MASSAGE AND REMEDIAL EXERCISES

IN MEDICAL AND SURGICAL CONDITIONS

BY

NOËL M. TIDY

Member of the Chartered Society of Massage and Medical Gymnastics; T.M.M.G.; Sister-in-Charge of the Red Cross Massage Clinic, High Wycombe

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TO MY MOTHER

WHO HAS ALWAYS TAKEN SO MUCH INTEREST
IN ITS PROGRESS THIS
BOOK IS DEDICATED

PREFACE TO THE SIXTH EDITION

THE principal alterations in this edition are in the sections dealing with fractures. I have, in fact, rewritten almost the whole of the first three chapters, in order to bring them more into line with modern methods of treatment; and in these chapters several new illustrations have been introduced. Apart from this there have been few changes of any importance in the text.

My thanks are due to all who have helped me by their writings or by their suggestions; and to my publishers, Messrs. John Wright & Sons, who, in spite of repeated damage to their business by enemy action, have been so prompt in producing the last two editions, and whose courtesy and patience are unfailing.

NOËL M. TIDY.

Great Missenden.
December, 1943.

FROM THE PREFACE TO THE FIRST EDITION

SOME years ago it occurred to me that although there were many excellent books on massage and exercises, there was none that was quite suitable as a text-book for senior students, for those recently qualified, or for junior teachers in training for the Chartered Society's examination. There were various good elementary text-books, and there were advanced works like Dr. Mennell's *Massage: its Principles and Practice*; but the former type did not seem to me to contain sufficient information for students preparing for the Conjoint Examination, while, in order to profit by the latter, a far more extensive background of knowledge and experience was necessary than would be possessed by any medical gymnast at the beginning of her career. It was in the hope of in some measure supplying this want that the present work was written.

The book makes no claim to originality. It has been my object merely to give an account of various modern methods of treatment, and to indicate, as far as possible, where further information about them can be obtained. At the same time I have personally tested most of these forms of treatment.

The exercises suggested are gathered from many sources—often forgotten sources. It is impossible in a work of this kind to avoid mentioning many of the well-known movements first classified and named by Dr. Arvedson, or by Ling, Ostrom, and other Swedish or Danish

specialists. Other exercises have been seen at gymnastic displays or demonstrations at many different times and places. A certain number I have worked out myself, though even those I have 'invented' may, as likely as not, have been 'invented' before. I must, however, offer my very grateful thanks to Miss Angove and her staff at Guy's Hospital for all I learnt while working under her, as well as for the experience I was able to gain in the treatment of heart and lung conditions.

I have made little or no attempt to describe special massage manipulations, partly because the illustrations necessary to make such description effective would have taken up more space than could be spared, and partly because this has already been done most fully and beautifully by Dr. Mennell in his book on massage, as well as in other works on the subject. I have been careful to use only such terms as are contained in the Society's syllabus, or such as would be understood by every medical gymnast. When advising *passive movements*, I have tried in every case to make it quite clear whether *relaxed* movements (the only *true* passive movements) or *forced* movements are to be used, since the term 'passive movement' has been a fruitful source of misunderstanding in the past.

In describing the various treatments, I have paid considerably more attention to some subjects than to others. My aim has been, in fact, to provide most details where other books provided least. I have, for instance, given fairly full notes on the treatment of fractures, and have tried to suggest approximate dates on which to begin the movements, guided by my own experience and that of others, and by the study of the works of many authorities. As regards other conditions—scoliosis, for example—almost too much information is available. It is impossible even to summarize all the different systems of treatment. In such cases, therefore, I have tried to point out the general principles on which treatment should be based, leaving my readers to work these out in practice, with the assistance of the lectures and demonstrations which the C.S.M.M.G. is so generous in providing for its members.

