. 7. Showing Lever Brace for upper dorsal region, with infra-clavicular pads instead of thoracic straps, for attachment to the body.

For the cervical region or disease of the first and second dorsal vertebræ, the brace just exhibited (Fig. 7) should have added to it a jury-mast (as in Fig. 8) or a head piece (as in Fig. 9), which is provided with facilities for fixing the head firmly in any position, by the insertion in the neck-strip connecting the head-piece to the rest of the brace of three clamps, which are so placed as to secure this object. The choice between the jury-mast and fixed head-



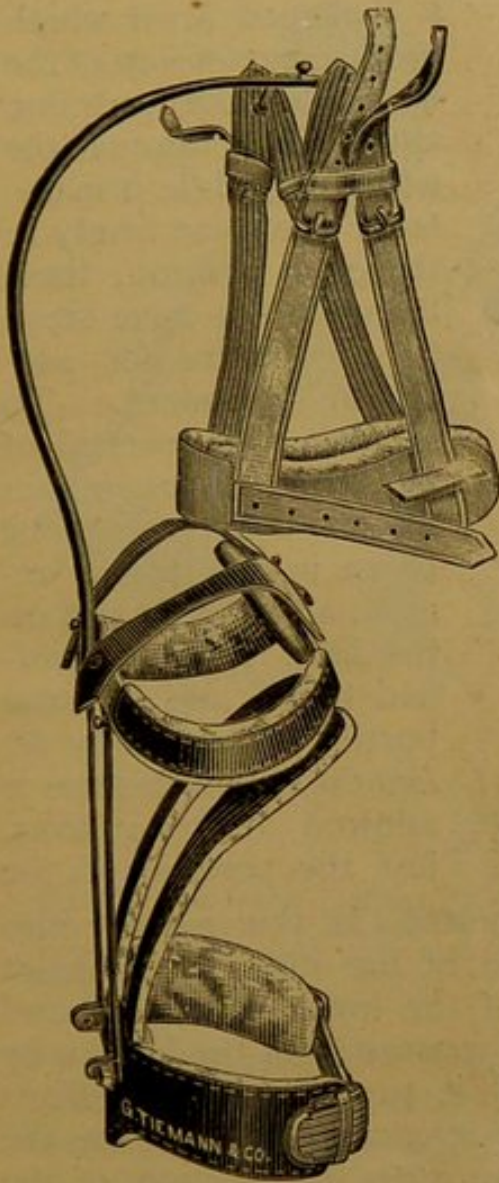


Fig. 8. Same, with jury-mast attachment for cervical disease.

piece in these cervical cases is usually one which the surgeon is called upon to decide for himself, and is to some extent regulated by the gravity of the case; the latter being more effective in caries which is proceeding very rapidly in its course.

When the disease is situated in the lumbar, in some cases in the lower dorsal region, and the short arms of the lever are too short to exert sufficient forward pressure upon the kyphos, the lever is reversed, the point of intersection of the long and short arms being placed in the dorsal region instead of over the sacrum. In such a brace the base plate is placed in the upper and middle dorsal regions and there secured to

the body by appropriate straps. From this the short arm lever strips pass down on either side of the spine to the seat of disease where they terminate in pads, the whole being bound down to the body without constriction by a T plate over the sternum (see Fig. 12) and the long arm of the lever passes to the sacrum, there terminating in the pelvic girth (see Figs. 10 and 11).

When this brace is secured to the body, it forms



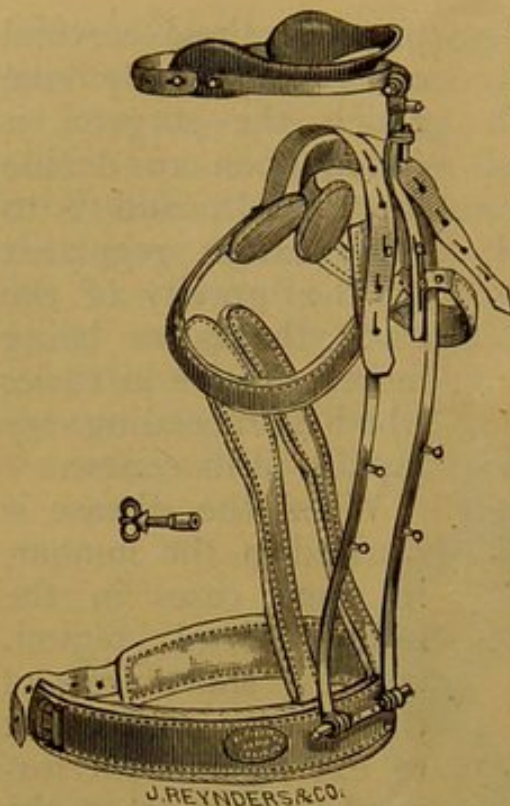


Fig. 9. Same, with head-piece and clamps in neck strip, for fixation in any direction, instead of jury-mast.

