Taylor (C. F.)

THE

MECHANICAL TREATMENT

OF

ANGULAR CURVATURE,

OR,

POTT'S DISEASE OF THE SPINE.

READ BEFORE THE NEW YORK STATE MEDICAL SOCIETY, AT ITS FIFTY-SIXTH ANNUAL MEETING, AT ALBANY, FEB. 3D, 4TH, AND 5TH, 1863, AND PRINTED IN THE SOCIETY'S TRANSACTIONS.

BY

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THE TREATMENT

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ANGULAR CURVATURE OF THE SPINE.

The disease known as "Pott's Disease of the Spine" is of so frequent occurrence, that it is remarkable that there has been so little advance made toward its successful treatment, since the time when Dr. Percival Pott first drew the attention of the profession to its pathology; and though a disease so common that we see the deformity which it produces almost every time we enter an assembly or go into the streets, yet I have observed that these cases are too apt to be avoided by the general practitioner; the physician contenting himself by sending the patient to an instrument maker, for one of the many apparatuses to be found in the shops, and too often leaving the whole matter of kind, form, and fit to the selection of the mechanic.

Now this transferring of responsibility from one's

own shoulders to the blacksmith might be well enough, if this person were a pathologist and anatomist as well as a mechanic, but as unfortunately that is never the case, the only alternative would seem to be for the doctor to control the mechanical part of the treatment himself. The mechanic may assist the surgeon as the nurse does the physician, but the one should never take the other's proper place. This would seem to be the more necessary since no two cases are mechanically alike, and no instrument, no matter how well adapted to one case, will necessarily be proper for another. Simply to apply an instrument, even a good one, is not enough; it should have a definite object, and be mechanically, anatomically, and physiologically adapted to each particular case; if it fail in any of these it will be ineffectual. There are many excellent medicines, but they must be given according to specific indications or they are worse than useless. Intrinsic excellence is of no avail without proper adaptation.

These observations must be allowed; for extensive acquaintance among this class of cases has forced the conviction upon me, that the subjects of Pott's disease really and almost invariably be-

long to what may be called neglected cases! And if I can show, before the conclusion of this paper, both from the treatment proposed, which is based wholly upon the pathological indications, and by the actual result of such treatment, that the usually long duration of this disease may be very much lessened, the constitutional disturbance diminished, and the unsightly deformity now the almost universal result wholly prevented; in short, if I shall be able to satisfy you that, with proper treatment, the majority of these cases—now so generally looked upon as incurable—may be absolutely cured, I trust you will not consider the time spent in considering these neglected cases as being wholly unprofitable.

Without entering at too great length into the minute pathology of this disease, and without the slightest attempt to make a display in this fruitful field of morbid anatomy, I wish simply to call your attention to the fact that, like morbus Coxarius, it is a disease affecting strumous constitutions, most frequently developed spontaneously, but often arising from traumatic cases, and affecting first the *cartilage* of the joint, and the bone itself at a much later period. This is the case in the very large majority of cases. It is

true, we have cases of caries of the vertebræ where the osseous structure seems to be primarily affected, as we have caries of the lower jaw and other bones; but I believe such cases to be very rare Indeed, in my experience, cases of original caries of the vertebræ do not amount to one in fifty; and where this does happen, I believe such cases generally prove fatal; so that this fact may have brought a disproportionally large number of specimens of original caries of the vertebræ to the hospital, and thence to the demonstrator's table. But it still remains true, that of the affection which produces the distortion of the spine known as the "angular curvature," the disease is originally in the intervertebral cartilage and on the surfaces of and between the vertebræ; and my conclusions, based on nearly one hundred cases, are, that the vertebræ themselves are not generally at first affected, but that the disease is communicated to them, after many months, where the inter-vertebral substance has become absorbed and the osseous tissue of two or more vertebræ is made to bear pressure and concussion without the intervention of the elastic cartilage. That the vertebræ themselves do finally become diseased is certain, but even when they are almost entirely absorbed,

every rational sign indicates that this waste takes place principally from the surfaces of the affected bones; they having been brought into contact by the previous displacement-by-absorption of the inter-vertebral cartilage. If this be the case, it is of the utmost consequence to know it, for if it be possible to base a treatment upon this view, we may hope to arrest the progress of the disease, and possibly to save the vertebræ.

Let us look for a moment a little more closely at the influence which mechanical pressure at the point of disease must have in the destruction of the vertebræ and the consequent production of the subsequent curvature of the spine.

Figure 1 represents the usual aspect of a patient who has suffered from Pott's disease of the spine, It will be seen that the spine bends entirely at one point, and is nearly straight for a certain distance above and below that point. In other words, the disease, by weakening the spine at one point, has made the rest of the column relatively stronger, so that flexion, instead of being distributed along the whole spinal column through twenty-four vertebræ, occurs almost entirely at one point, and that is the diseased point; so that the diseased portion, which, by reason of being diseased, is incapable of sus-

taining its accustomed amount of pressure, is forced, by reason of being weaker, to receive a

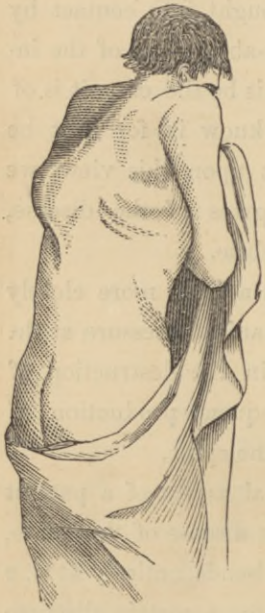

Fig. 1.

