

FRACTURES AND OTHER TRAUMA

THE AMBULATORY TREATMENT OF FRACTURES OF THE LOWER EXTREMITY

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ABOUT the year 1880 Owen Thomas, of Liverpool, attempted to permit patients who had suffered fractures of the lower extremity, more especially of the femur, to walk with the help of the caliper, which today bears his name, before sufficient time had elapsed for firm union to take place. Thomas' important contributions seem to have been forgotten by surgeons until the time of the war when, under the stimulus of that master surgeon and great gentleman, Sir Robert Jones, the importance of both traction in the treatment of fractures and the value of early protected weight bearing with the help of Thomas' apparatus again became recognized.

It was a simple forward step, following the employment of the Thomas knee splint as a walking caliper, to have suggested the use of a short caliper, reaching not to the tuberosity of the ischium but to the tuberosities of the tibia, as a convalescent appliance in the treatment of fractures of both bones of the leg, about the ankle joint, and of the foot.

The methods introduced by Thomas and Jones were primarily recommended in order that patients, in whom union of bones had progressed to a stage of minimal consolidation, might be able to bear weight without the risk of bending or torsion strains being transmitted to the site of the new callus deposition. Apparently, the first effort to permit weight bearing upon the fractured leg before such consolidation had taken place was attempted by Dollinger, of Budapest, who in 1893 described a method of applying plaster-of-Paris with this end in view. Dollinger recognized the fact that it was possible to apply plaster to the unpadded limb so that weight might be borne from the bottom of the plaster to the tuberosities of the tibia. In order that no weight whatever should be borne by the foot or leg below the site of fracture he placed a layer

of padding beneath the foot and between it and the plaster covering the sole.

Immediately following the first phase of the war, that is about the end of 1918, my attention was directed to the contributions of Delbet, of Paris, who in 1915 had published the description of a method for reducing and fixing fractures of the leg and about the ankle joint. We employed Delbet's method as a convalescent protective apparatus in the case of fractures of both bones of the leg after union had sufficiently consolidated to make it appear reasonable that some weight bearing upon the limb might be attempted, but earlier than it was deemed advisable to run the risk of either bending or torsion strains. An attempt was made to apply Delbet's dressing in both its original manner and in the form as modified by us in the early treatment of fractures especially about the ankle joint. It was found, however, that if Delbet's apparatus was applied soon after the date of injury the limb became dependent, swelling occurred in the foot and at the site of the windows created between the upright bars and the 2 cuffs. In consequence, if the patients attempted to walk not only was there pain but linear ulcers were likely to be exhibited over the tendo achillis, over the tendon of the tibialis anticus muscle, and at the edges of the windows.

The success which attended the employment of Delbet's dressing in the support of incompletely united fractures of the leg impressed me with the feasibility of employing the upper surface of the upright cone, represented by the malleoli, and the inferior surface of the inverted cone, represented by the tuberosities of the tibia, as a means of transmitting weight from the former to the latter. Early in 1919, therefore, I began the application of plaster without padding in fractures of the foot, about the ankle joint, and of the leg. At the time I was not familiar with the contributions of Dollinger and consequently was not misled into the employment of a pad beneath the foot between it and the plaster.

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During the Clinical Congress of the American College of Surgeons in Montreal, in 1926, a number of patients suffering from fractures about the ankle joint and of the os calcis were demonstrated walking in unpadded plaster casts a few days following receipt of injury. Although upon several occasions prior to 1928 addresses were presented before a number of medical societies in which the application of unpadded plasters to permit early protected weight bearing were read, no publication was made describing the technique until August, 1928, at which time I published a paper which had been read before the Academy of Surgery in Philadelphia on March 5, 1928.

These remarks are made at this time because I believe it is true that I have the right to priority in the employment of unpadded plasters in order to make it possible that early protected weight bearing be carried out by patients soon after fractures of the leg, foot, or ankle have been suffered. Since 1928 a number of articles have been published in which the indications for and the contra-indications against the method of application, and the advantages and disadvantages of the method have been described and discussed.

As I have reported on many occasions a description of the technique which we have employed in the application of the unpadded plaster in the treatment of fractures of the foot and about the ankle joint, the procedure will not be described in detail here. I have also discussed what I believe to be the essential differences between my own technique and those of Delbet and Boehler.

