Rehabilitation following amputation.

Contributors

Great Britain. Ministry of Pensions.
Great Britain. Ministry of Health.

Publication/Creation

London, [1954]

Persistent URL

https://wellcomecollection.org/works/fnzbtjf7

License and attribution

Wellcome Collection
183 Euston Road
London NW1 2BE UK
T +44 (0)20 7611 8722
E library@wellcomecollection.org
https://wellcomecollection.org

REHABILITATION *following* AMPUTATION

BRITISH
MINISTRY
of
PENSIONS

REHABILITATION

following

AMPUTATION

AMPUTATION SITES, THE AFTER TREATMENT OF STUMPS AND THEIR PREPARATION FOR LIMB FITTING

THE experience of Limb Fitting Surgeons and Medical Officers of the Ministry of Pensions in the handling of many thousands of amputees through two world wars and the intervening period, has proved very clearly that stumps of limbs amputated at certain levels and in a specified manner have longer life, are less liable to require subsequent surgical interference, tolerate best the stresses and strains of limb wearing and give the patient the best chance of satisfactory rehabilitation. Statistics substantiate each of these points. Likewise, the care of those who suffered amputation during and shortly after the first world war brought to light the need for post-amputation treatment of stumps, and their preparation for limb fitting; thus by the time that the second world war had commenced a system of treatment had been organised.

Subsequent experience and the comparison between those who have received such treatment and those who have not, leave no doubt whatever that the treatment about to be indicated is an essential part of the successful rehabilitation of the amputee.

The handbook "Artificial Limbs and their relation to Amputations," published by the Ministry of Pensions, which deals with these subjects in detail is being revised and enlarged, and will shortly be published.

THE REHABILITATION OF THE AMPUTATED

A. AMPUTATIONS OF THE LOWER EXTREMITY

I. AMPUTATION SITES

(1) Amputations above the knee

The stump which should be provided when surgical conditions permit, measures from 10-12 inches from the tip of the Great Trochanter. (Figures 1, 2, and 3.)

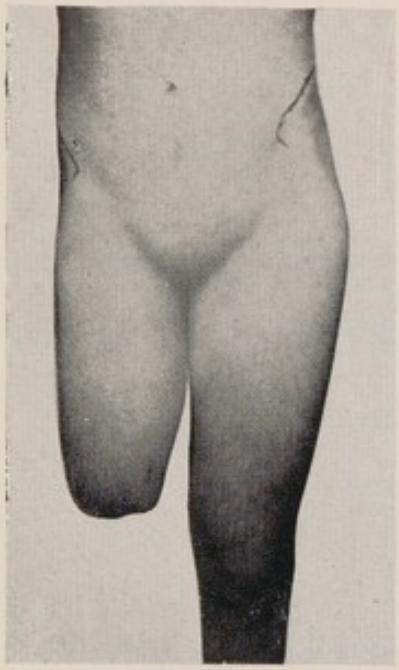


Fig. 1. Ideal above-knee stump, anterior view.

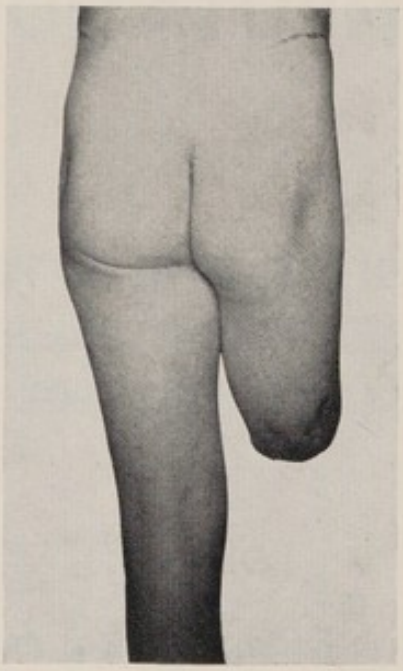


Fig. 2. Ideal above-knee stump, posterior view.

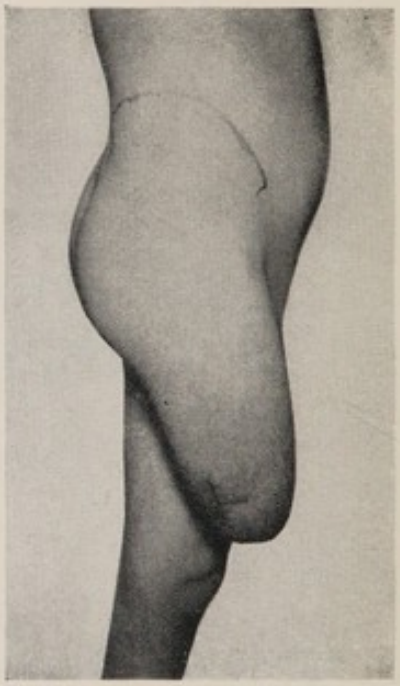


Fig. 3. Ideal above-knee stump, lateral view.

Skin:

There are two alternative flap methods, one by the long anterior flap, which provides a posterior transverse scar lying an inch or so above the extremity of the cut femoral shaft, the other by equal anterior and posterior flaps which provides a terminal transverse scar. Whilst the latter method is favoured by some, on the grounds that it is simpler to perform, experience and statistics prove that the former method is the better, in that the scar can never become abraded by friction of the limb, and the effects of the piston action, which is almost unavoidable during the use of the limb, are least harmful.

Muscle:

It is of advantage to divide the hamstring muscles an inch higher than the skin incision in order to prevent their becoming adherent to the overlying scar, as the occurrence of such adhesion is a frequent source of trouble. Whenever possible the deep fascia, but not the muscle, should be sewn over the cut end of the bone.

Nerves:

In order to minimise pain during the immediate post-operative period and subsequent trouble from nerve bulbs, it is essential to avoid injuring the sciatic nerve at the time of amputation by undue traction or crushing of its trunk.

Short Stumps:

When the surgical condition demands that the stump be less than 10 inches measured from the tip of the great trochanter, it is still possible to fit an above-knee prosthesis, provided that when the hip is extended there is just sufficient bone left below the level of the ischial tuberosity to exercise control.

An above-knee prosthesis can be fitted even if the stump is less than 6 inches, provided it is not bulky (Figures 4, 5 and 6); if it be abnormally

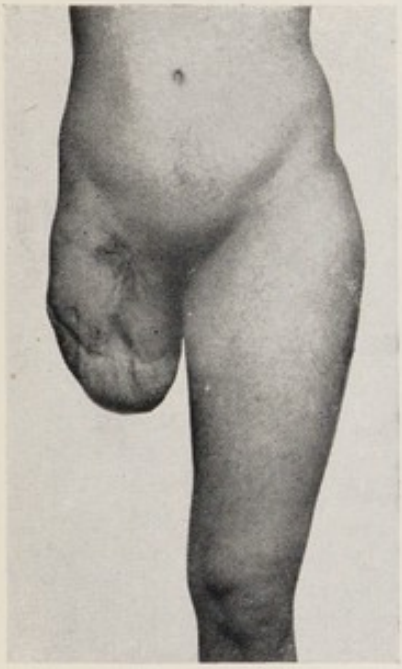


Fig. 4. A very short above-knee stump of 5 inches, anterior view.

