

a way as to crowd the head of the tibia *forward*; and in the same manner above the knee, applying the bandage in front of the femur so as to crowd its lower extremity *backward*. In this manner you will at once see that we are putting into practical application, upon the instrument, the same principle we were applying when the double extension was used while the patient was in bed.

Now, if the patient be an adult, he will probably require the aid of crutches in walking, otherwise too great a strain will be brought to bear upon the plasters which hold the instrument in place; but, if a child like the one before you, he may go about without their assistance. As you see, he walks without any limping, by keeping his well knee stiff to match the diseased one, and has no pain whatever when the instrument is properly adjusted. Compare his present condition with what it was an hour since (*see* Fig. 134), and no argument is necessary to prove the value of the treatment (*see* Fig. 139).



FIG. 139.

Artificial support for these diseased knee-joints (which, if properly applied, removes all pressure from the articulating surfaces, and gives the patient perfect comfort; which can be worn for months, and, if need be, without changing) permits the pa-

tient to be out-of-doors, where he can obtain fresh air, the influence of sunlight, and, in short, to avail himself of all the hygienic measures which are to contribute so largely to his final recovery.

LECTURE XVII.

DISEASES OF THE JOINTS.—KNEE-JOINT (CONTINUED).

Treatment of Chronic Disease (continued).—Removal and Reapplication of the Instrument.—Passive Motion.—Protection of the Joint after the Splint has been removed.—Shall the Joint be permitted to ankylose?—Cases.—Operative Interference in Extreme Cases.

GENTLEMEN: In our last lecture we studied the method of treatment in the earlier stages of the disease and the mode of applying the instrument used for making extension in chronic disease of the knee-joint, and to-day we will first answer the questions, How often is the instrument to be removed and reapplied, and how long must it be worn?

It may be necessary to reapply it very often, if it has been carelessly or unskillfully applied, or if poor plaster has been used. For it must be reapplied just as soon as it fails to meet the indications, no matter if it is every hour in the day.

But, when the instrument is carefully adjusted, good plaster is used (Maw's moleskin), the skin *clean* and *dry*, and the plaster not warmed too much before it is applied, it may remain perhaps for three months, or even longer.

As long as the instrument maintains the proper amount of extension it need not be changed. When it does become necessary to readjust it, you must remember never to attempt to apply new plaster over the layer of dead epidermis which will be found if the plaster has been worn for a long time, for you might as well fresco an old scaly wall.

The instrument must be worn until the joint is well; until concussion, produced by bringing the tibia and femur together, does not cause pain; and until pressure over the coronary ligaments is painless. When this can be done, you may remove the

instrument and commence the passive movements and manipulations that are to restore motion to the joint, and complete the cure. This part of the treatment requires time. When the patient has reached this point he is upon the highway which leads to complete recovery, and perfect success may be obtained if we are not too hasty in our endeavors to restore the limb to its normal condition. It is just here, not infrequently, that a very great mistake is made. The end of the disease has been reached, but the repair of damage done has to be accomplished, and now the surgeon should recollect that perfect restoration can only be obtained by cautious and gradual advances. The old saying that "the longest way round is the surest way home" is particularly applicable to the management of these cases from this point onward. When passive movements are commenced they should not at any time be carried beyond the point of producing pain. You will hold one hand beneath the knee-joint, as you now see me doing, while with the other the leg may be carefully flexed upon the thigh, until you have reached the point at which pain is produced, but never carry it farther. If this treatment is practised regularly and systematically every day, you will find that flexion can be slightly increased each time, and thus you are to go on until complete flexion is obtained. You will also find that such passive movements will be much more successful if accompanied by a great deal of hand-rubbing. I do not believe we have given the consideration to gentle, but thorough friction with the hand which its importance demands. There is no more efficient means for reducing capillary congestion and removing infiltrated material from the tissues than gentle, free, but careful rubbing with the hand. There are those who pretend to possess remarkable healing power in their hands, and claim to be able to perform wonderful cures by rubbing, etc., but no one of any sense believes one individual possesses any special power over another in this direction; it is all humbug; and yet many joints, in which partial ankylosis may be present as the result of disease or from simple rest of the joint, are abandoned by surgeons and fall into the hands of these pretenders, who effect marvelous cures. These pretenders may be scientific by accident, perhaps, and one cure will be sufficient to give them a life-long reputation and to do the profession and society an immense amount of injury; but there is no reason why any surgeon should

not possess the same power, and afford the same benefit to his patients as any of the most successful of these traveling manipulators.

