this may be avoided by the continued use of mechanical means. But why should a treatment be commenced which must be continued perhaps for a lifetime, where, but for the surgeon's interference at first, the patient would have gone on happily through life unaided and independent?

f. As Class e., but with oppressed Breathing and Circulation: Anæmia: Intercoastal Neuralgia. Thorough Invalids, and useless in society.—Temperament and social surroundings being considered first, the gradual use of Sayre's exercise should be ordered; then a support, either of plaster-of-Paris or of felt. Outdoor exercise should be tried and encouraged, the patient being thus supported. This treatment should be persevered in till a cessation in improvement appears: the patient will be left better than she was found. A permanent support of felt can be ordered if requisite.

Prognosis in General Curvature: After-Treatment.—In classes *a.*, *b.*, and *c.*, a cure may be expected. It is astonishing in *b* how soon—three months—complete cure may be accomplished. In *c.*, the treatment on an average will last two years. In classes *c.* and *d.*, weaning from the plaster support must be carried out as in caries; while in *d.*, amelioration, and not cure, must generally be expected. The after-treatment in *c.* and *d.* consists in the "weaning" process, and the continuance of the swing exercise at least three months after all support has been stopped. Relapse in all these cases is very likely from any failure of the general health; they should be carefully watched for some months. Classes *e.* and *f.* are essentially examples of "after-treatment" from the first; the greatest gain expected in *f.* is the loss of subjective symptoms, and breaking the neck of invalidism. Cases of the class *d.* had better at once know what *e.* and *f.* already well have learnt, that some deformity, little or much, must be to them a "condition of life". This may be thought by some a pessimist's view of the matter; but, call it by whatever name one will, an appeal to everyday experience cannot but confirm it.

THE TREATMENT OF CARIES OF THE SPINE.

By E. NOBLE SMITH, F.R.C.S.Ed.,

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In discussing the etiology of this disease,* I expressed my reasons for agreeing with those pathologists who consider that caries is not necessarily a scrofulous or tuberculous affection. I there suggested how caries might occur in a healthy individual, as the consequence of continued irritation of traumatically injured tissues; and I also remarked that, although the disease might thus occur without a predisposing cause, it was much more likely to happen when the vital powers of the patient were depressed either by tuberculous or other constitutional disease.

These observations upon the etiology of the disease are here made for the purpose of drawing attention to the fact, that caries must be dealt with chiefly as a local affection. The general health in all cases, without doubt, requires

Fig. 1.—Drawn from a Preparation in St. Mary's Hospital Museum, being a typical specimen of Caries of the Vertebrae.

to be carefully treated; and, when symptoms of scrofula or tubercle are present, the administration of the appropriate remedies for these constitutional conditions will of course be required; but at the same time the fact must be recognised, that the disease of the spinal column cannot be cured by general treatment alone. Local rest of the diseased parts is the only treatment that will give relief or effect a cure.

The question next arises, How should this rest to the diseased vertebrae be given?

In order to answer this question, it is necessary for us to consider the alterations which take place in the spine during the progress of the disease, although these changes are probably well known to the reader. The ulcerative process usually commences at the anterior part of the vertebrae or intervertebral substances. It extends backwards, but seldom attacks the arches of the vertebrae. The usual result of the loss of substance from the ulceration is the production of a wedge-shaped excavation, the base of which presents anteriorly, and the apex posteriorly. This excavation does not generally exist as a space, because the bones above and below the seat of disease come

together as the caries progresses. Thus there are a falling forwards of the part of the spine above, an incurvation of the part below the disease, and a projection of the spinous processes in the back. Occasionally, but rarely, the disease attacks the same structures laterally, or even at the posterior part of the bodies of the vertebrae.

Fig. 2.—Very severe case of Caries, drawn from a Preparation in St. Mary's Hospital Museum, showing that even in so bad a case the Arches of the Vertebrae remain sound.

As the upper portion of the body falls forwards, the equilibrium is upset, and the superincumbent weight is not supported equally upon the vertebrae, but falls chiefly upon the anterior diseased portions of the column. Partly to relieve the pain caused by pressure of the diseased parts upon one another, and partly to restore the equilibrium and to raise the head to a more natural position, the patient supports or raises the upper part of the trunk by means of his arms, placed either upon his thighs or upon a table or chair, etc. He also uses the muscles of the back for the same purpose. Although the patient may sometimes relieve the pain by raising his body as described, yet he fails to relieve it for long; because, as the vertebrae above the disease are brought backwards, the vertebrae below the seat of disease accommodate themselves to the alteration of form—an apparent incurvation of these vertebrae taking place; and thus the superincumbent weight continues to be transmitted chiefly through the anterior diseased part of the vertebrae. The following diagrams show these conditions (Figs. 3, 4, 5, 6).