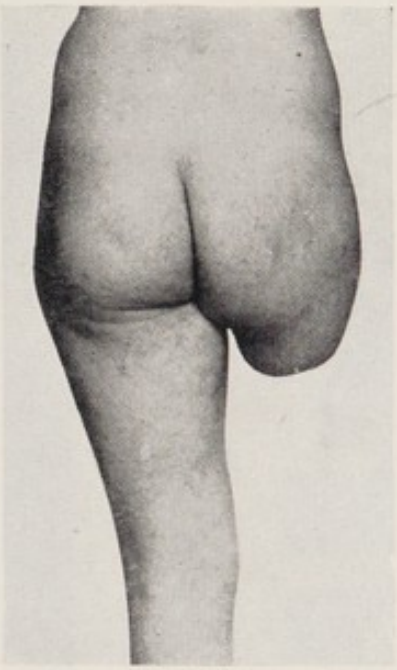


Fig. 5. A very short above-knee stump of 5 inches, posterior view.

Fig. 6. The same short stump fitted in a limb.

bulky or if the femur has been divided less than 1 inch distal to the lesser trochanter, a Tilting Table prosthesis is the only alternative (Figures 7 and 8). In this prosthesis the stump is immobile and functionless.

Fig. 7. Anterior view of the Tilting Table Limb.

Fig. 8. Lateral view of the Tilting Table Limb in the sitting position.

Fig. 7.

Fig. 8.

If the surgical condition is such that it is impossible to leave sufficient length of bone to control an above-knee prosthesis, it is best in the case of a male patient, to leave the head and neck of the femur and as much as possible of the great trochanter. In such a case the best level for amputation for a male is at the lesser trochanter, because the presence of the head, neck and great trochanter provides an anchorage around which the socket of the artificial limb can be moulded, thus giving greater stability to the bucket and security to the patient.

When dealing with a female patient it is found by experience that not only is this degree of anchorage unnecessary, but by disarticulation a better conformation of the amputated side is obtained, which is an advantage from the aesthetic point of view.

The following diagrams illustrate the anchorage point obtained by amputation at the level of the lesser trochanter (Figures 9, 10, 11 and 12).

Fig. 9.

Fig. 10.

Diagrams illustrating lateral and anterior contours resulting from disarticulation at the hip as compared with a sub-trochanteric bone section.

Fig. 11.

Fig. 12.

With certain exceptions, neither surgical nor prosthetic advantage is gained by providing a stump above the knee measuring more than 12 inches, or say 13 inches in a patient over 6 ft. tall. The additional leverage obtained by a stump exceeding 12 inches is of no assistance in controlling the limb, and further, the greater the length in excess of 12 inches the greater the likelihood that a re-amputation may be needed at a future

date on account of circulatory disturbance. This fact has been noticeable amongst British patients during the past thirty years, but the experience of those working amongst amputees in Eastern Canada and the Eastern States of America does not endorse these views.

Transcondylar and through knee amputations:

These remarks regarding lengths in excess of 12 inches apply particularly to transcondylar amputations. After such an amputation there is insufficient room between the end of the stump and the level of the knee joint for the knee mechanism which has proved so advantageous in enabling patients to acquire a natural gait; hence patients so amputated are precluded from having these mechanical refinements without receiving any surgical or prosthetic advantage in exchange (Figures 13, 14, 15 and 16).

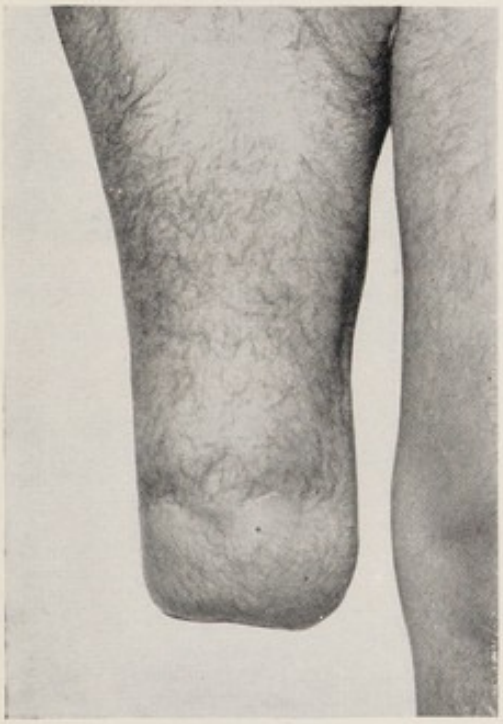


Fig. 13. A disarticulation at the knee, anterior view.

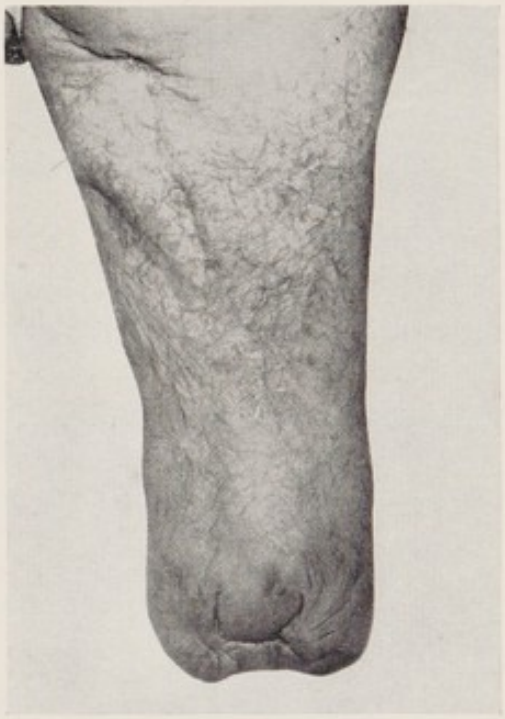


Fig. 14. A disarticulation at the knee, posterior view.

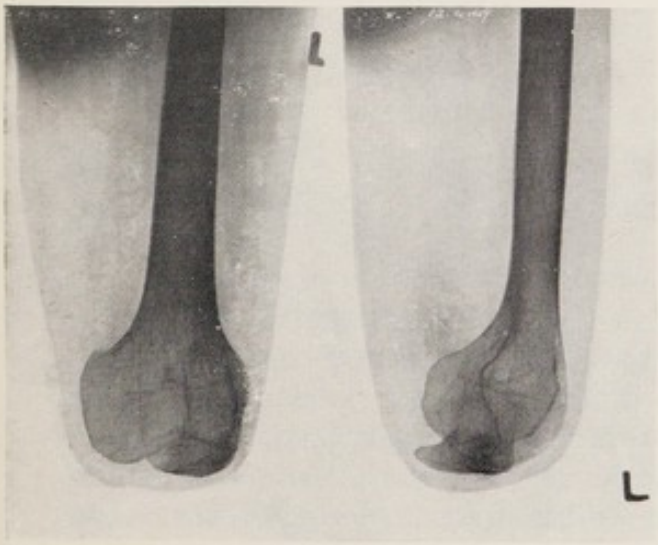


Fig. 15.

Fig. 15.

A disarticulation at the knee.