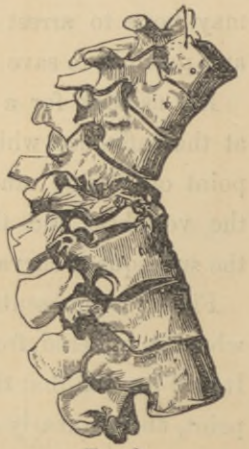

Fig. 2.

much larger amount of pressure. Thus we see in figure 2, which represents a section of the diseased spinal column, that those portions of the column above and below the diseased vertebræ act as two levers which have a common fulcrum at the point of disease, and to which every motion and concussion is transferred. These two levers are

firmly held together by the strong ligaments attaching the spinous processes, as well as by the powerful spinal muscles.

To make this important principle still more clear, let us suppose A in figure 3 to be a simple

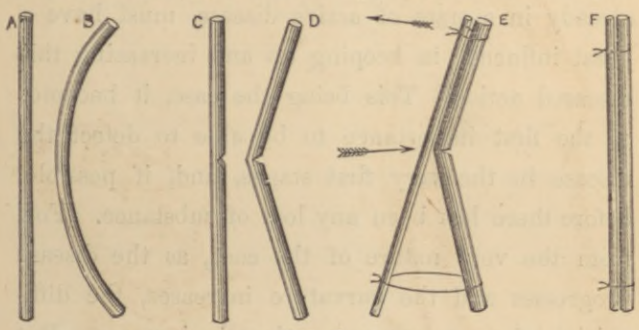

Fig. 3.

rod of equal flexibility through its entire length. If force be applied, it will bend through its entire length, as shown at B. But suppose it be weakened in one point, as in C, then the flexion would not take place through the whole length, as in B, but only at the weakened point, as seen at D; so that all force applied and all motion given to either end does not affect those portions between the ends and the weakened part, but is immediately and wholly transferred to the more flexible point, which is thus obliged to sustain the whole force. This is a true and exact illustration of the

action of pressure, concussion, and motion upon the diseased portion of the spinal column after the disease has once begun to produce absorption in the inter-vertebral substance; and this without the intervention of the elastic cartilage and upon parts already in a state of active disease, must have a great influence in keeping up and increasing this diseased action. This being the case, it becomes of the first importance to be able to detect the disease in the very first stages, and, if possible, before there has been any loss of substance. For, from the very nature of the case, as the disease progresses and the curvature increases, the difficulties of treatment proportionally increase. But if the disease is detected in the very first stages—especially if detected before there is any curvature or destruction of parts—then we may confidently hope that a treatment founded on these obvious indications will in many cases be followed by complete arrest of the diseased action, and the saving of the patient from years of suffering as well as a life-long deformity.

Happily the diagnostic symptoms, even at this early stage, are ample and not to be mistaken. If a strumous child or a child who a month before has had a fall, should complain of pains in the

sides or bowels—ill-defined, though often severe —failing to trace their origin to indigestion, look out for disease of the vertebræ. For the first symptom, and the one most persistent, is pain in the sides, stomach, or bowels—not in one case in ten at first in the back. Indeed, so far as the superficial portion of the back itself is concerned, it is very rarely the seat of either pain or soreness. In Pott's disease there is no use in "feeling" along the back. There is no soreness there, except from the irritation of the clothing on the projection, or, as sometimes happens, from too frequent manipulation in order to detect a sore spot. It is sometimes detected indeed, but it is in the first place made by the doctor's too frequent pressure along the spinous processes, till the most prominent ones become irritated and sore. In advanced cases there often is pain in the back, sometimes excruciating suffering, but it is always deep-seated, never superficial.

A very peculiar and characteristic symptom is the child's attitude. The spinal column, like other deep-seated organs, is not very plentifully supplied with sensitive nerves, and is not so painful when diseased as the hip-joint, for instance; but what is lacking in direct sensation is fully made up in the general sympathy by which the whole system

seems to participate in the *malaise*. The motions of the extremities are affected by any disease of this central organ of our mechanism, as the loosening of the balance-wheel or the weakening of the main shaft of a machine will affect the remotest part. There is a peculiar carefulness in the step; an instinctive poising of the body to avoid all shocks; an indescribable expression of the whole person and every attitude and motion, which exists in this disease, and in this disease alone. The toes are turned slightly inward; the shoulders and elbows are drawn backward; the chin is thrown upward; the gait is sliding; he catches hold of objects in passing them, and when he stops, he leans heavily on his mother's lap or whatever object may be near him. All this indicates the presence of the disease as clearly as a peculiar eruption indicates the measles. And these symptoms are as plainly seen at the first stages of the disease and before it has existed long enough to produce a deformity, as at any stage of its progress. And if, in addition to the above symptoms, the child will not stoop forward to pick up an object on the floor, but bends the knees and squats, reaching for the object by stretching the hand down by the side instead of in front; taking all these symptoms into

consideration, there can be no reasonable doubt but that there is disease of the vertebræ, and it should be treated as such, whether there be a projection in the back or not. If the respiration be short, sharp, and slightly labored, the dorsal portion of the vertebral column is the seat of the disease.