Special acknowledgement is due to Miss Coleman for her invaluable help in preparing the photographic illustrations of the exercises. These were all taken as moving pictures, and, after the whole film had been seen on the screen, the positions which gave the best idea of each exercise were chosen for reproduction. It was thus possible to obtain an effect of movement and activity, as well as, in some cases, of actual muscle action, which would have been impossible in ordinary 'still' photographs.

NOËL M. TIDY.

Great Missenden,
October, 1932.

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MASSAGE AND REMEDIAL EXERCISES

IN MEDICAL AND SURGICAL CONDITIONS

CHAPTER I

FRACTURES: GENERAL CONSIDERATIONS

Varieties—Causes—Displacement—General Symptoms—Healing—Complications—Principles of Treatment.

THE medical gymnast, as we well know, is required to deal with many different forms of injury. Cases of fracture, dislocation, sprain, rupture of muscle, or lesion of nerve are numerous in our hospital departments, as well as amongst our private patients. Although fractures in the recent stage are less commonly sent for treatment than formerly, we find ourselves constantly confronted with the late results of injury, such as stiffness of a limb due to the formation of adhesions within or around one or more of its joints. Also, we may be required to *prevent* the development of stiffness in the joints of the limb other than those immobilized by the surgeon, or to minimize muscular atrophy by teaching the patient how to exercise his muscles during the immobilization period.

A fracture has been defined as the interruption of the continuity of a bone. This interruption, however, may be complete or incomplete. The varieties, causes, and symptoms are briefly summarized below. For further details, the larger text-books should be consulted.*

Varieties.—

Fractures may be classified as follows:—

INCOMPLETE.—(1) *Greenstick*; in which the bone is bent, and broken only part of the way through its shaft; this type is found only in children. (2) *Fissured*; consisting of a mere split of the bone without displacement of the fragments.

COMPLETE.—(1) *Simple*; in which the skin is intact. (2) *Compound*; in which the broken bone has pierced the skin. (3) *Comminuted*; in which the bone is splintered, or broken into several pieces. (4) *Impacted*; in which the broken bone-ends are driven into each other. (5) *Complicated*; in which there is injury to some organ or important structure in the neighbourhood of the fracture.

SEPARATION OF AN EPIPHYSIS, occurring in young people before the bones are completely ossified, has also to be considered.

Causes.—

SPONTANEOUS FRACTURES are those which take place owing to bone disease, general or local, which causes the bones to be unduly brittle.

TRAUMATIC FRACTURES are those due to violence. The force causing a fracture may consist of: (1) *Direct violence*, as when the arm or leg is broken

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* e.g. R. Watson-Jones, *Fractures and Other Bone and Joint Injuries*; J. G. Bonnin, *A Complete Outline of Fractures*; L. Böhler, *The Treatment of Fractures*.

by a wheel passing over it, or by a blow. (2) *Indirect violence*, in which case the force is transmitted to the bone through some other part of the body, as when the clavicle is broken by a fall on the hand, or the tibia and fibula by a fall on the feet. (3) *Muscular action*, as in fracture of the patella due to a sudden contraction of the quadriceps extensors.

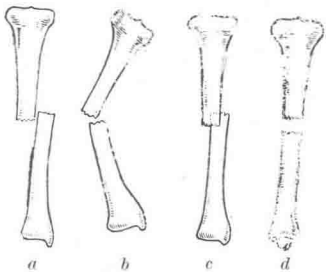

Fig. 1.—Types of displacement in fractures. *a*, Lateral displacement; *b*, Angulation; *c*, Overlapping; *d*, Rotation.

Displacement.—

Fractures may be transverse, oblique, or spiral in form, the transverse fractures generally being the result of direct, the oblique and spiral fractures of indirect, violence. The displacement of the fragments may consist of: (*a*) *Lateral displacement*. (*b*) *Angulation*, in which the fragments, instead of being in a line, form an angle with each other. (*c*) *Overlapping*, resulting in shortening of the bone. (*d*) *Rotation*, or twisting of the distal fragment. (*Fig.* 1.)