Fig. 16.

X-ray of the same stump fitted in an artificial leg.

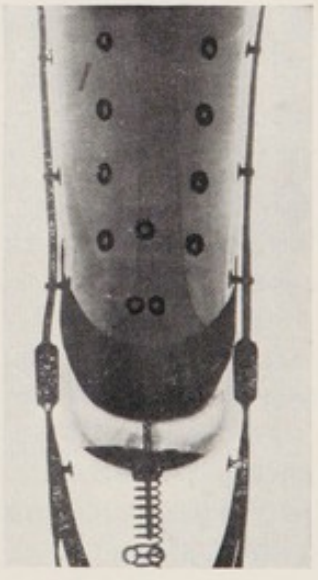


Fig. 16.

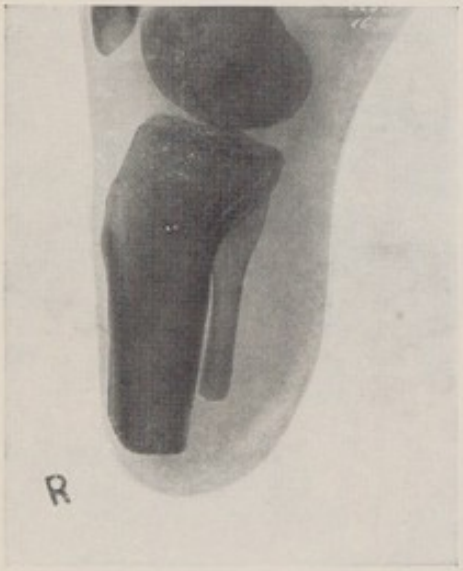
Regarding the exceptions referred to above, a disarticulation at the knee is sometimes strongly to be recommended in cases of elderly patients, where speed and absence of shock at the time of amputation are most desirable, and in cases of children in whom the desired length of femur cannot at the time be obtained through lack of growth, since it is necessary to retain the lower epiphysis until sufficient length of shaft is present.

A stump which has resulted from disarticulation at the knee rarely shows any circulatory disturbance, but the prosthesis which has to be provided for such an amputation is proportionately heavier and more cumbersome; furthermore it has not yet been found possible to incorporate the necessary mechanism in such a limb which will enable a natural gait to be achieved, although work is proceeding with this in view. Elderly patients for whom this amputation is frequently recommended for the reasons stated above, are not always insistent upon the acquisition of a natural gait.

(2) Amputations below the knee

Length of bone:

The tibia in a below knee amputation stump should not exceed 6 inches in length. $5\frac{1}{2}$ inches is ideal. The fibula in an adult man or woman is cut



Figs. 17 and 18.

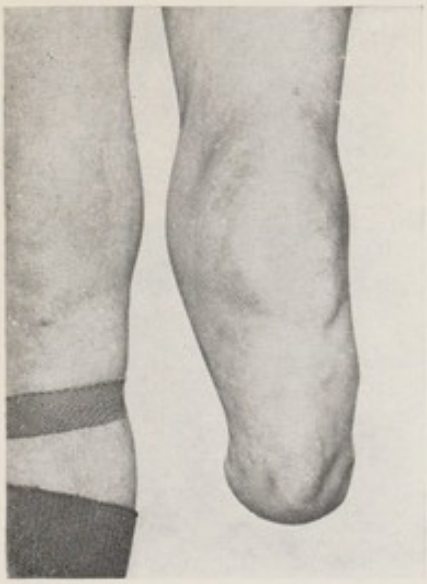
X-rays of an ideal Below-Knee Stump, anterior and lateral view showing bevelled tibia.

1 inch shorter (Figures 17 and 18). In an adolescent the fibula should, where possible, be more than 1 inch shorter in order to ensure that no synostosis may occur at a later date.

When performing the bone section it is essential that the anterior edge of the end of the tibia should be bevelled. Provided that the stump is not bulky, those of less than 2 inches in length can be satisfactorily fitted with a prosthesis. Stumps longer than 6 inches of tibia can easily be fitted with a prosthesis, but experience has shown, and this has been confirmed by statistics, that sooner or later they exhibit defects of circulation. The longer stump has a shorter life.

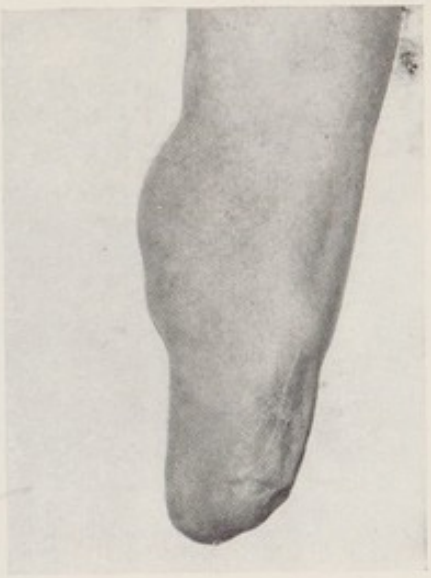
Skin:

The scar should not be over the anterior aspect of the tibia, nor should it be antero-posterior, such as results from the equal lateral flap method (Figures 19 and 20). In the latter case the scar becomes drawn up



Figs. 19 and 20.

Anterior and lateral views of the ideal Below-Knee Stump.



between the extremities of the tibia and fibula, and subjected to piston action when the prosthesis is worn so that the skin becomes furrowed and irritated.

Equal anterior and posterior flaps provide the most satisfactory stump. The resultant transverse scar, which is originally terminal, soon becomes retracted slightly posteriorly, in which position it is least affected by limb wearing.

2. PREPARATION OF THE PATIENT FOR LIMB WEARING

(1) Psychological

The approach to the patient by all those associated with him during preparation, treatment and limb fitting must be based on the recognition of the fact that the loss of a limb produces a psychological upheaval from which, fortunately, the great majority make an excellent recovery, but the recovery can be expedited and the mental shock limited if care be taken in the early stage to relieve the patient's mind of the natural anxieties to which he is subjected.

The new amputee is anxious as to his ability to pay for all the treatment for the artificial limb, and for future repairs and replacements; and patients should be informed that all this is now provided free of charge under the National Health Service.

The patients should be informed that if there is any matter in connection with their stumps or limbs about which they are doubtful, they have only to make enquiries at the nearest Ministry of Pensions Limb Fitting Centre.

When fitted with a limb they are often anxious about their future appearance and ability to walk. With regard to the former, the appearance when standing and sitting is normal and natural; the ability to walk in as natural a manner as possible is dependent upon the level at which the

amputation has been performed, the presence or absence of disabilities elsewhere, together with the co-operation of the patient in the training which will be given in the use of the prosthesis.

There is frequently to be found anxiety regarding the amputee's ability to return to a self-supporting life. A high percentage of those amputated in the lower extremity are able to return to their old occupations. Should there be need or desire for change they should be informed that the Limb Fitting Centres of the Ministry of Pensions are in close co-operation with the Ministry of Labour Employment and Training Bureaux and that the interviews regarding these two points are arranged in the patient's interest (Figure 21).

Fig. 21.

This amputation below the knee cycles to work daily.