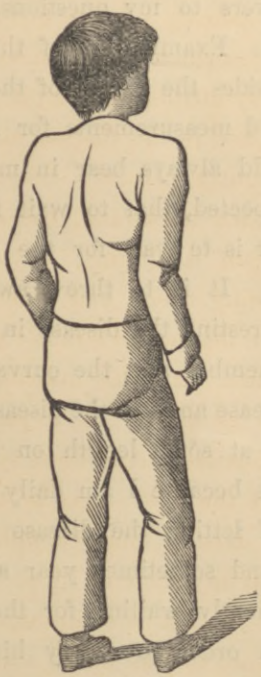

Fig. 4.

Figure 4 is an effort to represent the peculiar attitude of a patient with the first stage of Pott's

disease; before as well as after a curvature is visible. In my own practice, I never examine the back till I have caused the patient to walk across the room, pick up my knife and keys, and climb upon and get down from a bench or chair. Having done this, taken in connection with the mother's answers to my questions, I have made my diagnosis. Examination of the back reveals very little besides the extent of the deformity, if one exists, and measurements for an instrument. And we should always bear in mind, when this disease is suspected, that to wait for the projection to appear is to wait for the destruction of the vertebræ. It is to throw away the golden moment for arresting the disease in its incipiency. We must remember that the curvature is the result of the disease and not the disease itself.

If I dwell at some length on this matter of diagnosis, it is because I am daily witness of the sad effects of letting the disease run on month after month and sometimes year after year; the physician patiently waiting for the curvature to take place in order to satisfy himself that the patient really has the disease. Meantime, more and more of the vertebræ become diseased; the constitution becomes completely involved; ab-

scesses are formed; there is hectic, and the case, though it may ultimately survive, is hopeless of radical cure. Another humpback is added to the list, which, in my opinion, might, in most cases, by timely assistance, have been saved from such a fate. But even at quite an early period of the disease, and long before there is any protrusion of a knuckle of vertebræ, one can generally discover a deviation of the spinal column from its true line. This deviation at this early stage is quite frequently to one side. But there should be no danger of confounding it with the ordinary lateral curvature. In the first place, besides the rational symptoms, previously enumerated, the lateral curvature seldom takes place in children under eight or ten years of age; while a large proportion of vertebral disease occurs before six. But the appearance of the lateral deflexion of a diseased spinal column bears no resemblance to the ordinary lateral curvature.

Figure 5 shows the appearance of the ordinary lateral curvature; an appearance strikingly different from that shown in figure 6, which is a true representation of the one under consideration. It will be seen that in the common lateral curvature (figure 5) the spinal column represents a true curve.

This form of curvature is the result of unequal action of the muscles upon the flexible column, the

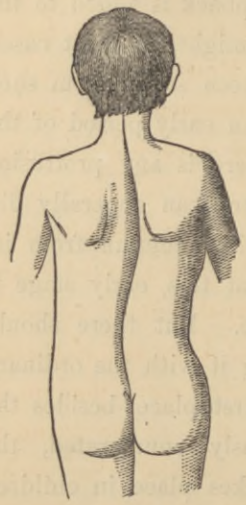

Fig. 5.

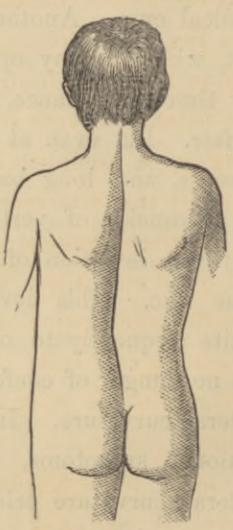

Fig. 6.

effect of which is to twist the spinal column from its proper course—in other words, to make a real curvature. But when there is disease of the vertebræ, the deflection from the true line is because the column itself has become weakened at some point, and the lines are almost straight above and below and approaching toward the point where the disease is located. It will be seen that the spinal column, in the latter case, appears to have toppled over to one side at the weakened point, and this

is literally the case. This lateral deviation is removed by conversion into the posterior projection, as the case progresses, and the vertebræ become more and more destroyed. Practically, it is a circumstance of very slight consequence, not amounting to a complication, and does not materially modify the treatment.

As the disease progresses, at the first slight loss of substance, there will be seen a marked change in the appearance of the spinal column, especially when viewed from the side. Long before there is a prominence in any one point more than in another, and while there is still to be found no spinous process projecting beyond the general level, if we view the patient at a little distance, we can detect a bulging outward of some portion of the spinal column, with straight lines above and below some point toward which they run. Taking, not a single vertebra, but the whole column into view, the appearance is precisely what we should suspect it would be if a little of the anterior portion of the column at a certain point had been removed. Figure 7 is intended to represent the natural antero-posterior curves of the spine; while figure 8 very well illustrates the first premonitory bulging out of the spinal column, before the sharp

angle appears. But not till one or more vertebræ have been well-nigh destroyed do we get that

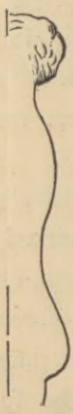

Fig. 7.

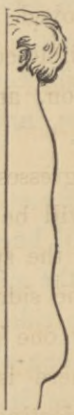

Fig. 8.

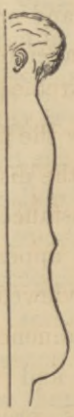

Fig. 9.

angular projection which is so characteristic, as seen at figure 9.

