

vastly increased, to say nothing of the constitutional effects likely to result from extensive suppurative inflammation. Had that course of treatment been pursued, the satisfactory results obtained could not have been secured, and, indeed, it is not beyond the range of probability that the sacrifice of the limb might have become necessary in order to preserve the life of the patient. The local anæsthetic effect of the carbolic acid added materially in maintaining the tranquillity of the patient, while preserving the wounds free from pyogenic tendencies.

January, 1875. Status presens.—The functions of the hand have steadily improved, and would be almost restored to perfection could the patient be induced to submit to suitable manipulations to produce complete flexion and extension of the fingers on themselves. Sensation has been gradually and almost fully recovered, a slight paresis being all that remains to indicate the places formerly deprived of feeling.

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ART. XVII.—*Description of a Splint for Combined Suspension and Extension in the Treatment of Fracture of the Lower Extremity.* By T. W. SIMMONS, M.D., of Hagerstown, Maryland. (With a wood-cut.)

THE combination in one apparatus for accomplishing two objects, extension and suspension, which separately have become highly esteemed in the treatment of fractures of the lower extremity, is the object of the instrument which I shall describe.

Experience in the treatment of fractures of the leg has not sustained the advantages of the flexed position over the straight.

The relaxation of the muscles while a fractured leg is held in a state of flexion, rather favours lateral displacement than otherwise; nor does it prevent, as has been abundantly shown, excessive overlapping and shortening, while, at the same time, it is most unfavourable to the application of any efficient method of extension at present known. In point of comfort the flexed position possesses no advantage over the straight.

The increasing favour which the principle of extension has received since introduced in 1824, by Dr. Luke Howe, has proved it to be important and almost indispensable in the treatment of fractures of the femur, in order to prevent inordinate overlapping of the fragments, to maintain apposition in a straight line, to subdue all perturbed action of the strong muscles to a state of quietude, and at the same time, render them agents of support. Extension can likewise be applied with great advantage to fractures occurring below the knee, as it sustains adjustment in a straight line without the need of tight dressing; this particularly

obtains when the fracture is seated at or near the ankle-joint, where but light pressure can be borne without soon becoming painful, and where lateral displacements are so liable to occur. It is not excessive, but moderate, uniform, and uninterrupted extension that is required to accomplish these results—extension sufficient to fatigue and overcome the contracting irritated muscles. Pressure made against the perineum and axilla by any of the counter-extending appliances in order to produce forced extension of a fractured leg, is altogether to be condemned as unnecessary, painful, and restraining, the weight of the body itself exceeding the power of extension required, somewhat, for example, in the proportion of 120–150 lbs. to 10 or 15 lbs., establishes at once all the counter-extension that could practically be desired, and by elevating the foot of the bed by three or four inches, it will be found to prevent, in a great degree, the tendency which is sometimes shown to move downwards in bed.

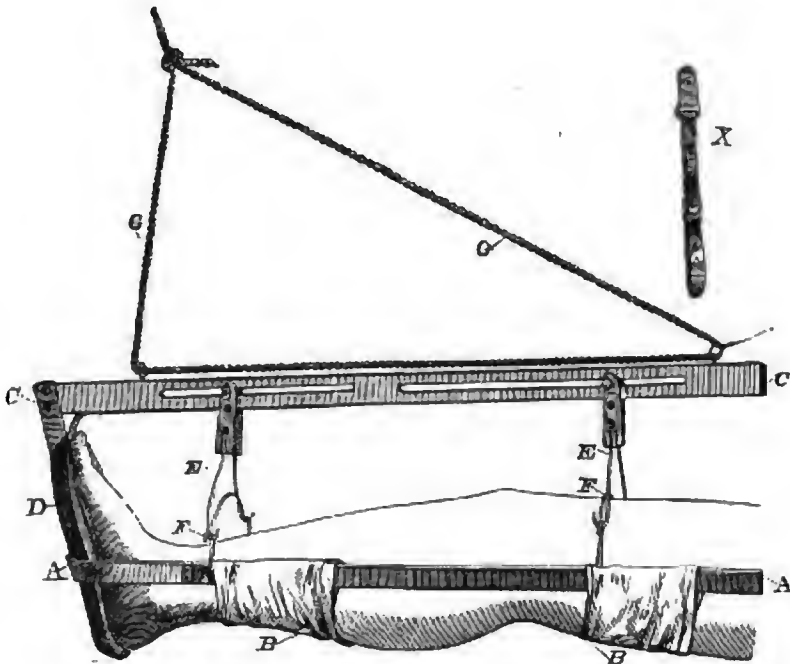
The principle of suspension in the treatment of fracture of the lower extremity has not been so generally adopted as that of extension or as it deserves to be. The advantages of suspending a fractured leg are positive, the patient being at liberty to sit up, to take the semi-erect posture, to change position from his back towards either side, and to move from one side of the bed to the other; it particularly facilitates the using of the bed-pan.