Every effort should be made by all those associated with amputees to impress upon them that their future will not be a life of crippledom, but rather one to which they can look forward with hope and confidence in their ability to become once more self-supporting citizens. It also should be impressed upon them that not only is consideration given to rendering the patient self-supporting, but by the supply of an artificial limb they are enabled to return to many sporting activities, and take up hobbies with which to occupy their spare time.

(2) Physical

After a period in bed, following amputation, the general bodily musculature has lost tone, and the remaining muscles of the stump will have atrophied.

When the patient is allowed up on crutches or in a wheel chair, certain postures, such as rounding of the shoulders, head flexion and cramped fingers can be acquired which are detrimental to limb wearing; these should be avoided or quickly eradicated.

If a patient has been sent for limb fitting in this condition, it is hardly surprising that many find the strain exhausting, and the stump incapable of controlling the limb.

The exercises described herein will be found adequate to render the patient fit in all respects to withstand the stresses and strains of limb wearing, and the more competition and humour that can be introduced in carrying out the initial training, the greater will be the co-operation to be expected from the pupils.

Remedial exercises prior to limb fitting:
(Figures 22, 23, 24 and 25).

Age, physical and mental capability should be considered when applying these tables. When dealing with large numbers, split them up into groups, e.g., age 35 years and over work together, and all under 35 work together. It has been found by experience at Roehampton, that if the young and old work together through a table of exercises, the older ones very soon become disheartened and give up, but by taking the same older patients through the same table, either individually or grouped with others of the same age, the desired result is obtained.

Figs. 22 and 23. Remedial Exercises for strengthening the abdominal and spinal muscles.

Fig. 24. Exercise for the reduction of hip flexion

Fig. 25. Exercise for the strengthening of arm and shoulder muscles and the quickening of mental reactions.

TABLE I

General Table of exercises for all types of leg amputation cases

Aim:

To attain and retain a general standard of fitness, bearing in mind the arduous task of limb fitting which lies ahead.

Object:

(a) Shoulder girdle and neck loosening.
(b) Spine straightening.

Time:

Exercises in this table occupy 45 minutes once a day, including rest periods. Older patients require larger rest periods, and for them the table may occupy one and a half hours a day. From 7 to 10 days is usually sufficient.

(c) Strengthening of abdominal wall and mobility of trunk.
(d) Strengthening of flexors of hip.

All of the following exercises are carried out on a mat:—

(e) Informal activity—Free passing, using Medicine Ball.

(f) Sitting upright—Hands resting behind back, head turning left and right alternately.

(g) Sitting—Shoulders raise and lower (shrugging).

(h) Sitting—Hands on hips, trunk and head turning left and right alternately.

(j) Sitting—Arms stretched sideways, small circles backwards.

(k) Sitting—Arms abducted, elbows flexed, head and trunk turning with alternate arm flinging sideways.

(l) Lying on back—Stumps fixed, head and trunk slowly raise and lower.

(m) Lying prone—Stumps fixed, head and trunk slowly raise and lower.

(n) Lying on side—Flex stump forward and extend backwards, concentrate on backward movement and so ensure full extension.

(o) Lying prone—Hands on mat in line with shoulders, arms stretch and bend alternately.

TABLE 2

(Progression on Table 1)

With Table 1 having been applied for a week or so, the patients should now be in fairly good condition physically and mentally, and able to carry out the more strenuous exercises of this Table.

The following exercises occupy one hour, including rest periods and continue for 7 to 10 days.

(a) Sitting upright—Hands resting behind on mat, head rotating loosely 3 times left and 3 times right.

(b) Sitting—Raise shoulders and rotate backwards and change to forward movements.

(c) Sitting—Arms abducted, elbows flexed, two backward presses to arms, flinging forward and sideways.

(d) Arms abducted, elbows flexed, head and trunk turning with alternate arm flinging, sideways and extended.

(e) Strengthening Group (using Medicine Ball).

- (i) Back to back in pairs one yard apart, head and trunk turning, pass ball back to partner.
- (ii) Sitting facing in pairs, ball held at chest, throw ball forward to partner.
- (iii) Ball held forward in left hand, place right hand on top of ball take ball back to right shoulder and push forward to partner with right hand, repeat with left hand.

(f) Stick exercises (with ordinary walking stick).

- (i) Stick held forward, hands pronated, rotating stick forwards and backwards.
- (ii) Stick held forward, head and trunk turning with stick swinging sideways.
- (iii) Stick held forward, keeping arms straight, raise arms and stick upwards, overhead and press backwards four times.

(g) Repeat exercises 9 and 10 of Table 1 with resistance.

3. THE PREPARATION OF THE STUMP FOR LIMB WEARING

(1) **Bandaging—Above-knee stump** (Figures 26 to 33).

For some time after an amputation stump has healed, a considerable amount of oedema is generally to be found at the extremity of the stump, which requires absorption before limb fitting can commence, and the shrinkage which it is necessary to obtain before limb fitting commences has for many years been brought about by the use of plaster pylons. These are still used in certain cases for effecting shrinkage, but are more often used in these days for the purpose of rendering the patient ambulatory at the earliest possible date, thus avoiding the use of crutches. It has been found in recent years that the most rapid and effective shrinkage of the stump can be brought about by a system of bandaging. This can be commenced immediately the stump has healed, although at that early stage the amount of pressure applied to the extremity is necessarily slight.

The best type of bandage has been found to be a crepe bandage. For thigh stumps, two such bandages 6 inches wide are required, and should be sewn together end to end and rolled after much of the elasticity has been removed by rolling the bandage in tension.

In bandaging a thigh stump the patient lies supine upon a couch and the free end of the bandage is placed upon the front of the stump as high up as the level of the inguinal ligament, being held in that position by the

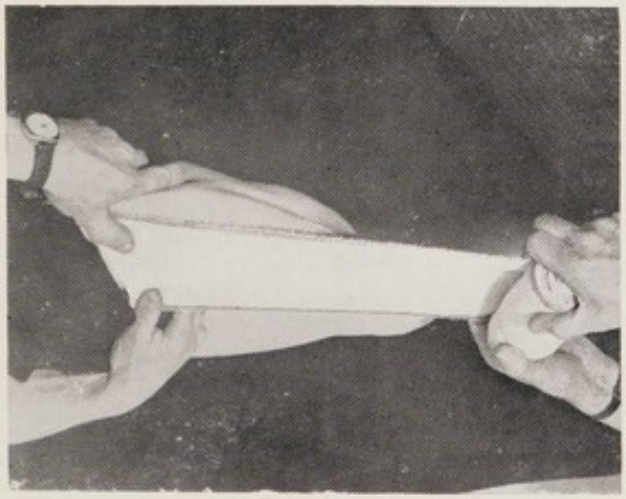


Fig. 26.

