

The diagnosis from Pott's disease should be made without difficulty. The characteristic deformity of rachitis is a rounded projection of the middle and lower part of the spine. It is simply an exaggeration of the contour of the sitting posture which the rachitic child habitually assumes, a posture that would be painful if actual disease were present in this situation.

If the patient be placed in the prone posture the projection may be reduced in great part by raising the thighs while gentle pressure is exerted upon the kyphosis; and although the spine is somewhat rigid, and although such extension and pressure may be resisted by the patient, yet there is complete absence of the muscular spasm characteristic of Pott's disease.

**Disease of the Middle Region.**—As motion in the thoracic region of the spine is limited, the early symptoms of disease are far less marked than in the region below. On the other hand, a slight exaggeration of the normal dorsal kyphosis causes noticeable deformity. Thus it is that deformity may be the first symptom that attracts attention.

The effect of the disease upon the attitudes varies. If the disease involves the lower part of the thoracic segment, and if it be at all acute, they are similar to those of disease of the lumbar region, namely, erectness, the peculiar cautious intoeing step, and the disinclination to bend the body forward.

In disease of the upper dorsal region there is usually a slight forward inclination of the body while the head is tilted backward or inclines toward one side. A peculiar shrugging squareness and elevation of the shoulders is often noticed, due in great part to the lowering of the head and forward inclination of the neck resulting from the deformity. Another effect is pigeon-chest. As the deformity progresses the sternum is thrust forward and the antero-posterior diameter of the chest is increased at the expense of its height.

This deformity of the chest may be the first symptom to attract the attention of the parents.

Of the early symptoms of dorsal disease pain and labored or "grunting" respiration are the most characteristic.

Pain referred to the abdomen and to the front and sides of the chest is usually an early and often a constant symptom. Thus, persistent "stomachache" in a child should always lead the physician to make an examination of the spine. A "spasm of pain" is sometimes excited by lateral compression of its chest, as when the child is lifted suddenly by the parent.

Of still greater importance is the labored respiration, which, indeed, is almost pathognomonic of Pott's disease. The "grunting" is caused by the interference with respiration, more particularly with the normal rhythmical movements of the ribs. The restraint is in part due to muscular spasm and in part to the voluntary efforts of the patient. The inspiration is quick and shallow, in great degree diaphragmatic, and expiration is accompanied by a sigh or grunt. This is apparently caused by a momentary closure of the larynx to resist the escape of air and thus sudden motion of the chest wall. Grunting respiration is of course an evidence of the more acute type of disease, but even in mild cases it is usually present when the patient is fatigued or during play. An irritating aimless cough is often a symptom of disease of the upper dorsal region, and spasmodic attacks resembling asthma are not uncommon.

When symptoms have existed for any length of time the characteristic angular kyphosis is usually apparent on physical examination, or at least the significant break

in the contour of the spine when the patient is inclined forward.

In tracing the neuralgic pain to its origin, the sharp downward inclination of the ribs must be borne in mind; thus the cause of pain in the "stomach" must be looked for between the shoulder blades.

As in the lumbar region, slight lateral deviation of the spine is not uncommon, and it may be accompanied by a slight twist or rotation, so that the ribs on one side are more prominent.

**Involvement of the cord** from extension of the disease backward is far more commonly a complication of disease of the upper and middle dorsal region than of disease elsewhere, and an awkward stumbling gait or even complete paralysis may be the first important symptom of the disease. Abscess is less common here than in the lower region. Its presence may be suspected if an area of dulness is found by the side of the kyphosis. In rare instances an abscess in the posterior mediastinum may press directly upon the trachea or bronchi and cause spasmodic attacks of dyspnea resembling asthma.

It is hardly necessary to mention the list of affections that may cause pain in the chest or abdomen, or induce a labored respiration or cough. As regards deformity the round stiff back, a postural deformity of adolescence, and the rachitic kyphosis may be excluded without much difficulty.

Spondylitis deformans, the typhoid spine, and the like differ essentially in history and symptoms. Acute or chronic affections within the chest may cause pain and even deformity of the spine. Such disease, however, could hardly be mistaken for Pott's disease. The abscess of Pott's disease in this region, as has been mentioned, causes dulness or flatness on percus-

sion of the chest, and within this area friction sounds and râles may be heard. If the diagnosis of Pott's disease had not been made, or if the presence of the abscess had not been determined by the previous physical examination, it might be mistaken, during an acute exacerbation of the disease or constitutional disturbance from other cause, for pleurisy or empyema, and at other times for phthisis. The tuberculous fluid may remain indefinitely in the posterior mediastinum, and the area of flatness may extend beyond the axillary line, yet it may give rise to no symptoms.