General Symptoms.—

The symptoms of fracture at the time of injury, or shortly after, are *unnatural mobility*, *crepitus* (grating between the broken bone-ends), *deformity*, *pain*, and *loss of function*. The muscles go into spasm; the more mobile the fragments, the greater the spasm. It is, in fact, due to a ' protective reflex ', designed to keep the fragments in position. It disappears fairly soon when the limb is supported and immobilized, so that it is rarely seen in the massage department. *Swelling* soon follows, and may be intense, extending over a great part of the injured limb. It persists for a time, and then gradually subsides. Its disappearance may be considerably hastened by the use of massage.

The surgeon makes his diagnosis partly by observation of the symptoms, but most fractures are now X-rayed as a matter of routine. The X-rays are also used later to ascertain whether the fragments have remained in the correct position after reduction, whether union is taking place, whether the screws or nails are holding in a bone which has been plated or nailed, or whether the bone-grafts are ' taking ' in a grafted case. The masseuse should make a point of seeing the plates of the case she is treating.

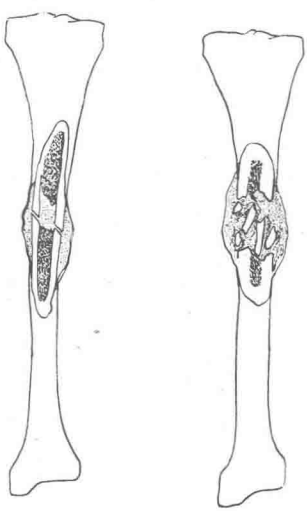

Fig. 2.—Cats' tibiæ showing method of fracture repair. A, Simple fracture, with external, internal, and intermediate callus; B, Comminuted fracture, with large callus mass in which the small fragments are embedded.

Healing.—

When a bone is broken, swelling takes place within twenty-four hours. This is partly due to hæmorrhage into the tissues, and partly to slowing of the venous circulation, with increased exudation of lymph.

Between the broken bone-ends a clot, or *hæmatoma*, forms. This is invaded and consumed by the white corpuscles, and its place taken by granulations formed by cells from the periosteum. Through this soft mass grow new blood-vessels. The new tissue is formed not only between the bone-ends, but outside these beneath the periosteum; and the space where the medullary cavity of the bone would be is also filled up by fibrous-bony tissue, laid down by the endosteum (the lining membrane of the cavity). The new substance is known as *callus* (*Fig.* 2). That outside the normal limit of the bone beneath the periosteum is called *external callus*, that in the interior of the bone *internal callus*. Both of these are included under the term *temporary* or *provisional callus*, because they are ultimately absorbed, and disappear. That between the bone-ends is called *intermediate* or *permanent callus*.

When union by callus is complete, the osteoblasts bring about a deposit of bone salts in the soft tissue, gradually hardening it. Osteoclasts pass into the new bone, and hollow out the cavities, making its structure less dense. The process resembles the ossification process in normal bone. The medullary cavity is reproduced, and the marrow-cells reappear. The provisional callus, internal and external, is absorbed.

TIME NEEDED TO OBTAIN UNION.—This varies in the different bones, depending on the thickness of the bone, the richness of its blood-supply, and the amount of separation between the fragments. For instance, the radius unites (by soft callus) in about 7 days, the humerus in 12 to 14, the femur not for a month or more. The time of union varies also according to what part of the bone is injured. The blood-supply near joints is good, so that fractures in these regions unite more quickly than those of the shafts of bones. Dr. Mennell and other authorities state that if a fracture involves the *articular* surfaces of a joint, and the broken part is exposed to the synovial fluid, little callus is formed, and sometimes union does not take place.

