

**Caries of the spine : being an advance chapter of The spine its deformities, debilities, and deficiencies (third edition now in press) / by Heather Bigg.**

**Contributors**

Bigg, Henry Robert Heather, 1853-1911.  
University College, London. Library Services

**Publication/Creation**

London : J. & A. Churchill, 1902.

**Persistent URL**

<https://wellcomecollection.org/works/gkb5amrf>

**Provider**

University College London

**License and attribution**

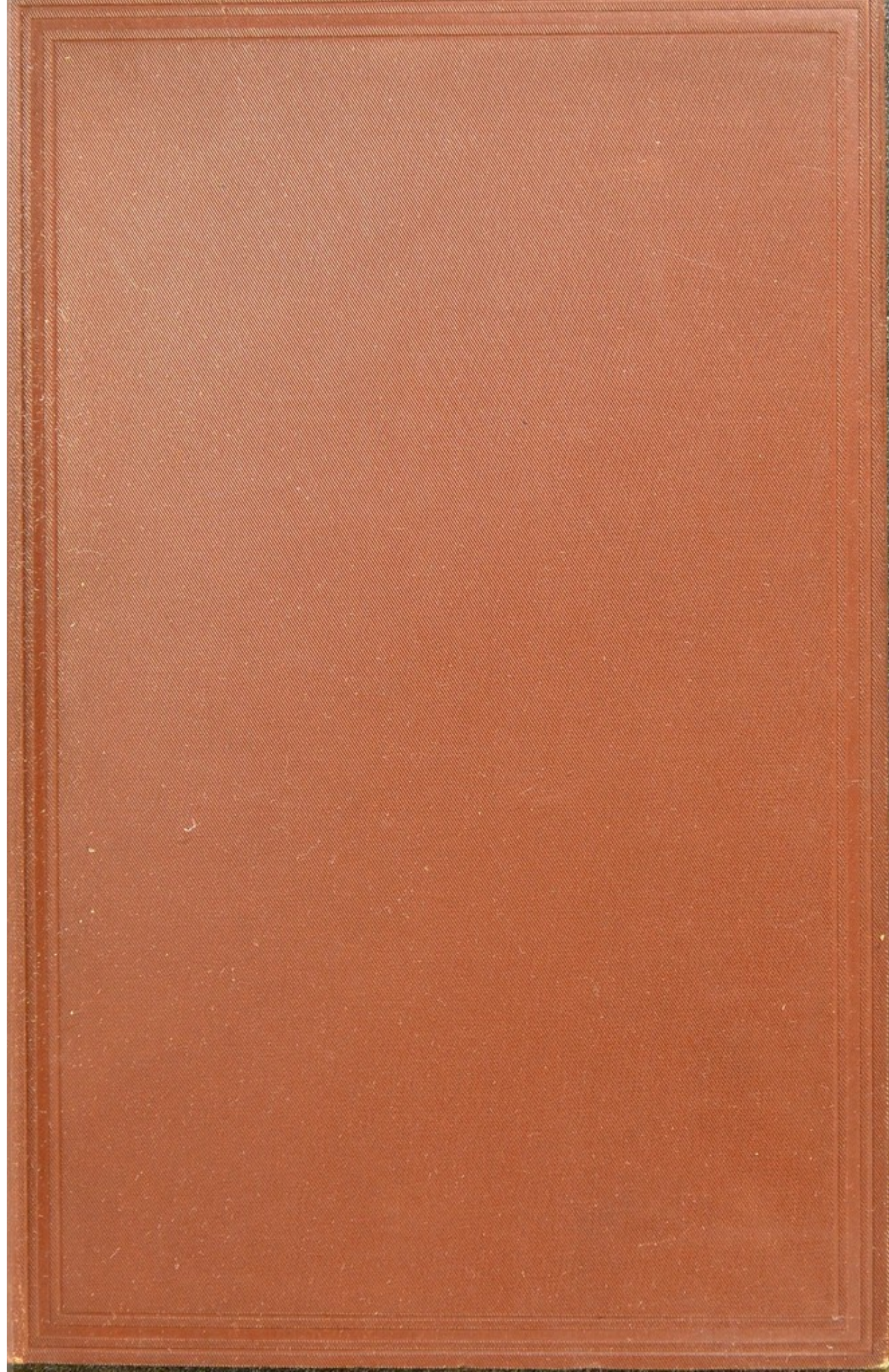
This material has been provided by This material has been provided by UCL Library Services. The original may be consulted at UCL (University College London) where the originals may be consulted.

Conditions of use: it is possible this item is protected by copyright and/or related rights. You are free to use this item in any way that is permitted by the copyright and related rights legislation that applies to your use. For other uses you need to obtain permission from the rights-holder(s).



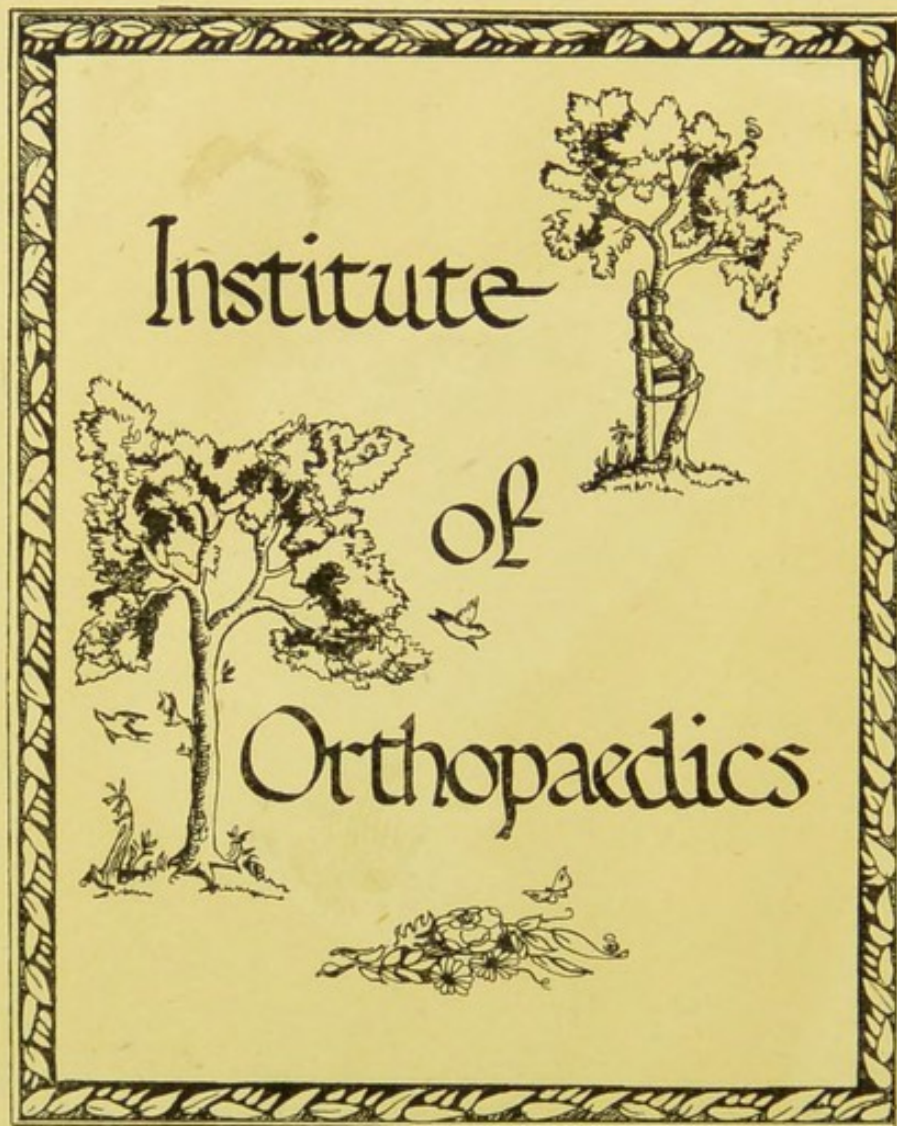
Wellcome Collection  
183 Euston Road  
London NW1 2BE UK  
T +44 (0)20 7611 8722  
E [library@wellcomecollection.org](mailto:library@wellcomecollection.org)  
<https://wellcomecollection.org>







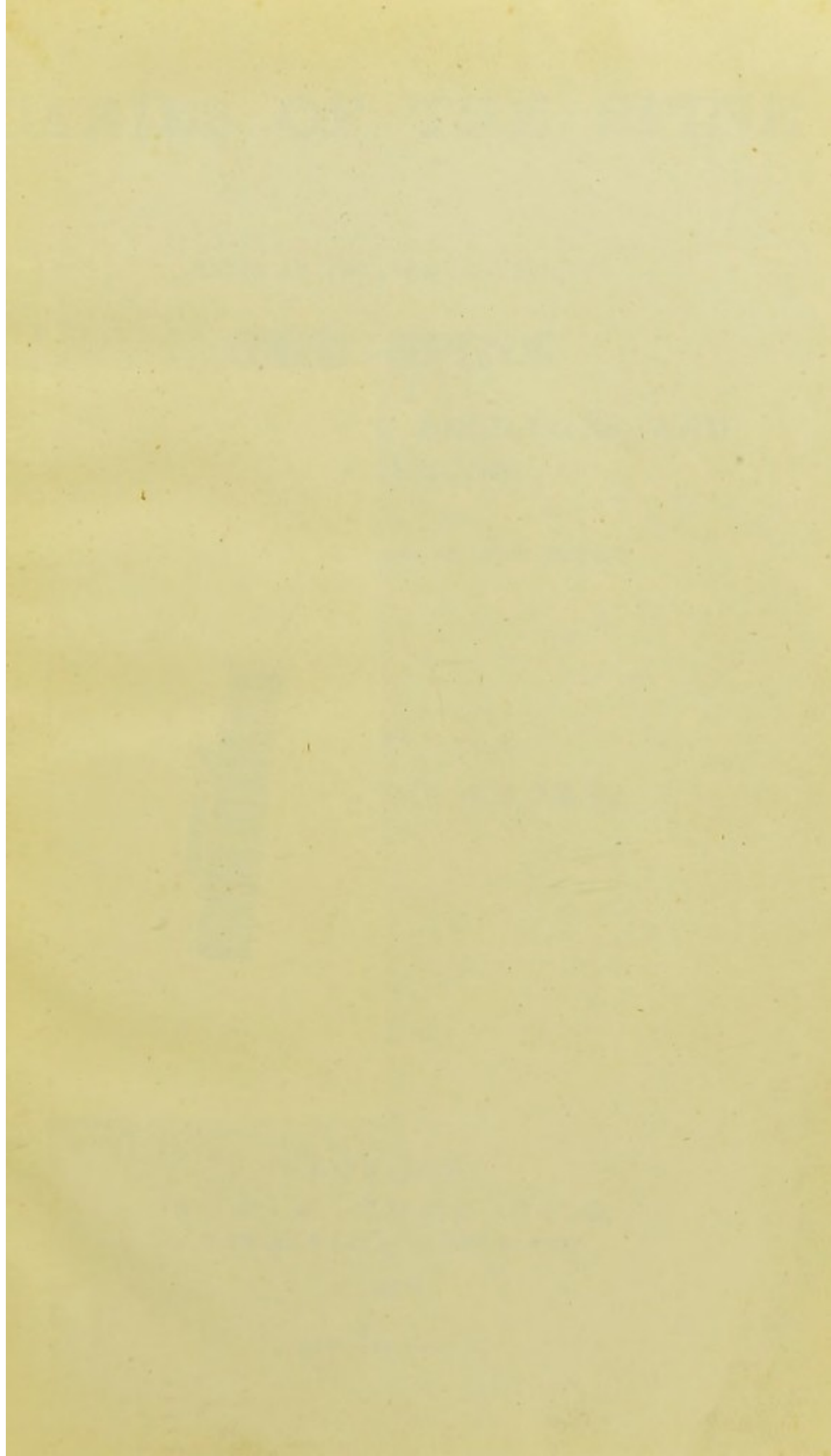
15/10/49




For Reference Only  
Glass Case.

SC WE BIG

C







Digitized by the Internet Archive  
in 2014

<https://archive.org/details/b21290684>

# CARIES OF THE SPINE

BEING AN ADVANCE CHAPTER OF

## THE SPINE

ITS DEFORMITIES, DEBILITIES, AND  
DEFICIENCIES

(THIRD EDITION NOW IN THE PRESS)

BY

HEATHER BIGG, F.R.C.S.ED.

LONDON:

J. & A. CHURCHILL  
7 GREAT MARLBOROUGH STREET

1902

*(All rights reserved)*



## PREFATORY NOTE.

---

THE following pages are only those of an "advance" chapter of my work on the Spine, the previous editions of which have appeared in 1880 and 1882. They require, therefore, nothing in the way of preface beyond, perhaps, this one remark, that whereas my earlier works were based principally on what I had learned from others and on generalisations drawn from my father's and my grandfather's case-books, this present issue is entirely founded on my own actual experiences. Those who are young and who attempt the treatment of very broad subjects seem almost always constrained towards compilation from their predecessors by the very common and obvious process of medico-literary absorption; those, however, who have grown older in practice can claim to deduce their rules and their principles from personal practice and observation.

HEATHER BIGG.

56, WIMPOLE STREET;

*June, 1902.*



## SECTION I.

### CARIES OF THE SPINE AND ITS DESCRIPTION.

**Name.**—The disease, which is variously known as angular curvature, Potts' disease, or caries of the spine, arises from a local disintegration of the bones and ligaments of the vertebræ. The first of the above names is derived from the very obvious nature of the ensuing deformity, the second, from the fact that Percival Potts issued in 1779 a small paper-covered pamphlet (now exceedingly rare) in which the symptoms were correctly described; and the third name is derived from the fact that more modern investigators have christened the disease from its pathological origin. It is by this last name that it should with the greatest propriety be designated.

**Nature.**—The disease, regarded solely by the results that ensue from the softening and the yielding of the bones of the spine, as well as from the uniform method of treatment that this condition requires, may perhaps rightly be designated under the single head and name of caries. But without going into pathology, it will be seen later on, when the process of bony softening comes to be considered, together with the nature and the disposal of the *débris* that ensues from it, that caries includes actually three different affections. In the first, there is no obtrusive accumulation of *débris* at all, and this type is known as "dry" caries; in the second, the *débris* accumulates in a cheesy, infiltrating mass, and this type may be known as "cheesy" caries; whilst in the third, the *débris* gathers into an encysted abscess which tends to burrow amongst the tissues, till it finds an opening on the surface, and this type may be known as "suppurative" caries.



From their very nature, these three types will exhibit very distinct variations of their accessory symptoms. Still, as in all of them the spinal bones soften and in time yield, the disease from that sole point of view may be regarded as a single one under the designation of caries, and its general details may to begin with be so described, whilst the modifications that form the different types of the disease may be taken into separate consideration as occasion requires.

**Origin.**—It has been a comparatively recent matter of debate as to whether caries is of traumatic or constitutional origin, that is to say, whether it is determined by some such cause as injury from a blow, or a wrench, or a fall, or whether it is dependent solely upon some unhealthy condition in the constitution. I incline to the belief that both these causes are responsible in different cases in different degrees. It is certainly most common to find that sufferers from caries are of strumous or tuberculous diathesis, and it is equally certain that constitutional treatment is always with advantage adjoined to the surgical treatment of the actual spine. On the other hand, it has been asserted (although my own statistics do not accord) that the disease is far more common in boys than in girls,—presumably because the former are rougher in play. And further, it would almost seem that the parts of the spine that are most liable to injury by wrench or strain are the ones most commonly attacked. Hence it would appear that actual injury is also a determining factor of an attack, but conjoined, as I take it, with some constitutional proclivity.

**Age.**—As to the age of access, spinal caries has been stated by some authorities to be essentially a disease of childhood. This is certainly not so, for though without doubt it is far commoner in children than in adult persons, and may even originate at or prior to birth, yet it is not infrequent between the years of twenty or thirty, nor would it seem that there is any time of life at which rare instances may not be met with. Not long since I was called to see a quite typical example in a woman of almost sixty years of age living in a high healthy village on the Berkshire Downs.



**Spot.**—As an almost absolute rule, only one single spot in the spine is attacked, although several contiguous vertebrae may be involved. Personally, I have never known two separate spots on the spine attacked simultaneously, although there seems no reason whatever why such separate spots of disease should not co-exist. But I have once seen a second attack occur at a new spot many years after the original spot has been healed, and I have also seen a recurrence at an original spot years after a cure has been apparently effected. Such cases are, however, most rare.

**Course.**—To completely embrace all the possible symptoms of caries, and to rightly appreciate all the contingencies of treatment, it is best to take in review the entire course of a persistent and untreated case of the disease from its simple outset to its presumed fatal termination. Such a course should never now-a-days be possible in entirety, seeing that the disease should be capable of being checked by proper treatment at any particular point, but it is not so many years since that the reverse was the case. The following description therefore is to be taken rather as an old map of what used to be, than as a present record of what now needs to be, at all events in the common run of cases.

The two first symptoms that as a rule arrest any attention to mischief in an incipient case of caries are, pain distinctly assignable to the spine, and a peculiar fixity of attitude which is adopted to save the trunk from all jar and movement. There may be the history of a fall or of a wrench to the spine, which some months previously has caused temporary hurt, but which in a day or two has become fugitive and forgotten. There is, however, at this time absolutely no deformity or prominence to be observed along the course of the back.

**Pain.**—As regards the pain, it is not always referred to the spine itself. In little children who lack adequacy of language it is often described as stomach-ache; in adults it may be so defined as to be recognisable as “girdle” pain, or it may be referred to some area of distribution of the sensory spinal nerves. On the other hand, the pain may



actually be acute over the very seat of the incipient disease. Be this as it may, it will be usually found that if the first and second fingers are passed firmly down the spine, one finger being on each of the spinous processes, a spot will be reached at which the patient will flinch from pressure, and a firm and pointed trial with the finger-tips will, in all likelihood, locate a point of extreme tenderness. Pressure over the actual spinous processes is most often painless, although percussion there may by simple jar cause flinching; and it is rather by deep-seated fingering between and around the spinous processes that the point of painfulness may mostly be fixed. This pain, however, must not be confused with a deep-seated muscular pain that is not uncommon in the *erectores spinæ*, and which can be generally discriminated by its extension upwards and downwards over a much longer distance than the pain of caries.

**Heel-jar.**—Apart, however, from pain on pressure or percussion, there is practically always a flinch from pain on “heel-jar;” indeed, this test (taken, of course, together with other diagnostic symptoms) is in my experience one of the most sensitive of all indications for obscurely incipient caries. The way of evoking its information is extremely important. If the patient is a child and too young to stand he is laid supine upon a couch with the legs extended together, and the adjacent soles of the feet are then struck by the examiner’s hand—gently at first, but with greater pronouncement afterwards, whilst the face is watched for any signs of flinch. In this way a gradual though gentle jar is transmitted through both legs to the spine in a manner similar to that used on the leg in testing for hip disease. If however the patient is old enough to stand, the procedure is different. He is placed erect on the floor of the room, made to rise on tiptoes, and then to sink suddenly so that his heels strike the floor and shake the room. As demonstration is generally easier than explanation, it is best for the examiner to go through this method himself, and then to get the patient to copy him—gently at first, but more roughly afterwards. In this way, the slightest sign of flinch on heel-jar is readily observable.

One word of warning is necessary concerning a plan of



making a similar test, advocated by Professor Sayre of New York, a quarter of a century ago. In a work that may now almost be considered obsolete, he advocated that the examiner should place his hands on the head of the patient, and “then pressing the bodies of all the vertebræ together, the child will cry out on account of pain.” I can only say that such a violent procedure is liable to produce direct injury to a tender spine, and that the gentler and graduated method I have indicated is much more effective and very much more safe.

**Hyperæsthesia.**—A familiar symptom that is frequently quoted as diagnostic is a heightened and refined sensibility of the skin to variations of heat and cold, as well as to direct touch over an area around the diseased spot. This doubtless is often to be found, but as it is likewise present in cases of hyperæsthetic and irritable spines, unaccompanied by caries, I cannot regard its presence as in any way distinctive.

**Attitude.**—As a consequence of pain and in order to shirk it, a peculiarity of bodily attitude and a cramped restraint from movement gradually become apparent in the patient. In the earlier stages this may be scarcely recognisable except to the practised eye, but later it is usually so marked that all the muscles of the body are rigidly exerted to keep the spine quiescent, and the trunk becomes held in what has been termed “a muscular splint.” In walking about, this enforced fixity is characteristically apparent; the patient shuffles along with a cautious gait so as to avoid all jar, and will seize any handy piece of furniture, both to steady the body and to ease the spine of its weight, or, failing this, he will place the hands on the thighs so as to carry and lessen the burden of the trunk. If now any object is thrown on the floor and the patient is desired to pick it up, he will do so by flexing the knees and lowering the body, till the hand reaches the floor, instead of bending the whole body forward in the natural way; in other words, instead of stooping, he squats. If he sits upright in a chair, his arms are employed in supporting the trunk, and his disposition is always towards lolling into rest or towards seeking the recumbent pose on any convenient couch.