In all cases a careful examination of the chest should be made from time to time in order that the presence or absence of abscess may be recorded.

**The Upper Region.**—The upper region of the spine, which includes the cervical and two of the dorsal vertebrae, is a region of free movement. This movement is in part true joint motion; thus it is necessary to consider disease of this portion apart from that of the remainder of the upper section. Occipito-axoid disease is comparatively rare, and relatively more frequent in adult life than in childhood. It is especially dangerous because the displacement or fracture at this point may cause sudden death by pressure on the vital centres. In a typical case the symptoms are neuralgic pain radiating over the back and sides of the head, following the distribution of the auricular and occipital nerves. The head is usually inclined forward and rotated slightly to one or the other side of the median line. There is usually thickening of the tissues on the posterior and lateral aspects of the neck, and there is in most instances sensitiveness to deep pressure. As a rule motion in these joints is absolutely

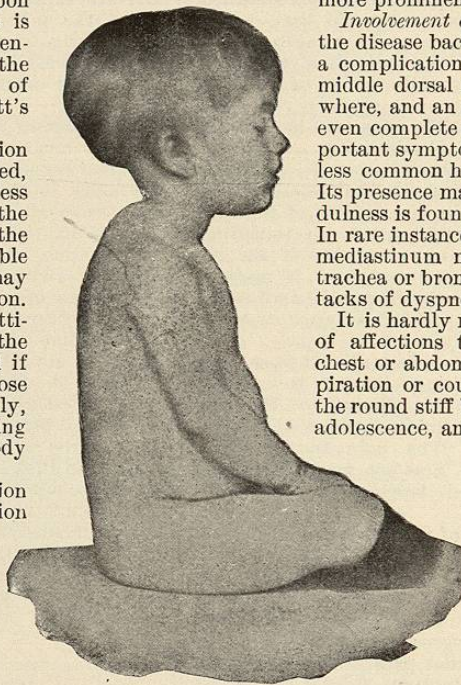


FIG. 4433.—Pott's Disease at the Cervico-dorsal Junction, showing the Effect of the Deformity in Thrusting the Neck Forward.

restricted, as is shown when one attempts to move the head up or down or from side to side.

In disease of this region if an abscess appears it usually presents itself on the posterior or lateral aspect of the neck, but in some instances it forces its way forward as a retro-pharyngeal abscess. In such cases the symptoms may be characteristic of obstruction, such as snoring, change in the quality of the voice, difficulty in swallowing, and sometimes spasmodic attacks of so-called croup.

When an abscess is present, and when the disease is at all acute, the reclining posture often increases the symptoms.

The symptoms of disease of the middle cervical region are similar to those of the upper dorsal section. There is usually a backward inclination of the head if deformity is present. In other instances the head may be turned to one or the other side, so-called false torticollis. Deformity at the upper extremity of the spine straightens the natural anterior curvature in the cervical region, and as a result there is compensatory flattening of the back; thus a short neck and a flat back are often the most prominent physical signs of disease of this region.

The distortion of the head symptomatic of Pott's disease is sometimes mistaken for torticollis. From chronic torticollis it may be easily distinguished, because in this distortion there is limitation of motion only in the direction opposed to the contraction and there are no accompanying symptoms. From so-called acute torticollis caused by enlarged or suppurating glands, or following irritation of the nose or pharynx, the diagnosis may be more difficult; but in this affection, if the head be inclined toward the contracted muscles, motion in other

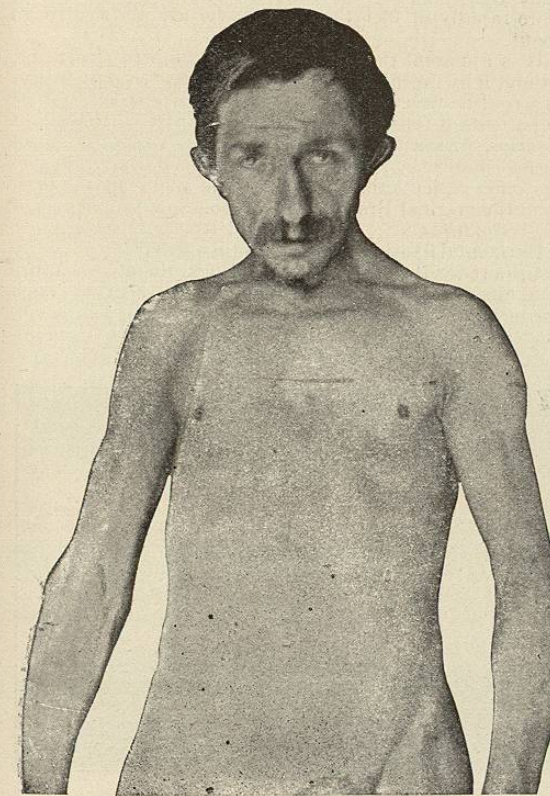


FIG. 4434.—Alloxoid Disease, showing the Characteristic Attitude.

