THE ORTHOPEDIC CARE OF LEPROSY PATIENTS

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My purpose today is to introduce the idea that there is a place for the work of an orthopedic surgeon in the care of leprosy patients.

Those who have looked after these people in the past have usually had in their minds two main aspects of treatment. First has been the search for a cure of the disease. Much patient research has been done over many years to this end and at last it seems that some measure of success is on the horizon. The new sulphone group of remedies gives us ground for cautious optimism that certain types of leprosy can be cured. The second line of approach has been the care of those patients who are frankly incurable. This is by far the greater part of the work of many leprosy institutions. Housing has been provided for them; nursing, food and religious comfort, and many other things to make their lot more tolerable and to enable those who cannot look after themselves to be looked after by somebody else.

My acquaintance with leprosy has been short, but from the very beginning it has seemed to me that a change of emphasis is needed in this part of its treatment. While we do not wish to decrease the amount of loving care which is expended upon the helpless patients, our primary object should be to prevent them becoming helpless, or, if they already regard themselves as helpless, to change their attitude by showing them that they can in fact develop an ability to look after themselves and to become useful members of society. The person who is being nursed is better off than the person who is helpless and destitute, but it is still better for that person to be made able to be self-reliant and to have some confidence and self-respect.

This is not the same as saying that the disease must be cured. The vast majority of these deformed patients are either incurable, as far as their disease is concerned, or else are, for all practical purposes, already cured. That is to say, the activity of the leprosy has ceased and they are left simply with the residual paralysis and deformity. These latter can be tackled along orthopedic lines by means of splints, exercises, massage, and by operation in such a way that the patients usefulness may be maintained or improved. And then one must see that they are given useful and gainful occupations to suit their limited capabilities.

The orthopedic problems in leprosy are mainly those of anaesthesia and of paralysis and we are concerned with these things in the hands and the feet.

Hands—Anaesthesia. The problem of anaesthesia in the hands must be taken seriously if one is to maintain the usefulness and activity of these organs. Every time a patient injures or burns his fingers a scar is produced and that scar by its contraction adds something to the tendency for the fingers to flex permanently into the claw-hand position which is our chief problem in rehabilitation of the hands.

In designing occupations for these patients, therefore, one must foresee anything which is likely to burn the hands, and allow a minimum of contact with sharp objects that may cut them. Damage is also often caused by local friction such as the continuous running of cotton over the index finger of a woman who is spinning. It is important therefore that no patient with anaesthetic hands should be allowed to do cooking or plumbing and if they are employed in occupations such as carpentry and cobbling where there are sharp instruments to be handled they should have careful instruction about the way to handle their tools so that their hands are always well clear of cutting edges.

Where there is continuous friction, as in spinning and weaving industries, the part of the hand that is subject to the friction should have a leather finger saddle or a pad which can take the friction from the skin. All patients, especially when starting a new occupation, should have regular hand-inspection by the doctor or the welfare officer, and any redness or sign of blistering immediately investigated, the hand put at rest, and his work watched when he starts again to see the exact cause of the pressure of friction so that it may be removed. This may involve altering the shape of the handles of his tools or instructing him in a new way of holding them, or the wearing of a leather pad as before described.

It will be found that many women are reluctant to give up cooking, and members of their family may urge them to continue it. The important part of cooking to these people's minds is the preparation of the food. If they are allowed to do this part they are quite willing for somebody else to do the actual cooking, involving the handling of pots and pans and fire. Thus, several families may co-operate—each wife preparing her own food, and one person who has normal hands doing the actual cooking for several families or groups.

Paralysis. The paralysis of the hand in leprosy is something which appears never to have been fully investigated, but during the past year I have been following a large series of cases with some care and it seems that increasing weakness of the hand follows a certain definite and well defined pattern. The first muscles to go are the interosseii between the ring and little fingers. The weakness then spreads to the lumbricals and interosseii across the palm from the ulna to the radial side, and when almost all power has been lost in these muscles then the muscles of the thenar eminence are involved—the opponens pollicis paralysis preventing opposition of the thumb. The long flexors and long extensors of the fingers and thumb, however, retain their power, as also normally do the flexors and extensors of the wrist.

