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FRACTURE OF THE PATELLA TREATED BY CONTINUOUS EXTENSION; PATIENTS NOT CONFINED TO BED.

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Two varieties of treatment of fractured patella are generally recognized, the mechanical and the operative. It is not my intention to allude to the latter method, except in a general way; nor, in fact, to the devices of the former plan except as they may be employed to illustrate the method of treatment that I present. The indications to be met in the treatment of this fracture are the stereotyped ones that are applicable to all fractures, namely, the reduction of the fragments and the holding of them in place until a proper degree of union ensues to permit of the removal of the retaining forces. In fracture of the patella the uppermost fragment is drawn upward by the influence of the quadriceps extensor muscle, while the lower is somewhat displaced downward by means of the non-muscular tissues attached to it. Ordinarily, crepitus can be easily elicited between the fragments, provided the attempt be made before the formation of the firm blood-clots that become closely connected with the broken surfaces of the bone within a few hours after fracture. The failure of the medi-

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cal attendant to obtain crepitus at this time should be attributed to the presence of these clots rather than to the influence of the stretched aponeurotic tissues connected with the upper surface of the patella. The presence of these clots and their influence in separating the fragments are frequently and easily demonstrated during the operative technique of wiring the patella for fracture.

The steps necessary for the reduction are, first, the extension of the leg and elevation of the limb to secure complete relaxation of the quadriceps extensor muscle; second, the drawing together and retention of the fragments in position until some form of union insures sufficient strength to properly maintain them in place. It is hardly necessary for me to describe the various instrumental means heretofore employed to effect the reduction and retention of the fragments in this fracture. It is sufficient to say, however, that their basis-action consists in extension applied directly or indirectly to the upper fragment and the holding of the lower fragment upward in position. The extension is represented in these cases as applied to the upper fragment and to the thigh, and also to both of these parts simultaneously. It is manifest to one familiar with the relationship of the tissues composing the thigh that extension applied to the thigh alone can exercise but little other restraining influence on muscular contraction than that dependent on coaptation pressure, because the dense fascia lata intervenes between the muscles of the thigh and the integument to which the extension is applied. However, when extension-apparatus is applied to

the upper fragment of the patella with sufficient firmness to meet the indication, then, indeed, some command of the quadriceps muscle is secured. But even in this instance the inequality, severity, and direction of the pressure necessarily brought against this fragment, together with the absorption of the surrounding soft parts incident to the pressure, quickly render its influence insecure and migratory, unless constant and tedious, not to say painful attention be given to the case.

In my judgment, the feature most commendable in the wiring method is this: It permits patients to move around on crutches within a few days, thereby relieving them of the tedium and depression of long confinement.

Of the mechanical appliances permitting patients to be at once about on crutches, plaster-of-Paris, applied in the form of a thigh or hip spica, extending down to cover the foot, with an oblique patella-traction arrangement of the bandage at the knee, is most often selected. With this method, even in a very few days, the limited direct-extension influence that the splint exercises on the upper fragment disappears, owing to the shrinkage of the limb, and in part to the pressure of the splint itself. The coaptation-influence on the tissues of the thigh, exercised by the splint at the time of its application, is soon much lessened on account of the same shrinkage. I have quite often witnessed the treatment of this fracture with the plaster-of-Paris splint when little attention was paid to the tissue-changes following its application, even up to final recovery; and candor compels me to state that in these cases the

results were quite as satisfactory in all respects as in cases treated more actively and with seemingly better philosophy. I have often remarked that the results of the treatment of fracture of the patella with a plaster-of-Paris spica were much more convincing of the fact of how little treatment the fracture required than of the efficiency of this particular method. However this may be, it is surely a great desideratum to employ a means that, while it holds the fragments as well as possible by mechanical measures, still subjects the patient to as little confinement as if wiring of the patella had been done. The plan that I have employed, with some interruptions, for a number of years past can be divided for the sake of simple elucidation into five separate steps.