directions will be unrestricted, whereas in Pott's disease all movements are checked by muscular spasm. It may be stated also that the distortion of Pott's disease is often irregular, and there is no evident contraction of certain

muscular groups, such as is usually present in simple torticollis.

**Injury.**—Injury of the upper segment of the spine may cause pain and stiffness and deformity, symptoms that could not be distinguished from those of Pott's disease but for the history of the case.

Weakness of the posterior muscles following diphtheria may cause a forward droop of the head. Spasm of the posterior muscles is sometimes seen incidental to meningitis and even as a less serious symptom in weakly children, but such deformities can hardly be mistaken for Pott's disease.

Abscess may cause symptoms of obstruction in the throat which might be mistaken for that due to adenoid growths or enlarged tonsils. It may be mentioned also that the seventh cervical vertebra often forms a noticeable projection at the base of the neck. In hysterical or hyperæsthetic individuals these symptoms are sometimes mistaken for those due to disease.

Forms of organic diseases of the spine other than tuberculous are described elsewhere.

The diagnosis having been established, an accurate record of the case should be made. This should include the general condition of the patient, the character of the disease, whether acute or quiescent, and the presence or absence of complications. The position and character of the deformity should be recorded by means of a tracing of the entire length of the spine, such a tracing being made by means of a strip of lead or tin while the patient is lying extended in the prone position.

**TREATMENT.**—Pott's disease is the most important of the tuberculous affections of bone, and the importance of proper surroundings, nourishing food, open air, and sunlight can hardly be exaggerated.

Special orthopedic treatment is essentially mechanical; its object is to resist the natural tendency of the disease toward deformity.

Under normal conditions the weight of the head and of the thoracic and abdominal organs tends to bend the spine forward. If the support is weakened by the direct destruction of the weight-bearing portion of the spine this tendency is greatly increased. It is evident, therefore, that the force of gravity is a very important factor in the production of deformity. Flexion of the spine compresses the vertebral bodies; extension of the spine relieves this pressure and transfers it in part to the articular processes.

The object of a brace or other support in the treatment of Pott's disease is to hold the spine in the extended position and to prevent motion at the seat of disease. The effectiveness of any splint depends upon the accuracy of

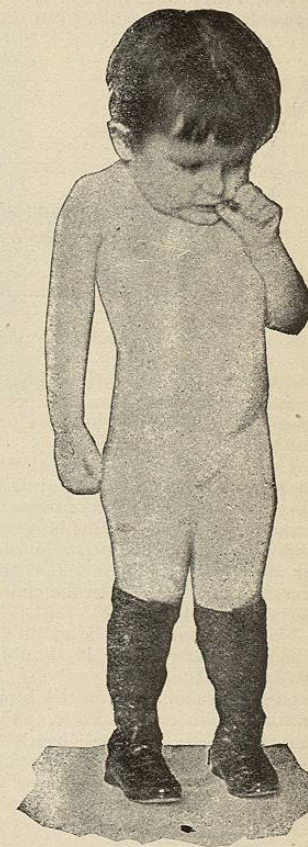


FIG. 4435.—Pott's Disease of the Upper Cervical Region, showing the Characteristic Deformity in an Untreated Case.



its adjustment, and it is apparent that such adjustment is more difficult in certain regions of the spine than in others. For example, if the disease involves the lower thoracic region the splint is likely to be effective because its two extremities attached to the pelvis and to the shoulders are equally distant from the point to be supported; but if the upper thoracic region is affected, it is difficult to fix the spine because of the insufficient leverage

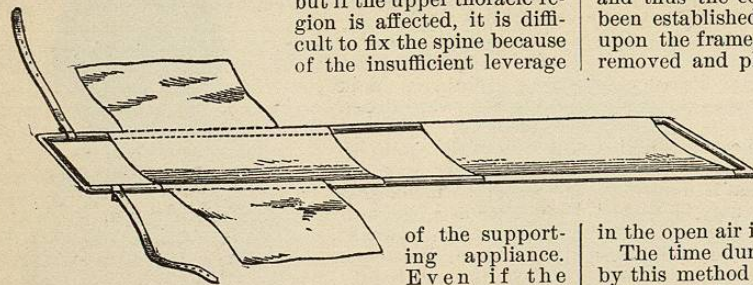


FIG. 4436.—The Bradford Frame.

it cannot remove entirely the jar and strain incidental to the upright posture. It is evident, therefore, that complete rest can be assured only in the attitude of recumbency.