The occasional application of electricity may also be of service. But, in resorting to any or all of these measures, the great point to be taken into consideration is, to carefully guard against carrying them to such an extent as to redevelop inflammation. If at any time you have been a trifle indiscreet, and have carried your passive movements too far, or have made your manipulations too freely so as to cause pain which shall last for more than *twenty-four hours* after the manipulations have ceased, or to give rise to the slightest elevation of temperature about the joint, place the patient in bed immediately, elevate the limb, apply cold, and secure absolute rest until all inflammatory action has subsided; after which your passive movements can be renewed. Passive movements short of exciting inflammation may be made as freely and as often as desired, without danger.

In all these cases, no matter in how favorable condition the joint may be when the instrument is removed, it is necessary for a time to apply some kind of apparatus to protect the joint against accidents, such as falls, trippings, etc., and also to prevent too free motion of the joint. For this purpose a piece of ordinary sole-leather answers very well. Take a piece of sole-leather about the same length as the instrument which has been employed, and sufficiently wide to embrace one-half or two-thirds of the limb, dip it in cold water, and, when it has become thoroughly flexible, mould it to the posterior surface of the limb, and secure it with a bandage. The leather when wet can be moulded to the limb so as to fit it perfectly, and, when dry, it gives firm, unyielding support, and at the same time can be easily removed and reapplied at such times as you may desire to practise passive movements and hand-friction.

Again, firm support may be given to the limb, and at the same time motion of the joint allowed within the limits of safety, by the use of the instrument which I now show you, made by Mr. Darrach, of Orange, New Jersey. (Fig. 140.) It consists of leather rawhide moulds, fitting the back part of the thigh and leg, and buckled in front.

These are connected by lateral steel bars, jointed at the knee; the flexion and extension are made by means of a ratchet-and-cog

wheel; at the back, there is also a spiral spring on the extending rod which permits limited motion when walking.

A knee-cap retains the limb in its proper position in the splint when motions are made.

There are some cases of chronic disease of the knee-joint,



FIG. 140.

however, in which ankylosis is the best possible result that can be obtained. Of course the question, whether you permit ankylosis to take place or not, must be fully decided, if possible, before you resort to passive movements. In some cases it may be impossible to decide this question until passive movements have first been tried.

If, after the application of the instrument, which shall maintain a constant extending and counter-extending force, the joint-disease goes on favorably and steadily toward a cure, and shows no disposition to recurrent attacks, you may reasonably expect that, when the inflammation has entirely subsided, passive movements and other necessary manipulations will restore the use of the joint completely.

On the other hand, if there is a lurking tendency to the development of inflammatory action, in consequence of nearly every

effort made for establishing a cure, whether it be in the way of passive movements or the ordinary means for affording extension and counter-extension; or, in some cases, apparently independent of any exciting cause; in short, the diseased joint is frequently taking on a new inflammatory action, and behaves badly, you may have grave apprehensions respecting the future mobility of the joint, and may reasonably regard ankylosis as a very favorable result. There are some cases in which the disease progresses reasonably well until passive movements are resorted to, and then there is at once an almost constant tendency to new inflammatory action, in consequence of such movements, however carefully they may be made. Such cases require to be managed with the greatest caution, and are very unpromising with regard to final results, as far as motion is concerned.

If carefully watching the progress, the behavior, and the tendencies of the case, bring you to the conclusion that the best result that can be obtained is that of ankylosis, let the ankylosis take place with the limb in a *straight* position. The old rule has been to secure ankylosis, in cases in which it was unavoidable, with the leg flexed upon the thigh at a slight angle; but I am opposed to this rule, for the reason that, when ankylosed at this angle, the solidification is very insecure, and is liable at some future date to give the patient trouble. This question, however, will be more fully considered when we come to speak on the subject of ankylosis.