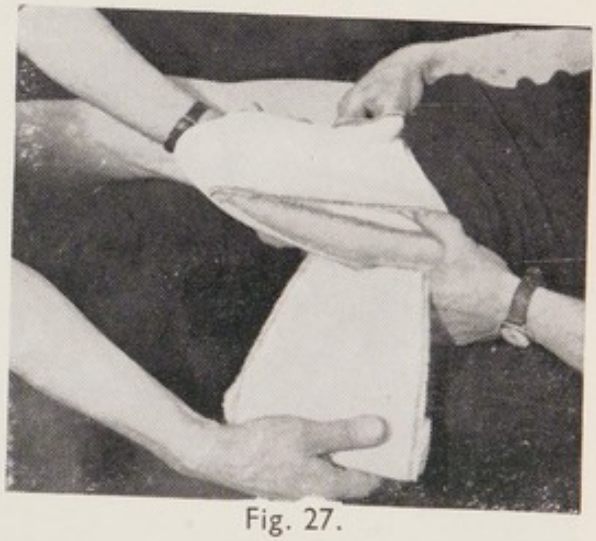


Fig. 27.

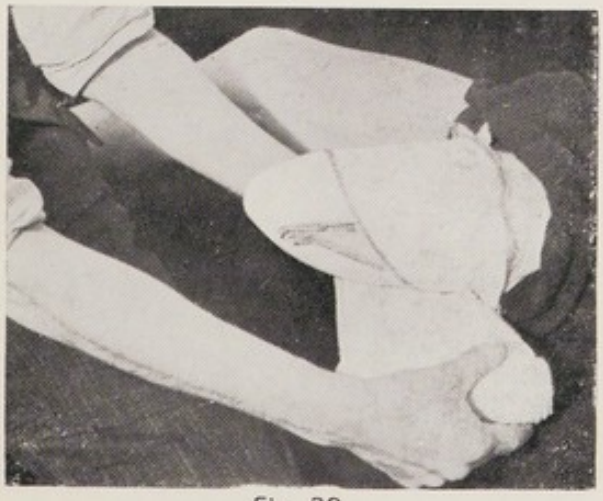


Fig. 28.

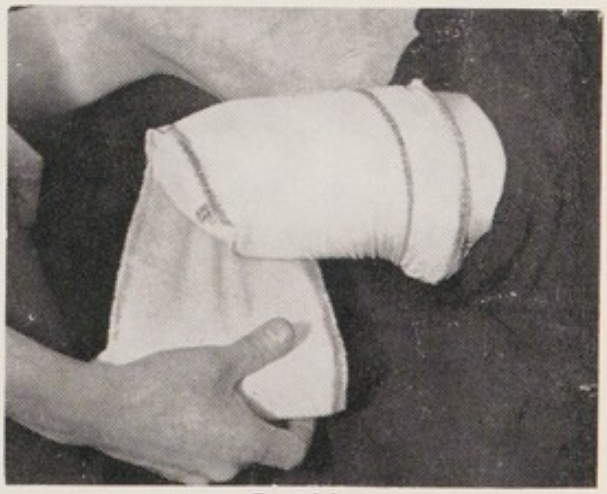
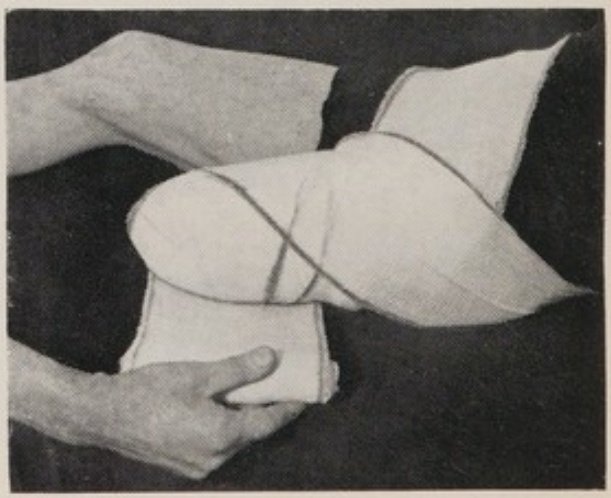


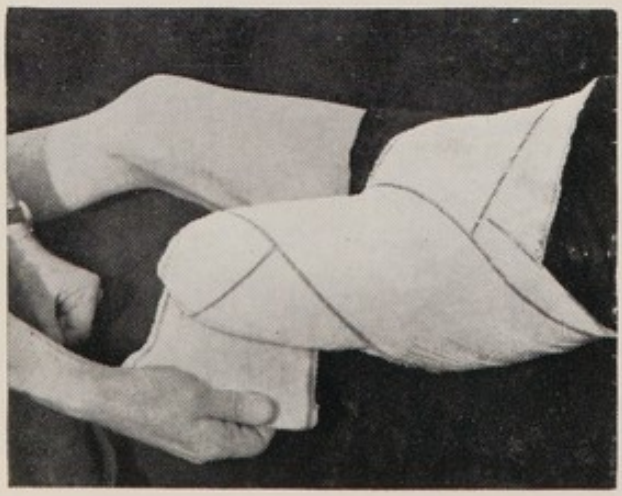
Fig. 29.

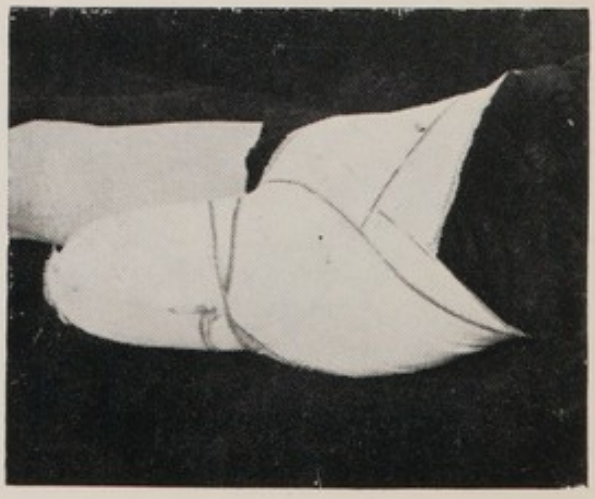
patients two thumbs; the bandage is now drawn down caudally with as much tension as the patient can bear down over the end of the stump and carried up behind to the level of the gluteal fold, being held in that position by the two forefingers of the patient. It is then brought down obliquely and externally over the stump's extremity, and up to the supporting point in front, thence down once more obliquely and internally over the extremity up to the gluteal fold again, being held by the patient's forefingers. The bandage is now twisted and a turn is made around the upper aspect of the stump as high as possible into the perineum, sufficient tension only being used in this turn to secure the upper extremities of the three slings.

The patient can now remove his hands. Next, the bandage is carried down to the stump's extremity, using increasing tension at that point and thence high up on the outer side to the buttock level. It is passed around the pelvis and back on to the stump making a spica turn. Care should be taken to ensure that the cross-over of the bandage is external and not anterior. From here the stump is again bandaged, using tension at the extremity, and then finished off.

It is important that the bandage be carried as high as possible into the perineum and that as the bandage is carried higher up the stump so the tension shall be diminished. The importance of carrying the bandage high into the perineum is to avoid a roll of flesh appearing between it and the upper edge of the bandage.







(2) **Below-knee stumps** (Figures 34 to 36).

When bandaging a below-knee stump a 4-inch bandage of crepe is used. If the stump be bulky it may be necessary to use two bandages sewn together end to end. The method of applying the three initial slings, already described is identical with the previous description, but corresponding to the spica turn around the waist, the bandage is carried round the lower end of the femur, just above the condyle, and back on to the stump again, leaving the patella and anterior aspect of the knee free and mobile.