a V shaped lever which produces extension of the bodies of the vertebræ and tends to improve the deformity, while it maintains the spine firmly in the erect position, these being, as we have seen, the desiderata for successful treatment. To illustrate this reversal of the lever, so to obtain sufficient leverage to be of use in the lumbar region, a patient is laid on the back upon the padded table, and all that portion of the body *below* the seat of disease is allowed to hang over, just the reversal of the

position already demonstrated. In this manner also we produce the extension of the spine by means of the backward traction of the lower extremity, and also produce the forward pressure upon the kyphos by the edge of the table. It is to sustain these effects when the erect position is assumed that we use the lever brace, and to adapt it to this portion of the spine, we reverse its construction as already detailed.

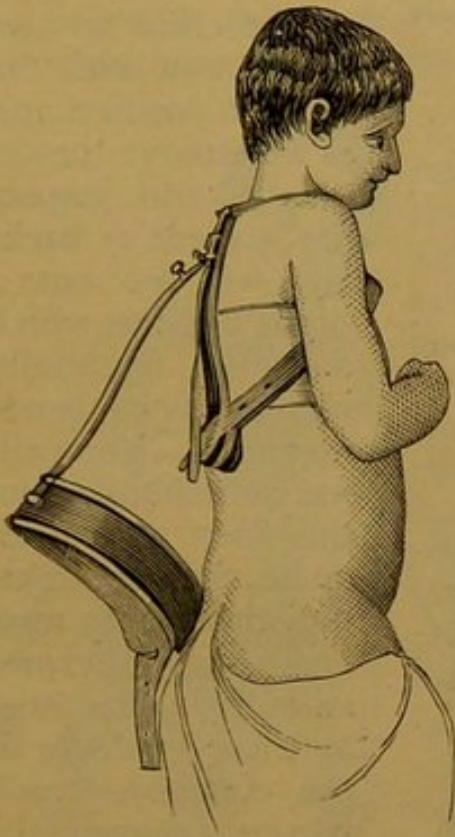


Fig. 10. Lever Brace for lumbar region with long arm, set at an angle with short arm. The pelvic girth not yet fastened.

To resume the consideration of the patient before us: A brace was constructed for him upon this V lever plan, the apex of the V being placed in the middle dorsal region; and there firmly fixed by a chest-plate and straps so arranged as to secure the base plate to the back without impingement of the soft parts. The short arm of the lever passed downward and bifurcated just above the kyphos (see Fig. 11), and passing to either side terminated opposite its inferior boundary.—

In this manner the direct forward pressure of the brace upon the diseased portion, was borne by the transverse processes without pressure upon the kyphos itself.

The long arm passed downward in the median line and terminated in the pelvic band, the clamp at the intersection of the two arms serving to regulate the amount of forward pressure at the seat of disease.



