"My neck is so sore." Such phrases should rather make the mother, or at any rate the surgeon, apprehensive; and the child should be stripped stark naked and thoroughly examined, on several occasions if necessary; for, as Howard Marsh says, although angular curvature may not be detected in a suspected case, still it must not be concluded that the spine is sound.

On hearing that a child has slight and obscure pains, which we may attribute to the result of an injury to the spine, one must be particularly careful not to treat the case lightly. One is inclined to say to the mother: "I do not think it serious." But, often, rest is as necessary as if one could see with the naked eye incipient osseous changes.

The earlier the treatment is begun, the better. Better even that two boys should be treated for spinal disease, where, after all, no disease existed, than that treatment should be delayed for a third boy, because the symptoms of the disease were not unequivocal.

And now a few words as regards treatment. In my opinion, the best method consists in placing the child at once on his back, on a firm flat horse-hair mattress, without a pillow. And there he must be kept, lying in absolute rest—by means of armlets, if necessary—for an indefinite time. If the disease be taken at the onset, that is, in the stage of inflammatory osteitis, a few weeks' rest may have the effect of causing the surgeon to wonder if his original and early opinion was, after all, correct. So much the better. But, if it be a matter of months, the small mattress may be carried out into the garden as a litter, or put upon an easily going wheel-chair. Later on, a plaster-of-Paris jacket should be carefully moulded over the trunk, from just above the great trochanters high up into the arm-pits; but no suspension need be used.

There is, in my opinion, no better splinting than that afforded by a Sayre's jacket, though that may be a matter for discussion. But I will insist on this: that, if a jacket be put on the child with early spinal disease, the patient must still be kept in bed, or else we are not obtaining for it that near approach to absolute rest of which we all talk so much. Little children do not fret, or become thin, because they are kept in bed; they are, when well managed, as patient as those of maturer years. The head of the bed may be raised by blocks beneath the legs, so that the inmate may get a better view of what is going on around him.

The treatment of the later stage of spinal disease, I do not here discuss. Indeed, if the early stage receive its proper attention, its discussion will happily include also that of the later stage.

I may go so far, perhaps, as to deal with the disease when the little spinal boss is making its earliest appearance, but no further. Of a permanent angle produced by caries, I will say nothing. It is not found in the early stage. I have heard disciples of my friend, Professor Sayre, lay claim to an ability to straighten such an angle; but I could never admit that even the enthusiasm which they displayed in the question was sufficient palliation for their pretentious and misleading assertion. Hence, at the meeting of the International Medical Congress in London, it afforded me the sincerest satisfaction to hear Dr. Sayre deliberately refuse to entertain the notion, as it also did to hear him admit that suspension is not an essential part of his method.

For the future, let us all recognise this fact—when we are encasing the body of a child whose spine is inflamed or carious—that we are simply treating the diseased vertebrae as we should treat the tarsal or carpal segments when similarly affected, viz., by securing for them the nearest approach to that absolute physiological rest of which our Hilton was the High Priest. And let us stretch our hand across an Atlantic ocean, which, under the influence of science and scientific gatherings, is yearly becoming less worthy of the adjective "wide", to give fraternal greetings to Professor Sayre—a fellow-workman, who has systematised and has brought to us a practical means of helping those countless children whom we had almost begun to regard as surgical outcasts.

THE TREATMENT OF LATERAL CURVATURE OF THE SPINE.*

By BERNARD ROTH, F.R.C.S. Eng.

A MOTHER notices that a shoulder or a hip is beginning to grow out in a child, generally a girl at the onset of puberty. The family doctor is called in; the patient is stripped, and the trunk flexed. If there be no decided or marked irregularity in the bent spine, the parent is assured that the patient "will grow out of it"; and that nothing special need be done, except, perhaps, lying down daily for a short time. I have heard this story frequently when examining a case of incurable spinal curvature which had developed in the course, of one, two, or more years. It is, however, precisely at the time when there is no decided

or marked osseous deformity, that complete cure is possible. Before pronounced osseous lateral curvature can occur, it must gradually pass through many intermediate stages from the time when the patient first began to assume a temporary vicious position of the trunk. The position of writing, as generally practised, is, more frequently than anything else, an initial cause of lateral and other curvatures not due to caries. The much larger proportion of girls than of boys affected, is due to the fact that girls do not enjoy, as a rule, one-fourth of the usual amount of physical exercise allowed to boys. Their muscles become weak; and, although they sit no worse than boys at their lessons, they have not sufficient strength to hold themselves erect, and to restore the balance of their curved backs out of school-hours.