*Treatment by Horizontal Fixation.*—A number of appliances to assure horizontal fixation are in use, but the most effective and convenient support is the Bradford frame or stretcher. This is a rectangular frame of ordinary gas pipe, a few inches longer and a little wider than the patient's body, covered with canvas or cotton cloth, except for an interval in the centre, as shown in the illustration (Fig. 4436).

This appliance may be modified with advantage in the following particulars: it should be made slightly narrower than the patient's body, its width corresponding to the distance between the articulating surfaces of the shoulder-joints. The cover should be made of strong canvas in one piece so that it may be drawn tight by means of straps and corset lacings (Fig. 4437). The centre should be covered by rubber cloth. Upon the canvas cover opposite the seat of disease should be sewed two pads of felt about six inches long, one inch wide, and half an inch thick. These should be parallel to one another and about one inch apart. They protect the spinous processes from pressure, and aid in fixing the spine. The patient, in most instances a young child, wearing simply a shirt and diapers, is then placed upon the frame, and is fixed to it by means of a front piece of canvas, as shown in the illustration. If the disease is of the upper region, the head should be fixed by an appliance similar to the ordinary jury-mast; if it is in the lower region the movement of the limbs should be restrained by means of a swath or by traction straps. When the frame has been adjusted the child's clothing is put on, having been made sufficiently large to include it and the frame. This illustrates the advantage of making the appliance as narrow as possible. When the patient has become accustomed to the restraint the frame is gradually bent backward until at the end of

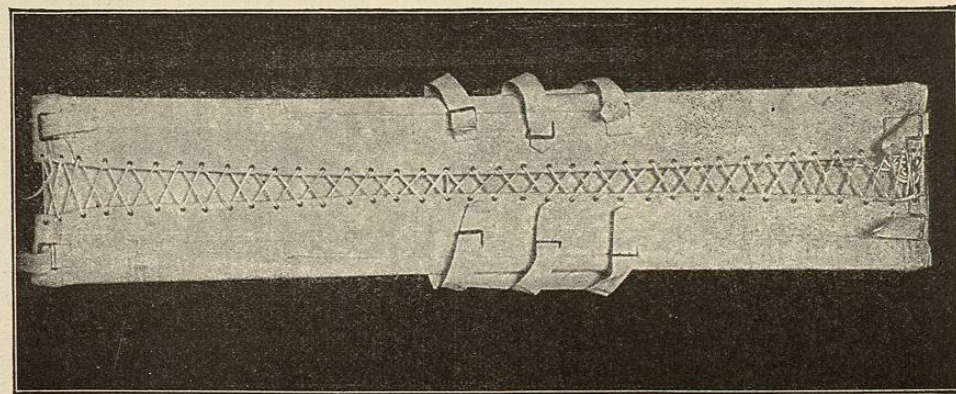


FIG. 4437.—The Modified Stretcher or Bradford Frame, showing the Covering.

a few weeks the spine is forced, if possible, into an attitude of extreme overextension. (Fig. 4438.)

In favorable cases treated in this manner the deformity may be entirely obliterated, and as it is evident that the diseased vertebral bodies have been separated from one another, friction and pressure must have been removed and thus the conditions most favorable for repair have been established. The patient is kept constantly fixed upon the frame, except that once a day he is carefully removed and placed face downward on a pillow. The back is then rubbed with alcohol and powdered, the frame cover is cleansed, and the child is then replaced upon it. As has been stated, the child wears diapers, and a dust-pan serves as a convenient form of bedpan. As much of the time as possible is passed

in the open air in the ordinary baby carriage. The time during which the patient should be treated by this method varies with the severity of the disease. As a rule it is from six to eighteen months. The indications for its discontinuance are the subsidence of the symptoms and the behavior of the patient. A child suffering from active disease almost instantly recognizes the benefit of treatment and dislikes to be removed from the frame; but when repair is advanced he becomes impatient at the restraint, and when he begins to crawl about with the frame on his back and to attempt to stand, it is evident that the necessity for this mode of treatment is passed.