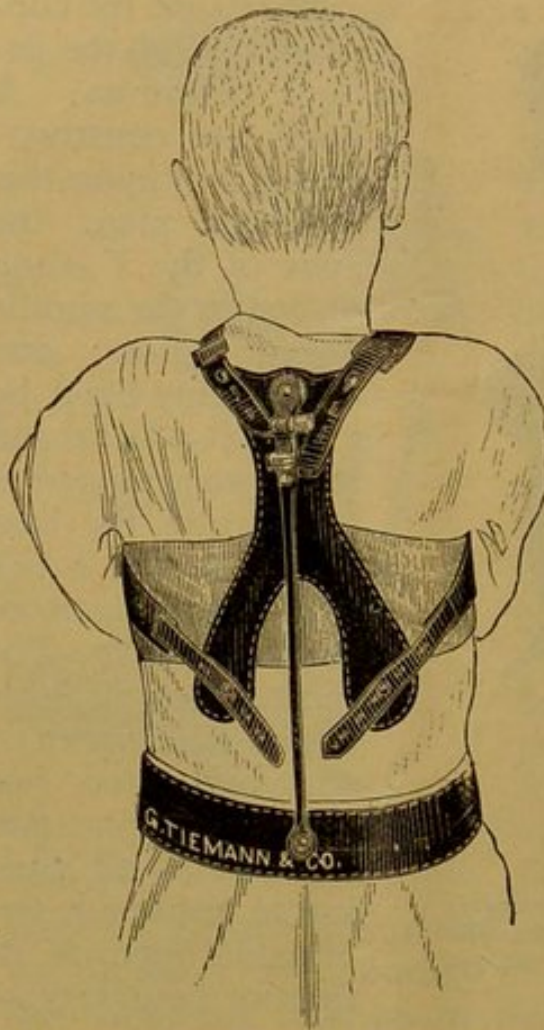


Fig. 11. Posterior view of same after pelvic girth is fastened. A rotary clamp is shown just below the antero-posterior clamp. This is used if any lateral rotation of the vertebræ coexists.

The child is now before you with the brace in position, and as we remove the apparatus and inspect the patient's back, you will see but a slight kyphos, which does not materially increase as he bends forward. You will see, as he jumps from the floor at our request, that on alighting, there is no anxious or painful expression upon the face, as there would be if the concussion took place between the vertebræ in an active stage of the disease, and pressure can elicit no points of tenderness.

He looks rugged and vigorous, and his stepmother desires to know if he can go without the brace, as he seems to be cured, or, as she expresses it, "just like any other boy," but this we cannot yet advise.

We will, however, diminish the forward pressure at the kyphos by decreasing the V angle between the short and long lever, so that the brace will become only a fixation splint of the first class. For all practical purposes the disease and its consequent deformity are arrested, and it remains now only to be careful, to restrain the spine for a few months to ensure the improvement becoming permanent; care be-



ing taken at the same time, of course, to continue the constitutional measures.

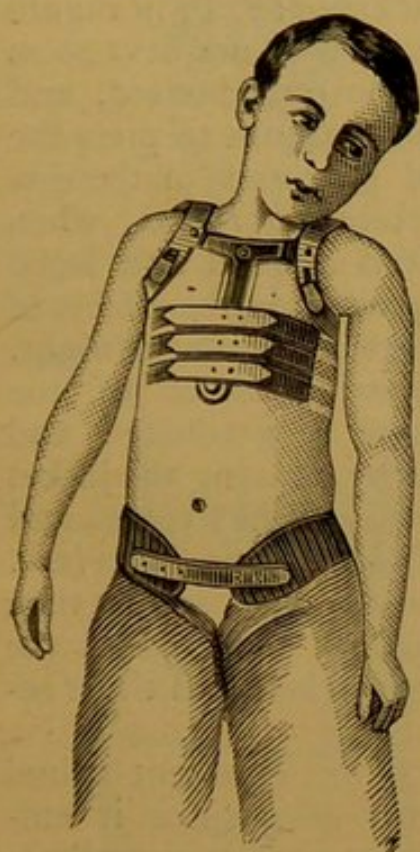


Fig. 12. The same anterior view, showing T plate and method of strapping.

There is one more point in respect to the mechanical treatment of these cases which is of prime importance, and that is, the right management.

Changes of position during sleep are very apt to cause spinal curves to be assumed which produce compression of the diseased vertebræ, and interfere with the process of repair, and therefore the use of some sort of spinal splint for the night is strongly advised, where the dorsal and lumbar braces already described cannot be tolerated in sleep; and sometimes they can not, although many become so habituated to them as not to have their sleep interfered with, espe-

cially if the sleeper lies upon the breast or side. A very effective splint may be prepared for night wear by applying a plaster-of-paris jacket during partial suspension.

Plaster-of-paris is mentioned first because it is so cheap and procurable, but felt or any other firm, rapidly hardening material will do as well, and this jacket is then to be divided anteriorly and provided with lacings in the ordinary manner. So far it does not differ from any other, but the additions which we are about to make to it, to some extent alter its character. A pair of thin pads should be placed on either side of the kyphos, posteriorly, and should be



attached to the jacket at its edge by strips of metal, which are of a length, equal to the distance from the kyphos to edge of the jacket. (P. P. in Figure

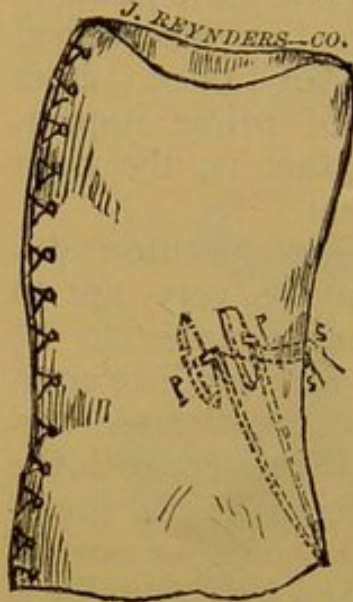


Fig. 13. Showing plaster jacket with pads for forward pressure.