After a careful examination, before the patient is allowed to dress, it is essential to ascertain to what extent the spine can be restored to its normal position, by a voluntary effort with the help of the surgeon. Although attention is first directed to the improvement of the lumbar curvature, any position that increases the upper lateral curve, if present, should be avoided. One arm directed and held upwards or outwards at a higher level than the other, is very frequently useful in helping to restore the symmetry of the trunk. Sometimes the best result is obtained by both arms being raised vertically by the side of the head, while avoiding undue elevation of the scapulae. This best position of the patient's trunk and arms for improving the spine, is the "key-note" of the exercises to be practised during treatment. It is extremely important to note whether any article of dress is too tight across the front of the chest, when the patient is holding himself in an improved position; the stoop of a scoliotic patient is often confirmed by closely fitting garments. This remark applies not only to the clothes worn by girls and women, but also to the shirt-collars, waist-coats, braces, buttoned coats, and overcoats of boys and men.

The treatment of lateral curvature should embrace the following points. *a.* The spinal muscles should be sufficiently strengthened, so that the patient can maintain an erect or improved position for an indefinite time, whenever required, without extra effort. *b.* The thorax should be developed by systematic breathing and methodical exercise acting directly on the ribs. *c.* All causes increasing or perpetuating the spinal curvature must be removed; that is, bad positions must be avoided, and good ones prescribed. *d.* The general health should be improved by attention to diet, by a daily morning bath, by tonics if necessary, and by as much open-air living as possible. The spinal muscles are strengthened by means of "medical gymnastics" (Swedish movements)—a scientific system of gymnastics based on anatomy and physiology. By them it is possible to bring any desired group of voluntary muscles of the trunk and limbs into regulated contraction, as slight or as severe as may be required. In many of these exercises, the position of the limb or of the trunk assures a sufficient amount of resistance to be overcome by the contracting muscle; while in others the resistance is given by the surgeon. The erectors spinæ muscles can be easily and thoroughly brought into action while the patient is either lying, sitting, or standing. Space does not permit me to describe more than two or three such exercises in detail. Let a patient lie prone, with the pelvis and legs supported, and the heels fixed on a padded table, while the head and trunk to the level of the iliac crests project beyond the edge of the table. The back-muscles must contract forcibly to enable a patient in this position to slowly raise his trunk into the same horizontal plane as his legs and pelvis, and to maintain that position for ten or twenty seconds, and then as slowly to allow his trunk to be flexed again by its own weight. The surgeon can easily increase the exertion, if required, by more or less pressure with one hand at the back of the patient's head or neck. During this exercise, which is repeated from four to eight times, the trunk and arms may be in any required posture. A less severe exercise for the erectors spinæ muscles is for the patient to lie prone on the floor or on a table, and, while the trunk is immovable, to describe slowly a circumduction, first of one hip and then of the other, while the knee is kept fully extended. The contraction of the erectors spinæ can be felt by placing the finger on them; they are forced to contract to steady the pelvis. The amount of exertion can be increased by a pressure of the surgeon's hand on the heel. If the back-muscles be very weak, and the weight of the leg be too great, the surgeon can partially support the limb during the circumduction. A third exercise for the same muscles is for the patient to sit erect, astride a narrow table. The surgeon, with one hand against the back of the patient's head, gently presses him forwards, he having been previously requested to yield gradually in the lumbar vertebrae. As soon as the trunk is flexed at an angle of 50° or 60°, the patient stops, and then returns slowly to the previous erect posture; the surgeon in his turn gently resisting with the hand at the back of the patient's head.