Fig. 34.

Fig. 35.

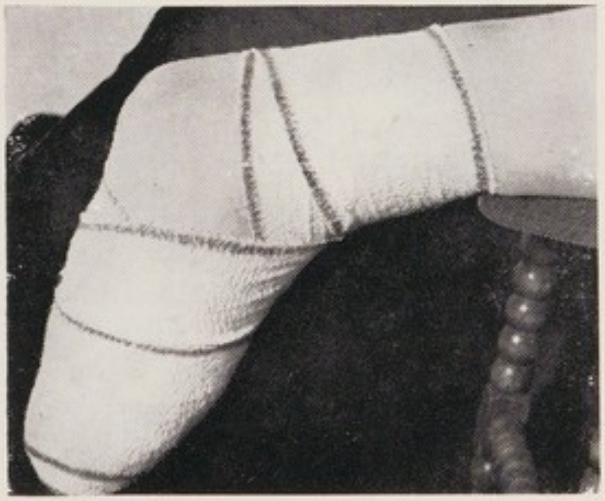


Fig. 36.

(Figures 26-36 reprinted by courtesy of the "Nursing Times")

4. STRENGTHENING EXERCISES FOR THE MUSCLES OF THE AMPUTATION STUMP (Figures 37 and 38)

As soon as the thigh stump is healed and the patient is allowed up on crutches, he will go to the physiotherapy department or walking training school, where apparatus is fitted and used as follows. A piece of timber 12 feet by 6 inches by 2 inches is fixed horizontally to the wall 4 feet above ground level. To this is fitted a series of pulley wheels, 3 feet apart. A piece of blind cord 9 feet long passes over each pulley; to one end is attached a sand-bag weighing 5 pounds to commence with, the weight later being increased to 15 pounds. To the other end is attached a canvas stump sling. A handrail is situated at such a distance from the wall that when the sling is attached to the stump and the patient is resting his hands upon the rail, the sand-bag is just clear of the floor. With the patient standing facing the

Figs.
37 and 38

Exercises for strengthening the adductor and extensor muscles of the stump, being performed upon a moveable frame apparatus.

wall, extensor exercises are commenced, adductor exercises being performed when he stands sideways to the wall. Two exercise periods of twenty minutes each daily, continue for at least a week, will re-develop the stump muscles sufficiently for limb wearing.

The need for re-education of the adductor and extensor muscles is determined by the use to which the stump is put when the patient is walking on an artificial limb supplied for a thigh amputation.

When he is standing at attention on an artificial limb the adductor muscles must be contracted to prevent the limb from breaking away at the hip. When he takes a pace with the artificial limb the latter must be carried directly forward in the adducted position, otherwise a circumducted gait will result. When the heel of the artificial limb touches the ground at each pace the artificial knee is slightly flexed; to produce extension which is necessary in order to prevent the limb giving way beneath the patient, the extensor muscles of the hip come into action and produce extension of the knee. The use of the extensors of the hip is again essential when a patient is ascending or descending stairs.

This apparatus is adaptable for the development of the quadriceps in below-knee cases.

The introduction of the competitive spirit in these exercises is of great value, and patients are found to take a great interest in the results.

Exercises can be done by out-patients in their own homes. For thigh stumps, a home-made sling, a blind-cord and a flat-iron will serve, the cord passing over the back of a chair upon the seat of which someone is sitting. Concurrently, exercises should be given for strengthening of the erector spinae and abdominal muscles before the limb is supplied.

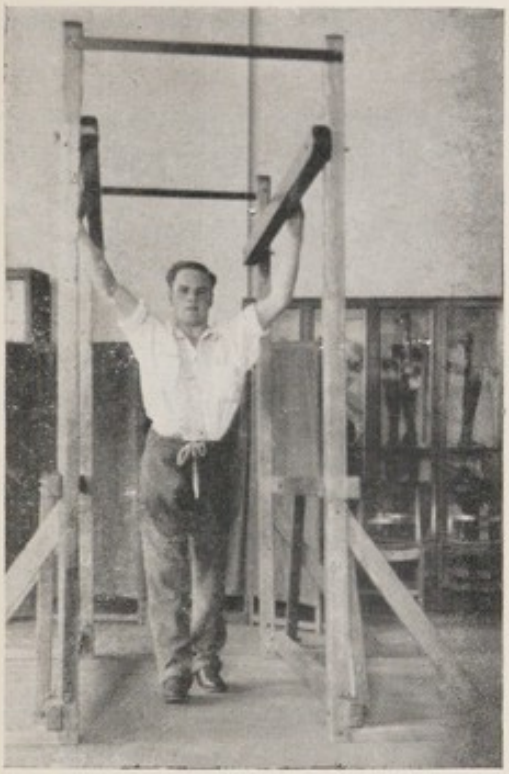
5. WALKING TRAINING WITH AN ARTIFICIAL LEG

The exercises detailed below are designed primarily for single amputation above the knee, but with few exceptions are of value also for amputations below the knee.

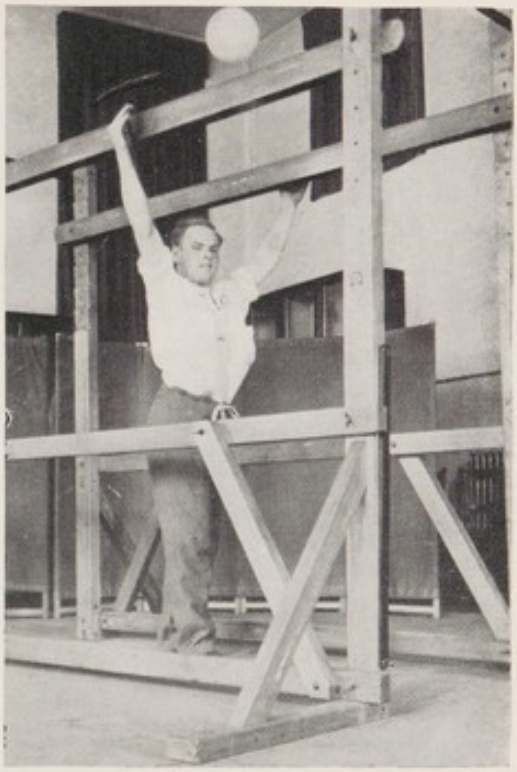
Before much walking is attempted, balance should be acquired and the hardening up of the weight bearing tissues effected.

(1) Balancing Exercises.—Using the "Overhead Parallel Bars"

(a) Stand within the rails, with arms extended above the head and hands gripping the overhead bars. Take the weight first on the good leg then on the artificial, gradually reducing the weight borne upon the hands (Figures 39 and 40).



Figs. 39 and 40.



Walking within the "overhead parallel bars," this exercise develops balance and an erect spine.

(b) As above but marking time, raising each leg in turn well above the floor, and gradually extending the period during which each leg is raised. In a short time the patient will be touching the overhead rails but lightly, and finally can perform the exercise without touching the rails.