In the normal action of grasping, the hand begins with the fingers extended and the thumb opposed to them. The first part of the grasp is chiefly the lumbrical movement of flexion of the metacarpophalangeal joint (Figure A I). As the hand closes upon the object it is grasping, the long flexors take up the task and the interphalangeal joints are flexed making the fingers curve around the object and grip (Figure A II). The leprosy patient, having lost his lumbricals, initiates his attempt to grasp by flexing his interphalangeal joints while the metacarpophalangeal joints remain extended (Figures BI and BII). Only when the interphalangeal joints are fully flexed do the metacarpophalangeal joints begin to flex. Thus the fingers are " rolled up " into the palm and present

their dorsal surface, of finger nails and distal knuckles, to the object to be grasped rather than the palmer surface of the fingers (Figure BIII). Any object therefore except a very narrow one is pushed out of the hand by the clenched fingers rather than grasped. It will be noticed that most patients with weak hands do their grasping by adducting the thumb against the second metacarpal and do not use their fingers at all.

We have therefore to try to provide a substitute for the lumbricals and for the opponens pollicis.

The other problem is to prevent contracture of the fingers in the clawhand position. The reason this develops is that for full extension of the fingers is required the co-operation and simultaneous action of the lumbricals, interosseii and the long extensors. The long extensors normally extend the metacarpophalangeal joints and the lumbricals extend the interphalangeal joints. If, however, the metacarpal joint is flexed, this flexion enables the long extensors to extend the interphalangeal joints. A test therefore of early loss of the intrinsic muscles of the hand is to ask the patient to flex the metacarpophalangeal joints and to extend the interphalangeal joints at the same time (as in Figure A I). This is quite impossible with paralysis of the lumbricals.

When patients find that they cannot extend their interphalangeal joints, they try to do it by contracting their long extensors more powerfully. This only produces hyperextension at the metacarpophalangeal joint but does not extend the interphalangeal joint at all. Therefore the interphalangeal joints are never extended, and when they have remained flexed for a long time they become stiff in that position. Capsular contractions develop and before long result in the familiar permanent claw-hand.

The first duty of the medical officer is to see that this contracted claw-hand never develops. The secret of this is to realise that passive flexion of the metacarpophalangeal joint allows active extension of the interphalangeal joints. In other words, if we imitate the action of the lumbricals in flexing the metacarpophalangeal joint then the long extensors are able to extend the interphalangeal joints. The simplest way to do this is to press the proximal phalanx forward into flexion with the other hand and then instruct the patient to straighten his fingers. If no permanent contracture has developed he will be able at once to extend these joints. If he is now instructed to perform this movement regularly many times in a day and accompany it by massage to his fingers using a vegetable oil, such as gingelly oil, he will maintain the mobility of his fingers and no contracture will ever develop. I have devised a splint patterned somewhat after the knuckle-duster splint described originally by Haighet. (See illustration.) This splint is simply a mechanism

for keeping the metacarpophalangeal joint flexed whilst allowing mobility to the rest of the hand. It is my habit in cases where there is weakness or commencing contracture of the fingers to make the patient wear this splint for two or three hours at a time twice a day and whilst wearing it to exercise his fingers through their full range, and between whiles to rub oil into his fingers and keep them mobile. In this way many a commencing contracture can be completely straightened out and a mobile hand produced.

This does not of course bring back power to the paralysed muscles. We know of no way of doing that, but it does improve the capacity to grip.

The next problem is to try and devise something which will do the work of the lumbricals and form a new and wholly active hand. This work is still in the experimental stage and I have nothing to report about the methods or results at present.*

Finally we are concerned with the hands which are fully contracted in a permanent way so that even passive extension is quite impossible and the grip is wholly absent. In these cases it seems impossible to regain the movements of the interphalangeal joints, but if an operation is performed on these joints to open them out to about 90° for the proximal interphalangeal joints and 160° for the distal and fix them in that position, then the movements of the metacarpophalangeal joints, which are never lost, will enable quite a reasonable grip to be achieved.

In assessing the occupation for the individual, the chief task is to decide upon the kind of tool which their hand is capable of holding. As a rule the more advanced the disease the narrower must be the handle of the tool. Even an advanced claw-hand can hold a handle ½in. in diameter; in milder cases 1in. or 1½in. in diameter. The milder cases can grip and leave go their tools quickly while the more advanced cases need a trade where, having once grasped their tool, they may keep it in their hands for longer periods without having to put it down. Some trade in which there is only one instrument to use or one handle to turn is the one to choose for these patients.

Feet—Anaesthesia. The feet are subject to more pressure and more trauma than hands, so the skin is more liable to give way. Trophic ulceration is therefore more a problem in the feet than in the hands.

The two factors which produce ulceration are sustained pressure and active injury.