The following is a prescription of exercises, which, with a few modi-

* Portion of a paper read at a conjoint meeting of the East and West Sussex Districts of the South-Eastern Branch.

fications according to circumstances, is used at the commencement of the treatment of all cases of spinal curvature not due to caries. It consists of twelve exercises, between each of which the patient has to rest for a minute or two on a couch with movable back, of which I gave a description with an illustration in the JOURNAL of March 5th, 1881. It has a wedge-shaped cushion, the lower end of which fits the hollow of the back.

"1. Lying on back, arms by the sides of the body, hands supinated; very slow deep inspiration by the nose; expiration by the mouth. (Repeated four times.)

"2. Similar exercise, with the arms extended upwards by the sides of the head.

"3. Same position as (1); head-rotation on axis to right and left alternately; also lateral flexion of head to right and left alternately. (Repeated four times.)

"4. Lying on back; simultaneous circumduction of both shoulder-joints from before backwards; elbows and wrists kept extended. (Repeated twelve times.)

"5. Lying on back; one hip-circumduction both ways; knees kept extended. (Repeated ten times.)

"6. Lying on back; simultaneous extension of arms upwards, outwards, and downwards, from a position of the elbows flexed and close to the trunk. (Repeated four times.)

"7. Lying prone; one hip circumduction both ways; knee kept extended. (Repeated ten times.)

"8. Sitting on couch, with back at an angle of 45°; ankle-circumduction down, in, up, and out, while the toes are directed inwards the whole time. (Repeated thirty times.) (For flat-foot.)

"9. Lying on back, with arms extended upwards by the sides of the head; flexion of both arms (surgeon resisting), followed by extension (patient resisting). (Repeated six to eight times.) (The patient's knees, flexed over the end of the table, fix his trunk.)

"10. Patient astride a narrow table, with arms down and hands supinated; trunk-flexion at lumbar vertebræ (patient resisting), followed by trunk-extension (surgeon resisting). (Repeated six to eight times.) (Already described in detail.)

"11. Patient, with arms extended upwards, leans against a vertical post with pegs on each side; these he grasps. The surgeon gently pulls the patient's pelvis forwards by his hands on the sacrum (patient resisting); and then the patient returns the pelvis to the mast (surgeon resisting). Also pelvis-rotation on its axis to right and left alternately (surgeon resisting with his hands on each side of the pelvis). (Repeated six to eight times.)

"12. Lying on back, with head and neck projecting beyond the end of the table; the head is gently flexed by the surgeon's hand on the occiput (patient resisting), followed by head-extension (surgeon resisting). (Repeated eight times.)"

The last four exercises are personally carried out by the surgeon, while trained female assistants do the remaining eight under his supervision. Six to twelve firm longitudinal strokings, from above down, of the patient's back by the assistant's two palms generally remove any aching caused by the exercises. These strokings are also usefully employed at home to relieve backache. The prescription requires about an hour, after which the patient rests a few minutes before leaving. Several of the simpler exercises have to be practised at home for about fifteen minutes twice daily.

The removal of all causes perpetuating or aggravating the spinal curvature is most important. For reading and writing, a high-backed chair, with the back reaching to opposite the shoulder-blades and slightly moulded to the trunk, is required. The patient should sit with the sacrum as well as the scapulae in contact with the back of the chair; the spine can thus be kept in an erect position with slight effort. The desk or table, sloping at an angle of 15° for writing and of 40° for reading, should be movable in a horizontal plane, so as to be brought over the patient's thighs. A Glendenning's adjustable modern school-desk, manufactured by a Darlington company, satisfies all the above requirements. In sitting, the thighs should be evenly placed on the seat of the chair, and never be crossed, as this throws the centre of gravity of the trunk to one side, and aggravates any curvature present. For severe cases of curvature, the couch with movable back already mentioned is to be preferred. Scoliotic patients should not stand more than is absolutely unavoidable, and then with the feet at least six or more inches apart. Walking, short of a fatigue which cannot be completely recovered from, after fifteen to thirty minutes' rest, is beneficial, as the back-muscles are being constantly brought into action while it lasts. If there be any relaxation or falling-in of the arch of the foot, anatomically shaped laced boots, with felt valgus pads, and with no heels, or only low broad ones, are necessary. Out of fifty consecutive cases of lateral curvature in private practice, I found that thirty-two had relaxed feet, some very severely.