Two essentials are required before an unpadded plaster which will permit weight bearing may be applied. In the first place, accurate reduction should be obtained and, in the second, there should be no swelling of the limb whatever. A third desideratum is that the skin be carefully cleansed. We use for this purpose soap and water, alcohol, and a generous coating of zinc stearate powder. If bullæ have been present, they are treated as indicated and their neighborhood painted with a suitable skin antiseptic.

If the case is seen immediately following injury and before swelling has taken place, it is possible to apply the unpadded plaster at once. Since, however, it is unusual to see cases before swelling or hematoma formation, there is usually a necessary preliminary fixation period following reduction. As a routine in our clinic we have for many years employed for this purpose the pillow splint which has been described previously. This preliminary fixation period lasts from 2 to 12 days. During this time disappearance of swelling from

the limb is accomplished by raising the foot of the bed and, in some cases, by means of the assistance of baking and gentle massage.

A discarded silk stocking, which is always available from the waste baskets in the nurses' home, is drawn over the powdered limb. Although we are quite convinced that the method of application of plaster as advocated by Boehler, Griswold, and others, which is characterized by the application of a posterior molded splint first and finished by means of circular plaster is good, we have continued to use a circular cast reinforced by a stirrup-like band. This band strengthens the heel upon which weight will be borne, and also the ankle joint which attempts to move. The band extends to above the junction of the middle and lower thirds of the leg, because experience has shown us that this is the part of the apparatus subjected to special strain.

It is evident that in the application of the circular turns care must be exercised so that no constricting bands of plaster be applied and that no dead spaces exist. Since it is of the utmost importance that there be absolutely no swelling of the limb, we are of the opinion that the latter should not be allowed to become dependent during the application of the plaster. Griswold's suggestion that the patient be prone and the leg be flexed at the knee joint is admirable.

Before the cast has set it is carefully molded about the malleoli and to the upper end of the tibia. The foot is fixed at a right angle at the ankle joint and, depending upon the nature of the injury whether external rotation, fibular flexion or tibial flexion, suitable pressure upon the os calcis and astragalus is accomplished to maintain reduction. The mid foot is flexed so that the first and fifth metatarsal heads are on the same horizontal plane and the longitudinal arch of the foot thus reproduced or exaggerated.

Since we have noted that the majority of patients wearing artificial limbs after amputations of the leg prefer to have some of their weight borne upon the lower border of the patella, we have made it a practice to carry the plaster up to this point in front. The posterior border of the cast is cut away sufficiently to permit flexion at the knee to a right angle. Prolonged experience has proved to our satisfaction that it is advisable to include the fifth and usually the fourth toes inside the plaster; because if the plaster stops at the base of the toes, swelling is likely to occur distal to the edge and painful pressure points are consequently likely to ensue.

As soon as the plaster is dry a heel fashioned from saddler's felt 1 to 1½ inches thick is attached

to the bottom of the cast with adhesive plaster. The patient is then ready to walk without the employment of crutch or stick.

Private patients have been advised to purchase custom-made boots so fitted as to go over the plaster. Such boots are usually so fashioned that they are not particularly noticeable, and consequently the patient is able to go about his business without being conspicuous. In Montreal the cost of such a custom-made boot is between \$10.00 and \$12.00. For patients who cannot afford such a luxury a cheap slipper-like covering can be made for \$1.00 or thereabouts. Hospital patients provide themselves with either a cheap slipper or a large moccasin. In general, it is inadvisable to allow patients to wear a covering containing rubber over the cast since the moisture which accumulates under these conditions is likely to soften the plaster.

In the treatment of fractures of both bones of the leg we have employed 3 methods. By some of our staff and in certain cases skeletal traction in a Thomas or Braun splint has been employed as an immediate method and continued from 3 to 4 weeks or until early union has commenced. In a smaller number of cases we have used traction and distraction by means of heavy Kirchner wires through the upper border of the tibia and either the lower tibia or os calcis. If such cases have been seen before swelling has occurred, an unpadded cast in which the ends of the wires are incorporated is applied at once and the patient is permitted to start immediate weight bearing. This technique has been employed in transverse fractures in which accurate coaptation of the bone ends has been possible.

Anderson and Griswold have obtained satisfactory results by the employment of pins inserted through the upper part of the tibia and the os calcis. Each has designed an apparatus which is employed for reduction and for fixation of limb pending application of plaster to the skin.

In January, 1935, Griswold reported his results over a one year period ending June, 1934. Of 67 fractured legs, the double pin technique was employed in 43. In the remainder, except for a small number of severe compound fractures, manual reduction and unpadded casts were employed without pins. The results were, in Griswold's opinion and with which I heartily agree, extremely satisfactory. He was also able to state that the period of hospitalization including both simple and compound fractures had been reduced to an average of less than 10 days.