In general people who wear shoes or sandals suffer from sus-

* See note added to article.

tained pressure and people who walk bare-foot from direct injury. The reason for the former is that normal rough ground gives a more even pressure over the surface of the feet than shoes do. The ideal ground surface for leprosy sanatoria would be sand, because as the foot sinks into the sand a little at each step the weight of the body is transmitted through every part of the foot—the sand having adjusted its shape to the shape of the foot. No part of the sole therefore takes more pressure than any other part, and pressure sores are unlikely. Grass turf is the next best surface as here again the springy nature of the ground allows it to be moulded to the contours of the foot. The worst type of surface is probably a hard gravel which is both unyielding and sometimes sharp.

Shoes when they are new present a flat surface to the sole of the foot and therefore the weight of the body is transmitted through a small area of the heel and the metatarsal heads—whereas all the area of the instep takes no weight at all. As shoes become older and a slight moulding of the leather takes place a correspondingly bigger area of the feet shares the pressure; but even so it is never distributed as well as it is in the barefoot patient unless the soles are especially designed and built to conform to the contours of the feet and to allow the whole of the skin of the feet to share equally in the weight-bearing process. It should be a rule that all shoes for leprosy patients should be sewn throughout. Nails should never be used—they are a frequent cause of ulcers when they begin to come through the sole as the shoe wears.

Probably, except with tight shoes, the factor "sustained pressure" does not operate while the patient is walking because the action of walking depends upon alternately resting on the foot and then raising it immediately from the ground. This allows intermittent circulation to all parts of the sole. The real damage is done whilst patients are standing or squatting, with no feeling of discomfort to make them change their posture and shift their weight from one leg to the other. These patients are content to stand still in one posture or to squat for very long periods at a time and the part of their skin which takes their weight is continuously compressed and has no blood supply for long enough to cause complete local gangrene. This is the essence of the etiology of the trophic ulcer.

It is of fundamental importance that no patient with anaesthetic feet should ever be allowed to stand still or to squat for more than 5 minutes at a time.

It should be the duty of the medical officer to see that everywhere in sanatoria there are placed large numbers of simple stools, benches, or even flat stones upon which the patients may sit when they wish to rest.

The matter of properly built shoes and sandals is also important. All patients who show any tendency towards ulceration near the metatarsal heads should have a metatarsal bar fixed to their shoes. This is a simple bar of leather usually 5/8th of an inch thick, nailed or sewn to the underside of the sole behind the point at which the weight of the body is taken through the metatarsal heads. If you look at the underside of the sole of a shoe or a sandal, you will see clearly where the chief weight of the body is taken, because that part of the sole will be worn whereas the nonweight-bearing part will not be worn so much. A metatarsal bar must be placed behind the point of maximum wear and tear. Almost all doctors place these bars too far forward on the sole. The object of the bar is to transmit weight to the instep and to spare the metatarsal heads.

It is also helpful but rather more expensive to try and get the sole of the shoe or sandal correctly moulded to the shape of the foot. I have been trying to do this by using sponge rubber in the sole and cutting the sponge rubber to the shape of a clay-mould which I make for the patients by requiring them to stand squarely with their whole weight resting on a lump of clay. The cobbler is then instructed to build a sole with the same lumps and hollows as the clay mould, and then finish off with a soft upper.

The aim of the medical officer should be to prevent ulcers of the foot rather than to cure them, and in the work of prevention it is necessary to inspect all anaesthetic feet and their shoes at regular intervals. The sanatorium cobbler should be in attendance at these inspections and should be a skilful workman with enough intelligence to understand the principles that are involved. Danger signs should be looked out for such as cracks in the sole of the foot and callosities and if shoes are found to be responsible for uneven pressure they should be adjusted so that they do not cause harm. Shoes should always be resoled before they have become badly worn out because constant contact with the foot will have moulded the inner part of the shoe to the foot and this inner moulded leather should be preserved for as long as possible, even for many years, by constantly adding a flat piece of leather as an under-sole before the inner-sole becomes worn. This should be done without removing the remnants of the worn under-sole, as in this way the original shape of the shoe is better preserved. The factor of direct trauma in the causation of ulcers operates in proportion to the amount of walking that the patient does, and the kind of ground he walks upon. Any long walk on rough ground will give opportunity for sharp stones to cut or wear away the skin of the sole of a bare-foot patient or for friction to produce a blister on the foot of one who wears ill-fitting shoes.