DELAYED UNION AND NON-UNION.—The time required to obtain union also varies in different individuals. *Delayed union* may be due to some general disease, such as severe anæmia, syphilis, etc., to some local disease of the bone, e.g., osteomyelitis, or to sepsis in the bone or in the surrounding tissues. *Non-union* may be due to the same causes; to extensive loss of bone substance, as in a gunshot wound; to the action of synovial fluid on the fractured bone-ends, as in a fracture of the neck of the femur; or to the fact that muscular or ligamentous fibres have become interposed between the fragments, as in certain cases of fractured olecranon or patella. In the last two classes of fractures, *fibrous union* only takes place—that is, the fragments are united by fibrous connective tissue only, and not by bone.

Union will also be delayed if the blood-supply to one fragment is impaired, as may happen, for example, if the fracture is in the lower third of the humerus or tibia since the power of the non-vascular fragment to lay down soft callus is limited. If the blood-supply of both fragments is impaired, e.g., as in a double fracture of the lower end of the tibia, the time required for union will be considerably longer, since the powers of repair are limited in both fragments. If one fragment is *completely* deprived of its blood-supply, it can take no part in the repair of the fracture, and finally dies. (This is known as *avascular bone necrosis*.) The living fragment lays down tissue which invades and ultimately replaces the dead portion—but this process is very slow indeed.*

Finally, many surgeons assert that most cases of delayed union or non-union are due to inadequate immobilization, too much movement, or too early movement, taking place between the fragments.

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* Watson-Jones, *Fractures and Other Bone and Joint Injuries.*

EFFECTS OF EARLY MOVEMENT ON THE PROCESS OF UNION.—While the soft callus is forming, the fragments of the bone are *hyperæmic*, owing to the inflammatory reaction which takes place as the result of the injury. This leads to *decalcification* of the fragments, because the calcium in the bone is carried away by the increased blood-flow. During the consolidation period, i.e., the hardening of the callus, the bone-ends become *ischæmic*, that is to say their blood-supply becomes greatly reduced; the calcium accumulates, and the bone is said to be recalcified. "Hyperæmia of bone is always accompanied by decalcification, and ischæmia by sclerosis" (Watson-Jones). Now a certain degree of inflammatory reaction and consequent hyperæmia is necessary for callus formation, and if such a reaction is insufficient it may have to be provoked by surgical means; but it should not be extreme or too long continued, or too much calcium will be lost from the fragments. A small amount of movement at the site of a fracture in the recent stage promotes callus formation by increasing the inflammatory reaction, but if this small amount is exceeded various unfortunate results will follow. In certain parts, e.g., near the elbow, a very large amount of callus may be formed, which will later ossify and block the joint, while dense fibrous adhesions may be laid down which will further limit mobility. But if the movement between the fragments is continuous or excessive, the bones may unite very slowly or even fail to unite at all. The newly forming callus is broken down, the hyperæmia persists, and consequently the decalcification process goes on too long. The bone-ends may be absorbed; fibrous tissue is laid down between them, enlarging the gap, and when the inflammatory process at last dies down and ischæmia sets in, there is little or no callus to be hardened, and the sclerosis merely occurs in the bone-ends. Delayed union may be treated by immobilization, but in the case of real non-union, it is too late for this to be of any use, and the surgeon will have to resort to bone-grafting or some other form of operation.

Complications.—

INJURIES TO JOINTS.—The fracture may extend into a joint, the movements of which may be seriously restricted by imperfect replacement of the fragments, or by excessive callus formation. The joint may later be attacked by osteo-arthritis, following on the traumatic arthritis due to the injury.

INJURIES TO THE SKIN, in compound fractures. In these cases, bacteria may enter and infect the wound, unless proper precautions are taken.