(c) When the patient has mastered the above exercises, he progresses from marking time to walking with the "Overhead Parallel Bars" rack for which he uses the Kick and Mark system, sliding the hands lightly along the overhead bars as he walks. Start with the artificial leg slightly behind the other, swing it forward freely with the stump, bringing the heel sharply to the ground, and extend the artificial knee by pressing the stump to the back of the socket.

(2) **When confidence is gained he will leave the "O.P.B." rack and commence exercises on the open floor using two walking sticks.**

(a) Standing erect, commence arm swinging exercises, forward, sideways and upwards, holding the sticks by the handles.

(b) Marking time, using two sticks.

(c) Progression walking with the "Kick and Mark" exercise.

(d) Walking between two lines 9 inches apart, painted on the floor and facing a wall mirror. Take care to ensure that the pace with the artificial leg is no longer than that with the natural leg.

(e) As in (d) above but to slow foxtrot time to music.

(f) As confidence is gained, use exercise (e) with patient holding the sticks in the middle and swinging the arms freely forwards.

(g) With progress the patient should now walk between two lines $4\frac{1}{2}$ inches apart.

(h) **Turning.** On arriving at each end of the painted lines, turning should be practised. With a right amputation and turning to right, pivot upon the artificial heel. For left turn, pivot upon the good foot. Regardless of any instruction, patients frequently develop styles of their own for this and other special exercises, and this is of no consequence provided that the patient has complete confidence in the style adopted.

(j) **Sitting Down.** Approach the chair from the front and judging the distance with practice, arrive opposite the chair with the good leg forward—pivot on the heel of the good leg toward the artificial leg and sit.

(k) **Stairs.** Ascend with the good leg leading, on lifting the artificial leg to the next stair, press stump to back of socket to ensure extension of knee before taking weight upon it. For descending, lead with the artificial leg ensuring full knee extension in taking weight on the limb on the stair below.

(l) Arising from a fallen position, lead with the good leg pushing upon the stick if carried.

(m) Picking up objects from the floor, take all the weight on the good leg, with artificial leg to the rear and flex both knees.

For amputations below the knee the above exercises (h) to (m) will be carried out normally, no special directions being necessary.

Concurrently with the above exercises, the following should be carried out, for the further development of balance, physical development and chest expansion.

(3) **Exercises using a Windsor Upright Chair**

(a) Stand behind the chair in such a position that if right leg is artificial the left leg is in line with and behind the left back leg of the chair, and *vice versa*. Grip the chair rail with the left hand and with walking stick in the right hand swing the artificial leg forwards and backwards in a straight line, no circumduction to be allowed.

(b) As in exercise (a) only with each forward and backward swing, press the stump and limb as far as possible.

(c) Standing squarely behind the chair, place both sticks upon it and balance alone with arms swinging freely, backwards and forwards, sideways and in a circle.

(d) As in (c), arms across the chest, elbows in line with the shoulders, perform a series of backwards presses with the elbows and fling the arms sideways.

(e) As in (c), standing well back from the chair, place both hands upon the top rail, bend the elbows and lower the body till the chin reaches the top rail. In this position carry out hip extensor exercises with the artificial limb and then rise to the erect position extending the elbows.

(f) With a stick in one hand, the other grips the top rail at centre, lifts the chair forwards and sideways alternately to the greatest possible extent. Repeat with the opposite hand.

6. MEDICINE BALL GAMES FOR IMPROVING SPEED OF MENTAL REACTIONS

Patients should sit opposite one another upon benches, and various games can be devised for passing the ball from one to another (Figure 41).

Fig. 41. The competitive game of "Ball Passing".

7. DIVERSIONAL ACTIVITIES WHICH LEND INTEREST TO TRAINING AND FURTHER THE DEVELOPMENT OF BALANCE AND CONFIDENCE

(1) Dart playing. (2) Table Tennis. (3) Indoor hockey with walking sticks and soft ball. (4) Dancing. (5) Golf and Clock Golf.

8. WALKING TRAINING WITH ARTIFICIAL LEGS. DOUBLE AMPUTATIONS

The exercises detailed in this section are for those who have suffered amputation of both legs and are wearing a pair of artificial legs. The exercises described are suitable for any combination of amputation unless otherwise stated.

(1) (a) The patient stands within the "Overhead Parallel Bars" with his hands extended above his head, gripping the top rails. He develops a sense of balance and can soon take less weight on the arms and at the same time accustoms the weight bearing tissues to taking pressure. Attention must be paid to erectness of stance.

(b) When able to balance, swing the arms forwards, sideways and upwards.

(c) Repeat exercise (b) outside the "O.P. Bars", holding a walking stick in each hand.

(2) Chair exercises, using a Windsor Upright Chair

(a) Stand behind the chair with the left limb in line with the right leg of the chair. Grip the rail of the chair with the left hand and use a walking stick in the right.

Swing the right leg forwards and backwards in a straight line. Repeat exercise for the other leg by changing position behind chair.

(b) Position as for (a). Raise the leg forward with two forward presses and then backwards with two backward presses, repeat for other leg.

(c) Kick and Mark exercise, only for those with above-knee amputation. Standing as in (a), place limb to rear, swing freely forward bringing the heel sharply to the ground causing full extension of the artificial knee joint. Repeat with the other leg.

(d) Standing behind the chair, place both the sticks upon the chair and balance with arms swinging freely, backwards, forwards, sideways and in a circle. This is not only good for breathing but for teaching balance and confidence.

(e) As in (d). Arms bent across chest, elbows in line with shoulders. Two backward presses of the elbows and then fling arms sideways.

(f) As in (d). Standing well back from chair place both hands upon the top rail—bend elbows till chin reaches top rail—extend elbows. Whilst doing this carry out hip extension exercises with legs alternately.

(g) As in (d). Arms crossed over chest, fling arms sideways and then upwards to full extent.

(h) A stick in one hand, the other grips top rail of chair—raise the chair as much as possible forwards and sideways to given count—repeat with opposite arm.

(3) SPECIAL EXERCISES

(a) Picking up objects from the floor

All weight to be taken on one stick—lower the same shoulder as stick hand to the top of the handle—slide the other hand down the shaft of the stick then free it and pick up the object.
With below-knee amputations the knee should flex.

(b) Correct sitting

Approach the chair from the front—turn sideways to it, placing the right hand upon the back top rail, with the left stick to the rear. Turn, allowing the artificial knees to flex, taking weight upon chair back and stick and lower gently to the chair. Not applicable to those who have both their natural knee joints.

(c) Getting up from sitting position

Place the left stick in front a little—turn body slightly to the right on the chair seat. Extend the left leg to just behind the stick and brace back. Place right hand on chair seat and push up with both hands towards the extended limb till upright. If the patient is stronger in the right stump reverse the above. Not applicable to those having one or both natural knee joints.

(d) Regaining an upright position after falling (Double above-knee)

Lying prone, place the sticks on either side of the body with handles in line with the hips. Bringing arms to the front support position, straighten them and push back till the kneeling position. Extend the limb which has the strongest stump slightly sideways and outwards. Push with the arms in the direction of the extended limb moving the hands backwards at the same time. Extend the opposite limb till both feet are firmly on the ground then pick up one stick taking the weight on it till the other is regained and using both sticks, regain the upright position.