More or less difficulty is experienced in convincing the patient that his habitually crooked position, with the head poking and on one side, and his trunk twisted and curved, is wrong, although natural and comfortable to him. It is still more difficult, and great perseverance is necessary, to convince him that the improved position which he is shown, is really an improvement; because, if he trusts to his own sensation, he is at first under the impression that he is more crooked than before. In these cases, I find a looking-glass frequently of much service.

I have not said anything about the mechanical treatment of lateral curvature, because no steel or plaster or poroplastic support should be prescribed, as long as there is any possibility of placing the patient in an improved position, and of his maintaining this by a voluntary muscular effort for even a few seconds. A spinal support must interfere with the natural expansion of the thorax in respiration, if efficient pressure is to be exerted in attempting to replace a spinal curvature. The following remarks, published in the *Transactions* of the late International Medical Congress (vol. iv, p. 171), express my views of Sayre's treatment. "I cordially agree with everything that has been said in favour of Dr. Sayre's plaster jacket for the treatment of spinal caries. With reference to lateral curvature of the spine, it is very difficult, from what has been both written and spoken by Dr. Sayre, to understand to which stages of lateral curvature he refers. I constantly examine cases of lateral curvature which, at the first glance, appear very badly deformed, yet it was quite possible to restore the apparently deformed spine back into a perfectly normal shape, and for the patient to retain this position for a few seconds; the fact being that there was no real osseous deformity, only a relaxed vicious position of the bones, ligaments, and muscles. I challenge Dr. Sayre or any of his disciples to exhibit, at a London medical society, a case of lateral curvature with osseous deformity of the vertebræ and ribs, even to a very moderate amount—but it must be there—and then to exhibit the case again within six or twelve months, as being cured by his treatment. Daily suspension by the head does not strengthen or exercise the muscles, as maintained by Dr. Sayre; it is against common sense. If you wished to strengthen a weak or flabby biceps muscle, surely you would not put the arm in a plaster bandage with the elbow fully extended, and then hang the patient repeatedly daily by the hand of the imprisoned limb. I have seen several patients with osseous lateral curvature who have been daily suspended by the head for months; and, if Dr. Sayre's theory were true, at all events the neck-muscles should have been strengthened, as they are most severely acted upon by the extension from the weight of the body; but nearly all poked their head as much as ever. Sayre's jacket is only of use in lateral curvature in cases of extreme osseous deformity, in supporting and giving relief to the patient, and in preventing the deformity becoming worse; also in cases of paralytic lateral curvature."

In the JOURNAL of December 6th, 1879, is an article on "the Influence of Sayre's Treatment on the Spinal Muscles", in which I maintained that the muscles waste from want of exercise. Dr. Sayre soon after published a lecture criticising this opinion, and proposing a still worse modification of his treatment. After a patient with lateral curvature had worn the plaster jacket for some weeks, till it became loose (in his opinion, because the spine was straighter; in my opinion, because the ribs were more compressed), he advised the jacket not to be removed, but a wedge-shaped piece to be cut out over the prominent ribs behind, and the two sides of the vacant space to be forced together by a fresh bandage tightly applied, and this process to be repeated two or three times at intervals. It seems strange how such a treatment could be advised, as it is only another form of tight lacing applied to a deformed trunk.

To return to the treatment I have recommended, and its results. More or less decided improvement is nearly always obtained within a month of daily treatment. Cases without osseous deformity are sometimes even quite restored in this time, but every care must be taken to avoid injurious positions, and prescribed exercises must be practised at home for some months afterwards, to prevent relapse. In cases with a moderate amount of osseous deformity, about three months' daily treatment will, on an average, give a satisfactory result, but complete cure here is not possible.

To sum up, the points I insist upon in this paper are these.

1. A more careful description of the stage of lateral curvature is required, including the mention of any osseous deformity if present, and whether the patient can be at once restored to the normal position, or, if not, to what extent.