Our routine method, however, has been to carry out reduction by means of traction, em-

TABLE I.—LENGTH OF TIME FOLLOWING INJURY AND START OF LOCOMOTION

	Days
Both bones of the leg	18 to 25
Ankle joint—seen immediately following injury before swelling	1 to 3
Ankle joint—seen after swelling has taken place	5 to 8
Os calcis—reduction usually third to eighth day	10 to 16
Astragalus—astragalectomy for crush fractures	5 to 16
Mid tarsal row—cuneiforms, cuboid, and scaphoid	5 to 6
Tarsal bones	2 to 8
Great toe	1 to 8

ploying for this purpose what we have considered to be our own modification of Delbet's sling. By means of this sling which grasps the os calcis at the point of attachment, the tendo achillis, and the astragalus just distal to the ankle joint, it is possible for the assistant to maintain traction by means of his body weight transmitted through the upper arm and at the same time to have both hands free for manipulation of the foot.

If swelling is present at the time the reduction is carried out, a single layer of sheet wadding is applied to the limb, particular care being taken that not more than one layer be applied over the upper portion of the tibia or about the malleoli. Circular plaster-of-Paris is applied with the sling in position. Care is taken to mold the plaster accurately to the cone represented by the malleoli and to the upper border of the tibia. The first plaster is applied with the knee joint flexed about 15 degrees and reaches to the junction of middle and upper thirds of the thigh. Since by this technique it is difficult to prevent posterior bowing at the site of fracture unless the foot is kept in moderate plantar flexion, this position is adopted.

When the plaster has set, the sling is removed from the foot in order that pressure points arising from its incorporation in the plaster under tension may not take place. Removal of the sling is usually accomplished without much difficulty by slipping a pair of bandage scissors between plaster and skin and cutting the loops. The whole sling is then withdrawn. Following the removal of the sling a few turns of plaster are applied so that the space in the sole of the foot may be covered.

The patient is returned to bed with the foot of the latter raised a distance of 8 or 10 inches in order that adequate circulation may be established as promptly as possible. On about the twenty-first to the twenty-fifth day the anterior half of the cast is removed and the site of fracture and limb as a whole investigated with special reference to the condition of the skin and the presence or absence of swelling. It is usually discovered at this time that the bone ends are

sufficiently fixed to prevent displacement and to permit movements of knee and ankle joints. At this time we customarily employ gentle massage and baking for a few days and induce the patient to attempt movements of the ankle joint to bring about dorsiflexion of foot to at least a right angle.

As a rule, on the twenty-fifth to the twenty-eighth day following injury we have found that absolutely all edema has subsided and that fixation at the site of fracture has become sufficiently stable to permit dorsiflexion of the foot without any tendency toward displacement or bending. A walking, unpadded plaster is then applied over a silk stocking, according to the technique described for fractures of the foot and ankle, but it is extended to about the junction of the middle and upper thirds of the thigh. Since, on the one hand, there is no necessity for the plaster fitting snugly to the skin above the knee joint, and on the other hand, on account of the ease with which the thigh tissues are molded, no attempt is made to make the plaster fit snugly at this point, 1 or 2 layers of either sheet wadding or flannelette are applied between the plaster and the skin above the knee joint. Just before the plaster finally sets this upper border is turned down so that no cutting edge will be produced. The reinforcing plaster-of-Paris stirrup is carried well above the site of fracture so that strain on the circular plasters at this point will be minimized. As soon as the plaster has dried a felt heel is fixed to the bottom of the plaster as recommended for fractures of the foot and ankle.

We have felt that it is rather important when the patient first begins to walk that he be instructed as to the proper gait to employ. Since the knee and ankle joints are complementary, he is advised that whether the fixation extend above the knee or not no useful purpose is gained by attempting to flex the knee joint in walking. He is instructed to keep the injured limb at all times in front of its fellow so that he steps forward whatever distance is convenient with the plaster encased foot and brings the normal foot up to but not past the injured member.