(e) Walking—Double above-knee cases

Kick and Mark exercise using two sticks, carry the body weight forward on to the extended limb with the opposite stick forward, repeat with the other limb and stick paying strict attention to erect carriage and adduction of limbs. Walking exercise between white lines painted on the floor in front of a wall mirror and to slow music.

(f) Turning whilst stationary

Turn trunk to left and right alternately, reaching with sticks as far behind as possible.
With both sticks forward and right leg forward, place sticks in left turning position and pivot of feet to the left.

About turn—two movements. To the left—right foot forwards, sticks to the left and turn—left foot backwards, sticks to left and bring right foot forwards.

Turning whilst mobile. To the right. Turn with the right foot forward at the same time swinging the left leg and sticks to the right.

(g) **Ascending stairs for double above-knee amputations—where handrail is provided**

Using one stick grasp the rail with the hand opposite to the strongest stump. Place limb with strongest stump on stair fully extended—place stick to the rear. Push on stick and pull on rail till weight is taken on leading limb and carry other leg forward to stair.

For one above- and one below-knee—lead with the below-knee.

Descending stairs—Handrail provided

Place one hand on rail and one stick forward on lower stair. Place one limb with heel clear of stair—take weight on stick and rail—bend opposite leg which lowers patient to lower stair.

No handrail. Approach stairs and turn sideways. Place one stick on lower stair (that of leading leg) with opposite stick to the rear. Place leading leg backwards a little, take weight on sticks, bend other knee and ease weight on to leading leg, swinging other leg to lower stair.

For one above and one below. Use one stick and lead with above-knee leg bending the below-knee leg.

9. STANDARD TEST TO BE TAKEN BY ABOVE-KNEE AMPUTATIONS ON COMPLETION OF COURSE OF TRAINING (DOUBLE AND COMBINATIONS OF DOUBLES)

(1) Correct carriage (Walking with a book balanced upon the head).
(2) Correct gait.
(3) Turning in various directions, stationary and whilst mobile.
(4) Ascending and descending stairs.
(5) Stepping over obstacles whilst stationary and mobile (a development of the "marking time" exercise).
(6) Correct sitting down and rising from sitting position.
(7) Picking up objects from the floor.
(8) Rising from a fallen position.
(9) Balancing with alternate legs.
(10) Balancing with feet together whilst swinging arms.

B. UPPER EXTREMITIES

1. AMPUTATION SITES—Amputations above the elbow

The best length of stump for an amputation above the elbow is one which measures about 8 inches of humerus from the tip of the acromion, and should not exceed 9 inches. Should there be less than 3 inches clearance between the end of the stump and the line of the natural elbow joint it is not possible to incorporate in the prosthesis the automatic locking mechanism of the elbow joint, which is of such value to the artificial arm user. No surgical or prosthetic advantage is to be obtained by providing a humeral stump of more than 8 inches. The shortest humeral stump which can be fitted with an arm giving the best functional value is a stump having at least 1 inch of bone below the anterior axillary fold. A stump shorter than this, in fact disarticulations at the shoulder, can be fitted with artificial arms the value of which are proportionately less.

Since the arm stump when fitted with a prosthesis does not bear weight, as does that of the lower extremity, the scar should always be terminal and transverse, the amputation being performed by the equal anterior and posterior flap method, or the circular method.

Amputations through the forearm

The best fore-arm stump measures 7 inches or not exceeding 8 inches from the tip of the olecranon. $3\frac{1}{2}$ inches of ulna only will provide a useful stump, but this is the minimum length.

2. PREPARATION OF THE PATIENT AND THE STUMP FOR LIMB FITTING

(1) Mental

As is the case when dealing with amputations of the lower extremity, so with the upper extremity, is the psychological approach to the patient of the greatest importance. The loss of an arm is more often than not a greater shock to the patient than that of a leg, because, good though modern artificial arms and appliances are, they can never fully replace the lost functions of the human hand, and it is, therefore, all the more important that the patient should be given as much practical encouragement regarding his future prospects as can justly be advanced.

It is important that at the earliest stage after amputation the patient should be able to associate with and observe the progress of others similarly amputated, using artificial arms in the Arm Training Schools. This is of far greater value than any verbal encouragement which can be given.

It must be impressed on the patient by all possible means that the artificial arm when supplied will not be a useless appendage, an object merely to fill the sleeve, but will be of practical value, and an aid to the remaining hand. The inability of the patient in years gone by to appreciate the value of the stump is largely responsible for the poor use many have made of artificial limbs when fitted. From the earliest stage after amputa-

Figs. 42 and 43.

Temporary adjustable leather fittings to enable a double amputation to feed himself whilst waiting for artificial arms to be supplied.

tion the patient should be encouraged to make use of his stump, and there are very many ways in which this can be done. If the patient is right-handed and has lost his right arm, a pencil can be attached to his stump whether it be an arm or fore-arm amputation, and after a few attempts he will write well. He should not only be allowed, but encouraged to do this even if at some later date he should elect to write left-handed. By using the stump for this purpose at this stage, he is being made to realise that it is of value. In the same way the stump can be made use of to aid the patient in feeding himself by the attachment of a fork or spoon, by strapping plaster or bandage. Leather gauntlets have been made for holding a pen, pencil, spoon or fork, which are adjustable, and can be attached to stumps of any size, and if these be loaned to the patient after amputation and before the stump is ready for limb fitting, the patient's reactions to the limb when it is fitted are greatly enhanced (Figures 42 and 43).

(2) Physical

The successful use of an artificial arm is largely dependent upon the patient having a full range of movement in the proximal joint, or joints, and exercises for the mobilisation of the shoulder and elbow joint (in fore-arm cases) should be carried out. It is well that amputees of the upper extremity should join in the remedial exercises already described, which are used for amputees of the lower extremity.

3. ARM TRAINING

The supply of an artificial arm to an amputee without adequate arm training in the use of it, is comparable to giving a small child his first bicycle without teaching him to ride and learn to balance. There are some arm users, as some children, who will overcome this lack of training and guidance by sheer inherent ability and determination, but many will not, and in the case of artificial arms, those who do not succeed without training will generally blame the artificial arm for their failure.

Fig. 44. The Arm Training School at Roehampton.

Fig. 45. The Arm Training School at Roehampton.

Whilst the limb maker who supplies the artificial arm will explain and demonstrate to the patient the use of the arm and the various appliances to be obtained, he has not the time or the facilities for providing the type of training necessary to secure the satisfactory rehabilitation of the arm amputee.

The Ministry of Pensions have instituted Arm Training Schools, completely equipped and supervised by an Arm Amputee Instructor at some of their Limb Fitting Centres, and every patient receiving his first artificial arm should be prevailed upon to take a course of instruction therein (Figures 44 and 45). For a single arm amputation the course normally occupies from ten to fourteen days, whilst for a double amputation a month is usually necessary. During this period the patient not only learns the functional value of an artificial arm, but is enabled to ascertain which of the very many appliances available are going to be the most

Fig. 46. A triple amputation.

suitable for his individual requirements and future vocational needs, and has the opportunity of practising with them in the School before passing on to receive vocational training elsewhere should such be required.

Figs. 47, 48 and 49.

The same patient shewn in figure 46 fitted with artificial arms and toilet appliances.