INJURIES TO BLOOD-VESSELS.—These consist of: (1) *Hæmorrhage*, due to tearing of large vessels. (2) *Blocking of a Large Artery.* If such a vessel be *partially* occluded, the result is ischæmic contracture (*see* p. 33); if it be *completely* blocked, in such a position as to cut off practically the whole blood-supply of the limb, the result is mortification (gangrene). Either of these conditions may also be caused by over-tight bandages, or by improperly applied splints or plaster. (3) *Thrombosis* (*see* Chapter XX) of veins in the neighbourhood of the fracture. This is manifested by the sudden development of cramp-like pain in the part, by an increase of swelling, and by marked tenderness along the line of the affected vein. Anything that appears to be abnormal in the circulatory condition of the injured limb must be immediately reported to the surgeon. In cases of suspected thrombosis, all treatment must be stopped.

INJURIES TO NERVES.—A nerve may have been injured at the time the fracture occurred. In this case, symptoms appear at once. If the nerve is actually severed, there will be immediate paralysis and anæsthesia of the parts supplied by it. The surgeon will at once suture the nerve.

A deep-lying nerve may become involved in forming callus, or compressed by displaced bone; in this case, the symptoms develop gradually. It is the duty of the masseuse to notice and report them.

PRINCIPLES OF TREATMENT

The aims of the surgeon and of those who co-operate with him in the treatment of fracture are, firstly, to obtain accurate anatomical alinement, and, secondly, to restore perfect function to the limb. The methods employed include: (1) *Splinting;* (2) *Physical Methods;* (3) *Operative Methods.*

1. IMMOBILIZATION, OR OTHER MEANS OF SUPPORT.—The old or *classical* treatment of fractures after reduction consisted of splinting and fixation of the whole limb until union was firm. This ensured a good *anatomical* result, but since the joints had in the meantime become stiff, and the muscles wasted, the *functional* result often left much to be desired. Then certain surgeons began to advocate the use of massage and early movement in the treatment of fractures, and this method, meeting with much opposition at first, was widely adopted. Possibly some of its practitioners showed a lack of judgement in applying it, but unquestionably the method was of great benefit to the many victims of these accidents, since the stiffness and weakness inseparable from the older method were avoided. There has, however, in tne last few years, been a marked reaction, and the tendency has been towards longer fixation in plaster, with free exercises after the latter is removed. But the difference between this and the old method is, that whereas in former days all or most of the joints of the limb were fixed, in the present method the surgeon does not resort to more extensive fixation than is necessary to ensure immobilization of the site of the fracture. No joints which can safely be left free are included in the plaster; and in these free joints movement is encouraged.

The author has therefore assumed that in the treatment of most fractures the immobilization method will be employed; adding, however, a few notes on treatment by early movement in cases where this procedure may still occasionally be recommended.

The immobilization is carried out by means of splints or plaster-of-Paris—with or without traction—or sometimes merely by adhesive strapping, bandages, slings, etc. In the case of the *upper extremity* special splints are often used, e.g., abduction splints of various types for fractures of the upper part of the humerus. Elbow injuries may be supported by some form of the 'collar and cuff', or by plaster slabs, while forearm fractures are generally enclosed in a plaster case. Fractures of the *lower extremity*, *pelvis*, and *spine*, are usually supported in plaster. Traction is generally necessary in fractures of the lower extremity, more rarely in those of the upper extremity.

2. PHYSICAL METHODS.—These include massage, and movement; electrical treatment; and light or heat. As stated above, those who advocate the modern method of treatment by immobilization in plaster lay great emphasis on the importance of perfect anatomical alinement of the bone fragments, and hence also of fixation until union is complete. Meanwhile, any joints which do not need to be fixed may and should be assiduously exercised in order to avoid stiffness in these joints and atrophy of the muscles which act on them. Slings or pulleys may often be usefully employed in such cases. Those which must be fixed in order to retain the fragments in position can only be moved after the period of immobilization is ended; but it is sometimes possible to exercise the muscles by means of static contractions, e.g., quadriceps contractions when the knee is fixed.