ADVANTAGES AND DISADVANTAGES OF DIFFERENT METHODS

From the patient's point of view there are many unfavorable features which may follow fracture of one or more of the bones of the lower extremity. These are: (1) Pain and possible shock to the nervous system; (2) loss of time; (3) expense of treatment, with special reference to hospital and surgical fees and possible apparatus; and (4) persistence of disability either for a long time or

permanently. Prolonged or permanent disability may be due to deformity, delayed union, non-union (pseudarthrosis), interference with joint function, contractures and consequent interference with action of muscles and tendons, circulatory disturbance as manifested by swelling and loss of tolerance to low temperatures, and painful foot due to atrophy of bone and ligamentous structures of either acute or chronic type.

Those who are familiar with the technique of plaster application and postoperative treatment of patients who have suffered fractures below the knee believe that the above unfavorable concomitants or sequelæ are in large measure avoided by the use of a technique which permits early protected weight bearing.

Pain and shock to nervous system. Since it is possible for such persons to be out of bed fully dressed and to carry on many or most activities within a few days after injury, the effect upon morale is striking. The natural effects of such improvement in morale are to minimize the incidence of that train of symptoms commonly referred to as traumatic neurasthenia or even that more subtle symptomatology known as *sinistrosis*.

Loss of time. By means of the application of unpadded plaster to the injured limb it is possible for professional and business men to return to full activity within a few hours after the time of injury in the case of fractures of the foot or about the ankle joint, or within a month in the case of fractures of the leg. The above refers to results in cases in which operative methods in the sense of piano wire or pin fixation are not used or at an earlier date if such methods are instituted (Griswold, Anderson).

Although we have not employed in our clinic any of the methods, especially that of Anderson, which make possible early protected weight bearing in the case of fractures of the shaft of the femur, it would seem that such a contribution as that made by Anderson is the inevitable result of improvements in the treatment of fractures below the knee by a similar technique. Since Anderson's description of his technique seems to prove the mechanical reasonableness of the multiple pin method, and since the results reported by him and the comparatively small number of surgeons who have employed his method are so satisfactory and apparently free from risk, it would seem likely that in the near future in certain selected cases, at least, we will find persons in wide spread parts of the continent returning to full occupation within a few days after having suffered a fracture of the shaft of the femur.

Although immediately following the introduction by Smith-Petersen, of Boston, of the flanged nail there was a somewhat general belief engendered that such fixation would permit early weight bearing, and although, in fact, in many cases the results of partial weight bearing assisted by crutches were satisfactory, I believe I am correct in stating that today the majority of surgeons have reached the conclusion that attempts at walking with weight bearing upon the injured limb in less than 3 to 4 months from the date of accident is inadvisable unless additional methods of protecting the injured bone are instituted.

In addition to business men, clerical workers, physicians, surgeons, and members of the legal profession who, as here indicated, are able to return to their usual activities almost immediately following fractures at least below the knee, housewives and mothers are usually able to carry on with their necessary duties with only a short period of absence from the home. Again, in so far as household activities are concerned the fact that domestic servants have to remain away from work for only a few days in consequence of a fractured ankle or broken foot is of importance both in that the routine of the household is not disturbed and, in so far as the injured individuals themselves are concerned their employment is maintained. Moreover, pupils and students at schools and universities are able to carry on with little time loss. In this connection, too, I should like to express the opinion that contrary to the general belief the value of such young people's time is equally if not more important than that of older persons.

Until such time as Workmen's Compensation Boards and insurance companies have the matter placed before them in an adequate fashion by their surgical advisers it will not be possible for employees to return to work until final consolidation of fractures and return of function has been obtained. Nevertheless, the very fact that with the speeding up in industrial operations the number of accidents is likely to increase will, I believe, make it imperative before long that on the one hand savings to industry and, on the other hand, increased earning capacity on the part of the employee shall draw forcibly to the attention of both commission and insurance company the importance of demanding that patients with fracture at least below the knee be treated in a manner similar to that recommended in this contribution. If, as seems probable, a shortage of labor in all directions in consequence of war activities becomes acute, there will be an added demand for the shortest possible period of lay-off,

particularly in the case of skilled workers. Unfortunately, in consequence of the past 10 years of inadequate employment the supply of skilled workers has become lamentably short.

Expense of treatment. Recent data with regard to the expense to the community, the individual, or other organization responsible, have shown that the greater part of the expenditure is on account of hospital erection and upkeep. If improvement in surgical care is to result in better end-results and a shortening of both temporary total and temporary partial disability, there seems to be no reason why surgical fees for the care of individual fractures should in any way be reduced. If it be possible, and it is, to treat 3, 6 or 8 persons rather than only 1 individual with the employment of but 1 bed, it is evident that the erection of new hospitals will be minimized. It is true, of course, that the more intensive the active treatment which is carried out, as is the case when a rapid turnover takes place, the cost per bed per day is increased; nevertheless, in the long run the cost of hospitalization in so far as fractures of the lower extremity are concerned, has been and will be enormously reduced.