In the treatment of fractures of the lower extremity by any of the ordinary methods, the limb is in a great degree immovably fixed in one position, and any attempt to change the position of the body must almost of necessity impart motion to the seat of fracture. But if the leg be suspended, this motion will be expended in swinging the leg, and thus change the axis of motion from the fractured point to the suspending cord, and preserve it against displacement. There is a strong desire felt to move a painful member, and if this be prevented it must add to the patient's discomfort in a manner easily to be imagined, and the facility to move a painful fractured leg will add as much to the patient's comfort as that afforded by moving any other painful member, provided it does not disturb the seat of injury; suspension, therefore, not only allows the patient to move his body as comfort may dictate, but at the same time insures a freedom of motion to the injured limb which affords comfort and protects adjustment.

Suspension is, therefore, no less valuable than extension.—Several attempts have been made to combine these two principles, but in these the extension was made from a fixed point beyond the foot, as by cord, pulley, and weight, thus virtually tying fast the foot, while the leg was in suspension. Under this arrangement it is evident that the least swinging of the leg must change the line of extension to an angle with the long axis of the limb, thereby foiling its object, which can only be obtained by an apparatus that will move freely with the limb whatever its motion may

be, and maintain at the same time a constant power of extension in a direct line with the long axis of the limb.

In the year 1869, recognizing the importance of securing both suspension and extension, I devised, and had constructed during the winter of 1872, what I have termed the *Suspenso-Extensory Splint*, which was shown to Prof. Christopher Johnston, of Baltimore, Md., who approved its construction, and exhibited it to his class, at the University of Maryland, during the session of 1873-4.



The accompanying figure represents this splint. The horizontal bar *c c* is made $\frac{7}{8}$ in. thick, $1\frac{1}{2}$ in. broad, by 3 ft. in length, is joined to a foot-board *D*, of like thickness, $3\frac{1}{2}$ inches at widest part, above 3 inches at heel, by $13\frac{1}{2}$ inches in length, being somewhat shaped like the bottom of a last on its external surface. To this horizontal bar are suspended two side splints *A*, by means of four wire bearings *E E*, provided with a perforated attachment above, through which two thumb-screws pass, in order to raise or lower the limb that the foot may be brought in position to receive the foot-board. These side splints, being 1 inch wide, are to extend 2 inches from above the sole of the foot up the whole length of the limb; they are held parallel, and at any desirable distance between each other, by two arches made of strong wire twisted upon themselves, to form eyes *F F*, through which the bearings are hooked. A most important point to be