Intelligent patients who are helped fully to understand these principles should be able so to regulate their activity that an ulcer becomes a rare occurrence. When it does occur further activity must be restricted until it is soundly healed.

Paralysis. When the muscles of the foot are weakened the balance of the foot becomes unstable, and this leads to one side or end of the foot taking more pressure than the other; and consequently ulcerating.

The commonest weakness in leprosy is that of the dorsiflexors of the foot and of the peroneii. This leads to a drop of the forefoot and of the lateral edge of the foot respectively. The leprosy patient with drop foot develops a high stepping gait, but even so he is not able to prevent his toes from dragging a little on the ground. And these patients get ulcers on the ends of their toes and on the metatarsal heads—not so much from pressure as from friction. They do better with shoes, and better still with stiff-soled shoes which have a strap running from the top of the shoe to a strap around the upper end of the calf keeping the foot dorsiflexed. It is more satisfactory if a metal upright is fixed from the heel of the shoes up the calf to support a strap around the top of the calf and the strap lifting the toe of the shoes. The same device may be used for cases with paralysed peroneal muscles but in this case the point of attachment of the lifting strap must be to the lateral side of the foot so as to replace the pull of the peroneii.

The question then arises, can we relieve the " drop foot " by any orthopedic operation? Here I am unable to give a final answer. I can say that it seems that there will not be much scope for tendon transplantation operations—because as leprosy paralysis is so frequently progressive the muscles that one uses for transplantation this year may themselves become paralysed next year. There seems to be more hope for the type of operation of tendon fixation or suspension where the dorsiflexor tendons are rigidly fixed into the anterior surface of the tibia, but we have not yet performed enough of these operations to be able to report on the results. Some form of foot stabilization may prove to be the best answer in the long run, although we have yet to find whether the bones and tendons of a leprosy patient will stand the kind of operative interference which this will require.

Ulcers. In dealing with established ulcers many of you will have had more experience than I have. I will just mention one or two points that I believe to be important. The first is that where possible every established ulcer should be treated by complete rest to the foot—that is no weight-bearing. Ideally the patient should

use crutches until the ulcer is healed or else stay in bed, failing which a thick ring pad should be bandaged to the foot surrounding the ulcer so that when the foot bears weight the actual ulcer may not come in contact with the shoe or the ground. A probe should be used frequently to find out whether the ulcer goes down to bare bone. Those that do not are probably best treated by injections of hydnocarpus oil deep to the ulcer floor. When the ulcer involves the bone an X-ray should be taken to see whether the bone is diseased.

Next to continued weight—bearing, chronic osteomyelitis is probably the commonest cause of persistence of trophic ulcers. Therefore when a probe is found to reach bare bone in an ulcer, an X-ray should be taken to discover the extent of the osteomyelitis, and unless this is very localized indeed it is usually best to proceed at once to the removal of the diseased bone. This is best done through a dorsal or lateral incision so as not to leave a weight bearing scar. I have found that if one removes a bone such as a metatarsal through a dorsal incision one is usually able at the same operation to excise the edges of the ulcer on the ventral surface and to sew it up. A dorsal incision should never be sutured up but should be left open packed with vaseline gauze to granulate, as described by Cochrane in his Textbook of Leprosy. The depth of the ulcer will therefore be drained dorsally until the wound heals up and the big scar will be on the dorsum of the foot instead of on the weight-lifting surface.

The last resort in the care of the foot is the operation of amputation, but it should not be delayed if it will allow the patient to walk on a sound stump rather than to remain incapacitated by a widely ulcerated foot with wide chronic osteomyelitis.

I have become convinced rather against my orthopedic instincts that it is justifiable and even wise to amputate as near as possible to the ulcerated area—that is to say for metatarsal head ulceration a Lesfranc's amputation or a Chopart or Piragoff is quite justifiable even though a skin flap may be within an inch of the open ulcerated area. There are three reasons for this:

Firstly, because these patients are so poor and their number so large we cannot afford to provide them with proper artificial limbs for high amputations.

Secondly, patients with leprosy seem to have a better capacity to heal than the average patient who requires an amputation. This is probably partly because there is no diminution in the blood supply of these feet as there is in so many other cases of local gangrene.

Thirdly, the battle against trophic ulceration is frequently a

retreating battle and it may be that the amputation stump itself will become ulcerated after a few years. If one has done a low amputation, there is an opportunity to give the patient a second or even third amputation at successively higher levels — as for instance Lesfranc's followed by Symes followed by Site of Election; each time leaving the patient with a sound stump which may last many years.