Although there is a strong prejudice against this form of treatment, I have never noticed ill effects from it, even when it has been long continued. The patient usually gains in weight and often grows rapidly, more rapidly in fact than those who are allowed to go about.

It is apparent that this form of recumbent treatment, although by far the most efficacious, is limited practically, as a routine practice at least, to early childhood, that is, to patients of four years or less, who can be carried about in arms. As a treatment for special cases, or to meet special indications, it has, however, no limit of age. For older patients the cover should be made in two parts, as in the original Bradford frame, to allow for the use of the bedpan.

Horizontal fixation must be supplemented of course by a support for the weakened spine when the erect posture is again assumed, and ambulatory treatment by such means is in the majority of cases the only one that is employed. These supports are either in the form of metal-

lic braces applied along the spine or as circular supports, of which the plaster jacket is the common form. The object of every form of appliance is to remove as far as possible the weight from the weakened vertebral bodies

by holding the trunk in the extended position, and to prevent motion at the seat of disease.

*The Back Brace.*—The most efficient spinal brace consists essentially of two steel bars that are applied on either

In measuring for this brace the patient is placed in the prone posture and a tracing of the outline of the back, beside the spinous processes, is made by means of the lead tape. This outline may be cut in card-board and

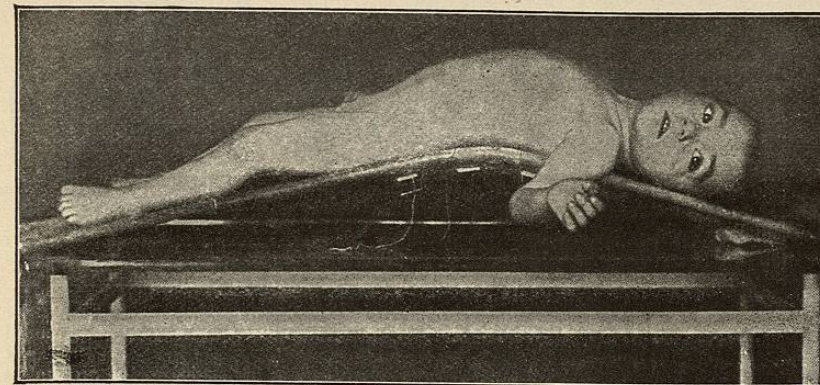


FIG. 4438.—The Stretcher Frame, showing the Attitude of Overextension.

side of the spinous processes from the top to the bottom of the spine (Fig. 4439). The attachment at the lower end is made by means of a pelvic band of sheet steel (gauge 18) from one and a half to two inches in width, long enough to reach from one iliac spine to the other. It is placed as low as possible on the pelvis—in other words, just above the upper extremities of the trochanters. To this the uprights are firmly attached at an interval of



FIG. 4439.—Whitman's Shoulder Brace; side view.

from one and a quarter to one and three-quarter inches from one another, so that the spinous processes may pass between them while pressure is made on the lateral masses of the vertebrae. The uprights are made of varying strength according to the age of the patient, usually about one-half an inch in width (of gauges 8 to 12), and of such quality of steel that although unyielding to the strain of use it may be readily bent by wrenches and thus accurately adjusted to the back. The uprights reach to the root of the neck, or to about the level of the second dorsal vertebra. From this point two short arms of metal project forward and outward on either side of the neck, reaching to about the middle of the clavicles. To

these are attached padded shoulder straps, which pass under the arms to a crossbar on the back brace; thus downward pressure on the shoulders is avoided and increased leverage is assured. Opposite the point of disease two strips of this steel, about three-quarters of an inch in length, are fixed. These are slightly wider than the uprights, and are perforated for the attachment of the pressure pads, made of layers of Canton flannel or felt, or of unyielding material, such as leather or hard rubber if this is preferred.

The pads should project from a quarter to a half-inch in front of the uprights in order that firm and constant pressure, to the extent that the skin will tolerate, may be made at the seat of disease.

fitted to the back; in fact, if the mechanic is unfamiliar with the work, each part of the brace, uprights, pelvic band, etc., may be cut in card-board and attached to one another to serve as a model. Before the brace is finished it should be applied to the back, and should be carefully adjusted by means of wrenches. The pelvic band is then padded and the parts that come in direct contact with the skin are usually covered with leather, or, in the treatment of young children, with rubber plaster and Canton flannel, to prevent rusting.