Böhler, whose methods are much in favour at present, considers that if a perfect anatomical result is attained, the patient should be able, *by his own*

efforts, to recover perfect function in the joint that has been immobilized. The objection to this would seem to be that many patients, if left to themselves, will not have the resolution or perseverance to restore the function in their own limbs, nor indeed will they know how to set about doing so unaided. In any case, their complete recovery will be delayed, and such long-continued disability is bad for the patient from a psychological, as well as a physical, point of view.

Most authorities, therefore, consider that the period of fixation should be followed by a course of rehabilitation exercises under the supervision of a trained gymnast, who should also have been responsible for seeing that the joints which were left free were properly exercised while the limb was still in plaster. In many cases a special course of occupational therapy is advisable. This should prepare the patient to return to his regular work, or, if the severity of his injury precludes this, should fit him for some other and more suitable employment. This, of course, holds good for any case of injury, and not only for fractures.

Massage.—In cases treated by these methods, massage is little used. In the early stages it is often impossible because of the inaccessibility of the limb; while after the plaster is removed the time when massage would have been of most benefit is past, and that for active movement is come. But in cases where at least part of the limb can be reached, massage may materially add to the patient's comfort by reducing swelling, and relieving tension and pain in the muscles; while after the removal of the plaster it may be of use in helping to strengthen wasted muscles, loosen or stretch adhesions or adherent scars, or improve the condition of the skin. Olive oil or other lubricants are occasionally used for this last purpose.

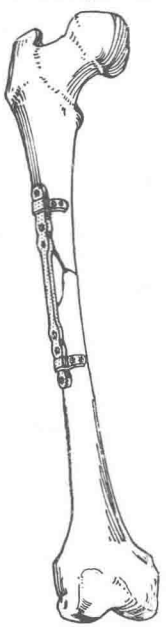

Fig. 3.—Fracture of shaft of femur treated by plating.

Faradism is sometimes applied while the limb is still immobilized, in order to obtain muscle contractions, since such contractions can be produced without causing a movement in any joint. It may also be given at a later stage to help restore the muscles to full strength.

Radiant Heat or Infra-red Radiation may improve the circulation, decrease pain, and prepare the way for active movement.

3. OPERATIVE METHODS.—Certain cases call for such measures as: (1) The fixation of fragments by plating, screwing, nailing, suturing with wire or catgut, or by the insertion of bone-pegs. (2) Bone-grafting. (3) Operations undertaken to reduce the displacement in fractures in which this cannot be done by manipulation.

PLATING.—Long stainless steel or silver plates are most often used, extending well above and below the site of the fracture, and being fixed to the fragments by means of screws (*Fig.* 3). Proper external splinting is essential in these cases, or deformity occurs, and the screws become loose.

WIRE is sometimes used to fix the fragments together, as in the case of fractured olecranon and patella. In the former, a long screw is sometimes inserted instead, being driven downwards from the superior surface of the olecranon process into the shaft below. The best example of the use of a nail is the Smith-Petersen nail, used to secure the fragments in cases of fractured femoral neck (*see* p. 42, *Fig.* 25). Wires or metal bands are also used to bind together the fragments in an oblique fracture of the shaft of a long bone (*Fig* 4). Torn aponeuroses are sometimes joined together by sutures of catgut, the bones being kept in position by this means. Similar sutures are sometimes used instead of wire in fractures of the olecranon and patella.

PEGS OF BONE OR IVORY are employed in transverse fractures, the peg being placed in the medullary cavity of each fragment (*Fig.* 5); or to fix small portions of bone in place—for instance, the great tuberosity of the humerus, when this has been separated from the main bone.

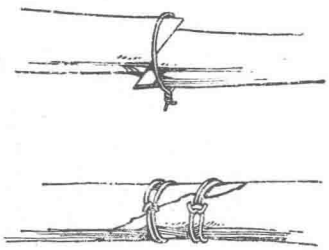

Fig. 4.—Treatment of fracture by wiring. In the upper figure the wire is loose and the fragments are not adjusted; this leads to chafing, delayed union, and secondary sepsis. In the lower figure are shown exact restitution, tight twisting, and efficient fixation.