**Breath-catch.**—Whilst the voluntary movements of ambulation are thus cautiously guarded, so also the involuntary ones of respiration are subject to hesitancy, a thing which leads to a symptom that is most diagnostic, and which may be termed the "breath-catch." It is produced in the following manner. The movements of respiration as they extend the spine are usually rather a relief from pain than otherwise, and are therefore freely performed; on the other hand, by expiration the ribs are lowered, and the vertebræ drop into painful compression if their substance is tender. As a result, the outgoing breath is suddenly checked half-way by an instinctive or reflex closure of the larynx, which latter however is immediately opened again with a sound like a short smothered cough, and the rest of expiration is more deliberately completed. This breath-catch has been termed a *stertor*, but that it is not truly so its mode of origin evinces. The symptom, however, before caries has reached the incontrovertible evidence of bony deformity, is, like heel-jar, of great diagnostic value. It is, of course, best noticed when the patient is standing, for in recumbency it may entirely disappear; further, it is needless to say that, from its respiratory origin, it is most obvious when the carious attack is in the dorsal region.

**Deformity.**—In mapping out the course of an ordinary case of caries, I am presuming that the symptoms occur in their most common order, and that those previously described would be present before any bony deformity had arisen. Of course, when once the characteristic yielding of the bone shows itself, diagnosis is clear; but it is before this actually occurs that the preceding symptoms are of such value in determining the nature of the disease, which, it is needless to say, should be caught for treatment at its earliest possibility.

Similarly, I am presuming that the symptoms to be described later on, supervene after bony deformity has become apparent; but this is by no means always the case, as, in rare instances, paralysis, which I have placed the last in the list, may show itself first, whilst all the other symptoms are masked or even absent. I only refer to this point in passing,



as I shall presently have occasion to deal with it more fully (p. 61).

The deformity of caries supervenes when erosion of the vertebræ (and concomitantly of the inter-vertebral discs) has reached such a point that their material substance is incapable of any longer sustaining the super-incumbent weight of the body. As a consequence of this, their structure gets crushed into yielding; and as it is usually their anterior parts that are affected, and as also the articular facets help to dictate direction, their lapse is almost invariably purely antero-posterior; at all events it is so at the outset. It is true that a patient, even in the early stages of the disease, will frequently stand tilted all to one side, but this is usually only an accommodative easement of attitude, and must not be confounded with lateral yielding at the diseased spot; the distinction is readily made, if the patient is laid prone on a couch, when attitude will be eliminated. The spine, as can be seen in Figs. 19 and 20, may yield enormously in an antero-posterior direction without the slightest lateral deviation; in some rare old-standing instances both lateral and rotatory deviation may be met with as well, but this arises as a rule after the original deformity.

The amount of deformity caused by caries depends largely on its situation in the spine. In the concavities of the upper cervical and lower lumbar regions, it may be so small as to be only recognisable by the fingers as a slight thickening or displacement; it is chiefly in the full convexity of the dorsum that those characteristic changes are to be observed, which have given to this curvature the title of "angular." Here, one (or more) of the spinous processes begins to project backwards out of line, and the natural interval between it and its fellows becomes widened (Fig. 18), whilst, as the surface-planes of the body of the affected vertebræ converge in front, an actual angle of error is formed in the true course of the spine. As a result of this change, not only are the spinal nerves nipped and dragged on, but also (as the height of the body diminishes) the thoracic and abdominal cavities collapse, and their contained organs become affected in such a way as to produce what I have termed and described elsewhere as the secondary symptoms of spinal curvatures. It



may also be added that there is often a certain amount of inflammatory thickening in the tissues around the carious parts, which rather hides than accentuates deformity.

**Débris.**—No destruction of tissue can take place without the formation and disposal of *débris*; and it is this consideration that brings me back to the statement I previously made, that three quite separate diseases have, from the angular deformity they produce, as well as from the similarity of their surgical treatment, long been grouped together under the single name of caries, although in actual fact they are quite distinct. Apart from their intimate pathology (which I leave to others) their differences can be immediately appreciated by the ways in which their *débris* is disposed of, a point which I have illustrated in the adjoining diagrams, and which I will now briefly describe in main, leaving the details to be more fully dealt with when I come to the subject of 'Treatment.'

In **dry caries** (Fig. 1) the *débris* of erosion is cleared off as fast as it is formed. There is therefore no encroaching accumulation, and consequently no obtrusive pressure on any of the adjoining parts, and in particular no interference with the spinal cord. An accidental post-mortem specimen simply shows the body of the affected vertebra to be honey-combed into cavities which are filled with working granulations, and in which the cell-builders of the body are attempting to replace the eroded tissues. When a vertebra is sufficiently undermined to give way, it does so in the angular manner that has previously been described, and that is all. Any of the symptoms that have been hitherto detailed may be found, but none of those that are to be presently considered. In short, there is no abscess, there is no paralysis.

---

The figures on the opposite page are diagrammatic only, although based on actual specimens. FIG. 1 shows the absence of all obtrusive *débris* in "dry caries." FIG. 2 exhibits the mass that very commonly grows to impingement on the spinal cord in "cheesy caries." FIG. 3 portrays an abscess in "suppurative caries" which has worked backwards to nip the spinal cord, but has then escaped forwards so as to relieve the cord from pressure. FIG. 4 illustrates the commoner course of such an abscess and its passage forwards without interference with the spinal cord at all.



FIG. 1.

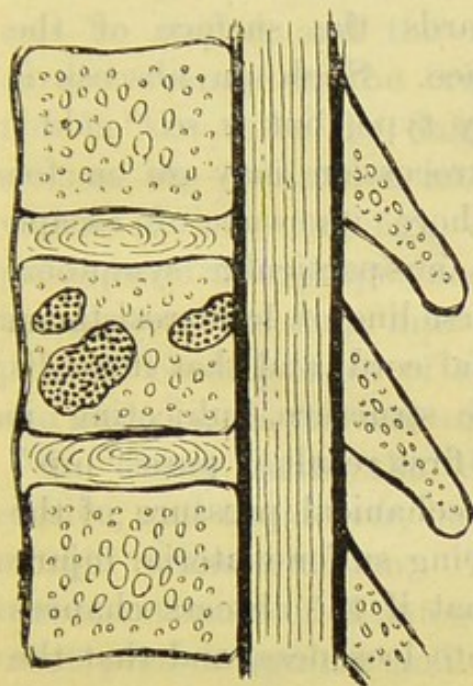


FIG. 3.

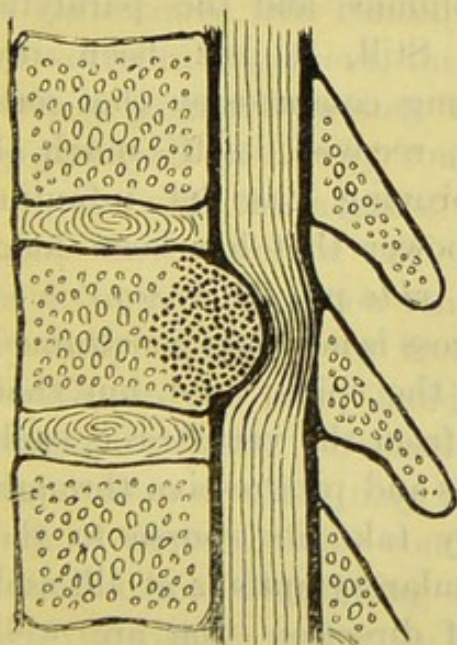
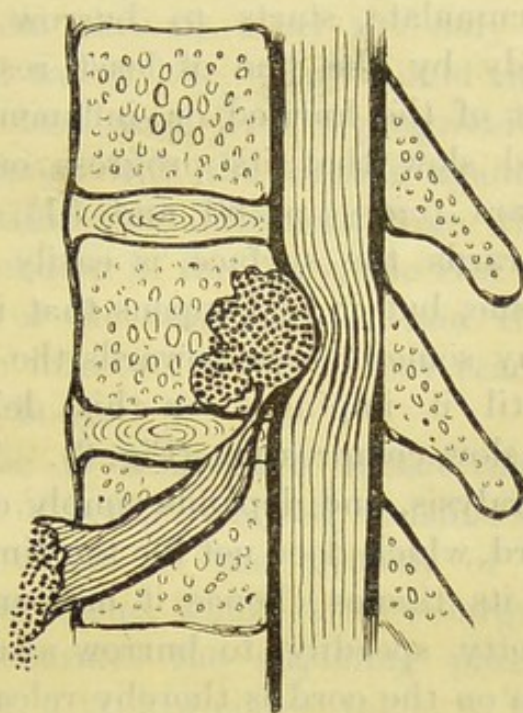


FIG. 2.

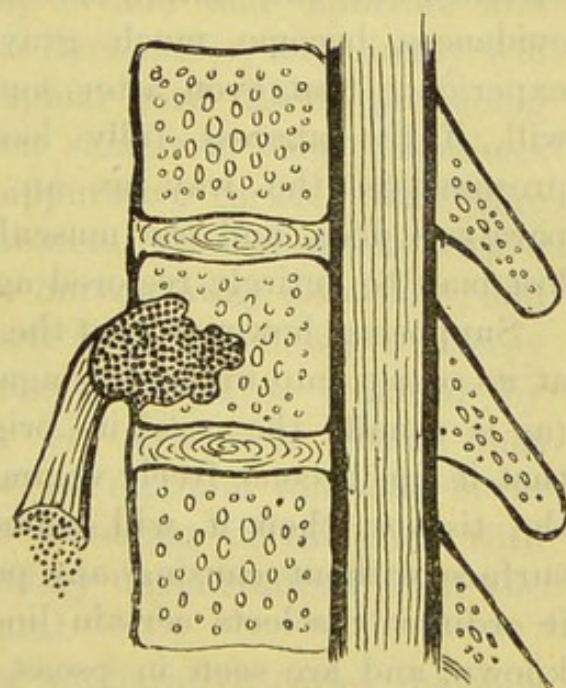


FIG. 4.



In **suppurative caries** (Figs. 3 and 4) the *débris* of erosion is not cleared away by absorption, but, on the contrary, it is carefully collected by the cell-workers of the body into an encysted *abscess*, which, as its contents accumulate, starts to burrow towards the surface of the body by the line of least resistance. Such an abscess is not of the hurried or inflammatory type, but is so "cold" and slow that its progress or retrocession may go on for years (*vide* pp. 50 and 51). Where its way of escape towards the surface is easily free no particular symptoms ensue, but it so happens that its first line of least resistance may sometimes be towards the spinal cord, and that it swells until it impinges on this delicate structure, subjecting it to slow compression (Fig. 3). The first result is pure "nip" paralysis, and depends simply on mechanical pressure of the cord, which does not for the time being suffer material injury to its tissues; hence it happens that if the abscess chances pretty speedily to burrow away into looseness, and that the nip on the cord is thereby released, it will be found that the paralysis soon clears up. On the other hand, if the nip is long-continued the tissues of the cord will become locally softened in the antero-lateral columns, and the paralytic evidences become much graver. Still, it has been my experience that even after some long compression the cord will, if the abscess fully loosens, recover itself—much, I presume, in the way as an improving case of infantile paralysis does, and the muscular power that has been long lost may be entirely restored again (*vide* pp. 62 *et. seq.*).

Supposing, however, that the abscess is not thus constrained at its outset into impinging against the spinal cord, but that (as is usually the case) its origin from the vertebræ is such that it can become freely voluminous and progressive through the tissues, then it will commonly take its course to the surface without causing any particular symptoms at all, and it ordinarily selects certain lines of direction that are well known, and are seen in psoas, lumbar, and retro-pharyngeal instances. Vagrancies of direction are not altogether rare as exceptions, and an abscess may work its way to almost any part of the trunk, neck, and thigh, or even of the upper arm. I have seen a dorsal abscess also traverse the entire medias-



tinum, and open in front by the side of the sternum without in the least degree perturbing the organs of the thorax, and other curious variations from the ordinary course are to be met with.

As a general rule, however, the progress of the disease can be stayed, and the abscess shrivels away till only a corded vestage of the original sac is left. But should this not be the case, the dangers that arise from a progressive abscess are—obtrusive interference with the organs against which it may impinge, constitutional detriment from the presence of a large pus accumulation in the body, the risk of the abscess bursting into any of the vital cavities, and the pyæmic consequences of septic infection when it may reach and open on the surface of the body.

In **cheesy caries** the disease is infiltrative rather than erosive, and the *débris*, instead of being removed, remains in morbid transformation. The result is the growth of a tumescent mass of disintegrating tissue, which in its enlargement presses against and degenerates the adjoining parts. To leave pathology on one side, a typical course taken to its extreme results is somewhat as follows. The disease will generally begin in the posterior parts of the vertebræ, and its tumescence will consequently invade and infiltrate first the vertebral ligament, then the dura mater, and finally will swell in pressure against the spinal cord itself, producing nip-paralysis in a way somewhat similar to what sometimes happens with the abscess of suppurative caries. But there is this distinction, a carious abscess when it meets with a check in one direction tends to burrow away elsewhere, and generally manages to free itself into looseness; a cheesy growth, on the other hand, unless checked or removed by treatment, swells pertinaciously on, and so it ensues that compression-myelitis may follow on nip, and this may be in its turn succeeded by complete softening of the cord with ascending and descending secondary degenerations until the paralytic results may even be fatal.

Broadly, then, the gravity of suppurative caries depends principally on its septic consequences if it bursts; that of cheesy caries on its paralytic consequences as it swells. And there is another point of distinction between the two. In suppurative caries the bone is (if I may so express it) very



largely fed on, and is, as the abscess increases, rapidly eroded; consequently some very pronounced and angular deformity may arise long before any abscess can be detected. On the other hand, in cheesy caries the disease may affect and weaken the bones so slightly that there is no deformity at all, and the paralytic results of cord pressure are positively the first marked symptoms. Indeed, I have frequently seen cases that have originally been diagnosed as ones of infantile paralysis, so slight or smothered were all carious signs. Hence I incline very strongly to the opinion that nearly all cases of caries in which paralysis has been the first very evident symptom are those of the cheesy type.

**Paralysis.**—The paralysis of caries is primarily motor, as indeed it is bound to be from the fact that the antero-lateral columns of the cord are the first to be involved. The motor power is not suddenly lost, but as a rule fades slowly away. To take a typical dorsal case, there is at first mere weakness and dragging of the lower limbs in walking, which so increases that the sufferer ultimately becomes unable to stand although the limbs still retain their power of movement in recumbency; finally this latter power disappears, and there is entire impotence of motion. Sensibility is not up to this point deranged, as far as the spinal cord is concerned, although there may be patches of cutaneous numbness, as well as the referred pains which have previously been described as being due to the involvement of the spinal nerves in an angular curvature. Generally also by this time the disease has been checked by early treatment, and a recovery of power as gradual as its original failure begins to occur. But should this unhappily not have been the case, the next stage is that the limbs, instead of remaining passively flail-like, begin to show muscular rigidity when they are handled, which rigidity slowly becomes marked and permanent. This is next followed by spasmodic contractions of the hip, knee, and ankles, whilst the adductor muscles are also similarly affected. Even at this stage the walking powers may commence to be restored, although the patient presents a pitiable appearance, struggling along with bent knees, contracted heels, and legs so “scissored” that they can scarcely be made to pass each



other in the step. The further stages, I have never had the misfortune to meet with in my own practice, but they may be briefly recorded as follows: continuous pain in the limbs, loss of control over the bladder and rectum, formation of bed-sores, inflammation of the bladder, blood-poisoning, and death—in short, the well-known sequences of fatal paralysis.

The consideration of the varying muscular areas affected, according to the spot of attack in the cord, as well as the responses of the muscular reflexes and reactions, I purposely omit, as unneeded in a work of this kind.

**Mortality.**—From what has previously been written, the presumptive chances of a fatal termination are obvious. In suppurative caries an extending abscess may press on some vital part, as suffocative retro-pharyngeal ones will sometimes do; or it may burst into the vessels and produce fatal hæmorrhage; or it may break into the vital cavities and cause pleurisy, pneumonia, or peritonitis; or it may burst on the surface of the body and becoming septic initiate blood-poisoning; or its constitutional drain may produce fatal exhaustion. On the other hand, in cheesy caries, the injury to the cord and its membranes may entail fatal paralysis, or cause meningitis. Yet notwithstanding this long list of threatened risks, death from caries should now be very rare, as both the suppurative and the cheesy expansion can be stopped if cases are caught early and rightly dealt with by modern methods. That this has only recently been possible is shown by the older statistics. Mr. William Adams, whose considerable practice extended over half-a-century, gives his fatal figures at 5 per cent. with children, and 20 per cent. with adults, but his records were made before asepticism had asserted its hold, and further, they may have included his hospital cases at a time when the children of the poor were treated as chronic out-patients, and could not obtain at home the proper sustenance to enable them to cope with the disease. In the present day institutions are increasing in which such children can have the nutritive advantages of in-patients' treatment, and that too in localities where free air and sunlight afford them material constitutional aid. All things considered, the mortality from caries should have recently much



diminished, and from my own experience it should certainly not touch in private practice 1 per cent., and should even be much less.

**Treatment of Caries.**—Having completed the description of caries in its possible course from beginning to end, and having also previously affirmed that the disease should be capable of being checked at any point in its course at which it can be caught for treatment, the question now arises as to what are the problems that have to be met, and how are they to be dealt with. They fall under two heads, reconstruction and cure. The one aims at stopping the deforming collapse of the vertebræ, and at getting such substantial repair of their substance as may render them strong again for future service. The other aims at getting rid of the process of disease and clearing away the results of its *débris*. These two things are so closely akin that they might be regarded as one, were it not that the public (that is the friends or parents of the patient) centre their view chiefly on the deformity, and that their commonest question always is “how can this bony prominence be stopped from getting worse?” whilst the surgeon, seeing farther, rather regards the cure of the disease itself, against which a little deformity more or less scarcely seems to count for so much in the gravity of balance.

The treatment of caries, moreover, whilst it has these two aims, conjoins also two methods of treatment—the mechanical and the constitutional. For the spine which has been eroded into yielding is in exactly the same surgical condition as a bone that has been fractured, having two sound parts meeting at an injured spot; and it will therefore require in a similar way some form of splint to keep the parts fixed in quiescence and freed from strain until the process of reconstruction has taken place. But with an ordinary broken bone the tissues at the seat of fracture are healthy and reparation begins to proceed immediately. With a carious spine, on the contrary, the seat of lesion is in diseased tissues, and before reparation can take place, fully and firmly, these tissues have to be restored to a state of health. Hence it is that the constitutional treatment has strenuously to be superadded to the



mechanical, so that the two working together may bring about reconstruction of the bone and cure of the disease.

But in the great majority of cases, even when this has been satisfactorily effected, it is only the first stage of the treatment that has been reached, and there is a second stage still to be pursued—which will be clear from the following illustrations. Supposing, for instance, that a case of caries has been caught for treatment at its very earliest outset, and before any angular prominence has started; it is then frequently possible to eliminate the disease, and substantiate the weakly bone, so that it does not undergo any appreciable alteration of shape at all. In such a case, of course, the spine will be left without any angular deviation, and it is obvious (with the exception perhaps of some little further precautionary safe-guarding) that treatment has come to its end. But supposing, on the contrary, as is usually the case, that it has not been possible to adopt treatment till after the angular curvature has shown itself, then it is obvious (seeing that it is neither practicable nor advisable to attempt straightening during the progress of treatment) that, after treatment has completed the cure of the disease and the reconstruction of the bone, the spine will still have an angular curve in its course; and it may be added that although it is now medically sound, it is none the less mechanically injured.

It is a fact, therefore, as I demonstrate in fulness later on (Section 3), that whenever an angular curve is newly introduced into the course of the spine, the latter will be thrown off its balance, and, if left unsupported, will commence to yield generally (using the term “yield generally” in contra-distinction to the previous pointed yielding at the carious spot), and then the body will tend to become more shortened and deformed. Hence, it follows that whenever such an angular curve has been newly left in the course of the spine, after the stage of the cure of the carious disease, there will still remain a second and mechanical stage of treatment, whose object it is to prevent, not only any general lapse into further deformity, but also (and this is most important) to secure such a general straightening of the spine as shall bring the original angular curve into harmony with the rest of the spinal column.



From this, it will be seen—as I was the first to point out in the original edition of this work, 1880—that the treatment of spinal caries must be considered in two separate stages, and this I will now proceed to do in detail.

---

## SECTION II.

### TREATMENT OF THE FIRST STAGE OF CARIES OF THE SPINE.

The treatment of spinal caries has to be at the outset both mechanical and constitutional. Instead of the word mechanical I might have employed the broader word surgical, seeing that the use of such mechanical adjuncts as bandages or splints are comprised in the breadth of surgery, but as later on certain purely operative proceedings will have to be considered, I have preferred to mark the distinction in this way.

**Indications of Treatment.**—The mechanical exigencies of treatment at this stage can almost be said to be easily gathered from the previous recorded considerations. To take the actual conduct of the patient first, his persistent desire is to be recumbent in an easy attitude, and if compelled to stand or walk he will constantly attempt to keep the spine supported and exempt from stir or jar by every means in his power, either by resting his hands on his thighs, or by clutching at pieces of furniture, or, if deprived of these aids, by shuffling softly about with a shirk of all jog and jolt. Again, it has been pointed out that the spine as a whole is practically divided into two strong healthy parts meeting at a yielding and diseased and inflamed spot, and from this point of view alone the treatment would fall on precisely the same lines as those of a common fracture, and would require therefore for the healing process such a splint as may ensure immobility of the parts.

Now the conclusions derived from the foregoing reasoning are precisely the views which are held at the present day,



and they are theoretically so clear that there never should have been any practical doubt about them. But for all this, it took a greater part of the last century for surgeons to realise their facts and to feel their way to results which, at any time, should have perhaps been fairly obvious.