Because these operations are always performed near gross sepsis it is important that the incision should not be primarily sutured completely but the skin flaps should be packed open to granulate, perhaps for secondary suture later on.

One should take care that the amputation scars are off the weight bearing area of the stump, and one should give to an amputation stump the same, if not greater, care than we have recommended for the anaesthetic feet. A careful mould of the stump should be taken and a sponge rubber socket made for the stump and fitted with a sole-plate.

I hope that I have left you with the impression that I know very little about my subject, because I wish to urge upon you all the fact that very little is known, and that it is our duty to press forward in this branch of surgery. We must keep before us a realisation that although many of our patients are hopelessly diseased as far as cure is concerned, a little careful application of the science and art of orthopedic surgery may be able to change their outlook from one of helplessness and despondency to one in which they can look forward to a life of usefulness and activity.

I wish to acknowledge the help and encouragement I have received from the staff at the Lady Willingdon Leprosy Sanatorium, and in particular from the Medical Superintendent, Dr. H. Paul, the Welfare Officer, Mr. Rama Krishna Ayyer, and from the Director of Research, Dr. R. G. Cochrane.

A note supplied by Dr. Paul Brand, dated March, 1952, reads as follows:—

Since this article was presented (May, 1949), the author has had a considerably wider experience of hand reconstruction in leprosy, and reports that experience has confirmed his original impression that the long muscles of the arm are very rarely paralysed, except that the flexor carpi ulnaris is paralysed nearly as frequently as the small muscles. This means that the long flexors, and particularly the flexor digitorum sublimis, are available for tendon transplantation, and that they are unlikely subsequently to

become paralysed. Some dozens of hand reconstructions have been attempted, and in many cases a full grasp has been restored, and in every case the hand has been left significantly more useful than it was before. The operations which are recommended are a transplantation of the flexor digitorum sublimis for the lumbrical in the index and little finger, and substitution of the flexor sublimis of the long finger, split and used, half for the lumbrical of the long, and half for the lumbrical of the ring finger; and the use of the flexor digitorum sublimis of the ring finger for the opposition and abduction of the thumb. These operations have been only slightly modified from the classical operations described by Bunnell in his book, "Surgery of the Hand," and by other authors on the same subject. The operations will be more fully described and annotated in further articles which will be appearing in surgical journals. It seems that general principles of hand surgery may be used in leprosy, except that a little longer time should be allowed for healing, both of skin and of tendons, and special care must be taken with plasters and tight bandages to avoid superficial pressure necrosis of the skin. The results, when followed by proper education and rehabilitation, are most gratifying.

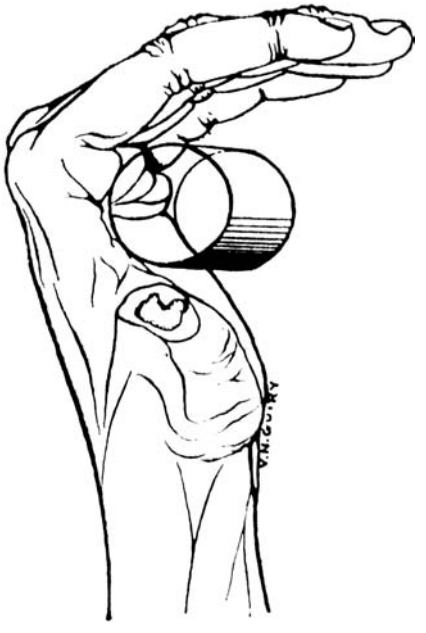


Figure A I.—Normal hand beginning to grasp. Thumb not shown. Metacarpophalangeal joints more flexed than interphalangeals.

Figure A II.—Normal grasp complete.

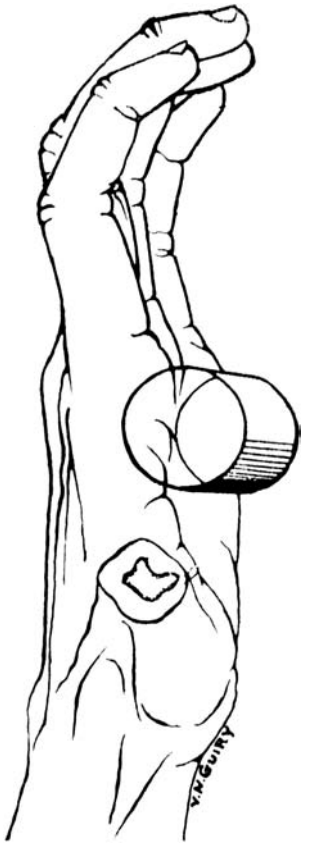


Figure B I.—Mild claw hand open before grasping.