If the brace is applied before the stage of deformity, it should follow the exact

shape of the normal spine; but if deformity is already present, particularly in disease of the thoracic region, it should be made somewhat straighter than the compensatory curves above and below the projection, in order to permit a gradual straightening of the compensatory lordosis in the lumbar region, and for increased leverage above the deformity. As has been stated, a certain amount of recession of deformity can be obtained by rest in the horizontal position; and if practicable this improved contour should be attained before the brace is applied. The apparatus is held in place by an "apron," which covers the chest and abdomen, and to which straps are attached. Ordinarily this is made of strong linen or cotton cloth, but a canvas front, shaped accurately to the body and strengthened with whalebone as is a corset, is a much more comfortable and efficient support (Fig. 4440). In applying the brace with the patient in the recumbent posture the pelvic band is first attached to the apron, then the straps in order from below upward, and finally the shoulder straps. Each strap is then tightened until the brace is firmly fixed in proper position. When a brace is properly applied and properly fitted, it holds its place by friction; but in certain cases when the disease is low in the back, it is sometimes of advantage to apply perineal straps to hold the pelvic band firmly in its place.

At first the brace is removed once a day in order to wash and powder the back, the same care being observed in moving the child as in the treatment by the frame; but when the back has become accustomed to the pressure, the brace should be removed only at infrequent intervals, and thus, if need be, only under the supervision of the surgeon.

This description indicates the essential qualities of the



FIG. 4440.—Whitman's Brace, with Chin-piece Applied.



back brace. It has been modified in various ways. For example, Dr. Taylor, its inventor, finally discarded the straight pelvic band in favor of one of a U-shape, as shown in the illustration (Fig. 4441). This makes the brace somewhat lighter and relieves the sacrum from the pressure of the pelvic band, but it does not add to its effectiveness. The efficiency may be increased, however, by improving the attachment at its upper extremity. Taylor has accomplished this by placing two triangular pads against the chest. If, however, the disease is of the upper and middle segment of the thoracic region, more efficient support is of advantage; for in such cases the upper part of the chest is flattened, the inclination of the ribs is increased, and the shoulders incline forward, carrying with them the scapulae. Thus the weight and the strain of the motion and use of the arms tend to increase the deformity.

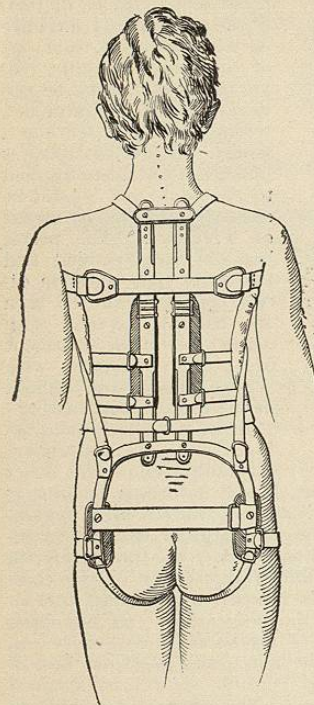


Fig. 4441.—The Taylor Back Brace.

In health direct forward or reaching movements of the arms are always accompanied by an increase in the posterior curvature of the dorsal spine. On the other hand, if the shoulders are drawn backward and held in this attitude, the curvature of the spine is lessened and the chest is elevated and expanded.

In the treatment of disease of the upper dorsal region it should be the aim, in the application of a brace, to follow this indication and to apply pressure directly upon the extremity of the shoulders, to assure the greatest possible fixation of the spine, and to restrain the movements of the arms that tend to increase the deformity.

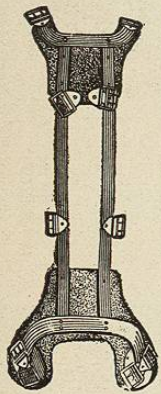


Fig. 4442.—Modified Taylor Spinal Brace.

The accompanying diagrams show how such support should be applied (Figs. 4443 and 4444). Two saucer-shaped plates of hard rubber or padded metal cover the heads of the humeri, and are joined by a rigid bar of steel which passes across, but does not touch, the chest. On the back brace are placed two triangular pads of similar construction, which cover and press upon the scapulae. These pads are, however, not essential, and are often omitted. The back brace is applied, the shoulders are then drawn backward, and the shoulder cups are firmly attached by straps to the neck bars of the brace above and below by axillary bands in the usual manner. By this means the thorax is elevated and the spine more effectively fixed, while direct movement of the arms forward is made impossible. It would seem that such restraint would be irksome to the patient, but in an extended use

of the apparatus I have never heard this complained of. In many instances, even when the disease is as low as the tenth dorsal vertebra, this form of brace may be used with advantage, but it is especially indicated when the disease is in the neighborhood of the seventh dorsal vertebra. In connection with the shoulder brace it is usually advisable to apply a support beneath the chin to prevent the forward inclination of the neck and to tilt the head somewhat backward.