**Historic Evolution of Splint Treatment.**—For at the beginning of the last century there prevailed the treatment of Percival Potts by counter-irritant issues and recumbency, and it was to the former rather than to the latter that he ascribed the benefits of his method. A few years later Baynton advanced and demonstrated that it was the recumbency that was the principal factor in the remedy. A little after this, Sir James Earle advocated, in addition to recumbency, the use of “machines” (that is to say, appliances made of steel and other materials), and Sir Benjamin Brodie likewise recommended them, “not for the purpose of elongating the spine and correcting the deformity, but simply to take off the weight of the head, chest, and upper extremities from the diseased part of the spine.” That he used them largely, I know from the old case-books of my father and grandfather, to whom he was in the habit of sending his cases.

These machines were originally made of a steel frame-work filled in with other materials, but it was soon found that the more comprehensive and splint-like they were, the better they fulfilled their purpose. Hence, even before the middle of the century, my father had introduced for adoption a leathern splint which was made as follows: a paper pattern was taken of the part to be fitted, and a piece of spongy sole-leather was cut to its shape; this latter was then soaked in water till it was quite soft, and it was then bandaged in position on the body of the patient, who had to lie quite still during the twenty-four hours that it took the leather to dry. If the patient moved much the leather crinkled out of shape, and, although this could be rectified afterwards, the leathern splint so made could scarcely be relied on for absolute accuracy of fit. To obviate this difficulty, my father used frequently to have a plaster mould taken of the part, and from this mould a cast was run on which a leathern splint



could afterwards be blocked with perfect accuracy. A little later he experimented with gutta-percha, a material that had only a few years previously (1843) been introduced into England, and he found that a sheet of it, a quarter of an inch thick, would, if dipped in hot water, become in a few seconds quite pliant and mouldable, and that if it was laid in this condition on the back of a prone patient, it became in a few minutes quite hard and set.

The spinal splints so formed of gutta-percha were absolute in fit. If of moderate size, the strength of their material sufficed, but if large, they were strengthened with light slips of steel; or, as an alternative, a plaster of Paris cast was run in the original gutta-percha mould, and a leathern splint was made on the cast so obtained. This last method of making a splint, I shall refer to later on as the "secondary" method.

It should also be mentioned in passing that, at about the same time, another material was invented for splints known as Hyde's felt; it consisted of a felt impregnated with gypsum, which, when dipped into water, and afterwards adapted to any part of the body, "set" in a few minutes in the way that plaster of Paris ordinarily does. This material, although pliant when wet, was not as mouldable as gutta-percha, a circumstance which, of course, applies to all felted materials.

Furthermore, it is to be noted, that whilst a splint alone was only applicable to a portion of the spine, and was not conveniently capable of supporting the upper dorsal and the cervical vertebræ, additional devices known as "head-gears" were super-added to the splint for this latter purpose as well as for relieving the spine from the weight of the head.

Hence it will be seen then that by about the middle of the last century, the perfected splint treatment was practised in England as the right one for spinal caries. That it was so employed by the best surgeons I know by the constant recurrence in our case books of patients sent by such men as Sir William Fergusson, Sir Prescott Hewett, Sir James Paget, John Marshall, and Sir John Erichsen. Moreover, the accounts and illustrations of the splints themselves are recorded in the current medical literature of the period, as the adjoining illustration (Fig. 5) will show, taken from



FIG. 5.

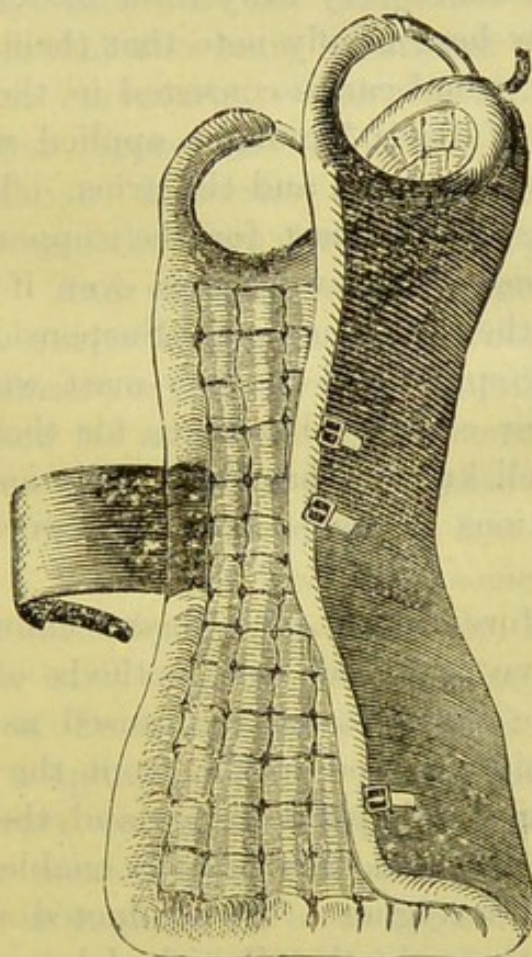


FIG. 5 represents a splint in common use long before the middle of the last century. It is figured in Bigg on 'Deformities,' 1862, in which work also will be found illustrations of the recumbency splint, the ordinary leathern splint, the "occipito-mental" headgear, and the jury-mast. These references are made to disprove the unfounded assertions of Dr. Sayre, of New York, made in 1877, that he was the originator of these methods of treatment.



, Bigg on Deformities,' 1862, and in the same work there are many other woodcuts which prove the same thing.

These being the actual facts, it was something startling to find that Dr. Lewis Sayre, of New York, in a work which he published a quarter of a century later (London, 1877), claimed that the splint treatment was a novelty of which he was the originator.

As I shall elsewhere very fully refer to his ideas of treatment, I need only here briefly note that their sum as regards the treatment of spinal caries consisted in the use of a splint made of plaster of Paris bandages applied whilst the body was suspended by the head and the arms. To this splint, in appropriate cases, a jury-mast for the support was attached. Now, none of these things were new even if there appeared some novelty in their conjunction. Suspension was not new, the treatment by splint and by jury-mast was not new, and the use of plaster of Paris bandages for the construction of splints was so well known, that its description can be found in the old editions of even such lay works as ordinary encyclopædias.

Whilst, therefore, Dr. Lewis Sayre cannot substantiate any claim to have invented new methods of treatment, he certainly has the right to be recognised as one who very strongly and rapidly forced to the front the somewhat neglected consideration of spinal caries and the correctness of the use of a splint, and this he was enabled chiefly to do because he was a foreigner. He conducted a couple of professional tours through the British Isles, visiting all the medical centres and giving lectures and demonstrations in most of the medical schools; whilst he was enabled at the same time to reap considerable emolumentary advantages from private consultations. He had done the same thing, a few years previously, with demonstrations on his now obsolete splint for hip-disease. As an American surgeon of great distinction, and as a guest in these islands, every immediate and cordial opportunity was given him of expressing his views, and although perhaps the dramatic and ambulatory ways in which he proclaimed and explained his own ideas may have been somewhat at variance with the more modest methods of English surgeons, still, Dr. Sayre pushed solid



facts to the front in a few months, which though not new, had been neglected. He enforced the correctness of the treatment of caries by splints, and moreover popularised plaster of Paris as a further material out of which spinal splints could be economically constructed.

Now it should here be mentioned that not only did Dr. Sayre affirm that the plaster splint was a proper treatment for caries, which was not altogether unreasonable, but he also asserted that the same treatment was infallible for lateral and other curvatures, which was altogether unreasonable and was soon disproved. Still, as a result of his apparently authoritative deliveries, the plaster splint almost immediately became the rage for everything that was wrong with the spine. And as the greater surgeons, who for the time tested his universal treatment, did not trouble to apply the splints themselves, an enormous number of cases were sent to my father for application. In consequence of this, a special room was fitted up for the purpose in our house, and from 1875 to 1880, I rarely put on less than five or six plaster splints a day. As I applied some thousands, and, moreover, kept careful notes of each case, I was, perhaps, in the position to early express the opinion, that for spinal caries plaster of Paris bandages afforded another material out of which a splint could be made, and which from its economy was very valuable in hospital practice, but that it did not by any means make the most perfect splint for the purpose, either as regards fit, or as regards material.

And even to those who accepted as a treatment for caries the principle of a splint applied during suspension, it became almost immediately obvious that some pleasanter material might be substituted for the harsh, crude plaster. With this view, a Mr. Cocking introduced a felt of the kind he used in the manufacture of hats, and to which he gave the surgical designation of "poro-plastic." This felt was practically a reversion to the Hyde's felt of the 'fifties, only with this distinction, that whereas the latter was charged with gypsum and became "set" after immersion in water, the former was charged with gum-resins and was softened by heat to become "set" on cooling. Hyde's felt could only be shaped into use once; Cocking's, on the other hand, could be reshaped



by heating as often as requisite, just, indeed, in the same way as gutta-percha can. But like all felts, it had this important drawback, that, having no "stretch" to speak of, it could only be made pliant, and was not capable of being modelled to the refinements of shape. Now, gutta-percha models with such complete accuracy, that every little hair and papilla of the skin is absolutely reproduced in mould.

From what has just been written, it might almost appear that both the principles of splint treatment as well as the right construction of the splint had only "been evolved" during the last sixty years. This, however is not quite so, for as long ago as the time of Queen Elizabeth, the same plan of treatment was advocated by Ambroise Paré, and although his splints were ordered to be made of iron, and to be opened at the sides, after the fashion of a cuirass, it can scarcely be doubted that they were appropriate in fit, seeing that the armourer's art was then at its perfection and that men had been defensively accustomed for generations to have their bodies encased in comfortably fitted vestments of steel. The use, therefore, of a splint for spinal treatment is tolerably ancient; it is only the introduction of modern material and of modern methods of construction that has brought the splint to its present-day perfection.

**Author's Method of Splint Construction.**—Now, without straying into any critical digressions on the various kinds of splints, I shall simply give at once a description of those methods and those materials that I have, with a very long experience, personally found to ensure the most satisfactory results. And it should in the first place be explained that a splint may be in construction either a primary or a secondary one. For example, if a splint be formed by winding a series of plaster of Paris bandages round the body, and this when set is continued to be worn (either unsawn as Sayre recommended, or sawn down the front and made removable for cleanliness,) then this splint being constructed of the very materials that were actually applied to the body, is a primary splint. But if, on the other hand, a sheet of gutta-percha is moulded on the body as a splint, and if this moulded sheet is removed and used as a mould from which to run a plaster of



Paris cast, and if this cast is used as a "block" on which to make a leather splint, then it is obvious that this latter, not being constructed of the material that was originally applied to the body, is a secondary splint.

Now, it might at once be asked, what then is the difference between a primary and a secondary splint? but it is just the differences that can be introduced between the two that constitute their entire distinction. If they were identical in shape there would be no object in the double process, nor would any advantage be gained, beyond an alteration of material. But it will be observed that from the primary mould a cast is obtained which forms the "block" on which the secondary splint is made, and it is the amendments and alterations that can with judgment be introduced into this "block" that make the secondary splint so superior to the primary one. Personally, I always use a secondary splint as being best, and I will therefore describe the four stages that constitute the details of its construction.

1. The primary splint or mould is taken either in gutta-percha or plaster of Paris. With quite little children it is impossible to get a satisfactory mould with plaster bandages, not only from the difficulty of the application, but because the children invariably shrink or move whilst it is setting. On the other hand, if they are placed prone on a sofa or on their mother's lap, they are rather soothed into quietude than otherwise by the warm application of gutta-percha, and for these reasons I employ it. With older children and with adults I more generally use plaster bandages for the primary mould, and take it whilst they stand with their arms supported in slings for the sake of steadiness. When this mould is set, it is removed by being sawn down the middle of the front in the usual way. If the head as well as the body has to be embraced, I take the mould in a different manner. The patient is laid prone on a couch, and a sufficiently large piece of jaconet wrung out of warm water is then dabbed home over the parts to be moulded; this in its turn is covered with liquid plaster of Paris laid on with the hand to the thickness of an inch or so, and on the top of this another piece of jaconet is immediately pressed. When the plaster is set the whole mould is bodily removed, being prevented



from cracking or crumbling by the jaconet which is incorporated with it.

2. From the primary mould, taken by either of the above methods, a cast is run with liquid plaster of Paris so as to obtain the block on which the secondary splint is to be constructed. The process of "running a cast," having been long employed by sculptors and others, is too well known to require detailed description; suffice it simply to say that the cast is an exact counterpart of the mould, and is, of course, if properly done, a replica of the shape of the patient. If the original mould was taken in gutta-percha the cast will be so exactly perfect that every little hair or papilla on the skin will be reproduced; but if taken by either of the plaster methods it will have surface irregularities, due in the one case to the folds of the jaconet, in the other case to the ridges that are unavoidably made by the bandages. These irregularities, however, are removable, as I shall now explain.

3. The next process is to rectify, amend, and smooth the cast, so that it may become by this correction the "block" on which the ultimate splint is to be made.

One of the most important rectifications that have usually to be made is when there is lateral deviation of the patient's body, especially in the loins.

I have previously stated that a carious spine rarely yields laterally at the point of disease, but it is extremely common to find that, either by accommodation to an easy attitude, or else by some reflex disturbance of muscular balance, the spine has lapsed into lateral deviation above or below the carious spot, and this is most frequently the case in the loins.

Now, if the block in such instances is rectified into lateral truth, a symmetrical splint can afterwards be obtained, into which the body will in a few weeks reshape itself, and its extraneous lateral deviation will then be eliminated. The adjoining figures will make this process clearer. Fig. 6 represents a primary mould taken, in this instance, by plaster of Paris bandages. Fig. 7 represents the cast that has been

---

FIGS. 6-8 are sufficiently described in the text, and are intended to illustrate the rectification that is wise and possible between the original mould and the final splint.



FIG. 8.

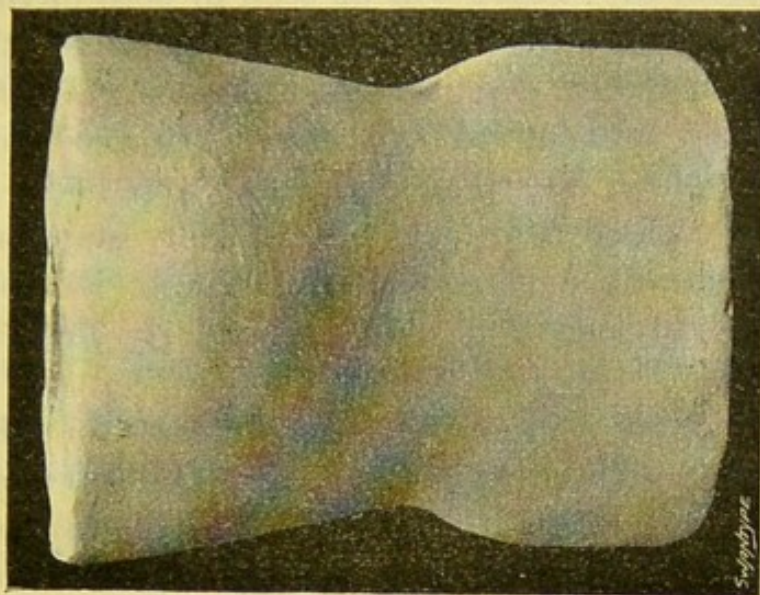


FIG. 7.

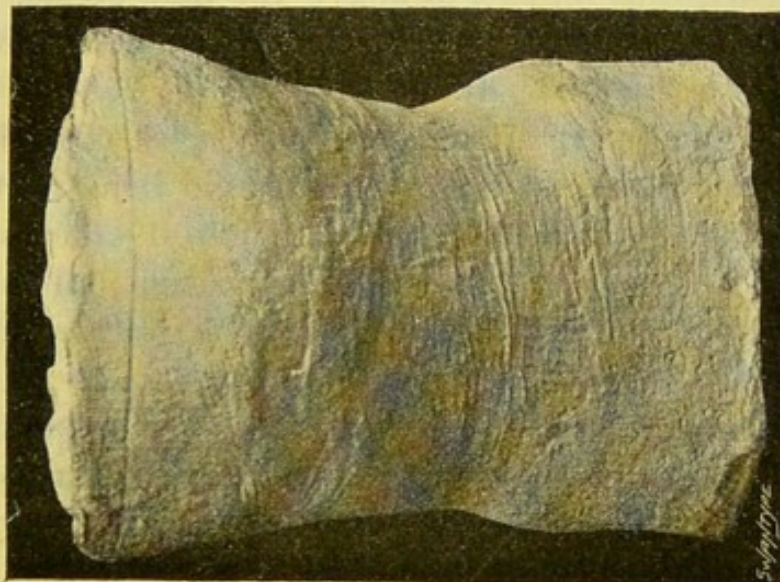
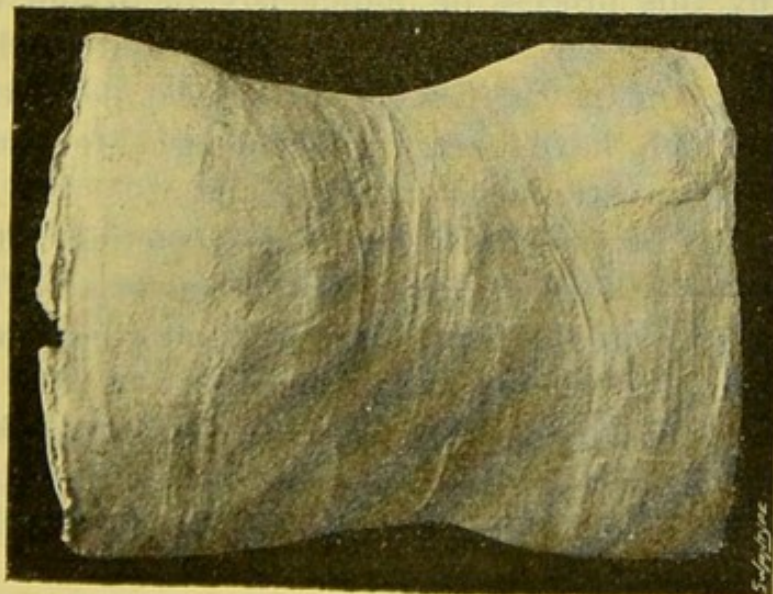


FIG. 6.





obtained from it. There will be seen in both of these a considerable lateral deviation of the loins, which throws the right hip out. Fig. 8 represents the same cast after it has been rectified into lateral symmetry. It need scarcely be added, that these lateral deviations of the body, which are thus easily corrected, are not of old bony standing, but are simply of recent and muscular origin. Moreover, there are other deviations that can be similarly dealt with and rectified.

Another rectification depends on the fact that the original mould models with equal evenness over the soft and the hard parts of the body alike. Now there is a considerable advantage to be gained by accentuating the hold of the splint over certain of the softer parts. If, for example, the splint is somewhat nipped in above the iliac crests, it will be more securely localised, and by amending the "block" it is easy to attain this end.

Again, the support of the splint may most often be advantageously intensified on some of the sound bony parts around the seat of the disease, a thing which, if done with great judgment, will not only absolutely prevent all increase of angularity, but will even tend towards its gradual diminution.

Lastly, all surface irregularities, which may be considerable if the mould has been taken with plaster bandages, can be smoothed away from the cast, so that the aspect of the splint which comes in contact with the body of the patient is perfectly even and comfortable.

Now I cannot lay too much stress on the excellent results procured by this process of judiciously rectifying the cast; it dictates government, both to the shape and to the repose of the body, and it carries out in refined perfection those *desiderata* which have been crudely sought for and which have remained unattained by other plans.

4. The final process is the actual construction of the splint itself, together with the selection of its material. There are four materials available, and these are gutta-percha, leather, plastic felt, and plaster of Paris bandages.

With little children, if the case is caught at the outset, and there is no particular angular deviation, I employ gutta-percha; and I use the original primary mould as the actual



splint, seeing that there is no necessity to go through the correcting processes I have previously described.

With children who have begun to walk, and with adults, I almost invariably use leather by selection as the material for the splint, it being blocked on the corrected cast in the way I have previously described. The leathern splint does not entirely encircle the body, but is filled in for some few inches over the front of the chest with lacing pieces of stout elastic webbing, sufficiently strong to hold the whole splint firmly against the back of the body, but sufficiently yielding to allow of the movement of the ribs and sternum in respiration. It must be obvious, therefore, that such a splint is persistently held in apposition to the trunk, and that its support is continuous. On the other hand, all such shell splints as those of plastic felt and plaster of Paris must have a respiratory gap of looseness, and even if they fit in inspiration, they cannot do so in expiration when the circumference of the thorax is materially less than their own fixed circuit. It is obvious, therefore, that with such shell splints, the support is intermittent and partial with each flow of breath.

Occasionally in caries of the lumbar and the lowest dorsal vertebræ, I do, for purposes of economy, use plastic felt as the material of the splint. But even when I do this, I always have the splint made on a corrected cast of the body. By these means the splint does not require to be steamed into shape at all, nor does it need to be softened in its various parts. If a splint is perfect and proper in fit, it will not rub nor grate the skin anywhere. Yet I have often seen plastic-felt splints softened not only across the chest (which is reasonable), but also so widely over the hips and around the carious spot in the spine, that all proper support has been positively destroyed.

Lastly, for temporary purposes and for occasional cases of the hospital class, I sometimes use a splint of plaster of Paris bandages, but as I have already referred to them and shall have to discuss them again later on, I need not here stop for further comment.