In Percival Pott's time (he wrote in 1779), violent attempts to straighten the spine used to be made, and Pott recognised the evil of such treatment. He pointed out that to draw the carious bones asunder could not be beneficial, as it would interfere with the natural mode of cure, which takes place by junction and coalescence of the diseased bones. This opinion was founded upon sound surgical principles, and holds good to the present day. Bonnet of Lyons has also deprecated all violent attempts at extension. "But," says he, "if we must not extend (*redresser*) the parts,.....is it not desirable to diminish the pressure of the upper parts of the body, and to immobilise as much as possible the parts which have been separated by the caries?" To this question I would answer "Yes". And, in order to effect this diminution of pressure upon the diseased parts, the object of treatment should be to place the spine in a position which allows the superincumbent weight to be supported by the posterior sound parts of the bodies and by the arches of the vertebrae, and, above all, to retain the spine in one fixed position. In fulfilling this object, no force whatever should be used.

When the patient lies perfectly recumbent (prone or supine), the spine assumes the desired position—i.e., the diseased parts are relieved from undue pressure; and, if we can then succeed in fixing the spine, the objects so well expressed by Bonnet will be effected.

In order to maintain the spine in the good position which it has assumed by recumbency, it is necessary not only to preserve the extended position of the portion of the spine above the disease, but also to prevent the part below the disease from arching backwards.

The means of treatment at our disposal are the following: 1. Recumbency: *a.* in the supine position; *b.* in the prone position; 2. Spinal supports: back-splints, etc., in conjunction with recumbency; 3. Plaster-of-Paris, felt, and other jackets, without recumbency.

It has been asserted that, by confining the patient to the recumbent posture, especially in scrofulous cases, the general health will suffer. Experience, however, proves the fallacy of this opinion; for, if recumbency be thoroughly carried out, and the spine also fixed in a good position, the health of the patient immediately and rapidly improves. That the patient should be able to take exercise in the open air, and

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that most of the inconveniences, troubles, and expenses of the sick-room should be done away with, are the points urged in favour of treatment without recumbency. But if, to gain these advantages, we run the risk of interfering with the progress of the disease towards recovery, ought we not to hesitate before adopting such a mode of treatment? Fresh air and exercise are very valuable adjuncts to the treatment of delicate subjects. Fresh air can and should be afforded to patients with diseased vertebræ; but exercise, if it moves the diseased structures, is surely contraindicated in the acute stage of this disease.

Fig. 3.—Showing the natural Curves of the Spine.

Fig. 4.—Showing the disturbance of Equilibrium from Caries.

Fig. 5.—Showing the usual position of the curves in a case of Caries when the Body is held erect.

Fig. 6.—Showing the position of the Curves in a more severe form of Caries than in Fig. 5.

Although urging the desirability of recumbency in these cases, I am well aware that, in a large number of instances among the poor, absolute recumbency cannot or will not be carried out; and then the surgeon must content himself with fixing the spine as thoroughly as possible. But fixation of the spine, combined with recumbency, is probably the best mode of treatment which we can adopt.

The plan of treatment for fixing the spine which is most popular in the present day is, as the reader knows, Sayre's plaster-of-Paris jacket. Since the introduction of this treatment, a large number of children throughout the country, who before that time had received no remedy at all, have been greatly benefited (temporarily at least) by this means of treatment; and there can be no doubt but that this plan, or some modification of it, will yet be the means of curing some cases, and of temporarily benefiting many others. Nevertheless, I do not believe it is the best plan which can be employed; and I shall now point out some of the disadvantages which belong to it.

1. The surgeon is unable to watch the progress of the disease; and, therefore, the angle may increase (from extension of the caries), abscesses may form, and ulcerations occur without his or the patient's knowledge;* and, as the progress of the disease cannot

be watched, the surgeon has no indication for the readjustment of the bandages.

2. Perspiration is checked, and, among the poor, vermin may congregate beneath the casing.

3. It interferes with, or prevents, thoracic respiration, and so favours collapse of the thoracic walls.

4. It retards the growth of the whole trunk, and especially of the thorax, and may thus cause considerable mischief when worn for three, six, or even sixteen to twenty months, without removal.*

5. Suspension is dangerous, and the position which it produces is not maintained by the bandage.

In fact, although the support given by the jacket may be sufficient to relieve the patient from much pain, and allow him to run about, it is not sufficient to prevent enough movement of the spine to cause irritation of the diseased bones.