observed in its formation is the angle between the horizontal bar and foot-board c, which should accurately be one of $11\frac{1}{2}^{\circ}$, that the foot may maintain a natural and easy position without its being too much extended on the one hand, or held too erect on the other; and as it is very important to preserve this angle intact, the horizontal bar and foot-board should be firmly and immovably joined together. The figure x represents a leather strap and buckle, four of which may be substituted for the wire bearings, as seen in the above representation of the splints. By this modification, the horizontal bar, with foot-board, constitutes the entire instrument, which can be readily constructed by any ordinary mechanic, and is adaptable to almost any sized leg. These bearings are provided with loops below, through which the splints are to pass, before being bandaged to the limb. Simple plastering laths, or something similar, readily to be procured, will serve the purpose of side splints; and in order to prevent too much lateral pressure from them, a simple stretcher, made of light wood, should be placed between the opposite bearings and allowed to rest on the upper aspect of the limb. This arrangement, though not so elegant as the apparatus herein represented, combines the same principles. In case of compound fracture a side splint made of common hoop or strap iron, about 1 inch wide, should be used instead of a straight wooden side splint, as it can readily be bent with the hand to form a bracket or bridge to correspond with the wound and form a fenestra. This material, when well wadded and wrapped, is sufficient to fulfil the office of side splint in every other respect.

In the application of the suspenso-extensory splint I have adopted the following method, but every surgeon will most likely use his own taste and ingenuity in this respect.

The head of the bed upon which the patient is to be laid should be removed several feet from the wall, directly under a pulley which has been firmly fixed in the ceiling, so that in the beginning the leg will be suspended at a perpendicular to the pulley, and by degrees, as an increased extension is desired, the bed is to be removed towards its former position. Two straps of strong adhesive plaster, about $2\frac{1}{2}$ inches broad by $2\frac{1}{2}$ feet in length, are next to be applied on each side of the leg, so as to allow about one-third of their length to project beyond the foot, in order to embrace the foot-board. When the fracture is seated at or near the ankle-joint, a well-adjusted gaiter is the proper substitute for the adhesive bands, as the space from below the fracture is too short to admit of the plaster getting sufficient hold. After the side splints are well wadded and wrapped they are to be placed on each side of the leg, extending from two inches above the sole of the foot to the body. When the fracture occurs in the upper third or neck of the femur, the outside splint should be made long enough to reach some distance above the hip-joint, to be secured by a bandage passed around the body; from one of these side splints to the

other loop a bandage BB back and forth under the fleshy parts of the thigh and calf, where the greatest weight of the leg should be received, at the same time they will prevent the side splints from rising under the outside bandage when suspension takes place. After the bearings have been placed in proper position as afforded by means of two slots formed in the horizontal bar so as to equalize the weight of the leg between them without reference to the seat of fracture; then a bandage should be well applied from the ankle to the body. The leg should next be swung, and if the foot is found to be too high or too low to correspond with the foot-board, the bearings should be so adjusted as to secure this adaptation.

The extending hands A should now be brought firmly around the foot-board so as to hold the foot in close contact with it; and if at any time by their stretching or otherwise the foot is found to separate from the foot-board, the extending hands should be detached from it and reapplied as before, their adhesive properties will not be impaired thereby, but strongly unite with the wood even without heat. A short bandage should then be applied around the foot and foot-board, so as to be conveniently removed if necessary to readjust the extending hands, without disturbing the longer bandage.

In common with suspension and extension another important feature is combined in the splint, viz., the very perfect manner in which all tendency to eversion of the foot is overcome, the foot being secured to the foot-board, not only affords a firm rest for it in all directions, but it very effectually obviates the troublesome tendency to eversion which exists in nearly all fractures of the femur. In suspending the limb, the cord GG should be passed over the pulley from behind, and brought down to pass first through the eye fixed near the upper end of the horizontal bar, then along the bar to the second eye next the foot-board, then carried up vertically, to be tied to the descending cord. The cord should be long enough at its free end so as to be secured within reach of the patient, that he may elevate or lower the leg at pleasure. The power of extension is increased in proportion as the cord is made oblique, and for all practical purposes it is unnecessary at any time for the obliquity of the cord to exceed an angle of 45° to a perpendicular; but by the application of a dynamometer to the free end of the horizontal bar, the degree of extension exerted can be estimated when deemed necessary. By this principle of extension there is developed a very important and beautiful adaptability of power to resistance which is not to be found in any other principle of extension, viz.: When the limb is large and muscular, medium in size, or small and weak, the degree of extension produced will be always in proportion to the degree of extension required.