**Area of the Splint and its Adjuncts.**—Having considered of



what materials the splint may best be made, and having also asserted by what method of construction it can be rendered the most efficient, there only remains now to be reviewed the precise area over which it and its adjuncts should be extended according to the varying situation of the carious disease along the course of the spine. And to do this succinctly it will be best to commence at the lowest vertebræ and to proceed upwards. It has, of course, to be borne in mind that the splint with its adjuncts has two objects to fulfil, the one being to allow the diseased parts complete fixity and cradled repose whilst the body is recumbent, and the other to save these parts from all weight and strain when the body becomes erect.

Even in considering the lowest vertebra of all, the distinction between these two objects becomes apparent. The last lumbar vertebra is so bound to the pelvis by its ligamentous attachments that its mobility is next to nothing, yet it would none the less require a splint for its treatment, seeing that the lower the situation of any vertebra is in the column, the greater is the superincumbent weight from which it has to be relieved.

All the lumbar vertebræ and the three lower dorsal may be grouped together. Disease of any of them requires the simple splint of "hour-glass shape," which should be carried well up over the shoulder blades above, and well down over the buttocks below, whilst fitting closely into the waist over the flanks. Such a splint (Fig. 9) cradles the trunk in recumbency; whilst in the erect position the upper swell of the body reposes in the upper bell of the splint, whose lower bell aptly encircles the swell of the hips and transfers all superincumbent weight directly to them in lieu of allowing it to be borne by the spine.

The next three dorsal vertebræ, that is to say, the ninth, eighth, and seventh, are dealt with by the same form of splint, only there are added to it as adjuncts two lateral crutch-pieces, which fix and uphold the arms at the axillæ, and which thereby bring into play the tonic stay afforded

---

FIG. 9 represents the simple hour-glass splint. FIG. 10 portrays the same splint with lateral crutch-pieces. FIG. 11 illustrates the splint with the dure occipito-mental head-gear.



FIG. 11.

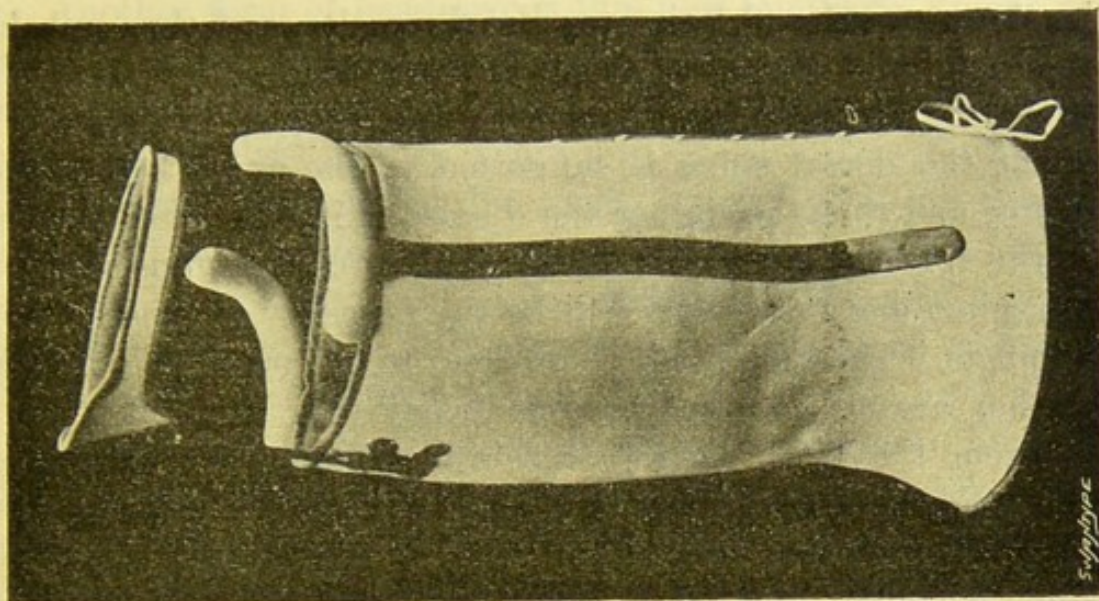


FIG. 10.

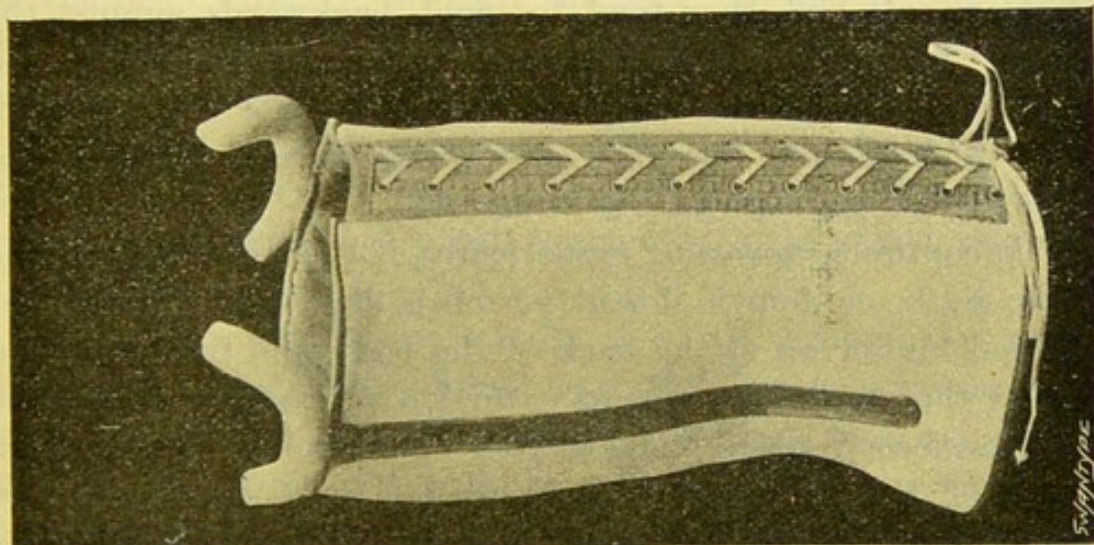
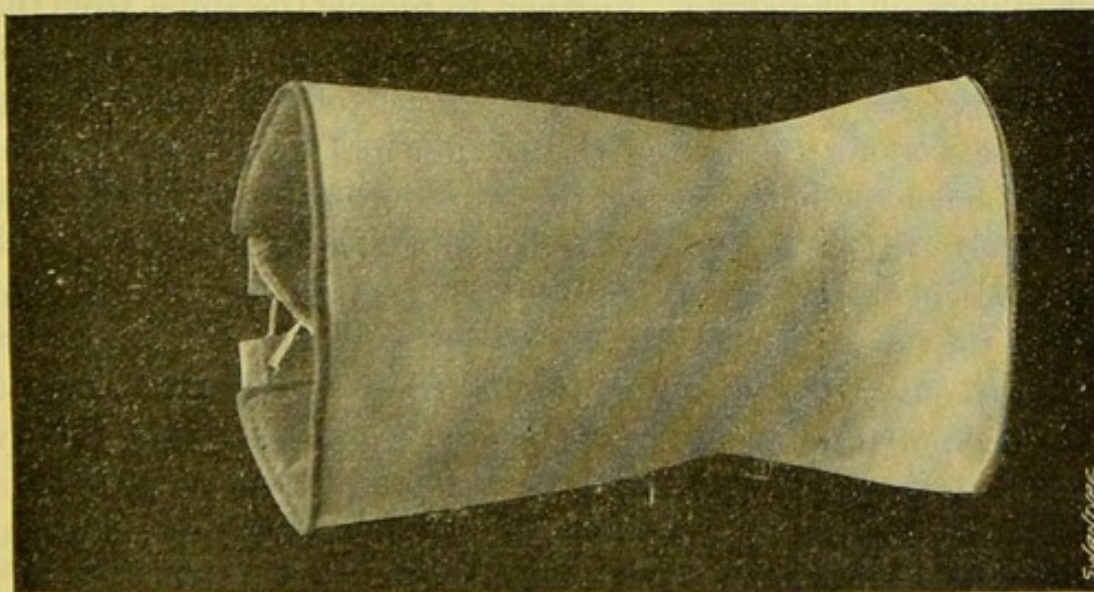


FIG. 9.





by the pectoral and latissimus dorsi muscles, and thus uphold the weight of the body from off the diseased parts. For it is to be remarked that with the simple "hour-glass" splint the dorsal spine is supported in the upper bell of the splint, and that the higher the disease is in the dorsal region of the spine, the less will be the support of this upper bell of the splint, and the greater will be the necessity of super-added adjuncts. The crutch-pieces referred to are made detachable, as they are not required in recumbency (Fig. 10).

From the sixth dorsal vertebra upwards, the weight of the head, neck, shoulders, and arms have to be gravely considered, and the reason for this is obvious. The dorsal spine is convex backwards, and the acme of its convexity is at the sixth dorsal vertebra. If, then, the vertebræ below this spot are softened, they tend to yield backwards against the splint, by which, however, they are quite restrained and supported; but if the vertebræ above this spot are softened, they tend to yield forwards and away from the splint, and thus to lose support from it altogether.

To continue, however, numerically, if the disease is in the fifth, sixth, or fourth dorsal vertebra, the splint has to be carried higher up at the back of the body, and the front hold across the chest has to be as extended as possible, whilst the crutch-pieces require to be so prolonged and so set back in front of the shoulders, that they keep the body closely held back against the splint. And they must also be kept at such a height as to completely take the weight of the arms and shoulders off the spine. Further, to relieve the spine from the weight of the head, some sort of head-gear has to be employed.

Now, every kind of head-gear must obtain its uplifting purchase along the line of the occiput and lower jaw by what may be conveniently termed the "occipito-mental" hold. The simplest of these head-gears consists of a stem attached to the substance of the splint by a "box," which is so arranged that the stem itself can be raised and lowered at will for adjustment. The top end of the stem terminates opposite the occiput in an axis, on which pivots a metal circlet rightly adapted to the occipito-mental hold, and this circlet has a hinged opening to allow of its being passed into position round the neck (Fig. 11).



Another form of headgear is that now familiarly known as, the jury-mast, an arrangement which Dr. Sayre claimed to have originated in the 'seventies, but which was devised by my father at least twenty years previously, and is figured in his works. It consists, like the former gear, of a stem similarly attached to the splint, only that this stem is arched up over the cranium, and to its extremity is attached a cross-bar, from whose ends leathern slings depend, which carry the head by the occipito-mental hold (Fig. 12).

Either of these head-gears is similarly efficient, but the former is much the less conspicuous, and it is certainly more comfortable, seeing that it does not cut into the sides of the face in the way that the latter one does. It will be seen that both of these head-gears transmit the suspended weight of the head directly through the splint to the hips. Other head-gears will be presently described, which convey the weight of the head to the shoulders, but these are obviously inapplicable to dorsal disease. Lastly it is to be noted that these head-gears are removable (in the same way as the crutched arm-pieces), so that they can be cleared away if not required during recumbency.

To again continue numerically upwards through the vertebræ, the upper three dorsal and the lower three or four cervical may, for the purposes of treatment, be grouped together. They are above all possible range of support from the simple hour-glass splint, and although they may sometimes be satisfactorily dealt with by splint and head-gear just described, this is by no means the best method. The proper plan is to prolong the ordinary splint upwards, as illustrated (Fig. 13), so that it may embrace the neck and the head. The necessity for this completeness of hold was long ago recognised, as Fig. 52 in 'Bigg on Deformities' (1862) will prove, but the splint there illustrated was intended solely for cradled recumbency. The more modern splint, which I was the first to design and describe a quarter of a century since, is not only available for recumbency, but, with the addition of removable crutched arm-pieces, it affords perfect quiescence and support in both the seated and the erect position.

The remaining cervical vertebræ, the fourth to the first, are best dealt with in children by a similar plan, as their



restlessness demands the inclusion of body, neck, and head in one fixed safeguard. With adults, however, such completeness is often unnecessary, and the shoulders can safely be made the base of the support by which the neck and the head may be securely fixed. Fig. 14 shows the "collaret" (as it may be called) by which this is done; it is actually a leathern splint resting on the shoulders, the chest, and the back below, and carrying the head by a shelf that is adapted to the "occipito-mental" hold above. It is formed in the way I have previously described, from a cast that has been run from a primary mould, and it may be said that the correction of the cast to which I have attached so much importance is here an obvious necessity, as the muscles of the back and sides of the neck require an accentuated hold, whilst in front deglutition and respiration must be left absolutely uninterfered with. I have obtained excellent results with this collaret in the cases of adults who are not restless at night; if sleep however is perturbed, then the body and head splint is preferable.

I may here also add one or two further observations. With tiny infants in arms who may be under a year old, and who may suffer from caries of the lumbar or main-dorsal regions, I do not use a stiff splint at all, but employ a jean corset entirely cuirassed with strips of whalebone placed longitudinally in juxtaposition. For the shape of such a child tapers from the shoulders down to the buttocks, and a stiff splint tends to travel downwards out of its place. Further, the child's bones are so slightly ossified that the same rigidity of governing restraint is scarcely needed, and lastly, the cling of such a jean corset is more restful to the child's soft body than a solid splint. Of course, when the disease is above the mid-dorsal region such a corset is not commanding enough, and there is no alternative but the leathern splint-cradle which embraces both head and trunk.

Another point that may also be taken here is this: that when patients begin to assume the erect position (as will later be described), the body will sometimes tilt persistently

---

FIG. 12 represents a splint with the jury-mast head-gear. FIG. 13 shows the continuous body and head splint. FIG. 14 portrays the collaret splint.



FIG. 12.

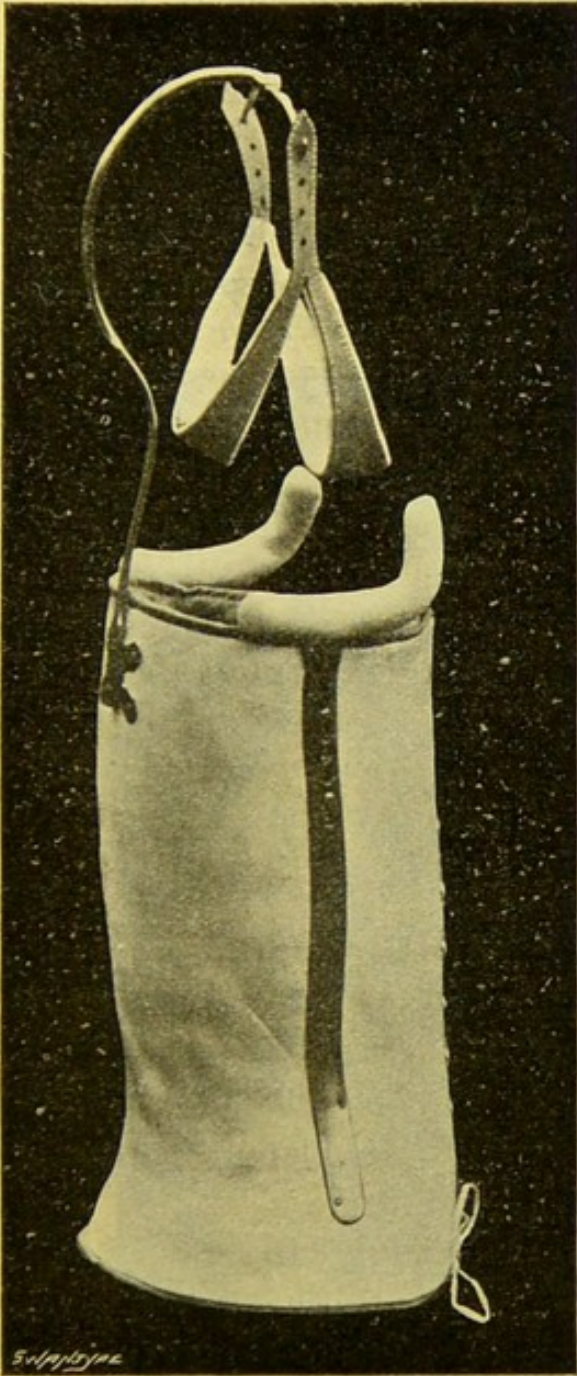


FIG. 13.

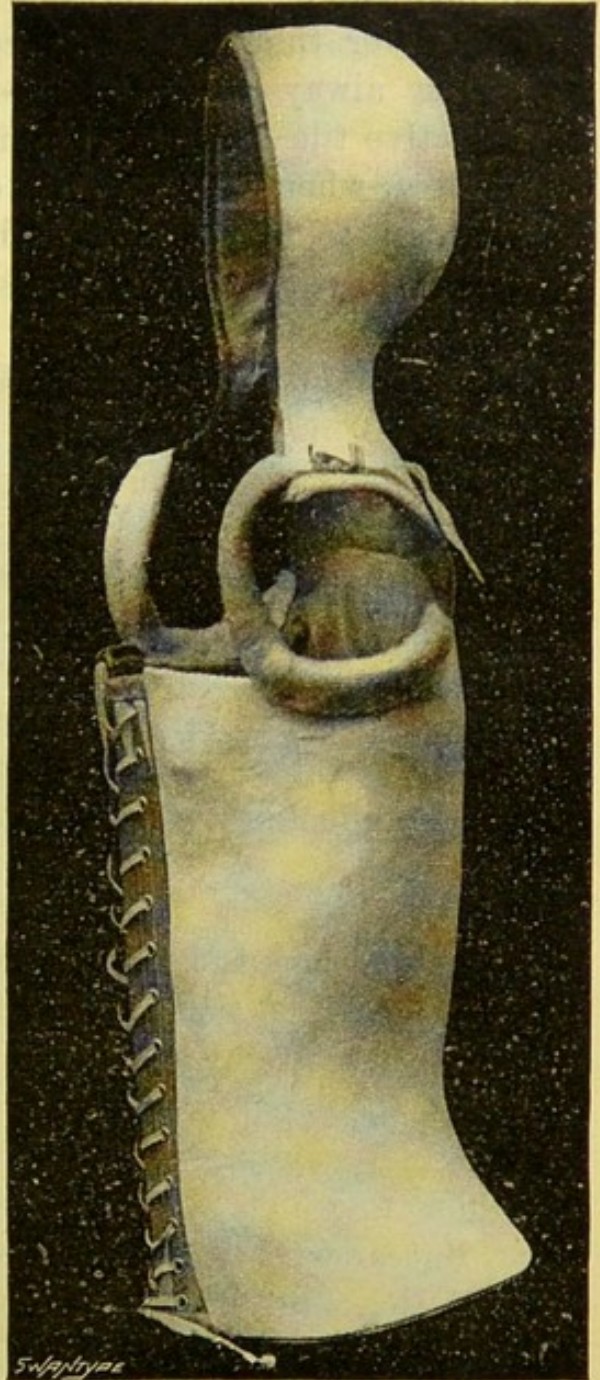
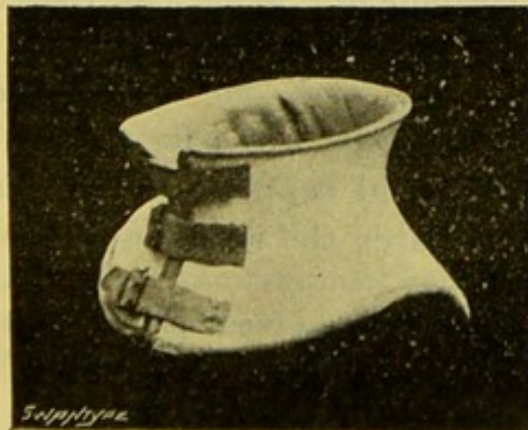


FIG. 14.





to one side or the other, not from any lateral curving of the spine (for the yielding of caries is, as I have pointed out, almost always truly antero-posterior), but from an accommodative tilt over the hip joint of that side.

Now, when this arises it can be remedied by one of two adjuncts to the splint. The simplest one, which usually answers well with children, is to attach a strong "suspender," made of several strands of elastic, to the lower edge of the splint opposite the trochanter, and to fasten this in tension to the top of an ordinary stout stocking worn on the leg of the side from which the body tilts. The elastic power so exercised is generally sufficient to bring the body into lateral truth, and the strands of elastic can be cut away one by one as they become unnecessary. The other method, if this one fails, is to encircle the thigh with a steel band fitting against the buttock fold, and to connect this band to the splint by a steel rod jointed truly at the hip joint—an arrangement which effectually prevents any tilting in the opposite direction.

**Recumbency and its Duration.**—Having detailed the precise form of splint that is applicable to caries in any particular part of the spine, and having made it clear that such a splint should be capable of giving perfect support both in erectness and in recumbency, the next point to be considered is the extent to which recumbency should be enforced.

But first of all the principle must be strongly insisted upon, that the splint should always be worn whilst the patient is recumbent; although, as I have previously pointed out, it may be permissible to remove some of its adjuncts, such as its arm-pieces. The surgeons of a century past relied, as Baynton did, on recumbency alone; at that time, of course, the splint treatment was scarcely known.

But it is very curious, when one comes to modern times, to find that even such a recent authority as Mr. William Adams advocated that mechanical support to the spine in any form was not needed until after the actual angular curvature had

---

FIG. 15 represents a child who has been splinted from the outset of the disease. FIG. 16 portrays a child in which this has been neglected to be done, with obvious angularity.



FIG. 15.