First step (Fig. 1). The first step consists in the application to the leg of a plaster-of-Paris splint, extending from the base of the toes up to and partly around the lower fragment (3). The splint is firmly applied to the limb a sufficient time in advance of the succeeding steps to permit of its becoming thoroughly hardened. It is carefully rounded at the lower extremity (2), so as to press into position and hold there the lower fragment (3). Its functions can be said to be threefold: 1st. It serves to protect the foot of the patient from the pressure of the rubber extension, which acts from this part of the limb. 2d. It confines in place the lower fragment, and the pressure upward of the splint, due to the elastic force of the extension transmitted through it to the foot, retains the upper border of the splint in proper relationship to the

lower fragment. At all events, any diminution of pressure on the part of the splint in this situation can be readily supplemented by the introduction of

FIG. 1.

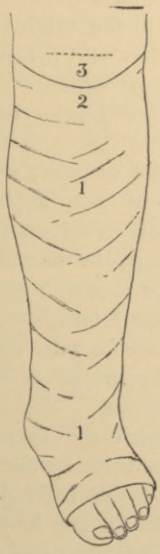

FIG. 2.

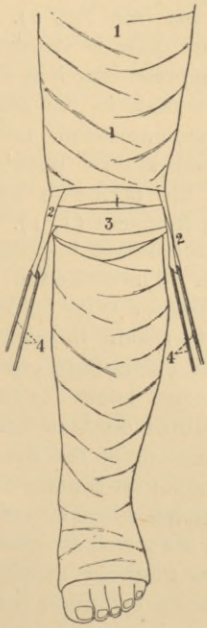

FIG. 1.—1, 1. Plaster splint as applied to leg. 2. Upper border of splint pressing lower fragment into position. 3. Lower fragment with line of fracture above.

FIG. 2.—1, 1. Extension as applied to thigh. 2, 2. Front view of extension straps. 3. Adhesive straps retaining fragments in position. 4, 4. Rubber extension made taut while adhesive straps are being applied.

suitable pads between it and the lower fragment of the patella. 3d. It affords attachment to the lower end of the supporting rod or brace, intended to maintain complete extension of the limb while acting as a posterior support.

Second step (Fig. 2). The features of the second step are quite as strongly expressed by the illustration representing it as words can define them. This step consists in the application to the thigh of an extension-apparatus fashioned after the manner of the well-known Buck's extension, which reaches from the perineum to the upper border of the upper fragment (1, 1).

It is confined in position by the ordinary muslin roller. The adhesive element of this appliance terminates a little below the knee in a loop (2, 2) at either side, through which may be passed the rubber extending cord (4, 4), or to which may be connected hooks for the convenient attachment of the rubber cords or bands that are to pass around the bottom of the splint, and by means of which the extension is made and maintained. The broad triangular adhesive strips to which the extension loops are sewed are confined in position at the sides of the thigh by means of simple roller bandages. Moderate extension is then made on the loops by means of the rubber cords, in order to draw as far as possible downward the soft tissues of the thigh and the upper fragment of the patella. While the extension is thus being made, the roller bandage intended to hold the adhesive-plaster strips in place is covered by plaster-of-Paris rollers from the upper to the lower limits of the adhesive-plaster extension,

and so fashioned as to control the upper fragment in the most serviceable manner while extension is in action. The object of this plaster-of-Paris addendum is, first, to aid in holding the primary dressing of the thigh in a firm position; second, and principally, to afford an upper support for the extending rod or splint to be placed behind the limb, and to aid, also, in confining the upper fragment of the bone in proper relationship to its fellow, as will appear in the succeeding step.

The second step meets the following indications: First, it coaptates the tissues of the thigh, thereby exercising a controlling influence over muscular contraction, and is the agent causing extension of the integument and the subcutaneous tissue. Second, it makes direct extension of the quadriceps through its firm application to the upper fragment of the fractured bone and the tissues immediately above and around it.