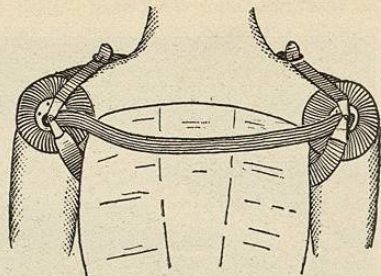


Fig. 4443.—Whitman's Brace; front view.

A very simple and inoffensive support of this character is a loop of steel surrounding the neck and attached by screws to a back bar on the brace (Fig. 4445). If a more efficient brace is required, as when the disease is of the upper dorsal or cervical regions, the Taylor head support should be used (Fig. 4446). This is an oval ring of steel, which may be clasped about the neck by means of a lateral hinge. On the front a cup of hard rubber supports the chin, and behind the ring fits upon an upright pivot, that may be raised or lowered upon a crossbar on the upper part of the brace. Free lateral motion is allowed, or it may be checked by means of a screw.

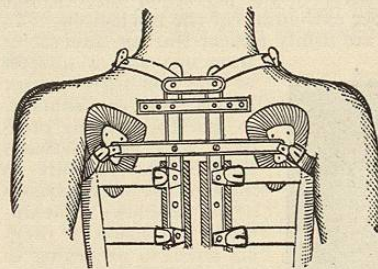


Fig. 4444.—Whitman's Brace; rear view.

If absolute fixation of the head is indicated, as in disease at or near the occipito-axoid region, two steel uprights are attached to the back of the ring, and are bent to fit the posterior and lateral aspect of the head closely. If necessary, a band of webbing is passed from one upright to the other and about the forehead.

In applying the support the chin should always be slightly tilted upward in order to throw the weight of the head backward.

The adjustment of the head support is made easier if the pivot is attached to the upright by means of a ball-and-socket joint (Shaffer) that may be regulated by a screw and key. This arrangement is of service when the head is distorted, but it is by no means necessary.

When the Taylor head support and similar appliances are used, the greater part of the pressure is sustained by the chin, which may after a time undergo an unsightly recession. It may be of advantage therefore in certain cases, particularly when restraint of the motion of the neck is desirable, to transfer this pressure to the forehead by means of a strap attached behind to light bars of metal shaped to the occiput and attached to the upper extremity of the brace (Figs. 4448 and 4449).

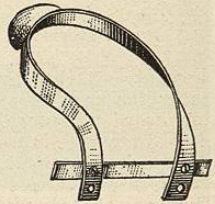


Fig. 4445.—Chin-piece to Whitman's Brace.

A jury-mast may be used to support the head also. Its adjustment will be described in connection with the plaster jacket, with which it is usually associated.

*The Plaster Jacket.*—It was at one time claimed that a

plaster jacket applied while the body was partially suspended would actually relieve the weakened area of superincumbent weight by holding the diseased surfaces apart; but it is now generally conceded that the jacket supports the spine, as does the brace, by holding it in the erect or extended position. One is a circular and the other a posterior splint. There is this difference, however: the brace fits the spine accurately and holds its place by pressure and friction. The jacket is held in place by the support of the projecting pelvic bones. It lacks the accuracy of adjustment of the brace at the seat of disease; but, on the other hand, it provides a solid support on the front and sides of the body that may be even more effective.

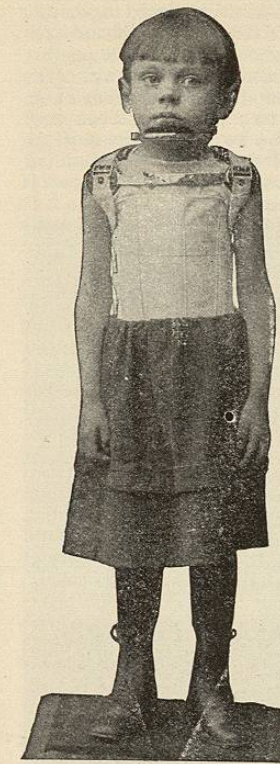


Fig. 4446.—Whitman's Anterior Shoulder Brace Applied with the Taylor Brace and Head Support.