We have now completed the study of the essential features of treatment, both when the case is seen soon after the receipt of the injury, and also when chronic disease of the joint is fully established.

The following case illustrates the disease and the treatment we have just been studying:

CASE. *Chronic Synovitis of Knee-Joint, with Angular Contraction and probable Ulceration of Cartilages; Tenotomy; Extension by Splint; Recovery.*—Ann H., Jersey City, aged fourteen; father healthy, but mother died of phthisis; fell, when nine years of age, on the sidewalk, striking her right knee on the curbstone, producing a severe inflammation of the knee-joint, which confined her to her bed for some weeks. Leeches, cups, poultices, and the usual antiphlogistic treatment, were adopted for some time, and finally resulted in recovery. For nearly a year she consid-

ered herself well, although she always had more or less pain in the knee-joint, after any very severe exercise; but it was not thought of sufficient importance to call for professional advice, as it generally subsided by a few days' rest, although her father had applied a blister to it occasionally. When about twelve years of age she again sprained the joint by slipping on an orange-peel, which produced the most intense pain, immediately after the accident, and which continued until the time I saw her, two years after. She had been cupped and leeches repeatedly; blisters and issues had been applied for some months, but all without any benefit, and finally the agony became so intense and the patient so much prostrated, that the disease was decided to be incurable, amputation advised, and I was sent for to perform it. Dr. Wm. K. Cleveland went with me to assist in the operation. We found the girl sitting on a chair, with her knee flexed at an acute angle, the foot resting on a stool a little lower than the chair on which she sat, her body strongly bent forward, and both hands firmly clasped around the limb just below the knee to prevent, as far as possible, any movement at the joint; at the same time she appeared to push with considerable force, and stated that that was the only way in which she could get any ease. Her father stated that she had sat in that position most of the time—day and night—for the past three months; she would not let go her leg even to feed herself, and they had therefore to feed her. Whenever her position was changed, either to be put in bed or to attend to the necessary calls of nature, it produced a paroxysm of the most intense pain, which frequently lasted some hours, and could not be relieved by any anodyne, although she took morphine in very large doses constantly. Her knee was very much enlarged, almost transparent, and the irregular contours quite defaced by the general rounding out of all the parts. The limb below and above the knee was very much smaller than the opposite one. Her pulse was 160; face very pale and emaciated, and her countenance bore the most marked expression of intense suffering that I have ever witnessed. It was impossible to walk about the room, or in any way jar the floor, without causing her to scream in agony.

When Dr. Cleveland took hold of her foot to move her in position for the operation, she seized him by the arm with her teeth, and held on with the grip of a tigress, until I grasped her limb

above and below the knee, and by firm extension and counter-extension, to separate the bones from each other, gave her such relief that she let go her hold upon his arm. As long as I continued the extension she seemed comparatively quiet, and said it gave her great relief; but the instant I relaxed it at all she screamed in agony. This fact decided me not to amputate, until she had had the benefit of extension fairly tried. It was impossible to do this efficiently without first dividing the hamstring muscles, as the leg had been so long contracted. I therefore held the limb still while Dr. Cleveland put her under the full influence of chloroform, when I divided the outer and inner hamstring tendons subcutaneously, covering the wounds immediately with adhesive plaster and a roller. By a very slight force the limb was at once made almost straight. A long strip of adhesive plaster, about four inches in width, was secured to both sides of the leg by a roller, for the purpose of making extension; and in the loop below the foot a board was placed, wide enough to remove pressure from either malleolus. To this board a cord was attached, and run through a hole made in the foot-board and over a pulley, and to its extremity I attached a smoothing-iron weighing about five pounds. Two bricks were placed under each post at the foot of the bed, to raise it higher than the other end, so that the body, constantly sliding in the opposite direction, would make a proper counter-extending force, without the necessity of a perineal band. This was all accomplished before the effects of the chloroform had passed off, and when she recovered her senses she said she felt perfectly easy. As she had already taken a large dose of morphine just before we arrived, nothing more was given her, but instructions left to administer to her twenty drops of Magendie's solution in the night if necessary.