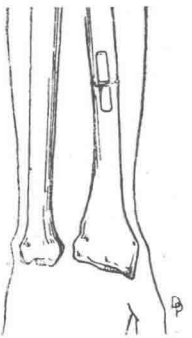

Fig. 5. — Treatment of fractured radius by intramedullary peg.

BONE-GRAFTING is generally the operation chosen when much of the bone substance has been destroyed. The graft is in most cases taken from the patient's own tibia, and is incorporated by various methods into the fractured bone. The actual graft, which forms a temporary bridge across the gap, eventually dies and is absorbed; but in the meantime it has been invaded by bone-cells from the patient's own tissues, so that new bone is laid down in it, and ultimately takes its place.

Operations, then, are performed in cases of non-union of the fracture; of extensive loss of bone substance (as in crushing accidents, or as the result of gunshot wounds); and of serious displacement irreducible by manipulation; also in the majority of cases of fractured olecranon or patella, in which, otherwise, fibrous union only is to be anticipated, and in which, therefore, much time is saved, much inconvenience obviated, and all risk of re-fracture avoided.

TREATMENT OF FRACTURES BY EARLY MOBILIZATION AND MASSAGE

The following details of the treatment of fractures by *early* mobilization and massage are retained at the request of some who still make use of this method.

Manipulations and Movements commonly required at Various Stages of an Average Fracture

The treatment of a fracture may be divided, roughly, into three stages: (1) *First, or recent stage*, before firm union has taken place; (2) *Second stage*, when union has taken place with sufficient firmness for the patient to perform ordinary, but not forcible, movements; (3) *Third stage*, when union is quite stable, and the risk of re-fracture or deformity is at an end.

First, or Recent Stage.—

CONDITION.—As soon as the accident happens, the muscles go into spasm, causing severe pain. Swelling soon appears, and may be very extensive. If a joint is involved, it becomes the seat of traumatic arthritis, while if the injury is in the neighbourhood of ankle or wrist, there will be tenosynovitis of the

sheaths of the flexor or extensor tendons. Pain and aching may persist more or less through the acute stage, though some fractures are more painful than others.

In a few days, adhesions tend to form, not only in the joint involved, or in that nearest the site of the injury, where they are due to the acute inflammation, but also in other joints of the limb as a result of non-use and passive congestion. The tendons at wrist and ankle may adhere to their sheaths, forming yet another obstacle to free movement.

THE AIMS OF TREATMENT in this stage will be to relieve muscular spasm and pain, to reduce the swelling, and to prevent the formation of adhesions and the consequent loss of mobility. To these ends, we shall make use of :—

MASSAGE.—

Reflex Stroking to get rid of the spasm, if still present. This must be done very slowly, evenly, and rhythmically. It is generally performed centripetally, but this is not essential, as the pressure should be too light to affect the circulation mechanically.

Effleurage—very light at first—should take the place of the stroking as soon as the spasm has passed off, in order to reduce the swelling. It probably brings about its effect partly by mechanical means and partly by reflex action. It should at first be used well above the site of injury, so as to clear the lymphatics in this region, and then lower down, so as to press the exuded fluid on into the vessels which have been emptied to receive it. A return to the upper part of the limb should be made after this. For instance, if we are treating an injury in the region of the wrist, we shall begin our effleurage on the upper arm, from elbow to axilla ; we shall then pass to the forearm, and later return to the upper arm.

Kneading is next added, perhaps on the following day. The parts of the limb at a distance from the fracture may be kneaded with the palm of one hand, or even of both, provided the site of injury is adequately supported in some way ; but in the vicinity of the break finger kneadings are safer at first, as these small manipulations are less likely to disturb the bony fragments or drag on the inflamed structures than are the larger hand movements. Like the effleurage, the kneading should be begun well above the injury, and be brought gradually closer to it. The site of the fracture must be avoided during this period. If it is touched, the inflammation, and consequently the pain, will be increased, and the callus may become 'irritable', and may be formed in excess. In certain situations, e.g., near joints, the consequences of this will be most serious. If the fragments are *mobile*, only effleurage should be used in the neighbourhood of the fracture until some definite union has taken place, and even this should be done very carefully.