Third step. This step consists in strapping the fragments of the patella in such a manner as to draw them well together and properly maintain them in position. These strips of plaster (3, Fig. 2) are fastened in position behind to a wooden support or brace, about two inches in width, one inch in thickness, and extending from near the upper border of the thigh portion of the splint to the lower part of the splint surrounding the leg. These adhesive strips should be applied cautiously, so as not to irritate the integument, and also to prevent either of them from being drawn downward between the fragments of the broken bone. If this accident happens, greater separation of the fragments ensues,

and union of a serviceable kind is much delayed, and may be defeated. These strips can be applied with greater care, convenience, and effectiveness, if traction be made away from the median line of the thigh, as represented in Fig. 2 (4, 4).

Fourth step (Fig. 4). This consists in fastening the posterior support or brace (2) in proper position, and fixing it there by means of plaster-of-Paris rollers carried around it and the upper and lower segments of the splint where they lie in contact with each other. These bandages harden quickly, and thus incorporate the posterior support firmly with their structure, forming an interrupted plaster-of-Paris splint, with a posterior connecting brace (1, 1, 2). The interval at 2 shows this brace with the patellar adhesive straps attached, by means of which the strips are retained in position.

Fifth step (Fig. 4). The posterior support in this illustration is unusually thick (2), being composed of wood. A small iron rod on each side of the posterior surface of the limb will answer much better for many reasons, and is less cumbersome. However, this one illustrates sufficiently well the importance of the posterior support, and better, perhaps, than a less conspicuous object. Fig. 4 shows the posterior support as placed against the posterior surfaces of the plaster splints previously described, and confined there by fresh plaster rollers. This should be accomplished while the extension force is in action. These bandages are represented as carried around the limb from the extremities of the support to the contiguous borders of the underlying plaster splints. As already mentioned, the

hardening of these newly applied bandages incorporates the posterior support with the plaster-of-Paris structure so firmly that an unyielding common ap-

FIG. 3.

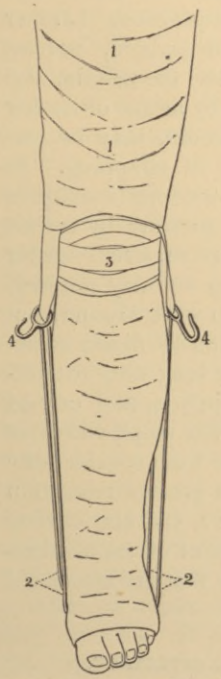

FIG. 4.

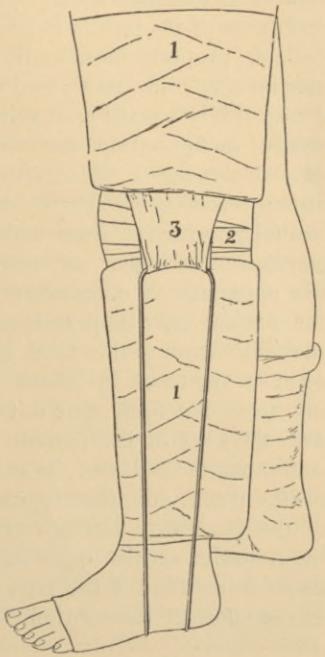

FIG. 3.—1, 1. Plaster bandage applied around thigh extension. 2, 2. Rubber extension in position and action. 3. Patella-retaining straps. 4, 4. Hooks for rubber extension bands.