She passed a more comfortable night than she had done for months, and from that time took no opiate or other anodyne. Her appetite improved, and her bowels became regular, without the use of any cathartic medicine. Iron and quinine, together with the most nutritious food that she could digest, were the only remedies given. A large coarse sponge, placed around the entire knee-joint, and secured by a very firmly-applied roller, was thoroughly wet in cold water, and constantly kept so by frequent irrigations day and night. The extension of the joint by the weight and pulley and the compression by the wet sponge were continued

about two months, after which I made extension by means of the apparatus already described, and which allows the patient to exercise in the open air at the same time that the extension is continued, which is so important in the treatment of all chronic inflammations of the joints.

The instrument was applied, and when the extension was adjusted she could bear almost her entire weight upon the limb; but, when the bars were shortened so as to remove the extension, the slightest pressure upon the foot gave her the most intense agony. With the instrument properly adjusted, she could exercise in the open air upon her crutches, with the greatest freedom, and in perfect comfort. From this time her general health began to improve rapidly. After the first application she came to my office from Jersey City, a distance of several miles, every few weeks to have it readjusted, and each time showed evidences of most marked improvement. It was almost a year before she could bear much pressure without pain, when the extension was removed; but, as this pain subsided, I became more free in my use of passive motion and in about twenty months from the time of the operation I had the satisfaction of seeing her walk without pain, and with tolerable motion of the joint. It is now nearly fifteen years since the case was under treatment, during which time she has enjoyed uninterrupted good health, and at the present time the motions of her knee-joint are so perfect that no one but a critical observer would suspect that there had been any disease there.

CASE. *Thomas B. C., Fourth Street; Chronic Synovitis of Knee-Joint; Suppuration; Subluxation; Anchylosis; Operation; Recovery.*—This patient had scarlatina when two years old, following which he had chronic inflammation of the left knee-joint, commonly called white swelling. After about eighteen months, contraction of the muscles took place to such a degree as to cause subluxation of the tibia backward into the posterior inter-condyloid notch. Eight or nine fistulous openings around the outer part of the knee led to carious bone and into the joint. Drs. R. K. Hoffman and R. S. Kissam had examined him, and pronounced amputation the only means of cure.

I was called to see him in the spring of 1853, in consultation with Dr. Batchelder, who advised compression by means of

sponge, and gradual extension; this was faithfully persisted in for some months, but with no appreciable improvement in the position of the limb. The sinuses on the outer side of the knee were then laid freely open—connecting with the joint—giving exit to a large amount of pus, and some carious bone which seemed to come from the *external* condyle of the femur and the patella only. The joint was freely injected with warm water, and the wound kept open by tents of oakum saturated with Peruvian balsam. Small pieces of bone continued to exfoliate for some months, when the wounds gradually cicatrized, and the parts became perfectly healthy, but with no improvement in the position of the limb. All the constitutional symptoms improved from the time the joint was freely opened; his appetite increased, and his sleep was tranquil without narcotics.

In January, 1854, as his general health had become restored, I decided to attempt to improve the deformity by tenotomy of the hamstring muscles and *brisement forcé* of the knee-joint. The boy was perfectly anaesthetized with chloroform, the tendons divided subcutaneously, the wounds carefully closed with adhesive plaster and a roller, and then the knee-joint forcibly broken—by flexion and extension, and internal rotation—until the limb was brought parallel with the other, and almost perfectly straight. A tight roller was applied from the toes up to near the knee; a large sponge placed in the popliteal space, and strips of adhesive plaster were applied over the sponge, and drawn *tightly* around the joint from the bandage below the knee, to some six inches above it. The roller was then continued over the plaster, snugly applied to the whole thigh. A piece of sponge about two inches in length, and about the size of the fore-finger, having been placed over the track of the femoral artery—as is my usual custom in this operation—the roller was carefully applied to cause partial occlusion of the calibre of the artery, and thus diminish the supply of blood to the joint, without being so tight as to induce its complete strangulation. Two pieces of firm sole-leather, cut to fit the foot and limb in its entire length, having been softened by soaking them a few minutes in cold water, were applied on either side of the foot and limb, and secured by a bandage. Great care was taken to model the leather to all the inequalities of the part, while it was still soft and pliable, and the limb was forcibly held in its improved position until the leather

became dry and hardened, when it retained it as perfectly as any plaster mould could do.¹

I wish to call especial attention to the principle involved in the dressing in this case, as I think it of cardinal importance, having witnessed its practical benefit in many serious operations. *I mean the pressure on the main trunk of an artery leading to any part in danger of inflammation, in such manner as to diminish the supply of blood, to prevent inflammation by partial starvation.* Great caution is, of course, necessary not to produce gangrene; but a little practice, and close observation, will soon give the necessary tact of knowing how to use pressure, without abusing it.