But whether the disease has been discovered in that fortunate period before absorption of the inter-vertebral substance has progressed beyond the first stage, or whether the loss of substance in some of the vertebræ has caused an outward distortion of the spinal column, the indications of treatment remain the same. *We must relieve the pressure at the point of disease.*

We have previously seen that the fact of disease renders the affected portion less capable of sus-

taining motion, concussion, and pressure than before, and that the peculiarities of the mechanical arrangement of the spinal column cause an increased amount of motion, concussion, and pressure to be directed to the diseased part of the column. It would seem that nothing could be clearer than these indications, and I believe they are generally recognized by the profession. But I am forced to say that the mechanical arrangements, professedly constructed on this idea, have not been equal to the plain requirements of these cases. Not to mention the lingering horrors of the "prone system," now happily abandoned, or the still practiced confinement to the bed, where all obvious hygienic measures—by which alone may we expect to keep life in some of the strumous cases—are rendered impossible, the result of all tried methods has proved so unsatisfactory that, even now, many of our best surgeons prefer to trust entirely to nature, good food, and fresh air, and refuse all mechanical appliances whatever. They expect a deformity, but prefer to save the patient's life.

But if we look for a moment at the false principle on which nearly all instruments have been made, we shall not fail to discover sufficient cause for this acknowledged want of success. In all the

instruments which I have examined there has been but one idea on which their construction has been based. All of these instruments are made with the one idea of making counter-extension from the hips to the shoulders. From a band around the waist or resting on the hips, some form of crutches are erected to the arm-pits, and upon this slight support has all the relief to be derived from instrumental aids depended. I believe that no instrument made on that plan can, from the nature of the case, be efficient. In the first place, if we recur to our first illustration (figure 1), we will see that a child, in whom the disease most frequently appears, has little or no hips—literally nothing on which to afford a base of support. No matter if the band be fastened so tightly as to be utterly intolerable, there will yet be a tendency to slide downward whenever any considerable weight comes upon it. But such pressure on the soft parts as would secure even tolerable firmness is unendurable; and the result is, that these instruments are left comparatively loose, even at the hips. But at the arm-pits the difficulty of finding a point of action sufficiently firm, upon which to exert a counter-extending force, is very much increased. Not to mention the fact that it would be too pain-

ful to suspend any considerable portion of the weight of the body by the arms alone, the arms are exceedingly movable in the upward direction, and a force acting under them only raises the weight of the arms themselves. I have often seen patients with shoulders forced up under their ears, while the spinal column was bending forward continuously. Besides, the principle of producing counter-extension in the longitudinal direction of the spinal column, even if firm points of attachment from which to act could be found (which can not be), is mechanically incorrect.

The amount of force necessary to overcome a bend in a rod, is inconceivably greater when traction is made at each end than by any other process. Only when the crook is very great can longitudinal traction exert special force on the bent portion; and this local effect rapidly diminishes as the two parts of the rod approach the same line. A crook in a chain link or rod never pulls entirely straight. This principle of mechanics is recognized by all handicraftsmen. If a bent bar of iron is taken to a blacksmith he would never attempt to straighten it by pulling at each end; he would simply and naturally lay each end on his anvil and apply his force in the middle. Thus

he would have a force at each end acting in the upward direction, and another force in the middle acting in the downward direction. Why should we not have as much regard to mechanical laws in straightening a curved spine as is used in straightening a bent piece of wood or metal? If we turn again to figure 3, we can see at E and F an illustration of the correct mechanical principle of applying force to overcome the weight of the upper part of the body. It is the simple lever employed in what is called in mechanics the knuckle-joint, where force is applied with the greatest economy known in mechanics.

In endeavoring to apply this mechanical principle toward overcoming the pressure at the diseased portion of the spinal column, we find a happy conjunction of favoring conditions. Such an instrument I hold in my hand, and figures 10 and 11 represent the same, applied. There is no painful pressure downward on the abdomen and hips; but a broad band passes around the trunk low down—so low that in front it almost touches the thighs in sitting. It passes just above the pubis and entirely below the abdomen, so that the abdomen is sustained upward instead of being, as in most instruments, pressed downward. There

are two pieces or levers passing up the back: not over the spine but each side of it, so that it

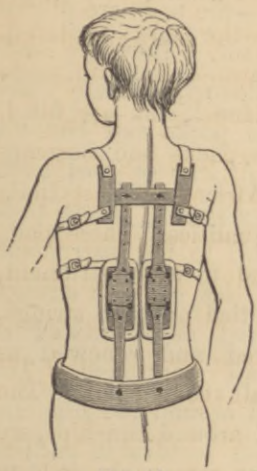

Fig. 10.

Fig. 11.

is firmly held from lateral deviations. At the top is a cross piece in the form of two T's with the small ends united. The object of this arrangement is that the straps may pass directly forward and around the arms, and thus prevent a great loss of force by diagonal action; and also that they shall touch the person only where their pressure is needed—namely, on the forward part of the shoulders. This arrangement entirely obviates the painful and injurious ligaturing of the arms which would occur if the straps passed

forward from one point. At a part of the instrument opposite the point of disease—the point where we make our fulcrum—the pads are placed. These pads are very important. They are made of chamois skin or canton flannel, and are filled, not with cotton which soon packs and becomes hard, but with long, elastic African or East India wool, which has no felting qualities. These pads are not permanently attached to the instrument, but are made separate and tied on with strings, so that they can be removed and renewed as often as they become at all compacted. The shoulder-straps and the band around the hips are likewise provided with similar removable pads to protect the skin from pressure and abrasion. It will be seen that the instrument, like the spine itself, acts like a double lever with a common fulcrum at the curvature. This action is directly backward at the hips and shoulders and directly forward at the middle of the back, or wherever the diseased part is located. Thus the posterior portion, the only healthy portion of the diseased vertebræ, is made to support a part of the weight of the body and the intervertebral cartilage and bodies of the vertebræ, where the disease exists, are relieved of pressure. Every attempt at for-