Frictions.—These may be given from the beginning to the uninjured joints of the limb. After three or four days they may be given to the nearest joint, provided the actual site of injury is avoided. There are cases, however, in which this procedure must be deferred, as in displaced epiphyses.

MOVEMENTS.—The joints well away from the fracture may generally be moved, or rather the patient may move them himself, from the beginning, provided that the site of the fracture is supported meanwhile. For example, a patient who has sustained a Colles's fracture may move his fingers from the first day, and his elbow and shoulder from the second, so long as the wrist and radio-ulnar joints are efficiently controlled.

As a rule, the first movement may be administered to the joint nearest the fracture after a few days, e.g., to the wrist in a Colles's fracture in about four

days, and to the shoulder after fracture of the surgical neck of the humerus in about eight. The site of the injury should be most carefully supported until union is quite firm. The movements should be *in very small range* at first. In some fractures we have to wait till some definite degree of union has taken place before allowing movement, as in the case of a fractured olecranon. In fractures due to indirect violence, the *last* movement to be prescribed is generally that which was the cause of the original injury, and which would therefore tend to re-displace the fragments, or put further strain on torn ligaments or muscles, as eversion in Pott's fracture. With regard to the kind of movement, some hold that *relaxed passive movement* is best in the earliest stages, others that *assisted active movement* should be given from the outset. The relaxed movement, though excellent in the hands of an expert, is not so safe in those of a less skilled worker, because of the difficulty of ensuring that the patient *does* relax all his muscles. If he does *not*, the movement becomes an eccentric resisted one. All but the most experienced will be wiser to keep to the assisted active movements.

We have said above that the movements should be in very small range at first. They should be increased gradually, the patient carrying the movement a little further each day. Unless improvement continues to take place, we are evidently not doing enough. The question remains : How are we to know if we are doing too much ? We shall not go far astray if we remember that the treatment of fractures until union is quite firm, and we reach the stage for 'forced movement', should not be painful, and if we also keep in mind the fact—so often emphasized by Dr. Mennell—that any increase of pain at the site of the fracture, or of swelling in the limb, or any decrease of mobility in the joint affected, means that we have done too much, and should reduce the amount of active work, or even omit it for a time.

This rule holds good in the second stage as well as in the first. Many a masseuse has been blamed for allowing a joint to become stiff through insufficient movement in the first week or ten days. She is quite probably to blame, but often for having done too much in the early stage rather than too little, the over-strong movement having increased the inflammation in the part, and so given rise to excessive output of callus, or the formation of denser adhesions. At the same time, someone has said that he who has *never* done too much probably always does too little. Fortunately, a single small error of judgement is rarely irreparable—I am not, of course, referring to gross blunders—and if the above rules are observed, errors should be reduced to a minimum.

Any fracture which can be adequately supported will be the better for immersion for 5 to 10 minutes in the whirlpool bath, if this is available.

Second Stage.—

CONDITION.—In untreated cases there will be considerable muscular atrophy and stiffness of joints. If the fracture has been treated from the beginning, the wasting will not be marked and the stiffness will be slight or absent. In any case, there will be imperfect function of the limb as a whole.

THE AIMS OF TREATMENT during this stage will be to restore muscular strength without putting any undue strain on the bone until union is quite firm. During this period, also, the splints are permanently removed, and the patient is encouraged to use the limb.

MASSAGE, then, will be increased in depth.

MOVEMENTS.—The *active movements* will be continued, and *free exercises* added. Patients with fractures of the lower extremity will begin to practise leg and foot exercises, without, however, taking the weight of the body on