Each appliance has advantages and disadvantages that become apparent in the treatment of certain phases of the disease or conditions of the patient.

The plaster bandage is a simple support whose efficiency depends upon the accuracy of its adjustment to the irregularities of the body, and upon the leverage that it exerts above and below the point of disease. It should be applied while the body is held in the best possible position. Its inner surface should be smooth, and the bony prominences that are susceptible to friction and pressure should be protected. A seamless shirt should be worn. These are made in several sizes and are sold by the yard at a low price. The shirt should fit the body closely and should

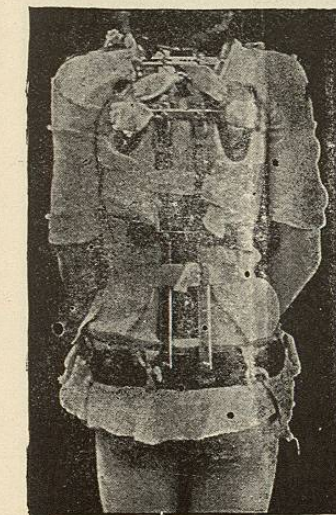


Fig. 4447.—Whitman's Shoulder Support with the Taylor Brace.

be long enough to reach to the knees. The patient is then placed upon a stool and the halter of the suspension apparatus is carefully adjusted. The arms are extended over the head and the hands clasp the straps or rings; thus the chest is expanded to its full limit. Sufficient tension is made upon the rope partially to suspend the body and to draw the spine into the best possible attitude. In most instances the heels should be slightly lifted from the stool.

Dr. Sayre, to whom we are indebted for the exposition of this valuable means of treatment, insists that the sensations of the patient should be the guide, and that traction should be made only to the point of com-

fort. This is a valuable indication in the treatment of the adult, but it is not often of service in childhood.

Before the plaster bandage is applied pieces of piano felting or Canton flannel of sufficient size should be placed about the anterior pelvic spines and over the upper part of the sternum. A thin strip of the same material may also be used to cover the spinous processes. Finally, long strips of saddler's felt, or other material of sufficient thickness, are applied on either side of the prominent spines to protect them from friction, and to provide greater pressure and fixation at the seat of disease. The "dinner pad" is now very rarely used, except in the treatment of adults and in certain cases of deformity in which the abdomen is retracted. In childhood the abdomen is usually prominent, and as the jacket expands somewhat no extra space is required. The pad, which is supposed to represent the space required after a full meal,

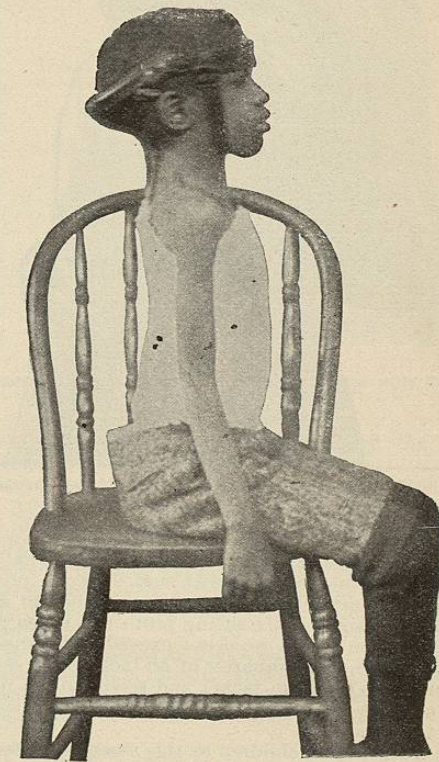


Fig. 4448.—An Appliance for fixing the Head, used with the Plaster Jacket.

is made by folding a napkin in the shape of a sandwich. To this a bandage is attached, and is placed beneath the shirt just below the ensiform cartilage. When the jacket is hard it is drawn out. Another long bandage is placed beneath the shirt, to remain permanently for the purpose of cleaning the skin beneath the jacket. The bandages should be freshly prepared of dental plaster, which should be rubbed into strips of crinoline from three to five inches in width and about six yards in length. From three to six of these are required according to the size of the child. As ordinarily applied by means of the swing the surgeon sits behind the patient, grasping the child's legs between his knees to prevent swaying of the body; and during the application of the bandages the layers of plaster should be constantly rubbed in order that the support should fit the body accurately. At the same time gentle pressure may be exerted with the aim of straightening or overextending the spine. It is well to make the first turn about the waist and use the first bandage about the pelvis, as this is the base of support. The bandages should also be applied with especial care across the up-