2. If osseous deformity be present, even to a slight extent, complete cure is impossible.

3. Many cases of apparently severe lateral curvature have no osseous deformity, and can be at once restored temporarily to a normal position.

4. A patient with confirmed lateral curvature, with or without osseous deformity, is so habituated to the vicious position, that attempts on his part to improve the spine, except with the help of the surgeon's instructions, generally increase the deformity.

5. Exercises of the spinal muscles, with and without resistance, by the surgeon or an assistant, while the patient is in an improved position, are absolutely necessary to the rational treatment of spinal curvatures not due to caries.

6. Good positions should be always assumed, not only at meals and at lessons, but whenever otherwise occupied. This is practicable in slight cases, even with ordinary backed chairs; in some cases, a couch, with horizontal seat and movable and moulded back, is necessary.

7. A moderate amount of walking, short of much fatigue, is beneficial.

8. Lying prone or supine does not tend to cure lateral curvature, as it does not strengthen the spinal muscles. Lying for a quarter or half an hour is useful when it rests the patient; but, if it be continued for several hours daily, only harm results from the physiological activity of the spinal muscles being prevented.

9. Sayre's plaster-jacket and other spinal instruments are injurious in all cases not due to caries, where the patient by an effort can maintain an improved position of the spine, even for a few seconds only. Sayre's jacket is only permissible when the sole object is to prevent further increase of extreme osseous deformity.

10. Swinging by the head does not strengthen the spinal muscles, and dates back to the time of Dr. Glisson, more than two hundred years ago. In Germany, "Glisson's swing" has been known and used for many years (see JOURNAL, July 26th, 1879).

11. By all vicious positions being avoided, good ones shown and maintained, and suitably prescribed exercises carefully carried out, better and quicker results are obtained in cases of lateral spinal curvature, than by any other treatment hitherto practised.

I intend publishing shortly an abstract of fifty cases of lateral and antero-posterior curvature treated by me in private practice since January 1st, 1881.

THE TREATMENT OF SPINAL CURVATURE BY MEANS OF THE CUIRASS.

By NICHOLAS GRATTAN, L.R.C.P. & S.Ed.,

Senior Surgeon to the County and City of Cork Hospital for Women and Children.

FOUR years have elapsed since Dr. Sayre's remarkable demonstration on the Treatment of Spinal Curvature by means of Suspension and the use of the Plaster-of-Paris bandage. As he has already written fully on the subject, it may seem presumptuous in me to make any further remarks. It is only, however, after the lapse of some time, that the true value of a remedy can be ascertained. When it is first discovered, those who have faith in it are apt to look on it as the remedy of the age, and to use it on every possible occasion, too often rashly and unwisely; whilst those who do not understand or appreciate it, and who have seen its bad results when it was injudiciously applied, are inclined to deny its value altogether.

Perhaps the man of genius who first discovers a really valuable remedy, and whose intuitive skill will save him from some of the blunders of his less gifted brethren, is not so capable of judging how far it is likely to be successful in general practice, or of seeing the dangers which may attend its indiscriminate use, as the man of ordinary ability who has carefully studied his own and his fellow practitioner's failures and successes. Surgeons all over the world are now called on every day to decide whether they will or will not use Sayre's plaster-jacket, in cases of spinal disease; both surgeons and patients have in many cases a strong prejudice against it.

Having employed this method of treatment both in hospital and in private practice, since Dr. Sayre's visit to Cork in 1877, with considerable success, I venture to make the following remarks as the result of my experience on the subject. I believe the prejudice to which I alluded, is caused by the fact that at first too much was expected from the use of the jacket, by practitioners who had not carefully studied Dr. Sayre's book. Unhappy results have certainly attended its use. These results have followed too severe extension of the spine in cases of caries, especially where ankylosis had already commenced. Serious injury has also arisen in cases of lateral curvature, from a too long continued use of the jacket, which produced atrophy of the spinal muscles, and consequent weakness, owing to the want of proper exercise.