ward flexion, the effect of which without the instrument would be received on the diseased vertebræ, like a finger caught in the hinge of a door, is now borne by the instrument, which acts as a constant protection to this part of the spine, sustaining on itself every strain and jar. Indeed, it is really a kind of splint for the—in effect—broken back. Every particle of pressure on the hips and shoulder-straps is just so much force tending to straighten the spinal column. All the points of attachment are unyielding. That at the hips being directly backward, obviously so; at the shoulders equally so; for instead of lifting the arms up and away from the body, the direction of the force is toward the trunk and in contact with the upper and lateral angles of the chest. The powerful pectoral muscles are acted on in the direction of their greatest strength, yet are obliged to sustain but a small part of the force of the instrument, or little more than to keep the straps from slipping off the shoulders.

In addition to all this, the lower part of the body—the abdomen—is still further sustained in the upward direction by the apron in front (see figure 11), which is fastened at each corner as shown. It is evident that the nearer the two

portions of the spinal column, above and below the disease, are in a line with each other, the less force of the instrument will be required. Hence the action of the instrument becomes daily more and more easy to bear, as the spine becomes more nearly straight. But one of the most important particulars in regard to this instrument, remains to be noticed. The instrument is provided with several hinges—stop hinges in front, but free to bend backward—which allow the most unrestrained use of the muscles of the back. Whenever the spinal muscles are brought into action, instead of acting against unyielding resistance, the instrument bends freely backwards; thus stimulating and encouraging muscular action, as the patient, when free to do so, involuntarily makes frequent effort to gain momentary relief from the instrument by attempting to straighten himself up. Indeed, the spinal muscles, by alternate action and rest, actually alternate with the instrument in sustaining the weight of the body and overcoming the curvature. It has proved to be useful in causing the development of the spinal muscles, instead of binding them up and causing their atrophy, as results from the use of instruments which prevent muscular action.

The action of the instrument is simple, effectual, and easy for the patient.

The plan here proposed, which I believe to be the only correct mechanical theory for the treatment of this disease, makes an immense advance in the right direction. But it has many parallels. Not to mention a similar principle lately applied by Dr. Sayre and others with so much ability and success in the treatment of morbus Coxarius; it is not many years since several men, with ropes and pulleys, were required to reduce a simple dislocation at the shoulder or other joint. And though there was every advantage of having firm points to which to attach the counter-extending force, yet the action of the muscles could be overcome only after long and violent effort, and great suffering to the patient. Now, the surgeon uses the arm as a simple lever, and moving it in the direction indicated by certain mechanical laws, reduces the dislocation easily, painlessly, effectually, and at once!

While it is of the utmost importance that any instrument should be constructed, not only with an intelligent and correct mechanical idea—one which should be in harmony with the anatomical structure and physiological functions of the part—there

should be the nicest care in fitting and adapting it to each case. Especially is this true of instruments for the spinal column, the most devious and complicated part of our framework. For this purpose, I never trust the mechanic who makes an instrument to fashion it to its final shape, but I mold and fit it myself to each case before me. It is impossible to be sure that an instrument is properly proportioned and shaped unless the patient is present; for this deformity is of too complicated a nature to be fully expressed by any measurements.

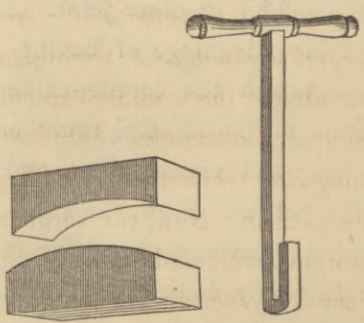

Fig. 12. Fig. 13.

Fig. 12 represents pieces of wood, between which, when placed in a vice, the steel pieces are bent to the form of the back. Fig. 13 also shows a kind of hook, one of the instruments used to twist them outward or inward, as the case may require, so that the pads shall always present a flat surface

to that part of the back with which they come in contact. No matter how projecting the latter may be, the instrument must be exactly fitted to it. There are also little screws by which the hinges are forced open and the form of the instrument made straighter or more bent, as the case may be; thus increasing or diminishing the sustaining force at will. Thus the instrument is perfectly adjustable in all directions, giving us complete control of its action; and not restraining any part not necessarily restrained in the one direction in which the instrument acts. All the muscles of the trunk may be brought into action, except that there can be no flexion through the diseased portion of the vertebræ except freely backward, thus developing the spinal muscles, as before stated; a very important consideration.

My practice is to allow the patient the most unrestricted liberty, and when thus protected from shocks and pressure by the instrument, I have never known the least harm to flow from this entire freedom of action; but, on the contrary, the greatest good.

After attending to removing the causes which excite local diseased action, of course the general health must be built up by every means calculated

to attain that end. And it is no small gain for these strumous cases to be able to have unrestrained contact with the fresh, out-door air.