In this case of young C., although the operation was very severe, and the force required to break up the adhesions very great, and continued for some time with rather rough manipulation in order to get the limb in good position, yet it was not followed by any constitutional excitement or irritative fever.

The boy took an anodyne the first night only, and from that time had no pain or trouble whatever. The limb was kept immovable in the leather splint, and was not disturbed in any manner for thirteen days. At the expiration of that time it was dressed and found perfectly satisfactory, the wounds all healed, with no inflammation about the joint. Our object being to obtain ankylosis, the limb was again redressed, but without the sponge over the femoral artery. At the end of two weeks, on again examining it, it looked so favorably that I determined to produce a movable joint, instead of ankylosis. Passive motion was tried, with great care at first, but afterward continued with much more freedom, and finally resulted in a very useful joint, having about two-thirds the motion of a natural one.

The patella is very small—not more than one-third the size of the opposite one, the external condyle of the femur is very much reduced, there is paralysis of the peroneal muscles, from sloughing of the peroneal nerve, the foot is smaller, and the leg one inch shorter than the other. Yet, with a high heel, an elastic spring on the outside of the shoe, and an India-rubber substitute for the

¹ Subsequent experience has taught me that it is better to close the wounds and retain the limb at perfect rest in its abnormal position until the external wounds have healed (which will generally be done in five or six days), before proceeding to break up the bony adhesions.

peroneal muscles—running from the top of the fibula to the ankle, where it terminates in a catgut cord, which plays around a pulley, and is inserted at the outer margin of the sole of the boot near the toe—the boy walks, dances, runs, and skates with his playmates without crutch or cane.

CASE. Chronic Inflammation of the Knee-Joint with Subluxation.—March 4, 1873.—James M., of Williamsburgh, carpenter, aged fifty-two, very strong and robust; four years since, while lifting a heavy weight, he stepped on a stone and slipped, "something cracked in his right knee like a pistol." The knee swelled very much; did not lay him up; continued work all the time for two years, although the knee was swollen to nearly twice the size of the other. He was then thrown from a wagon, striking upon the outside of the lame knee, and was laid up with an acute inflammation of the joint. Six months after this a gathering took place, and opened on the inner side of the popliteal space, discharging very freely for two or three months. The opening still discharges a small amount of glairy fluid. The probe passes five and a half inches around the joint, but I do not touch bone.

Present condition seen in Fig. 141, with comparative measurements of the two limbs.

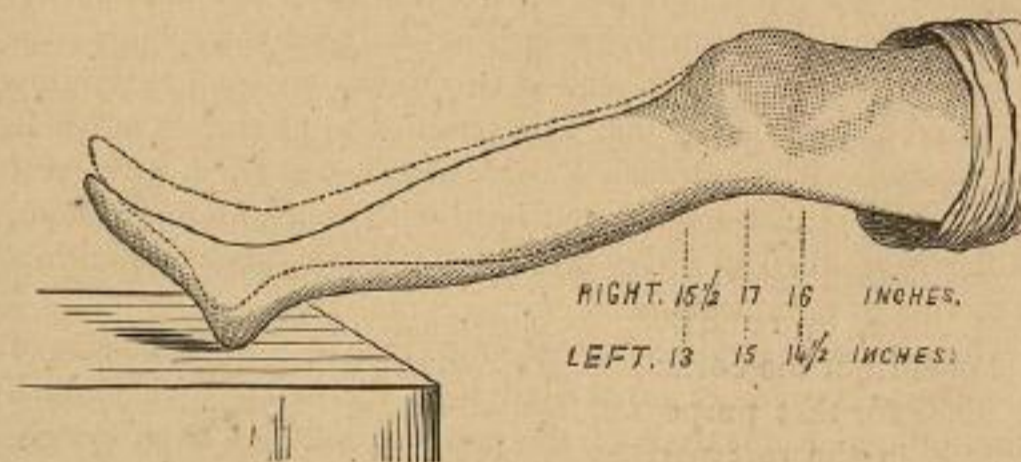


FIG. 141.