The general impression of all surgeons with whom I conversed on the subject (an impression which I shared for some time), was that Dr. Sayre directed that the patient should be suspended until only his toes

touched the ground. Now he does unfortunately say in page 17, "The patient is to be gradually drawn up until the feet swing just clear of the floor", but he proceeds to add most emphatically a little further on, "Do not attempt the impossible: do not try to straighten curved spines, the result of caries, that have become partially or completely consolidated; do not break them up; but simply extend the patient very slowly, until the patient says he feels comfortable; and never extend beyond this point." This caution, more than once repeated, cannot be neglected without the most disastrous results ensuing.

It is an easy matter, in the case of an adult, to extend "until the patient says that he feels comfortable"; but with a young and often frightened child, it is extremely difficult to find whether his comfort is increased or not, except in cases of advanced spinal disease. I would suggest to the surgeon to use his own judgment, while extending, to watch the patient carefully, and to extend *just to the degree which* (when the jacket is applied) *will relieve the spine of the burden it has to bear, and no more.* I believe, as this advice is carefully followed, so will the patient be relieved, without any danger of producing an aggravation of his spinal mischief.

A young delicate child may be often best extended by having his hands held up, so that his elbows are level with the top of his head. The assistant who holds him up can keep the spine steadily extended in this manner while the bandages are being applied, if his own hands be supported by passing them through the axillary supports of the extension apparatus.

The extension apparatus which I prefer, is that manufactured by Cocking. The neck appliance, being of soft felt, does not hurt, and the head and the axillary supports can be regulated with the greatest nicety and ease.

At the Children's Hospital, we occasionally extend the children over the backs of two chairs, a pillow being placed under the child's shoulders and hips; the chairs are slowly separated to the required extent, and the bandages are easily applied. Hammock-extension I have found satisfactory with children; I had, however, the misfortune to injure an adult by its use; while in the hammock, he suffered so much pain from over-extension that he had to be at once lowered. I suspended him according to Sayre's method the following day, and applied a jacket. This gentleman is now quite well, having constantly worn a cuirass for eighteen months. With any weight such as that of an adult, there is a tendency in the hammock to sag in the centre; owing to this, I do not see how the danger of over-extension with this appliance can be avoided.

Whilst prolonged rest to the spine, procured by the continued use of the plaster-jacket, is essential for the successful treatment of Pott's disease, I hold that the long continued use of any jacket in cases of lateral curvature, (where caries does not exist), is injurious. Very many of these cases are best treated by means of self-extension without the aid of any mechanical appliance; but when the curvature is severe, in order to enable the patient to exercise in the open air without pain, some external support must be worn during the day. In treating these cases, I have found Cocking's felt jacket, or the plaster-jacket with a lacing arrangement, of great service. It is necessary to impress on patients suffering from lateral curvature the importance of suspending themselves as frequently as possible, and never less than three times a day. Before retiring to rest, the jacket should be taken off, and reapplied each morning, while the patient is suspended. This treatment, with fresh air and attention to the health, has always proved beneficial. With regard to extension, I have found it nearly impossible, on account of the trouble and expense involved, to make many of my patients use a neck suspension-apparatus, as recommended by Dr. Sayre; they will not take the trouble. I am more successful when I desire them to procure a piece of round timber suspended from the ceiling by a rope, just like a trapeze, from which to swing by the hands several times a day; this I can get them to do. They enjoy the exercise; but nearly all, more especially children, object to use the neck-piece. Nevertheless, where the curve is high up, I insist on the neck-piece being used, and self-suspension practised, strictly according to Dr. Sayre's directions. With regard to the jackets, I believe that Cocking's felt jacket, if worn at night, becomes soft.

The plaster-of-Paris jackets, whether used for caries of the spine, or for lateral curvature, I generally cut down and lace, according to the method described by me in the *Lancet* of November 20th, 1880; by so doing, I can more readily arrange the pads, or remove any portion I think likely to press upon projecting parts. Jackets laced in this manner will be found even stronger than before they were cut, and they can be removed at intervals for the purpose of cleaning the patient. I seldom use a dinner-pad, but make my patients have a good meal before operating. I believe the hips are best padded by sewing two or more layers of thick flannel outside the skin-fitting vest; but I find that the less I pad my patients, the better their jackets fit. I have had much loss of time and disappointment with my plaster bandages. Sometimes a