I am aware that better than all theories are a few facts, and I therefore will close this paper by relating a few cases which will illustrate the treatment which I have pursued for about four years, and in nearly one hundred cases. During all this time only two cases have had abscesses formed after commencing the treatment; and these cases only still further illustrate the correctness of the treatment. In both cases there was evidence of incipient psoas abscess; the disease was in the lumbar region, and in one case the deformity was very great—both thighs being so far flexed by contraction of the irritated psoas muscles, that progression was extremely difficult, and with a deformity much greater than that which is shown in figure 14. There was marked relief, as usual, on applying the instrument;* but I saw them but a few times; they

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* Since writing the above, I have again seen the worst of the above-mentioned cases. When last seen there was an abscess inside of the right thigh, about the size of a common saucer. I strongly urged the friends to keep the back well supported with the instrument, trying to make them understand the consequences of inevitable deformity and misery if the diseased action should not be speedily checked. It seems that these admonitions have

were poor Irish children, living in poverty and filth, and after an unusually long interval, during which time I have no means of knowing that they were actually wearing the instruments, they both returned with psoas abscess. I have not yet had one case of lumbar abscess which has formed after applying the instrument; and I am very certain that in many cases abscesses already incipient have been prevented from forming, and finally dissipated by arresting the diseased action in the vertebræ, in the way proposed.

Figure 14 represents the form of a boy five years old, who came to me in November, 1862, from Albany, N. Y. I should remark that these figures are strictly correct, measurements having been taken by laying a flexible strip of lead along the spine and marking the exact shape on pasteboard, which is then cut out, numbered, and filed away.

Fig. 14.

had the desired effect, for the patient has just returned after an absence of two or three months, having, in the mean time, faithfully carried out my instructions, with the abscess two-thirds absorbed, the contractions of the psoas muscles relaxed, and the patient walking quite erect!

This little boy was unable to walk, except for a few steps, and then only by supporting himself by putting the hand to the left knee, which was drawn very far up. He was exceedingly feeble, and feverishness and hectic, in addition to the contraction of the psoas muscle, indicated the formation of an abscess. On applying the instrument and literally straightening out nearly all the curvature shown in the figure, the constitutional symptoms rapidly subsided, and in four or five months his general health seemed to be well re-established. But the contraction in the psoas muscle relaxed more slowly, though at the end of a year this contraction had entirely disappeared. He is now apparently entirely relieved of all local disease and constitutional disturbance, though there is still a very slight prominence at the previously large projection. This part of the spinal column will need protection for a considerable time, and until anchylosis has been thoroughly accomplished, otherwise there might be danger of re-exciting the disease in case some violent concussion of the spine should accidentally happen. His attitude is erect.

Do not for a moment let it be supposed that such a result could have been attained by merely putting on the instrument, or without constant atten-

tion and watching. The instrument alone can not cure so formidable a disease as this.

And I must stop a moment to express astonishment at the confidence with which many people propose to dispense with professional aid in the mechanical treatment of this disease—a state of things for which the profession is responsible—for people who would never think of applying a splint to a broken bone or of reducing a dislocation—both simple enough operations for those who understand them—have been educated, by the practice of the profession, to rely wholly on the instrument, whether it be good, bad, or indifferent—where an instrument is used—to remedy the much more formidable curvature of the spine, embracing some of the elements of both a fracture and dislocation in one. Here there are certain definite objects to be accomplished; the pressure must be removed from the point of disease; the curvature must be reduced, requiring different methods of procedure, whether the part affected be at the upper, the middle, or the lower portion of the back, or above it, in the neck; or whether there be also a lateral deviation either alone or together with the posterior projection. The flexible spinal column, liable to constant deviations, for which no form of splint

can be made of general application, as can be for the leg; this column, distorted often to the greatest extent by disease, can only be brought back to its original position by long and patient endeavor and the strictest attention to the minutest mechanical deviations, and that continued all along for years, it may be, as the case progresses. The instrument must not only act properly in the beginning, but must be *kept* acting. The whole curvature can not be reduced at once; but as fast as a little elevation of that portion of the spinal column above the disease has been effected, the same process must be continued till the whole amount of attainable relief has been secured. For we must set out with the idea of actually reducing the curvature, or so much of it as is possible. To limit our expectations to merely maintaining the patient as we find him, is to acknowledge defeat in the beginning.

This process of reducing the curvature requires great care and judgment to accomplish. Even if there be evident relief and improvement on the first application of the instrument, in a few days —that is, as soon as this improved condition has become normal—the patient is ready for still further elevation of the column, and still further relief will follow. And so we must go on gaining,

point by point, watching constantly against abrasion or chafing of the skin by any part of the instrument, protecting all soft parts subjected to pressure of straps or pads, so that we may not be interrupted in the steady progress of the cure. In general, the patient's own sensations will be a good guide to us. As assistance to the diseased spine *always* brings relief and comfort, any expressions of discomfort or distress, general or local, in the back, sides, or abdomen, would cause us to increase the action of the instrument, especially when such increased action seldom fails to bring immediate amelioration of all these symptoms. No apparatus which hurts or is irksome will be worn or ought to be worn, especially by a child.

On the whole, there is need, in these cases, to see the patient at least once in two weeks, for such modifications as will be necessary in the mechanical treatment alone. For, I repeat, that the physician must make all the changes himself, as being the only person who properly can make them, as he is the only proper person to administer any other medical or surgical treatment. The adjustment of the instrument is purely mechanical, depending for its accuracy on the accuracy of the eye, which must be first educated for this purpose; and it is

always best not to depend on the patient's or his friends' knowledge in these respects.