DIAGNOSIS.—Chronic inflammation of the knee-joint, with subluxation.

TREATMENT.—Extension in two directions, as seen in Fig. 130, after which the knee is to be compressed with wet sponge and roller. May possibly require exsection.

April 10th.—Measurements decreased from 17 to $16\frac{1}{2}$ about the knee; below the knee $15\frac{1}{2}$ to $14\frac{1}{2}$; above knee not changed. Position straightened to dotted line in Fig. 141; knee-extension splint applied.

May 16th.—Readjusted rollers. The plasters, which have been on one month, are in good condition, and the instrument was properly extended; could bear almost his entire weight on limb without pain. Limb perfectly straight; discharge from it very slight; improved in every way.

June 16th.—Readjusted plasters for the first time; much improved.

May 7, 1874.—Plasters removed for the fourth time, and the joint is perfectly cured. The limb is straight, and can sustain entire weight of body. Has moderate motion. Removed all dressings, and applied roller-bandage; advise frictions and electricity, with passive motions.

July 1, 1874.—Patient walked to the office from Williamsburgh; is in perfect health; no pain whatever about the knee-joint; can extend leg perfectly straight, and flex it to nearly a right angle. Flexion may, possibly, be increased in time.

Very many of the cases, however, which you will be called upon to treat, will be those which have been neglected, and in consequence the disease has become far advanced.

You may, then, see a joint in which there is extensive destruction of the soft parts, extensive disease of the bony structures, accompanied by exhausting discharges, and very grave constitutional disturbance.

In such cases, if there is reasonable hope of being able to relieve the patient of this source of constitutional exhaustion and disturbance, by removing the dead bone, and establishing free drainage from the bottom of all sinuous tracts, an operation may be made for that purpose. If deemed justifiable, make a large opening in the soft parts so as to establish perfect drainage and prevent any collections of pus; then drill, gouge, and chisel, until all dead bone is removed; draw setons of oakum or perforated India-rubber tubing through the joint to avoid the possibility of the retention of pus, place the limb upon an extending and counter-extending apparatus, and carefully watch the progress of the case.

If this progress is favorable, both locally and constitutionally,

it will be good evidence that your operative interference has been in the right direction. If, however, the changes are unfavorable, you may next resort to exsection of the joint.

In those cases which have become so far advanced as to admit of no delay, exsection or amputation may be resorted to at once.

There are cases also in which the disease steadily progresses toward an unfavorable termination, even when the very best plan of treatment is adopted and carried out in the most faithful manner. Such cases will probably require exsection or amputation; therefore we will study the subject of exsection at our next lecture.

LECTURE XVIII.

DISEASE OF THE JOINTS.—KNEE-JOINT (CONCLUDED).—EXSECTION.

Mode of performing the Operation of Exsection.—Splints and Dressings used after the Operation.—Partial Exsection.—"Bryant on the Least Sacrifice of Parts as a Principle in Operative Surgery."—Differential Diagnosis.—Bursitis.—Necrosis of the Lower Extremity of the Femur.

GENTLEMEN: You will recollect I stated at my last lecture that there are certain cases of chronic disease of the knee-joint in which the operation of exsection will be demanded, and it is to the consideration of this subject that I shall first direct your attention this morning.

Exsection of the knee-joint should be performed in the following manner:

Make a single U-shaped incision, beginning at the posterior portion of the inner condyle of the femur, passing downward and across a little below the lower border of the patella, and thence back to the posterior portion of the external condyle of the femur. I prefer the incision made in this manner to the H-incision, for the reason that it is equally serviceable, and exposes a much less extensive surface of bone. Turn the flap back and remove the patella whether it is diseased or not. By some it is recommended to peel the patella out from the periosteum, but removing a healthy patella in that manner is impossible.