Although there will, I believe, always be a certain demand for the employment of those procedures which are grouped under the heading of physiotherapy in a small selected group of cases, it immediately becomes evident as soon as a method of early protected weight bearing is employed that the necessity for prolonged employment of physiotherapy is either completely eliminated or much reduced.

Persistence of disability. With reference to the persistence of disability either for a long time or permanently, and this refers equally to men coming under Workmen's Compensation Commissions and to business executives, professional men, and others, this may be considered under 3 separate headings: (1) total temporary disability; (2) temporary partial disability; and (3) permanent partial disability.

Since total temporary disability is reduced for many classes of persons to the matter of hours or days for fractures of foot and ankle, and approximately to only 4 weeks for fractures of both bones of the leg, this feature of such fractures is in large measure eliminated. This is true although temporary partial disability does, in fact, to a certain extent take its place, although for many persons the disability suffered while the protective plaster is being worn is more theoretical than real. Although permanent partial disability following fractures will never be completely eliminated because the original trauma not infre-

quently causes injuries to essential soft tissues as well as to bones and, although early protected weight bearing will not take the place of skillful early reduction, it is nevertheless true, we believe, that many of the causes for permanent partial disability are avoided by the employment of the unpadded plaster and immediate weight bearing and locomotion upon the injured limb.

CAUSES OF PROLONGED OR PERMANENT DISABILITY

The causes of prolonged or permanent disability have been stated. However, it is in order, I believe, to make the following remarks:

1. It is evident that with regard to deformity immediate skilful treatment with exact anatomical reduction of displacement as nearly as possible is of paramount importance. It is also true that in too many patients deformity, particularly of fractures about the ankle joint, develops secondarily as the result of too early unprotected weight bearing upon the injured limb. Since patients, who are able to carry on more or less completely with their usual occupations, are much less likely to complain of the length of time required for complete consolidation, this secondary cause of deformity is not likely to complicate the progress of the case.

2. The question of delayed union is one which has been discussed in a large measure in the preceding paragraph. I wish, however, to make the statement that in my opinion the fact that in practically all textbooks on general surgery the length of time indicated for sound consolidation in fracture repair is too short. Sufficient attention has not been paid by many surgeons to the differentiation of early fixation by provisional callus at the site of fracture and consolidation of sufficient strength not only to bear weight but to resist torsion and bending strains. There can be no doubt in my opinion that many patients are subjected to operation for bone grafting or perhaps other procedures with a diagnosis of delayed union on account of the optimism on the part of the attending surgeon regarding length of time required for consolidation of certain fractures.

3. Non-union or pseudarthrosis with definite adventitious bursa formation in consequence of liquefaction of the osteoblastematous tissue unquestionably occurs and is exhibited at one stage during the course of bone repair. We all have seen such cases; nor is there any difference of opinion as to the necessity in such cases of somewhat radical interference with a view to removing the tissue between the bone ends and usually the insertion of a bone graft. I believe I am correct

in making the statement that the incidence of pseudarthrosis in those patients treated by surgeons, who have become familiar with the technique of early protected weight bearing, has been enormously less than that encountered by surgeons who have continued to treat fractures by other methods. Our long experience of approximately 20 years in the treatment of hundreds of fractures of the ankle joint and leg by means of the unpadded cast and early protected weight bearing has resulted in but one case of non-union, although during the same period many cases of non-union have been referred to us which had been treated by other methods.

In a previous contribution I referred to an article by Kuentscher which unfortunately, so far as I know, has not been confirmed by English or American investigators. In this article Kuentscher indicates that experiments by himself and others, more especially Kompecher, have proved that if during bone repair the new callus is kept under the influence of traction, pseudarthrosis is the result, but if under the influence of pressure bony union may be expected. In other words, by pulling the fragments asunder fibrous union results and by pressing them together bony union ensues. Although in a properly applied walking plaster but little weight is borne upon the bone ends, unless serious errors in technique have been made, there is but little likelihood of distraction.

Many of us are of the opinion that walking upon the fractured limb results in stimulation of bone consolidation in the same manner as that procedure introduced by Owen Thomas and popularized by Sir Robert Jones, namely, that of exposure and hammering the bone ends in cases of non-union.