FIG. 4.—1, 1. Upper and lower segments of interrupted splint. 2. Posterior support of splint covered by retaining straps. 3. Side view of extension strap.

paratus is formed. The object of this support is obvious to anyone. It serves to keep the limb extended, thus preventing undue traction on the fragment of the quadriceps muscle, and it affords attachment to the adhesive plasters that confine the fragments of the patella in proper position. Leather collars, properly fashioned and padded, passing around the limb above and below the patella, and drawn firmly toward each other by means of leather straps, as figured in the text-books, may be employed instead of this method of strapping. In either instance the hamstring tendons should be carefully protected from undue pressure by the interposition of some soft suitable material. After the apparatus is completely and suitably applied, the patient may be permitted to walk around, but the limb during this time should be flexed somewhat on the trunk by means of a long sling extending from the foot, which it supports, and carried over the neck of the patient. The employment of this expedient will flex the entire limb considerably on the trunk, and thereby cause greater relaxation of the quadriceps extensor muscle, and also obviate the influence on the upper fragment of the involuntary contraction of the muscles that are associated in the effort of locomotion.

THE ADVANTAGES OF THIS APPLIANCE.

The following advantages appear to me to be quite clearly defined:

1. It apposes the fragments of the patella from the first as well as any other non-operative appliance can accomplish this purpose.

2. It maintains them in position better than any mechanical means yet employed, unless the patient be confined in bed and a constant and tedious scrutiny be exercised by the physician in charge.

3. It permits the patient to be up and around sooner and more comfortably than any non-operative method of treatment yet employed.

I have thus far treated nine cases by this method, with results equal to those of any other non-operative method, and with much more comfort to the patients. Like all methods, this one, too, has its fallacies. It is important to regulate the degree of elastic extension in accordance with the requirements of each particular case. If greater extension be employed than is essential, the straps by means of which the extension is secured may be torn or drawn away from their fastenings. At all events, great discomfort will be caused. It is proper to say, however, that a degree of extension may be employed which will be readily withstood by the straps at the earlier period of their application, which is out of all proportion to the requirements of the case, and at a later period would promptly cause slipping of the adhesive straps. In one instance, as a matter of experiment alone, I applied a degree of elastic traction to a case equivalent to forty pounds. It may be thought, perhaps, that the application around the thigh of the plaster-of-Paris casing, and introduction of the posterior support connecting the two portions of the splint, will interfere with the extension influence applied to the thigh itself. This, however, is not the case, as the extension acts independently of the incasing

plaster, while at the same time the incasing plaster serves to confine the adhesive strips properly in position. If the interval between the plaster splints corresponding to the knee and popliteal space be not thoroughly and carefully covered, either with straps, cotton, or bandages, pain and edema will, for obvious reasons, take place there.

After the adhesive strips are properly applied to the patella, the intervals between the splints, behind and in front, should be filled in with layers of absorbent or other kind of cotton, and bandaged closely in place. At the time the posterior support is placed in position, cotton or other suitable material for exercising moderate pressure should be interposed between it and the posterior surface of the knee, already the patella-retaining straps are applied, as then this material can be drawn firmly into place. As before remarked, the fragments should be carefully and properly strapped, and great care exercised in the application of the straps, else one of them may be drawn between the fragments, and before its discovery may cause greater separation and interfere with the union.

Finally, it is necessary that the plaster splints should be kept firmly apposed to the underlying surfaces, which, of course necessitates their being cut up quite soon after their application. The cutting up can be easily done by means of an ordinary knife after the manner usually employed in other forms of splints of a similar nature. If a proper portion of the splint be removed in the line of incision, the splint can then be firmly drawn in

place around the limb by means of an ordinary muslin roller.

In presenting to your consideration this method of treatment of fractures of the patella, I do not claim any originality as to the application of extending force in this manner to the thigh, as I recall distinctly having seen, while an interne in Bellevue Hospital in 1870, a similar extension applied to the thigh for fracture of the patella by Dr. Stephen Smith. However, in that instance the patient was kept in bed, and no effort was made to control the lower fragment by means of a plaster splint or by the influence of the extension employed in making traction upon the upper fragment. I have not, however, as yet seen or learned of the treatment of fracture of the patella by a method in any way contemplating the use of extending influence associated only with the limb itself, the introduction of a posterior stiffening support, and non-confinement of the patient in bed.

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