13.) These strips are bent so as to throw the pads inward, and thus become springs to press the transverse processes of the diseased vertebræ forward, when the jacket is applied and laced up, thus producing the effects of the lever brace during the night. The forward pressure of the springs may be graduated and controlled by piercing the jacket on either side of the kyphos, and through these passing cords (s. s. Fig. 13) to the pads, so that they may be pulled back against the rear of the jacket, and there secured.

This jacket, so modified, is an excellent spinal splint to be used during the day also, since it embodies the principles of the braces just described, and can be recommended for such cases as do not care to use a brace, and also for young children. In applying it, draw back the pads and secure them against the back of the jacket by the cords and then when the jacket is laced in front, after being placed on the body, the cords are to be loosened, and the pads will then press forward on either side of the kyphos, with a constant elastic force which depends for its intensity upon the strength and angle of the springs by which they are attached to the jacket.

(Fig. 13 shows such a *lever jacket* with the pads projecting inward and their spring strips attached to the jacket inferiorly, while Fig. 14 illustrates the same



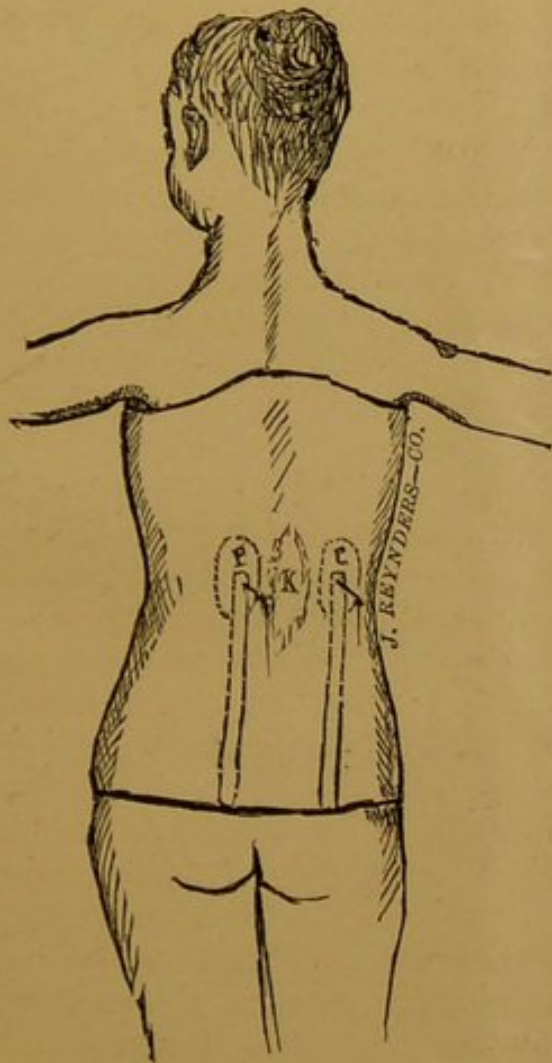


Fig. 14. The same applied.

jacket in position.) It is not, however, necessary for the lever or spring effect, that the strip connecting the pads with the jacket should be attached to it inferiorly in all cases, for they may be also attached (although not so advantageously) superiorly, transversely or obliquely; or indeed, in any position so long as the pads are on either side of the kyphos and are forced to exert a forward pressure upon the diseased vertebræ. It is perfectly practical also to attach the pads to the back of the jacket opposite the transverse processes of the kyphos,

by means of coiled spiral springs; but whatever form of lever or spring is used for its production it is impossible to bring the plaster jacket to its highest degree of effectiveness without the employment of forward pressure at the seat of disease. The jacket maintains the body in the erect position, while the pads tend to prevent increase of the deformity and to diminish whatever already exists, until the process of repair and consolidation is complete.