The use of the plaster-of-Paris jacket, when compared with no treatment at all, or when compared with that very inefficient mode of treatment—recumbency in bed, without any special means for fixation of the spine—appears in many cases at first remarkably satisfactory; but at the same time it is not perfect, and is not the best means of treatment which we have at our disposal.

The majority of the old-fashioned spinal instruments are very cumbersome, very complicated, very expensive, and are inefficient as spinal supports. They are nearly all formed upon the principle of propping up the body by means of crutches beneath the arms, a plan which never thoroughly succeeds, because the arms allow of so much perpendicular movement that fixed points are not obtained.

Back-splints of leather and other materials, moulded to the body, may, with great care and attention, serve every purpose that is required; but the apparatus which best fulfils all the requirements of these cases is that invented and used by Mr. E. J. Chance, at the City Orthopædic Hospital, and which I have named the "Skeleton Adaptable Metal Splint." It consists of two light metal bars passing from a pelvic belt upwards, one upon each side of the spinous processes of the vertebræ. These bars are bent to accord with the angle

Fig. 7.—Posterior View of the Splint in Position.

Fig. 8.—Postero-lateral View.

of deformity, and they reach as high as the second or third dorsal vertebra. Fixed to the upper ends of the bars is a pad, to which is attached shoulder-straps. At the angle of deformity, each bar is separated from the back by a pad. Between the angle and the pelvic belt is another pad, to which is attached straps, which extend to an abdominal belt. Between the projecting portion of the spine and the pelvic belt, the bars do not fit into the curve of the back, as it is not desirable to perpetuate that curve, but, upon the contrary, it is of advantage to control the tendency to curvature, and the abdominal belt acts in such manner (Figs. 7, 8).

The effects of this splint are as follows. 1. It fixes the spine in a good

† Even if the jacket be removed and reapplied frequently, still, growth is not permitted to proceed, because the evil is kept up by the reapplication of the jacket.

* I have seen instances of each of these occurrences.

position; the mechanical bearings being shown by the arrows in the figure (9). 2. It favours thoracic respiration (a very important point in severe cases). 3. It can be accurately adjusted and readjusted by the surgeon himself. No other apparatus that has yet been made generally known possesses these qualities, and all others have disadvantages which do not belong to this one.

Fig. 9.—Lateral view of the Splint in Position.

With regard to the adjustability of this splint, it may be observed that, although the spine may be fixed in a good position upon one day, it does not necessarily follow that it will be desirable to attempt to maintain it in that position until the disease has ceased, and the bones have become ankylosed. On the contrary, resolution is almost sure to be accompanied by a slight and gradual alteration of the position of the bones; and it is for the frequent adaptation of the splint to these alterations of the diseased spine that the skill and ingenuity of the surgeon are required.

Good results, as the reader well knows, are often obtained when the spine is fixed by other forms of apparatus than that which I have described, and in all cases a good result doubtless depends chiefly upon the care and attention which is bestowed upon the case, both in the

surgical treatment and in the nursing; but at the same time the more efficient the mechanical apparatus the greater chance will there be of a cure resulting, and, practically as well as theoretically, the splint described in this paper is, I believe, by far the best which we have at our disposal.

Dr. C. F. Taylor's antero-posterior support somewhat resembles in appearance the splint described above; but it differs from it in many important points. Dr. Shaffer's modification of Dr. Taylor's splint appears more likely to prove useful for controlling the spine; but both Dr. Taylor's and Dr. Shaffer's instruments are very inferior to the apparatus which is advocated in this paper. So long as the disease remains in an active condition, the patient ought to be kept constantly in a recumbent position.

The superiority of the prone position over any other was long ago shown practically by Verrall.

Mr. Chance has carried out this plan of recumbency ever since Verrall's time, and Mr. Erichsen has for many years recognised its value. The best proof which I can offer as to the superiority of this plan, is the fact that the patients almost invariably experience much more comfort in the prone than in any other position, especially if they be placed upon a suitably made prone couch. And at the present time I have a patient with a very severe degree of caries, who, when I first saw him, was resting upon his elbows and knees, and who had remained in that attitude (which he had assumed voluntarily) for more than six months.

THE EARLY DETECTION AND TREATMENT OF SPINAL CARIES.

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AN affected spine too frequently receives no offer of therapeutic aid until its pathological bankruptcy is declared; whereas, judicious assistance, afforded at the proper time, might have spared a shameful collapse. In the early and comparatively obscure stage of spinal disease, the surgeon is too apt to assume a hopeful attitude, or to temporise; and then, later on, when a projecting spinous process appears, to say: "Tis as I feared; there is disease of the spine." So angular curvature has come to express spinal disease; and spinal disease is expected to manifest itself by angular deformity. Such an association of ideas is most unfortunate. Surely, the angular deformity is the one sign of spinal disease which our treatment itself should aim at precluding.