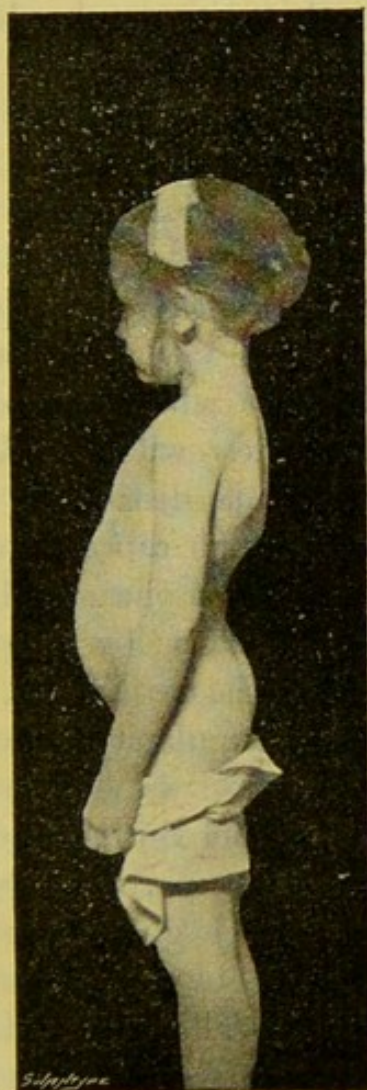
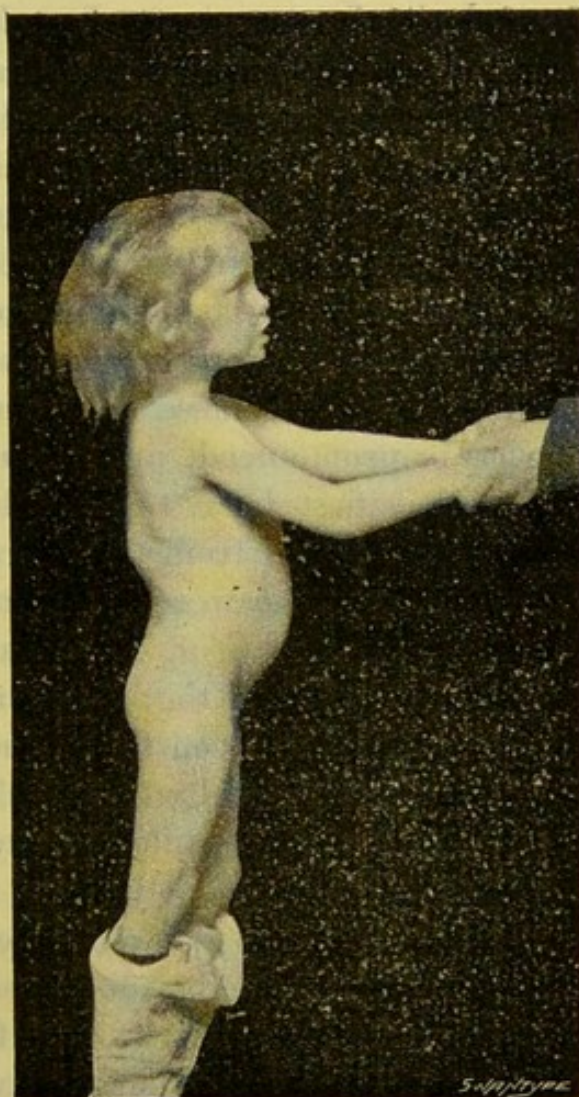


FIG. 16.





taken place. Surely no error could be more egregious than to assert that the splint—the very thing that stops deformity—should not be applied till the nature of the disease has been by deformity declared. To adhere to such a view seems to me to indicate an entire lack of trust in one's own powers of diagnosis. I, on the contrary, hold most strongly that the splint should be applied the moment that the disease can be by its earliest symptoms detected, and if possible before any angularity has supervened, and that from that time onward until complete consolidation has taken place it should never be discarded, whether the patient is recumbent or is erect. In this way it is frequently possible to stop deformity altogether.

Nay, I would even go further, and say that, with so grave a disease, if the early symptoms are doubtfully distinctive, it is better to apply a splint at once and to follow the line of safety rather than to hazard that of risk.

But as a rule cases only come for treatment when angularity is pronounced, and after pure recumbency without a splint has first been tried and has failed. This distinction may be gathered from the preceding figures which represent two children who were each attacked by caries at the same spot. The one (Fig. 15) was treated immediately by the splint, the other (Fig. 16) was not dealt with until after recumbency had been first tried and obvious angularity had in consequence resulted.

I had the opportunity some years ago of putting this point, which I so particularly wish to enunciate, to experimental test. A child, in one of those institutions which guardians the orphans of the better classes, was attacked by incipient caries, and was sent to me for an opinion. The resident doctor, whom I knew personally, inclined to the recumbency views of the late Mr. William Adams, whilst I held an opposite opinion. We decided, therefore, to put the matter fairly to the test, and the child was kept scrupulously recumbent on a proper bed, and under the watch of an experienced nurse, for some months. The result was that, although the case progressed favourably in all other respects, the angular curve gradually established itself. The child, therefore, was ultimately splinted, made a good recovery, and finally, at the limit of age, left the institution in good strength and health,



but of course with an angularity in the course of the spine, which, however, had been eliminated from mischief during the second stage of treatment (*vide postea*). There can be no doubt, therefore, that the splint should be used in conjunction with recumbency from the very outset of the disease.

This paramount principle being settled, the next point is, what amount of recumbency should be enforced, and what amount of erect exercise may be permitted during the twenty-four hours in any particular stage of spinal caries?

Without further preamble I may at once state the rules that have seemed to me to be the broadly wisest:

1. In the early stages, as long as there is pain or "breath-catch," the patient should be kept absolutely recumbent. If the splint has to be occasionally removed for cleanliness he should be laid on a couch, being supine while the splint is unlaced, and being rolled over into proneness whilst it is removed, and the splint should be replaced, after washing, in the same way.

A hammock suspended across the bath has been recommended for the washing of little children, but in my experience the sagging of the hammock may be detrimental, and the child's spine is less disturbed if he is laid on a firm level surface.

2. When all pain and "breath-catch" have disappeared in recumbency, the patient may gradually be brought from the recumbent to the erectly seated position. This is best done by the employment of a spinal chair, which is nowadays economically made of the same material and pattern as the ordinary deck chair, and the back of which can be, month by month, advanced in angle until it is vertical to the seat. If there is still no pain nor "breath-catch" when the body is erectly seated, then the experiment may be made of removing the splint for a few moments for the purpose of seeing whether the patient can now stand without pain or self-support. If this proves the case, then a certain amount of walking exercise (still in the splint, of course) may be permitted, and may with discretion be gradually increased.

3. A few months later the experiment may be made of again removing the splint for the purpose of testing the patient's spine by heel-jar (p. 8). If the latter is entirely absent, then recumbency may become subordinate, and be



gradually reduced until it resolves itself into an hour's rest after the mid-day meal.

It will be observed that these rules are made to depend rather on symptoms and on the course of the disease than on such set periods of time as were empirically prescribed by older writers ; and they seem to me to be in the main those that should be followed in an early-caught and uncomplicated case, a careful watch being kept meanwhile for the advent of any of those graver consequences which sometimes embarrass treatment. As to the exact duration of the disease, it is very variable and dependent on constitutional strength, on healthy surroundings, on occupation, and on the monetary provisions available for good nutriment and treatment.

In enforcing recumbency considerable firmness has to be exercised, for it often happens that the moment an efficient splint has been adapted to the body the patient can not only lie without pain but can also sit up and even walk about without distress. The natural inference, therefore, either of the patient himself (if old enough) or of his friends, is that he may immediately assume the erect position and be allowed to take what walking exercise he can. But pain, although the principal, is not the only indication of the necessity for recumbency, for whenever the disease is above the sixth dorsal (for the reasons I have previously given), recumbency becomes an important factor in the prevention of angular deformity, and has to be insisted upon for this purpose as much as anything else.

Many of the older surgeons (from Baynton to Adams) were inclined to over-persist in recumbency, and the patient was frequently confined to bed as an invalid and mewed up from all access of air and sunlight. But the more progressive disposition of the modern school has almost been to discard recumbency altogether, and to let the patient, when once fitted with a proper splint, get out and about as much as possible.

The true course lies between these two extremes, and when recumbency is prescribed it should be conducted in such a way that the patient is as much out of doors as possible, and enjoys the freest access to sunlight and air, either by lying beneath the verandah of a balcony or by being wheeled about on a proper spinal couch. Indeed, as I shall later on point



out, the "open-air treatment" is one of the most important adjuncts in the general treatment of the disease.

Altogether it would seem that the value of recumbency is at present rather under-estimated; still, I have occasionally known the reverse to be the case.

I remember seeing in 1885 a young lady who had positively been kept for over five years on a spinal couch for a light attack of caries, and treatment resolved itself rather into dealing with the soles of the feet, which had become so sensitive that it took some little time to establish their tolerance of the bodily weight on the ground; the spine had become consolidated before I saw the case.

**Resumption of the Erect Position.**—Presuming, then, that a case has been discreetly dealt with by such recumbency as the symptoms require, there comes a time in the usual satisfactory progress towards cure when the assumption of the erect position can be more and more amply introduced, until the patient is able to resume his habitual ways of life. And, as this favourable restoration continues, the support to the spine itself can be gradually diminished until it is at last superseded by the lighter steel appliance that safeguards the second stage of the disease and completes the treatment.

Now, when the patient begins to get about, there are certain common-sense precautions that have to be observed. Of these, the most important are—the avoidance of all jar, of all strong muscular effort, and of all sudden strain. I usually interdict these generically by saying: "You must not jump down steps, nor lift the coal scuttle, nor suddenly open a heavy window, nor, indeed, do anything that is similar to these things."

With adults, it is not as a rule difficult to get the principles followed which are embodied in this advice, but children will sometimes evade even the most careful watching.

For example, some two years since, I had under my care a little girl with caries in the upper dorsal region, who had been progressing extremely well. All pain and "breath-catch" had for some months disappeared, when suddenly they again recurred, and from no question that I put to the mother could I gather any reasonable explanation of the



retrogression. It was only when I chatted with the little child and her sister, and tried to sift out their games and doings at home, that I discovered the cause. The children, it appeared, woke up when the morning light came into their bedroom, and they were in the habit of playing games until it was time to dress. As they had recently returned from the sea-side, where they had seen the bathers taking headers into the water, they had invented for their own amusement the game of standing on the pillows of the bed and taking headers into the centre of the wire mattress. The effect of this on a healing spine can be imagined; when the game was interdicted the lost ground was made up and the child duly progressed to complete cure.

Some things that retard cure are of course unavoidable, as, for example, whooping cough, a malady which, from the constant racking it gives to the spine, is of all things most to be dreaded when a child is getting the better of caries. To bronchitis in a less degree the same remark applies. Other things, however, are capable of being met: travelling by rail jars the spine, but if it is absolutely necessary for the patient to undertake a long journey, it may be performed in recumbency, or be rendered less injurious by the use of an air cushion on the seat. When driving is requisite a two-wheeled trap like a hansom is better than a four-wheeled one, as the latter jolts doubly as much as the former, and having smaller wheels does so the more roughly.

When consolidation is practically completed, and recumbency is discontinued with the exception of an hour's simple repose after the mid-day meal, and when the patient requires more active exercise than ordinary walking, it has been my experience that tricycling on level roads best affords this with safety. Some fifteen years ago, a young solicitor, who had been under my care and was so far recovered that he was able to resume his professional work, asked me, towards the end of the summer, if he might join his brothers in a holiday tour on cycles. My answer was emphatically negative; on the contrary, I told him that his holiday would be best spent by lying all day long out on the beach of some sea-side place. When I saw him in the autumn he seemed so much improved in all respects that I at once surmised that he had followed



my instructions ; but it turned out that he had done exactly the reverse, and had taken the proposed tour in easy stages on a tricycle, and with most obvious benefit to himself. This and subsequent experience has led me to consider tri-cycling a permissible exercise when consolidation may be reckoned to be healthily complete, and it is even less taxing to the spine than walking.

**Constitutional Treatment.**—Caries as a rule, if early caught, should run an uncomplicated course towards cure, the sole requisites of its right management being—the splint, appropriate recumbency, and proper general treatment. The essentials of this last part of the treatment are comprised in three things—very generous nutrition, a life led to the fullest in air and sunlight, and perhaps, also, the administration of certain medicines which appear to be specifically beneficial.

Now it does not fall within the scope of this work to enter on the broad principles of recuperative dietary, but this may at all events be asserted, that the adjunct of some nutritious fish-product entails marked results. Cod-liver oil is the substance that is most employed, and is perhaps the best. When children cannot take it, they will frequently eat sardines with avidity, even if part of the oil with which these are preserved is replaced by cod-liver oil. If neither of these can be taken or digested, it is usual to fall back on malted products. Still, without denying their value, I can scarcely consider them the equivalent of a fish-product, and for the following reasons:—Some few years since I saw a poor wasted child, who had cervical caries, with an abscess opening in two places in the neck, and who was quite unable to take or digest anything that would stop her increasing emaciation. At this juncture, a merchant captain, whose ship traded in the Northern Sea, gave the mother a quantity of pieces of a horny fibrous material, which he told her was used in Russia for wasting children. It was prepared by simmering a small portion in water till it had disappeared, and the result was, on cooling, a jelly with a fishy flavour. This the child was always able to take and to easily digest, and it very distinctly stopped the waste of tissue and im-



proved the general health. After one of his voyages, the captain procured for me the substance in its entirety, and I found it only to be the raw-dried sound of the sturgeon. From him I also obtained the further information that in some of the countries he visited, where fish-curing was an industry, the skin of the fish was thrown aside as waste. These skin-scrap, when they had become dried up in the air, were collected by the mothers of the delicate children of the district and given to the latter in the form of a jelly which was prepared in a similar way to that which I have just described. These facts seem to me to indicate that fish-products play some medicinal part in the constitutional combat with carious disease.

As regards actual drugs the iodide of iron has appeared to me in ordinary cases to be of more value than anything else. It can be given either in combination with maltine and cod-liver oil (Burroughs and Wellcome's preparation), or else separately as a *liquor* that Mr. Martindale prepares. Ten drops of this latter preparation are equivalent to a dram of the syrup of the Pharmacopœia, and it does not disturb digestion as the syrup sometimes does.

In those rarer cases where the earliest symptoms are rather those of pressure on the cord, and which are presumably due to cheesy caries, mercury, either by inunction or by the mouth in small doses of the perchloride, gives good results, presumably by causing shrinkage of the cheesy swelling.

Of all remedies, however, a full and free life in open air and sunlight is, perhaps, the most efficient. The oxygenic advantages that accrue from the ample access of pure air to the system are too well known to need comment, and the best airs are generally to be found at sea-side places. What, perhaps, is striking is that the air of certain spots—such as Margate, on the east, and Weston, on the opposite coast—have come to be regarded as specific, a thing that has been explained to be due to some amount of free iodine that these airs contain.

Still, the curative effects of the sun's rays would seem, perhaps of all things, to have the greatest value. If one hold one's hand up to the sunlight, its pink translucence shows that the visible rays are transmitted through it, and with the thicker arm the same thing is apparent in a less



degree. It is evident, therefore, that the ordinary visible rays penetrate the body to some considerable distance. But without doubt there are rays of light that are less visible, but chemically more penetrating, of such a type as the ultra-violet or the recently discovered Röntgen rays. Now the micrococcus of some diseases cannot live in light at all—the tuberculous microbe being a notable example of this fact. If, therefore, the rays of sunlight (of whose constitution much probably has yet to be learned) are allowed to permeate the body, and if these rays are destructive to the micrococci of certain diseases that prey on the tissues, it follows that in those diseases, the most appropriate treatment must be to submit the body to the germicide influence of sunlight.

From the foregoing reasoning, the beneficent effect of the sun in the treatment of caries becomes evident. Patients should, during the summer months, be clad in such open-wove garments as do not materially intercept the rays, and should spend as much of the day as possible either in the direct sunlight, when this is not too powerful; or when this is, from the great heat, impracticable, they should sit in the shadow just out of the glare of the sun, so as to bathe in its reflected rays. During the English winter but little sunlight is available; still, the patient, well wrapped up, should take advantage of all that there is. On the other hand, if means permit it, a winter residence in some sunnier climate, either on the warmer shores of the Mediterranean, or by preference on shipboard voyaging in the Southern Oceans, gives the treatment an uninterrupted continuance (as the case given on page 59 will prove), but it is obviously only the wealthier who can hope for this desideratum.

**Ordinary Course of Treatment.**—The treatment of ordinary simple and uncomplicated cases do not need voluminous illustration. There should be in the splint a period of complete recumbency, then one of partial recumbency, then the gradual elimination of recumbency by the cautious and finally completed assumption of the erect position, until at last, when consolidation is effected, the splint (which may be worn for some short time longer, as a precautionary measure, by night) is discarded by day, and is replaced by the light steel



appliance that is needed to govern the final stage of the disease. I will, however, briefly exemplify these methods by giving the following case-sheet records, which are casually selected out of very many, and which will, at all events, show by contrast the differences in the time of treatment according to the circumstances of the patient.

July 8th, 1896, H. P—, a boy æt. 14 months. Anæmic. Resides at Walmer; parents in good position. Noted screaming when he began to sit up; no angular deformity or breath-catch; pain on pressure; given corset cuirassed with whalebone and recumbency. October, 1896, much better, does not cry on movement. February, 1897, begins now to try to sit up. February, 1898, can now sit up by himself; allowed walking to begin in German nursery go-cart. 1899, no relapse, and now well, no angularity.

March 2nd, 1898, C. B—, a girl æt. 10. Parents opulent circumstances, resident in healthy suburb, with large garden. Previous condition—has recently cried with pain between the shoulders, instant pain on extreme movement of spine, or in jumping down steps; pain in back when hot or cold water sluiced on spine in bath. Her aunt died of carious abscess. Present condition—slight prominence of sixth dorsal, pain on pressure above and below it, pain on heel-jar at same spot, squats and does not stoop in picking things from floor. Diagnosis—early-caught caries. Treatment—gutta-percha mould taken, from cast of which splint made and applied. Ordered continuous recumbency in sunny window, and, when weather warm enough, in garden all day long. Given fer. iod. Seen again February 24th, 1899. All pain had gone in first month, now no pain on heel-jar; left off splint provisionally without giving the safeguard of light steel appliance. July 29th, recurrence of pain; re-applied splint. February, 1900, splint only worn now at night, but given by day light steel precautionary appliance. November, 1900, both splint and appliance disused. 1901, is perfectly well.

May 13th, 1887, C. K. M—, male æt. 22, son of a merchant in opulent circumstances. Seen in consultation with Dr. R., of Finsbury. Present condition—recumbent in bed, great pain, fifth and sixth dorsal vertebræ angular. Diagnosis—obvious. Treatment—mould taken and leathern splint



applied. Complete recumbency for three months, partial recumbency with resumption of erect position for three months; voyage to Australia and back in sailing vessel. June, 1888, all symptoms disappeared, and consolidation complete. Given appliance of type Fig. 23, which worn as safeguard till June, 1889, and which reduced angularity to almost nil. May, 1890, examined after year's discontinuance of treatment, quite sound. Married in following year, and reported by letters at subsequent periods the enjoyment of perfect health.

December 15th, 1898.—W. R. P—, male æt. 24, journeyman cabinet-maker in straightened circumstances. Previous history—working at Eastbourne in March, ricked back carrying furniture, subsequent pain, saw doctor, diagnosed as myalgia. Rested and was better; returned to work, much worse. Went home to Midlands. Saw Dr. C—. Given a modified Taylor's brace, which hangs from shoulders; this worn three weeks, much worse, came to me. His sister previously under my care for caries and cured. Present condition—ninth, tenth, and eleventh dorsal vertebræ angular. Diagnosis obvious. Treatment—applied plaster of Paris splint for temporary purposes, and wrote opinion to Dr. C—. January 23rd, 1899, took mould and gave leathern splint with crutched arm-pieces removable at night; gave also fer. iod.; ordered complete recumbency, which was not fully carried out; progress intermittent. July, 1900, went to Margate for three months; progress since slow, but sure. March, 1902, has now left off splint as cured after three and a half years' treatment. Note: patient was neurotic and nervous, and inclined to try different doctors, hospitals, and homes; still, splint treatment was all along kept up, but proper rest and recumbency were not.

**Variations in Ordinary Treatment.**—It sometimes happens that cases from some unavoidable circumstances have to be treated without diurnal recumbency at all, and a certain amount of speculative judgment has to be exercised to determine whether this is permissible. For example, I saw in 1882 a subaltern of an infantry regiment, stationed at Shorncliffe, with typical yielding of the ninth and tenth dorsal vertebræ, and with the usual symptoms of caries. He



had exhausted his sick leave in resting, and when he came to me he wished to resume his military duties at the same time as he was being treated. Under these circumstances I gave him a steel appliance of the type Fig. 22, which he was able to wear under his uniform. I saw him first in April, and by December consolidation had apparently taken place. During the ensuing year he wore a lighter appliance of the type Fig. 23 to safeguard the spine from strain, and he never had the slightest signs of relapse. It is to be observed that as a subaltern he was unmounted, and, in consequence, was never exposed to the jolt of riding. Next, he was able to have the very best of feeding; further, he had ample time during the intervals between his duties to take what rest was needed; then he was at a sea-side station, with the amplest amount of summer sunlight and pure air; and, lastly, being a man of means, he could have thrown up his profession at any time had this been imperative.