Figure 15 represents a child only fourteen months old when he was brought to me, in June, 1862. The effect of the disease was plainly marked by a projection, as seen in the cut, showing considerable loss of inter-vertebral substance—for I judged that the vertebræ had not yet come in contact, and were still unaffected. This child is now (February, 1863) perfectly well, and does not longer wear the instrument. There is not the slightest angular projection in any part of the spinal column, which presents, both as to form and flexibility, the perfectly normal appearance. He was the smallest of very small twins. His father is Mr. Walter Turnbull, of New York, and Dr. George Belcher is the family physician.

Fig. 15.

Dr. Lewis A. Sayre sent me a similar case about three years ago, but I neglected to take measurements of it. There was rather a sharper projection of the vertebræ (in the lumbar region) than in the case just narrated. This also was a child of

fourteen months old, and the little son of Rev. Mr. Botsford, of Yorkville. This case, also, in one year was entirely cured. The knuckle of vertebræ entirely disappeared, and all constitutional symptoms along with it. And up to the present time there has been not the slightest evidence that the disease and deformity ever existed.

I have had quite a number of cases similar to the above where the angular curvature had actually commenced, which have resulted in perfect restoration, with complete recession of the projection. But the above will suffice. It is these cases, thus early affected, which produce the worst deformities if not arrested by timely treatment.

A very illustrative case I will now relate. A patient of Drs. Metcalf and Thomas, of New York city, had met with a fall in April, 1862. In May following he began to feel a severe pain in one of his ribs, near to the sterno-costal articulation. In about a month more the pain had left this point, and was seated in the side, and finally moved to and became permanent near the spinal column. Here the pain became almost unendurable, and for several months he could only move on his bed with the extremest suffering. The fact of the first painful sensations being felt in the anterior part

of the body, at a distance from the affected part, is only a usual fact in connection with deep-seated diseases; as we find that pain in the knee is often the first indication of hip-joint disease. In general, until a disease has progressed quite far, an affection near the large nervous trunk is referred to the extremity of the nerve.

About the first of October, this patient was able to sit up, but the suffering continued and was only temporarily relieved by frequent injections into the muscles of the back of sulphate of morphia. There was also both a lateral and posterior (see figures 6 and 8) curvature of the spinal column in the lumbar region; and this curvature was steadily increasing. I saw him in November, and, at the request of Drs. Metcalf and Thomas, took charge of his mechanical treatment. At that time the affection in the intervertebral substance seemed to have changed only from the acute to the chronic, but was still progressing. The distortion was very considerable. The instrument produced immediate and, with inconsiderable exceptions, permanent relief. Only a few times, and then generally from some indiscretion or imprudence on his part, did he have return of the severe pain in his back.

The case progressed remarkably well, and in ten months the curvature had entirely disappeared, together with the pains, and his health was fully restored. Not only the form, but the original flexibility of the spinal column was restored; the latter rather remarkable, considering the extent of the deformity. But it is probable that the osseous structure was not affected. Usually in a case so much distorted as this was, recovery takes place by anchylosis; but where the instrument is used, in the erect instead of the deformed position. But undoubtedly the number of intervertebral substances affected, rather than the actual loss of tissue at a given point, contributed to produce the comparatively large deviation of the spinal column from its true line. There was undoubtedly no caries of the osseous structure.

My impression is that nearly every case of this disease may be restored, both as respects form and flexibility of spine, if taken while the intervertebral cartilage is alone affected; but that after the osseous structure has become impli cated, recovery must take place by anchylosis. But even in the latter case, we may supply the conditions favorable for effecting this reparative process speedily and perfectly; and the

disease need not always result in perceptible deformity.

Figure 16 shows the deformity in a case sent me by Dr. Wm. H. Van Buren. I introduce it only because it is another of many similar cases which illustrate the result of the treatment here advocated. The curvature was steadily increasing till it had attained the character shown in the cut. The only thing remarkable about it is the very few constitutional symptoms it has ever manifested, and the fact that, though the progress of the disease was arrested at once, the most persistent efforts during the first year of treatment failed sensibly to reduce the size of the posterior projection, as I had confidently expected. But during the last six months this projection has been rapidly decreasing, and it is now just possible to detect it. It is evidently about to disappear altogether. Restoration of the intervertebral cartilage is slowly going on, and is nearly completed.

Fig. 16.

A very frequent complication in this disease—especially when the lower part of the dorsal or the lumbar vertebræ are affected—is paralysis of the

lower extremities. I do not mean that form of paralysis caused by compression of the spinal cord frequently happening in cases of extreme distortion. But the paralysis occurring in the first or acute stage of the disease, is owing no doubt to communication of the inflammatory action from the intervertebral substance to the membranes of the spinal cord. Or perhaps Dr. Brown-Sequard would call it a reflex paralysis, owing to irritation of sensitive nerves by the diseased action. And it not unfrequently happens that this paralysis occurs, along with the other symptoms of incipient disease of the intervertebral cartilage, even before there is any perceptible loss of substance in the spinal column, and of course before any projection appears in the back.

A striking case of this character was sent to me so late as last November, by Dr. Ireland, of Greenport, Long Island. There was no isolated projection whatever, and only the most careful examination could detect even the slightest characteristic straightening of the spinal column, which always precedes the projection of a knuckle of vertebræ. But there was the peculiar short, jerking respiration; countenance expressive of great suffering; movable, severe pains in the bowels; and when-

ever she was lifted or twisted in the least, there would be paroxysms of distress of uncommon severity, accompanied by suspended respiration, flushed face, etc. Added to this, was complete paraplegia, which had existed for several weeks. The case appeared to be an unusually severe one; as, besides the remarkable severity of the rational symptoms, boths thighs were considerably drawn up from contraction of the psoas muscles, as though an abscess were already in process of formation.