Let me give a parallel instance of a disease and diagnostic sign, with a similarly unhappy association. One's opinion is asked as regards the practicability of operative interference in mammary scirrhus, which has advanced so far that the mass adheres to the chest-walls, or the skin is bound down to the ribs. On suggesting that the case is past all surgery, one is told that the enlargement of the axillary glands—that confirma-

tion of the diagnosis of malignant disease—has only recently taken place. Unfortunately, the attendant has waited for the lymphatic invasion before deciding on the malignant nature of the breast-tumour: just as he might have waited for the angular curvature before diagnosing with certainty the spinal caries.

And I will now venture to institute another comparison—viz., between the spinal column and the knee-joint. In the latter cases, we have a short series of bony segments with intervening layers of cartilage; in the former, a long series. I will grant that the knee-joint is much more accessible, both for the purpose of examination and treatment, than are the spine-joints: for, in the lumbar and dorsal regions, the joint-segments lie well within the ventral and thoracic cavities, the better to support the superimposed weight; indeed, one can only just get at the tips of the spinous processes between the masses of the erector spine. Side by side let us trace through the various stages, from their very beginning, a case of knee-joint disease and one of spine-disease.

The two children, who are the subjects of them, may have been healthy; they may have been strumous; but, some months ago, one of them fell from a cart: that is the spine case. A few days ago, a boy was pushed down and hurt his knee. Let us watch this patient. He does not run about as he used to do, because his leg (not necessarily his knee) aches. He does not know exactly where the chief trouble is; children are not clever at locating pain; but, when he stands, he bears all his weight upon the other leg. The boy with the traumatic inflammation of the spine also complains of obscure aches and pains, which are very probably ascribed by his parents to "rheumatism", and perhaps even treated as such. It may be that the pains are referred to the chest, belly, or limbs, from irritation of the trunks of the nerves as they are passing out from the spinal cord. He does not care to run about, but complains of feeling tired, and lies near his mother, or on the hearth-rug. When he stands, he eases the inflamed joints by resting his arms over a chair, or anything else that may support him; and when he sits at meals, regardless of manners, he plants his elbows on the table, and supports his chin on his hands. If he be a little mite, he hooks his chin over the edge of the table. Very likely he cries when he is lifted off his chair or taken out of his bath. As he stands, he props himself up by grasping the thighs, just above the knees. But, as yet, there is no definite spinal projection.

Let us now return to the knee. Later on, its function becomes impaired. It refuses to work during progression, remaining always slightly bent, so as to save pain and jarring—and the patient limps along on the tips of his toes. Effusion has taken place; and the flexor muscles are assuming a condition of permanent contraction, partly because the flexed state of the joint minimises the intra-articular pressure, partly that there may be the least chance of a jarring together of the inflamed synovial or osseous surfaces.

So also with the spine, does flexion eventually come on: partly from muscular action, partly as the result of disintegration of the vertebral segments. But the definite angular deformity, as in the case of the diseased knee, is but a late sign of the occurrence of inflammatory changes. Now, what should we think of a student who was unable to diagnose knee-disease before the joint had permanently assumed the appearance of a fiddler's elbow?

If still we have not made up our mind as to the presence of the spine-disease, let us watch the little patient come down stairs, noticing how he eases himself down by the rails; let us see if he will jump from the bottom stair, or if he can touch his toes without bending his knees. Or, let us find out what has become of his hoop, top, or marbles, according to the season of the year: for children's out-door games succeed each other in regular chronological order. He has not lost his active appreciation of boyish delights, simply because he has "growing pains" or "rheumatism". Indeed, when he is eventually placed on his back in bed, he will have his whip or top put where he can watch it.

It may possibly be thought by some that much of this which I am now detailing is irrelevant to the subject of the early detection of spinal disease, or, at least, of so trivial a nature as to be unworthy of serious attention. I must, however, insist upon the urgent necessity of giving heed to these little matters. They are the straws which show the direction of the on-coming breeze; when the pathological storm is raging, almost any one can read the weather. To those who interest themselves in the ways of healthy as well as of sick children, these little matters are full of indications and suggestions. Unlike adults, children cannot often afford the surgeon much direct aid in making a diagnosis; but they are not, on the other hand, malingersers. The art of shamming illness does not usually manifest itself before they begin to experience the obstruction of the fifth proposition of the first Book of Euclid; or, until, in some way, their little educational burden is becoming intolerable. Therefore we must never refuse to listen to, and search out the cause of their oft-repeated complaint: "Oh, mammy, my belly does ache!" or