Let me now give a case in which the circumstances were unhappily very different, and which is not of a kind usually met with in private practice. In November, 1888, a housemaid with caries of the sixth and seventh vertebræ was brought to me by her mistress, who, not knowing the nature of the disease, had been under the impression that treatment would only be a matter of a week or two, and was willing, on this idea, to keep the girl on. When, however, she found that treatment would be a long affair, she dismissed the maid with a decent present. The girl, who had no means of subsistence whatever, refused to go into a workhouse infirmary, but insisted on trying to make a living by helping her sister, who took in dressmaking. I had no alternative, therefore, after exhausting argument, but to give her a proper splint, and let her follow her own devices. From her original visit till now (1902) I have watched her regularly, and have periodically applied the splint. During these fourteen years, she lived the first two dressmaking with her sister in confined rooms, and grew worse, an abscess beginning to descend through the abdomen. For the next five years she lived with her brother, who was a publican in a small way, and she took charge of his children, a thing which enabled her to get into the sun and air. The abscess



at the beginning of 1891 had bulged in the groin, and pointed there with lethargic variations of size for about three years, at the end of which time it began to shrink back, and continued to diminish through the abdomen. In 1895 she was able to take a situation as nursemaid, which she has since retained, and at present holds; here, also, she has had ample access to air and sunlight. The abscess has entirely shrivelled away, and she is at the present time about to discontinue the splint, as consolidation is complete.

A contrast between the two foregoing instances is instructive. In the latter there was a povertied absence of everything that could help constitutional strength, and could aid resistance to the disease, and the whole treatment was therefore one long battle against adverse circumstances. It is probable that if this unfortunate woman had had the benefit of recumbency, good food, pure air, and ample sunlight, a cure might have been effected in less than a quarter of the time that it has actually taken.

It is evident that the splint, although it is the most important factor of treatment, is not everything, but that full feeding and healthful surroundings play a very distinct part in the treatment. Indeed, I have noted that in very sunny and healthful climates a slight attack of caries may sometimes heal untreated by anything else beyond perfect rest. I have since the commencement of the Boer War seen two cases from the Cape, in both of which there was the obvious angular deviation of caries, which had quite consolidated long before they came to England, and I was consulted rather for the resultant deformity than for the original disease. One of these cases was a girl of twenty, who a few years previously had a fall from a chair and injured the third lumbar vertebra. The other case was a boy of twelve, who was in the railway accident at Glencoe Pass about five years since, at which his brother was killed, whilst he himself escaped with only an injury to his eighth and ninth dorsal vertebræ. In neither of these cases had special treatment been adopted, beyond recumbency in the healthiest possible surroundings; it will also be observed that in both these cases the carious vertebræ were favourably situated in the lower part of the spine.



From what has just preceded it will be seen that some portions of the complete treatment that I have laid down as best, may have to be omitted from force of circumstances, and that cure may none the less be finally attained. But this is so in all diseases, and it is the duty of anyone writing on the subject of treatment rather to show all the things that should be done than to indicate anything that may by occasional chance be left undone without detriment. The rules I have laid down I have found by long experience to be the safest and the best, and I can further affirm this, that out of all the cases I have had for treatment from the beginning, I have only twice had abscesses actually open on the surface of the body, and in both these instances it was because the parents of the children, on their own responsibility, discontinued the treatment too soon, thinking that absence of pain showed the cure to be complete. I believe, further, that the results it has been my good fortune to obtain have been in a large degree due to the particular method by which the splints I use are adapted in absolute fit to the body, and to the perfect repose and fixity that the spine thereby obtains.

**Complications in the Course of Treatment.**—It has already been explained that the general term Caries embraces three quite distinct diseases, and simply because these in their earliest and uncomplicated stages produce identical effects and are dealt with by identical methods of treatment. In all these three diseases there is local destruction of the substance of the vertebræ, and when the bodies of the bones give way, they do so by a deformity which is angular. In all of these diseases likewise the results are surgically met by a splint and by recumbency until such a time as constitutional amelioration turns the tide of health against the disease itself, and the eroded bone is consolidated by reconstruction. And in all of these diseases there is usually left a solid angular error in the natural shaping of the spine. In their earlier stages, they exhibit no characteristic differences by which they may be distinguishable, indeed, it is difficult to do more than hazard a shrewd, diagnostic guess at which of the three may be existent. Hence it is, that in laying down the rules for



the common treatment of their earlier and uncomplicated stages, I have, for practical purposes, included the whole of them under the one term Caries.

But if these three separate yet allied diseases pass on unchecked and uncured, then the differences between them, which were before unrecognisable, become very marked, and (as I have previously explained) because of the differences in the disposal of the *débris* of their morbid processes. In *dry caries*, there is no accumulation of *débris* at all, and there cannot therefore be (as far as I am aware) any obtrusive complications: its evidences consequently must remain purely negative and may be dismissed. In *suppurative caries*, the *débris* is gathered into an abscess, which in its vagrancy towards escape, may obtrude either in mere pressure against the spinal cord, or may in its wanderings interfere with almost all the organs of any part of the body. Lastly, in *cheesy caries*, the *débris* helps to form part of a spongy, infiltrating mass, which in its obtrusion generally impinges directly against the spinal cord, and does so in the most serious of all ways, by pressure and by infiltration. I shall now proceed to deal with these diseases under the headings of the complications that may arise from them.

**Abscess.**—It may be presumed that in all cases of suppurative caries, an abscess, no matter how small, must be formed at the seat of the disease for the reception of the *débris* of erosion. If the tide of health is almost immediately turned against the morbid process, then such an abscess may shrivel away almost as soon as it is formed, or it may at the most slowly steal some little way into the tissues without affording any evidences of its formation, and then as slowly shrink up again; indeed, the only positive proof that can ever arise of its previous existence is, perhaps, the accidental discovery of its remnants at a post-mortem many years afterwards. About such abscesses there is nothing to be said, as they entail neither symptoms nor recognition.

The more usual and greater abscesses that really are recognisable are so in two ways, and may therefore be classed accordingly. First, there are those that without producing any symptomatic interference with the tissues and organs



through which they pass, swell slowly towards the surface on which it is easiest for them to break and to escape, and they become in time readily recognised by touch and even by sight; it will be this type of abscess that I shall presently take first into consideration. Secondly, there are those abscesses which are recognised by their obtrusive interference with the functions of the organs against which they impinge, as for example, those abscesses that nip the spinal cord or press upon the œsophagus and the trachea; this type of abscess I will deal with later on under the heading of the symptoms they cause, regarding them less from the standpoint of abscess than from that of a growing and obtrusive foreign body.

**Closed Abscesses.**—Having made this distinction clear, I will take an ordinary psoas abscess as an illustration of the type of flowing abscess which comes towards the surface without necessarily causing any obtrusive interference or disturbing symptoms. I will presume that it has in the most usual way pursued its slow course along the muscle that guides its direction, that it has been recognised by palpation through the abdomen as a slowly enlarging alien body, that it has passed beneath Poupart's ligament, and that it has finally become evident to sight as a bulge in the groin, and that for the moment the skin and tissues over this bulge are in all ways stout and healthy. The question that arises for consideration is—what treatment, if any, should be adopted?

Now in the old days before antiseptic principles were known, the rule was to delay opening a spinal abscess until the very latest possible period, and this practice was obviously based on the experiences of the time, that the patient kept his fair chance of life as long as the abscess remained closed. The reason of this is now clear when septic principles are well known, but I should even say to-day that if an abscess is slow in increase, and if there is no particular tension on the sac, and no degeneracy of the skin over the place of pointing, that it is not always unwise to follow the old rule; and I have given a notable example of this in the case described at pp. 50 and 51.

The older surgeons, also, when the skin at the spot of



pointing began to show signs of giving way, were in the habit of regarding this as evidence that the pus ought to be released at this spot, and were wont to assist nature with the knife, and to expedite the inevitable by a direct incision, leaving the abscess to drain just as if it had burst by itself. As far as I know, a very large number of these latter cases usually died, sooner or later, of blood poisoning, and to this fact is probably due the very high rate of mortality shown by the older statistics. The method therefore, in this respect, was very usually fatal. As spinal abscesses however came in recent years to be more considered, it became clear that drainage by a permanent opening would be unnecessary if periodic removal of the pus contents could be effected. Aspiration was first tried, but this failed to very effectually clear the sac; and it was ultimately found in practice that better results could be attained by making a free valve-like incision through healthy tissue into the abscess, and closing the incision the moment the contents had been as fully as possible evacuated. This method relieved the tension, left ample room for the reception of further formed pus, and obviated the dangers of septicæmia.

About the same time it was conceived that the actual sac of the abscess itself might also be dealt with, and that not only could its possible clearance be effected by irrigation, but that certain healing fluids (as the glycerine of iodoform, and others) could wisely be injected into its cavity before the aperture of incision was closed.

Without going into any transitional details, it may be said that the method now advocated in the most up-to-date books is to make at proper points of election a couple of valve-like incisions for the better furtherance of irrigation, to swab out and even scrape the sac of the abscess as far as possible, to inject healing fluids, and immediately afterwards to close the incisions antiseptically.

Now on this procedure I may offer some observations. It comprises two things, the first is the clearance of the sac of the abscess from its load of pus, and the second is the occlusion of the walls of the sac by healing medicaments.

As to the first, it is similar in principle to the older treatment, only that the septic dangers of a remnant aperture in



the sac are avoided. If treatment stopped here the sac itself would be left as an aseptic reservoir into which fresh pus from the seat of the disease could safely drain. But when it comes to the second point, that is to say to the occlusion of the sac by medication, then I am bound to record that most of my experiences are counter to the advantages of the proceeding.

The first case in which I ever kept notes of such a method was many years since at the hospital, when the idea was a new one. A child of about twelve was treated for a right psoas abscess which was cleared by irrigation, injected with glycerine of iodoform, and the sac was duly closed. Nothing, at first sight, could seem more satisfactory than the results; the sac, as could be felt through the abdomen, did not fill again, and the result of this new procedure was considered eminently successful. At the end of less than a year however the child came again, and this time with a psoas abscess at the opposite side. What had happened is clear. The medication of the sac had in no way reached the seat of the disease, nor checked the output of the pus, but as the latter found its old reservoir of drainage cut off, it sought a new reservoir on the opposite side. Surely it would have been better to have merely unloaded the original reservoir, and to have left it as a receptacle for the output of the pus which was inevitably bound to flow until the tide of disease could be turned against its formation.

And in private practice I have often since seen the same thing. I give a case at p. 59 which had been treated by medicated injections for each newly-formed abscess-way, and in which no less than three separate abscess-ways had formed, all presumably for the reason given above. It seems to me therefore, that it is unreasonable to cause the occlusion of the existent pus-reservoir until the pus-formation itself can be checked; and of course the moment that this latter is checked, the reservoir will shrivel and occlude by itself. Hence it seems that medicated occlusion of the sac is not correct in principle, and it would also appear that if medicated injections were to be of real service, this would not be so much for the purpose of producing occlusion of the sac, as for impelling the medicament right up to the actual seat of



the disease, so that it might there exert its specific influence by direct contact and thereby stop the morbid process and the consequent pus-formation. And if the sac of an abscess were a simple tube of even calibre throughout, such a result might perhaps be attainable by the usual method of injection ; or at all events a probe-guided catheter might be skilfully passed up to the very seat of the disease and the medicament might be propelled directly against it. But the sac of an abscess is not such an even tube at all ; on the contrary, it is an irregular collection of constrictions and dilations, at one part often widely dilated, and at another part constricted almost to a pin-point. Hence it may be said, that up to the present, the possibility of dealing directly with the disease by injection through an aperture made in the abscess has not usually proved feasible. Nor are there at present any other known ways of directly reaching the seat of the disease, so that it might be submitted to direct treatment. The bodies of the vertebræ are not accessible from the front, and yet it is their fronts that the disease usually erodes. Through the abdomen the fronts of a few lumbar vertebræ might be partially exposed, but their vital relationships preclude any safe interference from this direction, and the sacral, dorsal, and cervical vertebræ are quite beyond reach. Any operation from the front seems then at present to be impossible. From the side some operative attempts in the loins have been recorded as successful ; although it would appear that these have been chiefly confined to the removal of some sequestrum that was already loose in the abscess cavity. From the back the hazardous operation of laminectomy would only expose the posterior surfaces of the vertebræ, but it is their anterior surfaces that are usually affected by suppurative caries. Hence it may be said that up to the present no direct way is known for getting at and healing the actual spot of the disease. One has therefore for healing to fall back upon the constitutional and medical treatment I have previously described, as well as on free exposure to air and sunlight, on the efficacy of which I have laid so much stress. In respect to direct healing I am almost inclined to hazard the speculation that the problem in the future may be solved by the focalisation of certain light rays on the point of the disease with a



view of slaughtering the micrococcus of its origin. Whether these light rays will be of the X-ray type, or whether they will be collected from actual sunlight, is a point at which one can scarcely yet guess; but this seems certain, that light represents a germicide agent that will be finally directed with precision on any internal point of the body without the necessity of making a surgical aperture for its admission.

**Open Abscesses.**—Now the type of abscess I have just described is the closed one. If it is opened, this is only done temporarily and surgically, so as to release the pus from its confinement and to experiment with certain medicaments, and the abscess is immediately sealed again by a healing closure. But I now come to another class of abscess, which one is not infrequently called upon to see in consultation for the first time, and which is patent by one or more openings that are freely discharging. In such cases the very obvious procedure is to pay the most scrupulous attention to perfectly antiseptic dressings, and to push the constitutional treatment to its fullest and most immediate extent. As to keeping the parts aseptic, the necessity for this is too well known to need any words of comment, for the whole danger of the condition lies in the proneness of an open abscess to become infected,—a proneness that was once so great that some sound surgeons went to the extreme of stating that septic contamination could never ultimately be avoided, a statement that is nowadays palpably erroneous. Curiously enough, abscesses that open on free internal surfaces are quite exempt from infection. I have known retro-pharyngeal abscesses to be opened without any safeguard for years, and yet never to become septic. As to constitutional treatment, I have generally found that these cases of dangerously open abscess are those that have been most “mugged-up” indoors on account of the presumed delicacy of the patient, and yet these are the very cases that should be most fully dealt with by air and sunlight, as the instance I will now give may perhaps accentuate.

The patient was twenty-six years of age, and I was called to see him in consultation in a suburb of Manchester. The previous history that was given to me was that at the age of



four he had measles, and that immediately afterwards he had an attack of caries in the loins, which culminated in an abscess that opened "somewhere at the left side of the back." This condition was rightly treated till he was cured, and though he was a somewhat delicate boy till he was thirteen, yet after that age he grew so strong that he excelled his contemporaries in cycling and in football. When he was twenty-five (that is a year before I saw him) caries reappeared at the old spot, and with such rapidity of pus formation that by the end of two months a psoas abscess had run down to point in the right groin. This was healed by the late Mr. Tom Jones by the modern method—that is to say, it was opened, irrigated, the sac injected with medicaments, and it was closed. The result was the common one, for within a few months a psoas abscess came down and pointed in the opposite groin. This was also dealt with in the same way. As a further consequence, a large lumbar abscess formed somewhat deeply, and failing to find a pointing exit the pus again began to travel down the lines of the old psoas sacs, till both these came to point again. The psoas abscesses were again opened, but instead of being injected and closed, they were allowed to remain open and to drain. After this the tax on the patient's health was so great, and his temperatures were so gravely variable, that his life was despaired of. It was at this juncture that by the parents' wish I was called to consultation. When I saw the lad he was lying in bed in a small room with a sunless aspect, utterly exhausted and incapable of even sitting up, much less of standing. The treatment I submitted for adoption was extremely simple, and it was immediately followed. The patient was forthwith placed on a wheeled spinal couch and sent to the sea-side (St. Anne's), so that he might pass the whole of the summer out of doors in the air and the sunlight. I gave him also a light crutched support that might be worn when he could begin to sit up, and which should take the weight off the diseased spot in the spine. He was to remain at St. Anne's till the English days began to get cold and to shorten, and was then to go to the Mediterranean and continue the same treatment, if possible on shipboard. I next saw him in May of the following year, when he was returning from the Mediter-



raneean, and was going to St. Anne's for the English summer. He walked into my room to all appearance well and strong. The lumbar and the left psoas abscess had entirely disappeared, although a slight and diminishing leakage of pus still percolated from the original aperture in the right groin. I have never seen him again, but have heard from him by letter to say he was quite well.

I have given this particular case because it exemplifies three points. One is that caries will sometimes (though most rarely) recur after many years at the spot of a previous attack; the next is that the case illustrates very markedly the view I have previously expressed on the medicated injection of abscesses; and the last is that it powerfully demonstrates the value of air and sunlight even in the most hopeless condition.

This completes what I have to say on the simple subject of abscesses generally, and for this purpose I have selected those that come towards the surface without obtrusive interference with the organs against which they abut. Under the next heading I have again to deal with abscesses, but, as will be seen, rather in reference to the complications that they may cause by their alien pressure.

**Paralysis.**—The paralysis of caries arises from pressure on the spinal cord by either the abscess of suppurative caries or the tumescent growth of cheesy caries. In both instances the early paralytic symptoms are so much alike that no distinction, so far as I know, has ever been attempted between them. The common diagnostic signs that are taken to discriminate carious from any other paralysis are well known, and are the particular involvement of the motor ways only, the immunity of the bowels and bladder from interference, the exaggeration of the tendon reflexes, and the ultimate supervention of characteristic muscular rigidity. But I hold that, even at the outset, one can often judge by instinctive experience whether this carious paralysis is due to the pressure of an abscess or to that of a cheesy growth. Seeing that marked differences exist in the prospective treatment of these two separate kinds of mischief, it is rather important to come to some definite conclusions as early as possible, and I



will therefore place the two in contrast for the purpose of indicating those points which may broadly serve as distinctions.

In suppurative caries it is the fronts of the bodies of the vertebræ that are usually attacked, and most abscesses start from this position, and never go near the spinal cord at all; but even when an abscess is so situated as to work back against the cord, the vertebræ are usually so weakened that they have commenced to yield. As a consequence of this, all the symptoms that have already been given as the earliest signs of caries (including angular deformity) tend to show themselves before any signs of paralysis come on. In addition also the paralysis will often exhibit fluctuations which are obviously due to variations in the tension of the abscess sac, whilst if the abscess suddenly burrows into freedom from resistance, or if it bursts (as in the illustrative case to be presently given), an equally sudden easement of the paralysis may ensue, the "nip" symptoms clearing forthwith, and those of "compression-myelitis" clearing slowly afterwards, though generally with completeness. An abscess, when pressing against the cord, does not degenerate it by infiltration. Since then there are constant chances that an abscess in burrowing will release the cord from pressure, and since also the abscess in its contact against the cord and its membranes does not deleteriously infiltrate the latter, the treatment of the paralysis of abscess can afford to be reasonably expectant.

In cheesy caries it is the posterior aspects of the bodies of the vertebræ that are generally affected, and whilst the tumescent growth swells backward against the spinal cord, the vertebræ themselves may scarcely be weakened at all. Hence paralysis may, and very often does, arise before any of the other symptoms of caries have become in the slightest degree apparent; and it is therefore not an uncommon thing to find that such cases have been diagnosed in their earlier stages as ones of simple infantile paralysis. The paralysis of cheesy growth exhibits as a rule no fluctuations, but on the contrary pursues its course with deadly evenness, unless indeed the tumescent growth can be checked by constitutional treatment or can be removed by operation. Further, the cheesy growth tends to infiltrate and degenerate the tissues



with which it comes in contact, and the result is that its effects on the cord begin with "nip" pressure, proceed to compression myelitis, and terminate with infiltrative injury to the substance of the cord and its membranes. Treatment, therefore, cannot afford to be expectant; and if it is found that medicinal and constitutional remedies fail to cope with the disease, I have come to the conclusion that operation by laminectomy is justifiably called for, and that the proper time for its performance is the moment muscular rigidity commences to appear (*vide* p. 66).

To better illustrate all the above points, I will now give the records of some typical cases. I have specially selected old-standing instances extending over a number of years as being more instructive than brief and recent ones, where the watched results would not be available. I will first give a typical case of the paralysis of suppurative caries, and will then give two cases of paralysis of cheesy caries, the one treated by the expectant method, the other by operative interference.

In the summer of 1879, a city clerk living in a northern suburb of London, and whose age was sixteen, ricked his neck, as he said, "by merely stretching it." Pain then arose on the left side of the seventh cervical vertebra with increasing stiffness and inability to move his head. He was treated successively with liniments, Turkish baths, and electricity, without relief, and at the end of two years he had with torticollis a large swelling around the affected vertebræ, and constant aching pain, which became acute if he was exposed to movement or to cold. In October, 1881, Mr. John Langton was consulted, who ordered absolute dorsal recumbency for six months, and this was attended by such beneficial results that the patient was able in the following April to resume his office work. A few days later, he was tripped up in the street, and, as he fell, his head struck violently against some railings. The whole of the symptoms immediately returned, and, although he was placed in recumbency, paralysis of the right arm and leg began to appear. As this went on increasing, Mr. Chance was consulted in March, 1883, and he advised the topical application of hot fomentations, with prone recumbency instead of supine. Mr. William Adams,



who was consulted a few months later, concurred in this treatment. As the paralysis, however, continued to increase, and to involve the rest of the body below the neck, he was taken in November, 1883, to the Queen Square Hospital, where he was examined by Dr. Beevor, and transferred to Dr. Ferrier, by whom he was submitted to constitutional and electrical treatment. As he was dealt with as an out-patient, he was taken to and from the hospital in a cab. On January 5th, 1884, as he was leaving the hospital, his cab collided, and turned over; and he again injured his neck severely, and, in consequence, became much worse. In July, 1884, I was called in to see him.