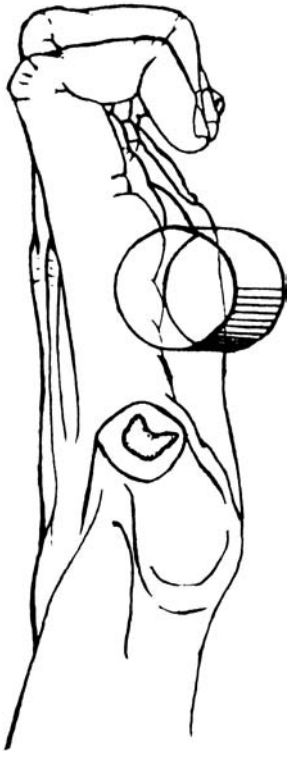


Figure B II.—Same hand beginning attempt to grasp. Note interphalangeal joints flex before metacarpophalangeal joints.

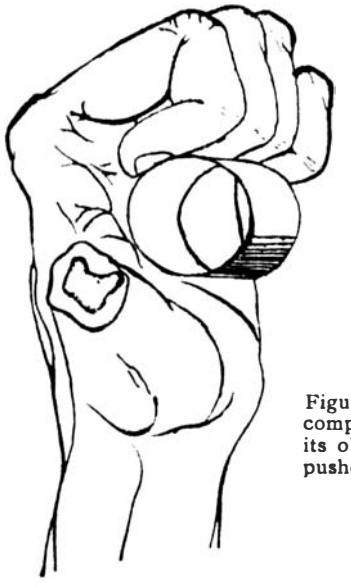


Figure B III.—Grasp complete but failing to hold its object which is being pushed out of palm.

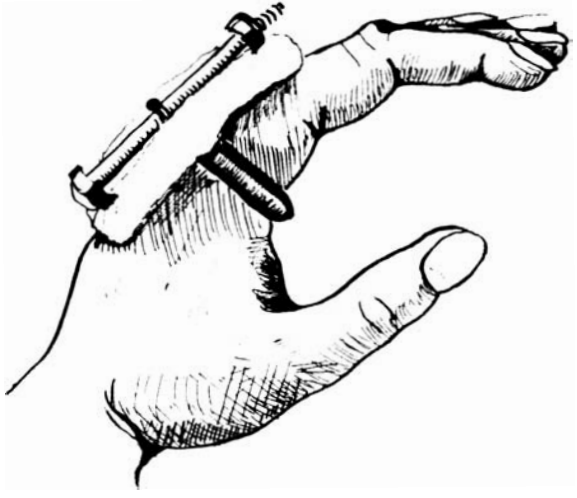
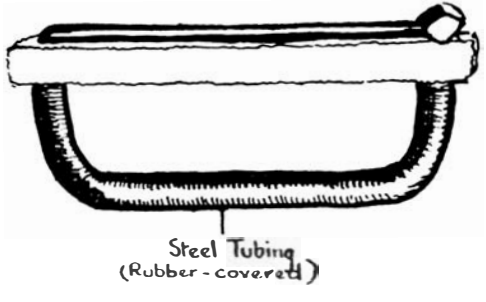


Figure IV.—Hand-splint for commencing contractures in position.

(a) Side view. (b) front view.



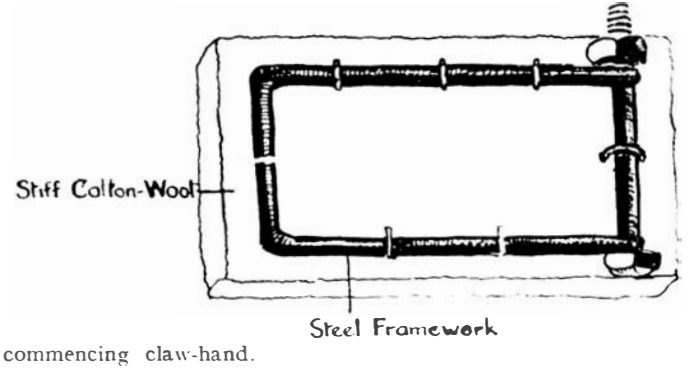


Figure V.—Drawing of simplified knuckle-duster splint for commencing claw-hand.