The instrument was carefully applied, the affected portion relieved as much as was thought best, and the patient sent home for the day. The next morning the mother came back with the child and reported that since morning she had been walking about. This was verified in my presence, the little patient walking feebly and slightly bent forward, owing to some remaining contraction of the psoas muscles, but apparently without pain. In about three weeks she could stand wholly erect, and now evinces no indications of her malady; she has not had a single paroxysm since the instrument was applied. She runs about in all respects like other children, and appears to have very good general health. She is three years old, and the daughter of Captain Tuthill, of Greenport, Long Island.

This form of paralysis is more frequent when the disease is developing in the lower dorsal or lumbar region, but has never failed to be relieved by relieving pressure at the diseased portion of the spinal column. It generally requires several weeks, however, to fully accomplish it, though it has several times happened that the patient could walk in a very short time after putting on the instrument. In several cases where children have been unable to walk for weeks, they could do so immediately after putting on the instrument; though in such cases the inability to walk arose, no doubt, more from weakness and instinctive fear of injury than actual paralysis. During the year 1862, I have had nine or ten such cases of paralysis, all of whom were relieved similarly, though not all so speedily as the above.

The above illustrative cases I have selected because they have all come under the cognizance of well-known practitioners. Many more could be added—especially several very interesting cases of arrest of the disease before the appearance of a curvature; but lest some one might dispute the accuracy of the diagnosis, only cases of considerable actual deformity have been introduced.

When this disease is developed in the sacrum, I

have never been able to afford any relief by the use of the "spinal assistant," and for the obvious reason that the same mechanical laws do not apply to a thin, jointless bone, like the sacrum, that apply to the long, flexible spinal column, having considerable thickness, and with the diseased portion, the bodies of the vertebræ, anterior to the unaffected spinous oblique and transverse processes, which serve as a point on which the spinal column may be elevated by the assistance of the apparatus. But when the disease develops itself in the upper dorsal or the cervical region, it can be treated with nearly equal facility as when it is lower down. An apparatus constructed for these cases is shown in figure 17. Its action is precisely like the other, only with the addition of the apparatus for elevating the head. This is effected by a very simple contrivance. The pads, of course, are moved higher up, and on the top-piece is a pivot on which is placed a piece of steel, bent so as to receive the occiput and to come forward and upward to just behind the ears. This is padded where the back of the

Fig. 17.

head rests upon it, and from each end a strap, made of proper shape, passes around under the chin. The action, like the other form of the instrument, is that of the lever, acting backward to elevate the head and neck. It has the rotary motion of the neck, and is regulated by joints and screws, like the first. In the five or six cases in which this form of instrument has been used, it has had the same beneficial effect as where the situation of the diseased section, in the middle of the back, enables us to make our attachment at the shoulders. The only unpleasant thing about it is that a small portion of the apparatus can not be concealed by the clothing.

In one severe case, particularly, the benefit of this contrivance was so remarkable that it is worth relating. The daughter of Mr. Thos. W. Crystie, of Newburg, N. Y., had the disease developed in the upper dorsal and cervical vertebræ, while she was still an infant, only twelve or fifteen months old. So destructive had been the disease, that several vertebræ seemed to be nearly destroyed, rendering her wholly incapable of supporting the weight of her own head. It would fall helpless forward upon her chest. She was dwarfed, there was a large projection above the shoulders, and she

was in very feeble health. I saw her in November, 1861, when she was ten years old. During all this time she had never been able to support her own head except with her hands, as she moved across the floor, and of course was debarred from the usual recreations of childhood. On applying the apparatus represented in figure 17, she immediately expressed the greatest pleasure at the relief it afforded. She could immediately walk about wherever she chose—for the first time in all her life. Although from the length of time since the first development of the disease one might suppose that anchylosis had taken place, yet such was not the fact; and the improvement in this case, considering its severity, was as marked as is usual in those coming under treatment at a more recent period of the disease. There was, unexpectedly, considerable straightening of the spinal column, and immense improvement in general health. She is now able to hold herself erect for a considerable time, without any support.

In what I have said, I have had reference to the treatment of the *disease* which produces the angular curvature of the spinal column; though the treatment fortunately is such that in curing the disease the deformity is also corrected. But after

the disease has progressed unchecked till some of the vertebræ have become partially destroyed, after a long time, often amounting to several years, they are cemented together by anchylosis, and the disease is thereby arrested and no longer exists. We have then remaining only the anchylosis, which, next to saving the form and flexibility of the spine, by early treatment, is the most favorable termination of the disease. But, by this treatment, the recuperative power of nature may be earlier exerted, and the anchylosis may take place while the diseased section is held in the erect, or nearly the erect, position, instead of being bent to the full extent to which the weight of the body could force down the spine at the diseased and weakened section, without some counteracting influence.

For these curvatures, when once begun, generally go on increasing till the part of the trunk above the diseased section reaches some support in its downward course. Either the ribs rest on one another, or if the disease be below the long ribs on which those above can rest, then the whole anterior of the body drops down upon the pelvis. Hence we see few small or even medium specimens of the angular curvature; the distortion is

nearly always great. But if left alone, as these cases usually are, the trunk settles downward till, having found a support which gives partial protection to the diseased vertebræ, the efforts of nature to produce anchylosis prove successful, and this position becomes unchangeable. Though the disease has spent itself, the deformity must forever remain.