His condition, then, was one of complete helplessness; he was voiceless, except for a weak whisper, his breathing was uncomfortably embarrassed in the throat, and he was liable to violent paroxysms of coughing. The diagnosis of cervical caries, with a retro-pharyngeal abscess low down in the throat, seemed quite clear, and I told his parents that there was nothing to do but to wait till the abscess should burst, as it probably would do in one of his fits of coughing. But I immediately encased the neck, head, and shoulders in a cradling splint, which gave both fixity and extension to the parts. This relieved the pain, but made very little difference in the other symptoms. On the night of January 5th, 1885, the abscess broke during a violent fit of coughing. From this time forward his improvement was rapid; the bodily paralysis quickly cleared, although that in the right leg and arm which were originally affected, did so at quite a different rate to those of the other parts, indeed, as late as 1893, there was a distinct difference in force of grasp between the right hand and the left, which, nevertheless, ultimately equalised. The patient was soon, however, able to resume his clerical work in the city. The abscess has, apparently, never completely healed, for there is still to this day, 1902, some little pus in his mouth in the mornings; whatever may pass during the day drops, of course, unnoticed down the œsophagus. He continues to wear a safe-guarding neck-splint, which is now little more than the old soldier's stock, although his head and neck movements are as good as normal.

This case is remarkable in many respects, but, perhaps,



mostly so on account of the misfortune of the patient, who, on three separate occasions, injured his cervical spine by accidents, any of which alone might have sufficed to initiate disease. It seems, also, most unfortunate that from the very outset the neck was not fixed and protected by a splint, but in the 'seventies the importance of the splint treatment was not, perhaps, so fully appreciated as it is at present. A splint, had it been immediately used, might not only have averted the consequences of his later accidents, but would probably (in my opinion) have led to an early cure. The bursting of the abscess gave instant relief to the paralysis, which, it is to be noticed, cleared in two distinct gradations, the one rapid and presumably due to the removal of the nip pressure of the abscess, the other slow and due to recovery by the cord from the myelitis that had affected the nerve ways of the right arm and leg. The abscess itself has, apparently, been continuously open for seventeen years, yet it has never become septic, seeing that it opens on an internal cavity and is thereby safeguarded. Had its orifice at any time closed, it is probable that all the symptoms might have recurred again. Indeed, where there is security from septic infection, one does not want the orifice to close at all; but one rather waits for healing at the seat of the disease. The abscess, of course, could only be allowed to burst, being beyond the power of surgical release, for it was too low down in the throat to be accessible from the front, and at the time of its occurrence, laminectomy had not been thought of, even if it could have been of service. Had the patient been in circumstances that had allowed him a year's early treatment by air and sunlight, it is possible that the disease might have cleared up; but as it is, he has been able to earn his living without being cognisant of any greater trouble than the presence of a little pus in his mouth in the morning.

I will now give a typical illustration of cheesy caries. The patient, a boy, was born in 1886, he began to walk when about a year old, and attained in the ordinary way his full powers of running about. A little before he was two years old, it was noticed that he began to walk less well, and that he became easily tired and dragged his legs. This weakness increased, and the case being diagnosed as one of infantile



paralysis, he was ordered to Bournemouth for a course of hot salt baths, a treatment which had no affect in checking the loss of power in his legs. This power so diminished, that, although he was still able to stand, he could only walk with assistance, and even this latter power gradually lapsed. About the middle of 1889, when he was nearly three years old, a lump was noticed on the spine between the shoulders, and, as this lump increased, whilst the power in his legs decreased, he was taken to Great Ormond Street Hospital (October 18th, 1889), when for the first time the case was diagnosed as one of caries. The following day his parents brought him to me. His condition, when I first saw him, was as follows: there was an obvious yielding of the sixth dorsal vertebra; he could just stand by locking his knee joints, and resting with his arms against a sofa; if laid supine he could move his legs feebly and slowly, but there was no rigidity.

Now, for the sake of clearness, this case may be regarded from two separate standpoints, first, the condition of the vertebræ, and next, the condition of the spinal cord. As to the former, I may briefly sum things up by saying that I gave him a splint and jury-mast, which he wore for three years. After this, the jury-mast was discontinued, but the splint was continued for another four years, long before the end of which time the vertebræ had become quite consolidated, and free from all carious symptoms.

But it is for the consideration of the course of the paralysis that I am specially giving this case. When the splint was applied, it by no means stopped the continuing loss of power in the legs; on the contrary, the strength faded away from them, till, by the end of a year, they became completely paralysed, and were incapable of any movement; but there was still no rigidity. The treatment was expectant. Small and continuous doses of hydrarg. perchlor. were given in the hopes of shrinking back the cheesy growth, after iodide of iron had been tried without success.

For clearness, I will give the changes in his condition *seriatim*. 1889, condition as stated when I first saw him; 1890, power completely gone, no rigidity; 1891, power beginning to return, in toes first, then in legs; 1892, power



coming back well, is beginning to be able to stand; ordered his bed to be surrounded with a hand-rail so that he can help himself to his feet in bed and practice standing; took him in consultation to Dr. (now Sir William) Gowers respecting correctness of medicinal treatment; 1893, can now stand, but rigidity with contraction of foot muscles of right leg beginning to appear, gave him an appliance with elastic mock-muscles to counteract this; 1894, can now stand and walk by pushing a chair, but contraction of knees and adductors commencing; 1895, motor power continues to improve, but it returns stronger in the flexor and adductor muscles; is beginning to walk with a guiding hand, but on tip-toe with bent knees, and has difficulty in getting one leg past the other owing to adductor "scissor-leg" contraction; 1896, treatment by splint discontinued as spine consolidated, is beginning to be able to walk alone, but in a most laboured way, owing to over-dominance of flexor and adductor muscles, which have to be counteracted by complete leg-instruments up to the hips. Is able to go to day-school; balance of power at the hips better, legs not so scissored, can pass them by each other with less effort. Without continuing the history year by year, suffice it to say that the boy, who is now sixteen years of age, can walk by himself with the assistance of leg instruments, which give elastic help to the extensors of the knee, and, in a less degree, to the uplifters of the foot. The ham-strings and the heel tendons are still over-dominant, or, in other words, they have recovered their power at a fuller rate than their antagonistic muscles.

The lengthy picture of such a case, luckily rare, is not a pretty one to contemplate, and it naturally sets one's thoughts wandering into speculation as to whether something better than the expectant treatment might not reasonably be adopted. In the case I next give, the early history of which is identical with that of the previous one, it will be seen what satisfactory possibilities there are from early operative treatment.

The patient, a boy, was born near Manchester in March, 1893. He acquired the power of walking at the usual time, and up till nearly two years of age ran about quite naturally. In March, 1895, a rapid weakening of his walking power was



observed, and he was sent by his doctor to the late Mr. Tom Jones, of Manchester, who diagnosed the case as one of infantile paralysis, and ordered Scott's emulsion with hot salt baths for the back and legs, followed by cold douches. Curiously enough the boy improved, but a few months later the fifth dorsal vertebra became prominent, and the power in the legs again began rapidly to lose strength. As the parents were dissatisfied they brought him to me with a letter from their doctor.

The condition when I first saw him (September, 1895) was as follows:—The boy held his body fixedly in a muscular splint and supported himself in sitting by his arms, whilst if he was deprived of this latter rest he exhibited a faint "breath-catch." He walked slowly and feebly, and clawed at the furniture for support; but there was no rigidity in the leg muscles. He had no pain by day, but at night (when, of course, the muscles were involuntarily relaxed), he started with pain in his sleep and cried. I gave him a splint with lateral crutched supports, and he was put on iodide of iron, whilst the hot baths and douches recommended by Mr. Tom Jones were, at the strong wish of the parents, still continued. As in the previous case, this treatment did not stop the loss of power; on the contrary, by the end of four months (January, 1896), all power in his legs had practically disappeared. But almost immediately afterwards its reappearance commenced, and by July the mother was able to report to me that the boy had much improved, and that the power was coming back again in his legs. This restoration of strength, with one slight intermission, continued for a couple of years. Then there appeared the first signs of rigidity in the calf muscles of one leg, the heel of which tended to contract—a condition which I met by giving the usual elastic counteraction. In January, 1899, the mother reported that the boy's legs "had become very stiff since Christmas, and that if he was lifted they crossed one another." Taking, therefore, these indications into consideration by the light of cases similar to the one I have just previously given, I concluded that it would be wise to advocate the performance of laminectomy, with the object of clearing away all pressure from the spinal cord. Having therefore obtained the parents' consent



to the operation, I put myself in communication with the distinguished originator of the operation, and saw the case in consultation with him at the Langham Hotel. He, after a careful examination, immediately decided on the wisdom of the operation, and arranged a time for the boy to come up again to town for the purpose. The operation having been satisfactorily recovered from, the boy was kept recumbent till December, after which he was allowed to sit up against a cushion for part of the day. In March, 1900, a splint was applied similar to the one with which I had treated the earlier stages of the disease. When I last saw the boy, March, 1901, he could stand by supporting himself against a piece of furniture, and although his ankles were flail-like in weakness, there was no rigidity nor contraction whatever. In short, the operation had cleared the cord and eliminated the rigid result of its embarrassment.

Now if the history of this case be compared with that of the previous one, it will at once be seen what is gained by operative intervention at the right moment. Of course in cases where the limbs make a balanced recovery of their power without any appearance of contraction or rigidity, then operative interference is unneeded. But this is not usually the case, and when I consider how terrible is the condition of the patient where the recovery of power is attended with contractions at every joint of the limbs, and where efforts at walking are painful and laborious over a long series of years, I cannot but conclude that laminectomy performed as soon as any contractions or rigidity set in, is the right and proper course to pursue, always provided that its performance is not prohibited by any grave contra-indications.

**Menigitis.**—This has been said by some authors to occasionally cause a fatal ending to a case of caries, the inflammatory processes extending from the seat of the disease to the membranes of the cord and brain. I have only ever, in private practice, seen one such case, and even that was a doubtful one. The patient, a tuberculous-looking housemaid of the age of eighteen, was brought to me from the country in January, 1894, by her master, who was a patient of mine. He said the girl had a "stiff wry neck." Her history was



that about a year previously, whilst dusting a room, she had fallen backwards and struck her head against a piece of furniture. She felt at the time "something go" in her neck, but in a few days had apparently quite recovered from the accident. A month or so later she began to have pain in the cervical spine, and (to be brief) came ultimately to be only able to hold her head rigidly in a one-sided position. When I examined her she had marked evidences of advanced caries in the third cervical vertebra, and as she seemed in other respects extremely ill I advised her master to take her back to his country home and to get her immediately into its cottage hospital. At the same time I wrote my opinion to his doctor, who was one of the hospital staff. The girl duly went into hospital, and some ten days after died of cerebro-spinal meningitis. Whether this was resultant on the caries, or altogether independent of it, it is impossible for me to say, but the hospital surgeon, who was at the post-mortem, inclined to the latter view. Obviously, however, the late treatment of such a case falls into the province of the general rather than of the orthopædic surgeon.

**Conclusions on the First Stage of Caries.**—This brings to conclusion the remarks that I have to offer on the treatment of the first stage of Caries. I have given the typical course of the disease (or rather, I should say, of the three diseases that are comprised under the one single title) in its range from origin to a possibly fatal termination, and I have also given over the same range the treatment that has appeared to me to yield the best results. I have also insisted that nowadays no case should ever progress through such a range in its entirety, but that, on the contrary, it should always be caught early by symptoms, and that the disease should invariably be beaten back into cure by simple means, that is to say, by a properly constructed splint and by right constitutional treatment. I have shown that the splint which I employ is made with much greater accuracy and efficiency of support than can be attained by any other known method, and I claim for such a splint the capacity for keeping the angular deformity within very restricted limits. I have also laid particular stress on the necessity of applying a splint



immediately the disease is diagnosed, and (if possible) before any angular deformity has become apparent. I have further drawn attention to the paramount assistance that an open life in full air and sunlight lends to the other means of constitutional treatment. And finally, I have referred to those exceptional cases in which the difficulty is not so much the cure of the caries of the spinal column as the relief from pressure of the spinal cord. Further, I have shown that whereas only a few years ago such cases could merely be dealt with by long expectancy, they are nowadays capable of relief by a discriminated laminectomy. Hence it would appear that not only is there no contingency in the course of Caries that cannot now reasonably be provided for, but that the consolidative cure of the spinal column is practically always attainable. But, as I have previously stated, it is when consolidation is complete with the healing of the bones that the first stage of Caries ends and that the *Second Stage* commences and has to be dealt with. I shall in the next section proceed to explain the reasons and facts on which this statement is based.

---

### SECTION III.

#### THE TREATMENT OF THE SECOND STAGE OF CARIES.

If cases of caries could be caught by symptoms at their very outset, and if they could be splinted before the vertebræ commenced to yield, and if the cure of the disease could be effected before there was any material change in the shape of the bones at all, then the spine, after cure and consolidation, would be quite unaltered in form and would be practically in precisely the same position as it was before the access and passage of the disease. In such an event, there would be no second

---

FIG. 17 is a representation of five normal dorsal vertebræ. FIG. 18 shows the same vertebræ, the middle one of which has consolidated after an attack of caries. The object of these diagrams is to contrast the differences in the planes of the body of a normal and of an affected vertebra.



FIG. 18.

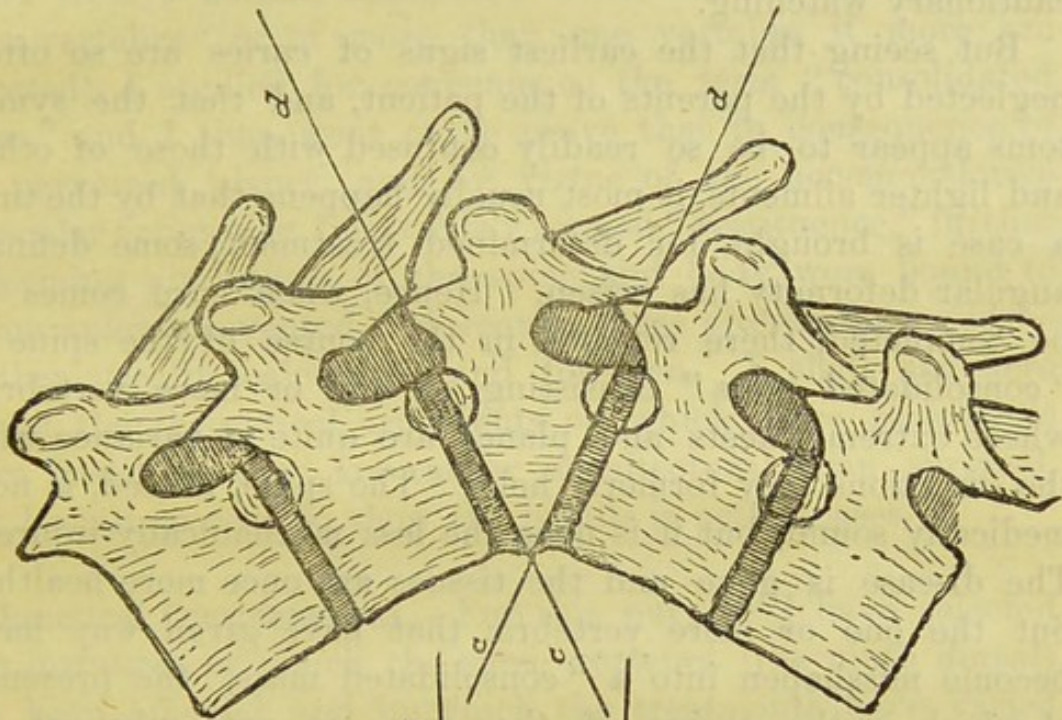
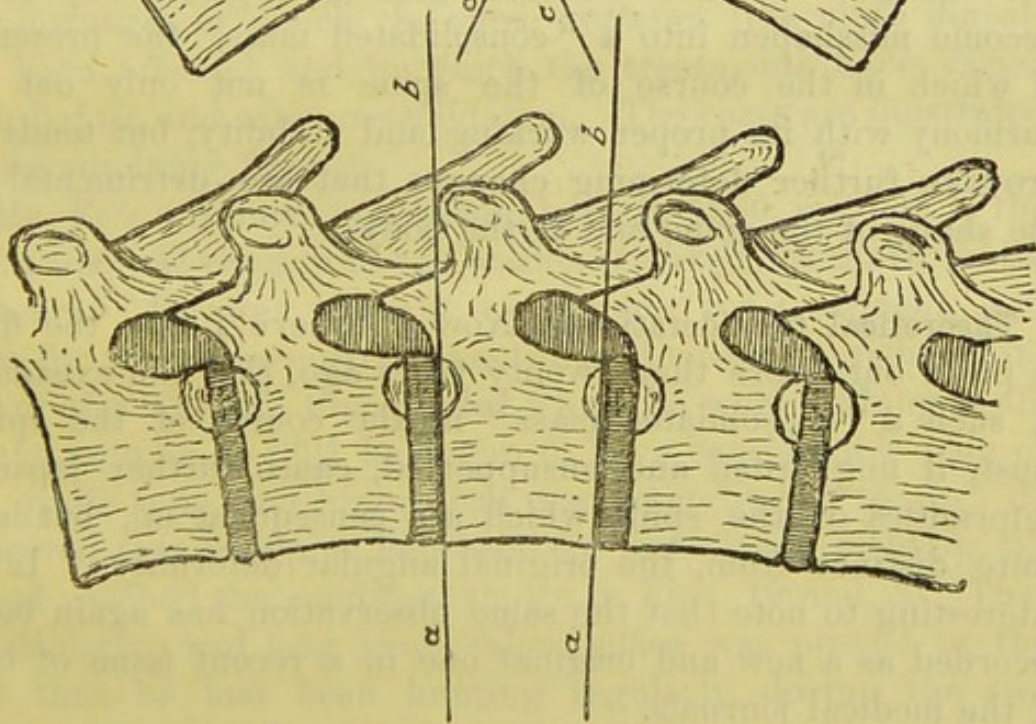


FIG. 17.





stage of treatment at all. To put it in other words, if when caries was cured no deforming derangement of the true planes and facets of the affected vertebræ had arisen, then nothing further would be needed beyond, perhaps, some little immediate safeguarding and some future periodic and precautionary watching.

But seeing that the earliest signs of caries are so often neglected by the parents of the patient, and that the symptoms appear to be so readily confused with those of other and lighter ailments, it most usually happens that by the time a case is brought for determined treatment, some definite angular deformity has arisen. Hence, when cure comes to be completed, there remains in the course of the spine a "consolidated mass" consisting of one or more vertebræ, whose extreme facets and planes are quite at variance with the directions they formerly held. The spine, indeed, is now medically sound, but it is none the less mechanically injured. The disease is gone and the tissues are once more healthy, but the one or more vertebræ that have given way have become misshapen into a "consolidated mass," the presence of which in the course of the spine is not only out of harmony with its proper working and stability, but tends to provoke further deforming changes that are detrimental to the shape of the spine and of the body.

**Theoretical Considerations.**—Now I believe I was the first to point out, more than twenty years ago, that the existence of such a "consolidated mass" in the course of the spine must, if unguarded and unsupported, cause further lapsing deformities of the spine which are consequent on, but are quite distinct from, the original angular deformity. It is interesting to note that the same observation has again been recorded as a new and original one in a recent issue of one of the medical journals.

In a previous edition of this work (1882), I gave the preceding diagrams for the purpose of theoretically explaining the causes of these changes. The figures show side by side the vertebræ of the same part of the spine,—in the one instance before the carious attack (Fig. 17), and in the other instance after the disease has run its course, and consolidation



has taken place (Fig. 18). The vertebra bounded by the lines *a b* is sound and true in its planes and facets; on the contrary, the same vertebra after the course of the disease and consolidation are bounded by the lines *c d*, and it will at once be seen in what respect its planes and facets must differ from a normal unaffected vertebra. To the remnants of a vertebra (or of more than one vertebra if more are affected), I applied for convenience the term "consolidated mass," and I then went on to prove that in consequence of its perverted planes, and by virtue of the accommodative muscular action that I previously termed "restitution," further deforming alterations of the spine and body were bound to ensue unless prevented. Moreover, these alterations could be mathematically calculated and foreseen. I shall not here repeat the theoretical arguments on which these statements were based, as they are rather architectural than surgical, but I shall proceed to show the results in actual cases.

**Practical Considerations.**—For this purpose I have selected two instances, in which the same vertebra (the ninth dorsal) has been affected, and in which the treatments have varied both before and after consolidation. The cases are illustrated in the adjoining figures:

Mr. F—, a country gentleman, born in 1880, resident in the Midlands. At the age of ten, caries attacked his ninth dorsal vertebra. He was brought to London for treatment, and wore for nine consecutive years the inadequate English modification of a Taylor's brace, after which he wore nothing at all. In the autumn of 1891 he began to have considerable pain of the girdle type, and his medical man brought him to me. It appeared that his spine had been for some years yielding, till it had reached the condition shown in Figs. 19 and 20. That consolidation had long since taken place was proved by the fact that he had been hunting regularly during the two previous years. It appeared, therefore, that the pain was probably of the intercostal type, and due to the enormous yielding that had been permitted. I therefore gave him a spring-tempered antero-posterior appliance of the kind shown (Fig. 23), which relieved the spine of its strain, and tended to bring the trunk back into balance over the angular spot.



The pain was relieved in a few weeks, but as the vertebræ have practically reached adult ossification, it is doubtful whether the body can be brought to complete erectness without some years of extension.