4. Space limitations do not permit a consideration of the various factors which result in interference with joint function which follow fractures and the more or less inevitable and necessary period of fixation. It would seem evident, however, that at least 2 important factors have an influence upon such unfavorable sequelæ. On the one hand, the peri-arthritis structures, ligaments, tendons, and tendon sheaths, as well as other less specific soft structures have a tendency to contract to the position maintained during the period of rest. It is for this reason that a number of surgeons prefer to employ a method which can be described best as that of early mobilization (de Champonière, Menell and others). The second important reason, in my opinion, for interference with joint function with the development in some cases of actual ankylosis is that of atrophy of cartilage and ligamentous structures which we be-

lieve takes place *pari passu*, with the invariable though usually minimal decalcification of the bones about the site of fracture.

As the result of weight bearing during healing adequacy of the blood supply to the injured limb is usually maintained; in consequence, atrophy of cartilage, ligament, and bone is minimized and loss of joint function due to this cause is avoided. In so far as the tendons are concerned, although no movement is possible in a well applied cast, these structures attempt to move and, in fact, do move within a limited range. In any event it is unusual when fixation is removed to find any considerable loss of joint function. If the position of the joints has been properly provided for prior to fixation, it usually requires only a few minutes of active movement before complete return of function is established.

5. Contractures and interference with action of muscles and tendons has been referred to in the last section. The fact that marked muscle atrophy occurs with shortening of the musculotendinous systems, which are placed at rest during the fixation period, is recognized by everyone who has treated patients with fracture of the lower extremities either in bed or on crutches with a dangling limb. Although a properly applied, unpadded plaster cast so fixes the joints of the limb that practically no movement takes place, such fixation does not prevent contraction and sliding of the muscles and, to a lesser degree, of the tendons. The fact that muscles which are induced to exercise against a fixed restraining force may be kept normal in size and activity is well known. Incidentally, the contracture of such muscles is of importance in stimulating a more nearly normal blood circulation through the limb as a whole.

6. Circulatory disturbances, when the limb first becomes dependent after prolonged bed rest or following the removal of a padded plaster cast, are such common phenomena that they need hardly be referred to here. Perhaps the most striking observation which will be noted by the surgeon, who has not previously used unpadded casts with early weight bearing, will be the fact that following removal of fixation the amount of swelling which takes place in the limb is rarely more than minimal, since the application of a plaster about the limb after the latter has been completely freed from interstitial fluid evidently prevents stretching of the interstitial spaces and protects the valves of veins and lymphatics from strain. At the same time stasis of blood in the capillaries and smaller vessels is rendered im-

possible. The necessity, therefore, for prolonged protection of the limb following removal of plaster is not necessary nor do such patients complain of discomfort during cold weather.

7. The author has upon several occasions published contributions regarding the condition which is described as acute bone atrophy and to which Sudeck's name has been applied. It is not my intention at this time to dilate upon what I believe to be the causes of the exhibition of this condition nor to discuss in detail its prevention or treatment other than to say that in our experience the most favorable treatment for the condition, when exemplified in the lower extremity, is the application of a walking cast and the resumption of active function in so far as weight bearing is concerned. The comparatively large number of cases of this extremely disabling condition, the prolongation of disability among patients who have been treated either in bed or, more especially with a dangling limb, and the almost complete absence of this complication among our own cases has convinced me that acute bone atrophy in the lower extremity is more surely avoided by the use of a technique which permits protected weight bearing during the period required for consolidation of the fracture.

The advantages of early protected weight bearing have been indicated at some length. The disadvantages are primarily two. The less important of these is that a certain amount of skill in the application of the unpadded plaster is evidently required. This, however, is not a difficult matter. The second objection is, I believe, more important. With few exceptions the patient must be admitted to the hospital and, except in the occasional case which is seen prior to the development of swelling, bed rest with suitable support and posture must be available for a few days until all interstitial fluid in the affected limb has been dissipated. I believe, moreover, that re-admission to the hospital for change of plaster when the latter wears out will in the long run prove more satisfactory and consequently desirable.

A sufficiently large number of patients have been seen who have worn the iron stirrup type of heel such as has been recommended by Boehler, and also the felt heel as recommended by me to be able to state with assurance that patients who have worn both forms of apparatus are unanimously in favor of the felt heel both as far as actual ease of locomotion is concerned and specifically with regard to the wearing of a suitable boot or other foot covering.

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