Master W— was born in February, 1887, his parents being in a good position, and resident in London. At the age of three and a half he was attacked with caries of the ninth dorsal vertebra, which was not clearly diagnosed till this had become prominent. He was then taken to Mr. William Adams, who ordered a couple of years' recumbency, and (according to his method) without a splint. At the end of this period his back was splinted, and he was allowed to walk. In March, 1895 (as Mr. Adams was retiring), the parents brought him to me, and I continued the same splint treatment for another sixteen months, by which time consolidation was quite complete. From that time to this he has worn a protective appliance to uplift the weight of the trunk from the spine, and to guide the spine itself into proper accommodation with the consolidated mass left by the caries. This appliance he will continue to wear till he is adult, and until the bones are fully ossified. His present appearance is shown at Fig. 21.

Now the very obvious differences that exist in the general shape and erectness of the body in these two cases can be observed by the most casual glance at their photographic representations. Yet if the actual angles of curvature are carefully regarded, it will be seen that in both instances they are practically the same; indeed, were it possible to remove the consolidated mass from the spine and to inspect it, it would be found that the perversion of plane and facet was much about the same in both cases. In both cases also the angularity is situated at the same spot, and is pretty severe, because no splint was used at the outset to check it. When, therefore, in both cases the angularity is so identical,

---

FIG. 19 shows a case of caries that has neither been treated originally by a splint nor safeguarded after consolidation; the body has therefore yielded enormously in an antero-posterior direction, although, as shown in FIG. 20, there is no lateral deviation. FIG. 21 shows a similar case which has been treated by a splint during the later part of the first stage, and by a proper appliance afterwards; the body is therefore erect notwithstanding the angular curvature.



FIG. 20.

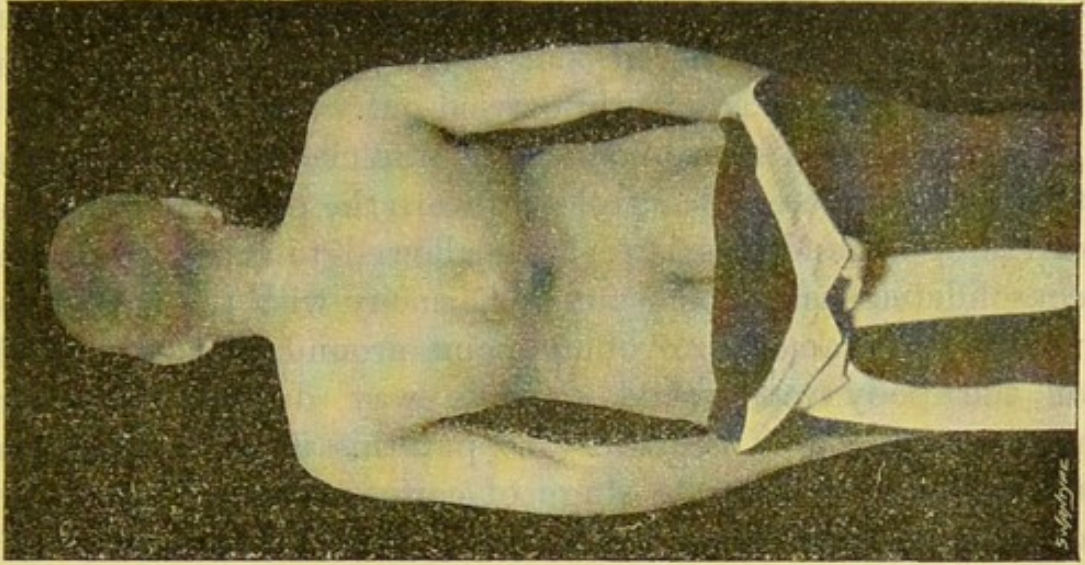


FIG. 21.

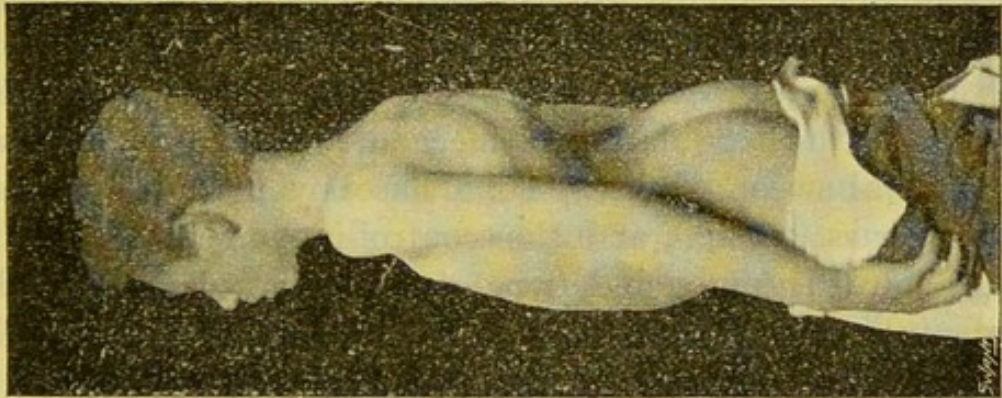
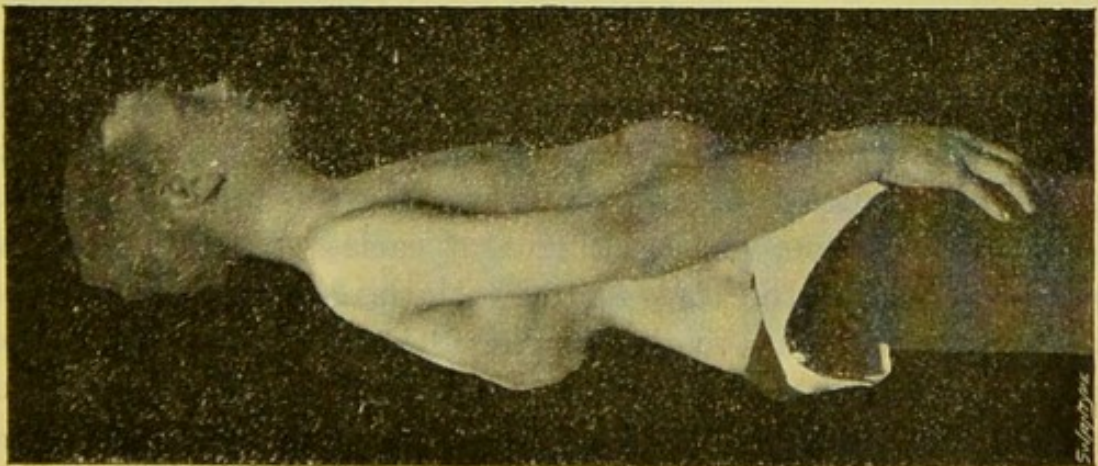


FIG. 19.





how is it that the shape of the bodies is so different? The answer is simple. In the one case, all treatment of the second stage was ignored and neglected, in the other it has been and is being efficiently carried out.

With the man's case no attempt was made, after consolidation was complete, to control or govern the possible re-shaping of the spine, and this latter was allowed to lapse, whilst the consolidated mass, being out of harmony with the rest of the vertebræ, became a provoking point around which the whole of the body was bound to give way during the entire remnant period of growth. To put this in other words, no treatment of the second stage of caries was ever attempted, or even perhaps thought of.

With the lad's case, on the contrary, the moment consolidation was complete, the discarded splint was replaced by an appliance that actively compelled the spine into such ameliorative changes as tended towards the erectness of the body, and which brought the consolidated mass into mechanical harmony with the other vertebræ. The body is consequently rightly erect, and the angularity is merged into conformance with the general sweep of the spine. The boy is at present only fifteen years of age, and the controlling treatment will be continued till his completion of growth, when the adult hardening of his vertebræ will probably render further support unnecessary throughout the rest of life. Or, to again put the facts in other words, the necessary treatment of the second stage has here been successfully accomplished.

**Principles of Treatment of the Second Stage of Caries.**—I have now demonstrated both on theoretical and practical grounds the fact that if (as is usual) there is any angularity left in the spine, the treatment of caries cannot terminate with the cure of the disease and with the consolidation of the vertebræ; but that, on the contrary, there is a second stage of treatment that requires quite as much care and attention as did the first. And to make this important point the more clear, I may perhaps put it in a further light.

Caries causes, by softening of the vertebræ a primary



curvature which is angular and antero-posterior. The moment this primary curvature is started, secondary or compensatory curves (also antero-posterior) immediately begin to form above and below it. Now with lateral curvature these consequences are well known, and it is fully recognised that the moment a single lateral curve is formed, it tends (if unchecked) to be reduplicated by "compensation" into a double or even a triple curvature. With carious angular curvature the similar fact seems to have escaped recorded observation, yet it is none the less certain that the primary curve of caries is immediately followed by the commencing formation of the secondary curves it provokes. But as pain, apart from deformity, is usually a premonitor of the advent of caries, a splint of some sort is generally and almost immediately applied, and this before the secondary curves have had much time to form. After this splint has been applied both sets of curves (that is to say both the primary and the secondary ones) are stopped, or at all events checked in formation, and the spine is held in passive quiescence until the disease is cured. When, however, the affected vertebræ become sound and consolidated, and the time comes to discard the splint, some angular curvature is almost invariably left in the course of the spine, and if the latter remains unsupported, then those secondary curves which had been prevented by the splint from arising at once commence to form. And as these secondary curves if allowed to establish themselves always increase the general deformity of the body, it follows that one of the main objects of the second stage of treatment is to prevent their formation.

Now although this point was, I believe, never clearly demonstrated till I drew attention to it in 1880, still there were some authorities who advocated that the splint might be advantageously continued for a year or so after consolidation was completed, and they gave as their only reason that it was perhaps wise to safeguard the spine for some further time after cure. And although this reason was somewhat vague and unscientific, still it goes to show that they knew by experience that detrimental changes in the spine often began to take place the moment the splint was left off. But even supposing that the splint was continued for another year or



so, it made no real difference at all, but only kept the spine passively in *statu quo*; so that the moment the splint was finally discarded, and that the spine was left unsupported, then and forthwith the secondary curves (provoked by the primary angular one) began to form and to deform in precisely the same way as they would have done if the splint had been left off at an earlier date. Hence, it is obvious that whilst the spine does require further government after consolidation is completed, yet this government is not rightly given by the continued use of a splint, and that the latter, which was of paramount service during the first stage of the disease, is valueless during the second.

Another object in the commencing treatment of the second stage is to take all weight and strain off the newly-consolidated bones, and thereby to prevent the primary angular curvature from in the least degree increasing. For, it is only possible to be certain of complete consolidation by the absolute disappearance of symptoms, and even then the strength of the newly-formed bony tissues cannot always be accurately gauged. It is therefore necessary when first the splint is discarded to make some protective provision against any chance of over-strain on these tender parts by taking from them all superincumbent weight until they are completely substantiated. Hence it will be seen that not only have the secondary curves to be precluded from formation, but that also for some time the primary curvature has to be safeguarded against any possible increase.

Nor does the treatment of the second stage stop here, but, on the contrary, it goes much further than the mere prevention of any increase of the existing curvature, for it aims at the straightening and lengthening of the entire spine into the best position allowed by the consolidated mass. And this straightening is not attempted (nor is it possible) locally and at the angular spot, but it is effected generally by reformation of the whole vertebral column.

It has been previously shown that no attempt should ever be made to straighten the spine during the active period of the disease at the angular spot itself, for absolute passive quiescence of this spot is essential to consolidation and cure. It is true that Dr. Sayre, in the exuberance of his idealism,



proclaimed in 1877 that such straightening was attainable by his suspensory method during the active stage of the disease, but his misconception was entirely and almost immediately disproved at the International Medical Congress held in London in 1881. Similarly no attempt can be made to get direct straightening at the angular spot after consolidation, although even to-day one hears Continental reports of a method of straightening by fracture—a plan which is as old and barbaric as the sixteenth century, and which is as inefficient now as it was then. Nor does it appear likely that any operative method will ever be evolved to attain the same end, seeing that actual straightening could only be effected by replacing the material lost by erosion in the fronts of the vertebræ. What, however, is possible is to reform and lengthen the whole spine, with due regard to the angularity of the consolidated mass.

And to this last statement another may be added as corollary—that the ultimate object of the treatment of the second stage of caries is to bring the consolidated mass itself into such mechanical accord with the rest of the spine that it can no longer be provocative of deforming changes. When consolidation is first completed, not only are the planes and facets of the consolidated mass out of harmony with the working of the rest of the vertebræ, but the lines of gravity of the weight of the trunk do not pass truly through it, hence the spine tends to yield above and below it in the way which has occurred in Fig. 19, and has been avoided in Fig. 21.

Now in the natural spine with its natural curves and its rightly formed vertebræ, the lines of bodily weight pass truly through it, and it is therefore stable. Similarly, there is a set of curves into harmony with which the consolidated mass can be brought, so as to be no longer provocative of secondary changes; and when this has been done (as it has been in the case Fig. 21) the spine is then stable, and if the patient is adult it can forthwith be left as free of support as the natural spine itself can be.

**Method of Treatment.**—From what has preceded, the full objects of the treatment of the second stage of caries can now be summed up. They are:—(1) To take all superin-



cumbent weight off the newly consolidated spot ; (2) to stop the formation of such secondary and deforming curves as would be provoked by the untrue plane and facets of the consolidated mass ; (3) to get and to maintain as much straightening and lengthening of the spine as possible ; and (4) to bring the consolidated mass into such a position of accordant harmony with the working of the spine as may render the latter stable.

Now in the first stage of caries, no alteration in the shape of the spine is sought for at all ; on the contrary, all that is wanted is absolute passive rest to enable the bones to heal, and for this purpose no appliance is so suitable as a splint, which is the most comprehensive and most passive of all appliances.

But when it comes to the second stage, and it is desired to lengthen, straighten, and rearrange the spine, then it is obvious that the continuance of a passive splint is out of all question, and that on the contrary an active appliance is needed that can dictate to the spine the changes that are beneficial to its shaping.

The precise form of the necessary appliances and the details of construction vary with each separate case, but the same mechanical principles underly them all. As may be seen in the representation of two typical appliances which, at first sight appear widely different in construction (Figs. 22 and 23), a base-hold is taken on the pelvis which constitutes the fixed point from which support and control can be exercised. The superincumbent weight is taken off the angular spot by means of crutch-pieces under the arms if the disease has been in the lower part of the spine, and by the further addition of some kind of head-gear if the disease has been higher up. Two tempered-steel bands extend along the course of the spine over the transverse processes of the vertebræ, and these bands are so "set" as to dictate to the spine the required direction of its changes. These bands are not stiff pieces of metal, merely moulded to the exact shape of the faulty spine, but they are tempered like a truss spring

---

FIGS. 22 and 23 represent two types of the appliances used in the control of the second stage of caries, and which are capable of many modifications of detail according to circumstances.



FIG. 23.

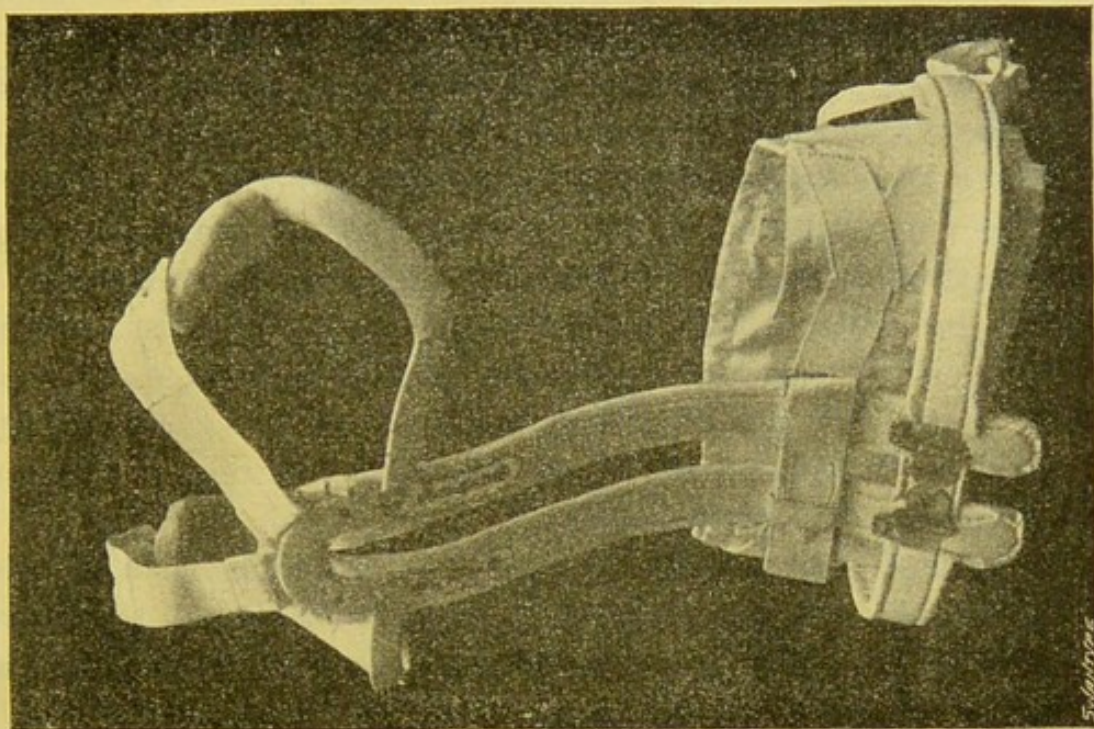
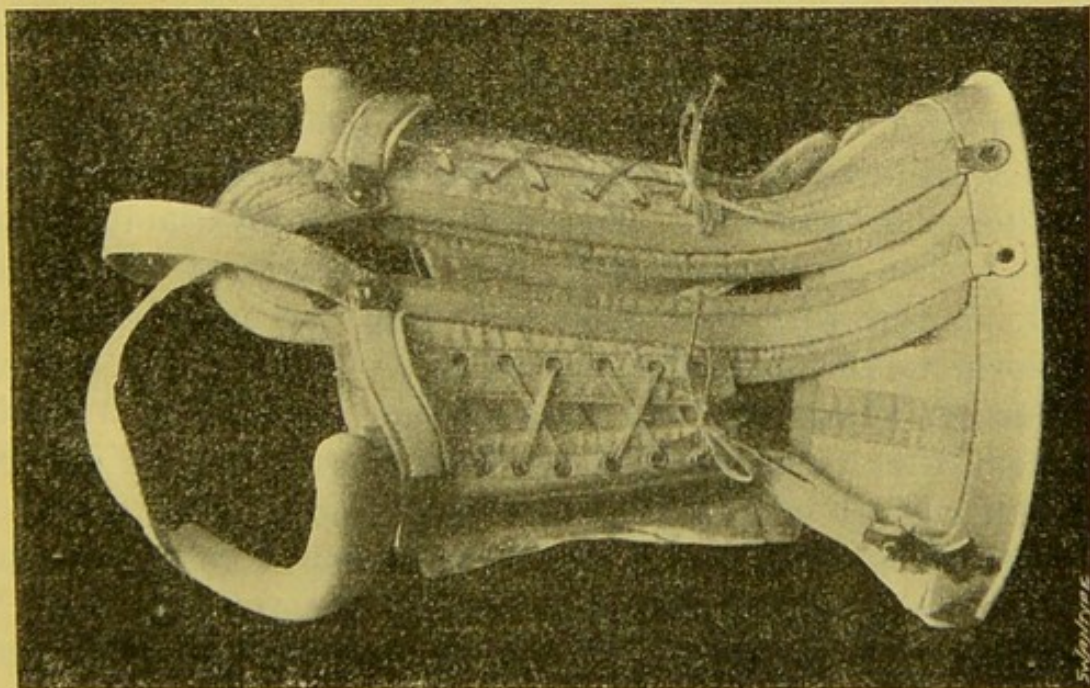


FIG. 22.





and are "set" to dictate to the spine the necessary changes it shall make, which they do in virtue of their spring or elastic power. The influence of such power is commonly familiar in cases of club-foot, and it is equally applicable to any other jointed part of the body, and particularly to the spine, which is of all parts the most freely jointed. By such power secondary curves are prevented, the spine is straightened and lengthened, and the consolidated mass is brought into stable concordance with the rest of the vertebræ. It may be added that this treatment has to be most carefully pursued in the dorsal and upper lumbar regions, as these are the ones that are the most liable to excessive change: the cervical and lowest dorsal vertebræ do not require the same stringency of directed control.

As caries is far more common in growing than in adult persons, so it very generally happens that when the disease is cured, and the first stage of treatment is ended, there are still some years to run before the body has completed its growth, and the bones are fully ossified. Under such circumstances, even after getting the spine into its best and stablest position, I continue the support till the patient reaches the age of twenty. With adults such long continuance is unneeded, and when the spine has once assumed its most stable shape the appliance may be carefully discarded. To do this I gradually diminish the support till it is reduced to a minimum, after which the appliance is altogether removed. One precaution I invariably observe, and that is to accurately take the height of the patient, doing this with bare feet, and with the measurer carried down to the skin of the head in a parting of the hair, and further noting that the measurement is taken at a distinct hour after rising, because the body shortens to the extent of half an inch or so during the day. Once a year, and at the same hour after rising, the measurement is repeated, and if any shortening shows itself (beyond the yearly normal loss of about a thirty-second of an inch), then the resumption of some support has to be considered. But this necessity is extremely rare, for the height is almost invariably maintained, and this being so, the case can then be finally considered to have been carried through to its satisfactory termination.



