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Pre- and Postoperative Therapy Following Tendon Transfer Surgery

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INTRODUCTION

In this chapter the pre- and postoperative care will be discussed for patients having paralysis of hands or feet in whom tendon transfer surgery is performed to correct the important primary functional impairments.

Peripheral neuropathies and nerve injuries may lead to paralysis and weakness of hands and feet. With the peripheral neuropathies we include also the sequels of such entities as (post) poliomyelitis and Guillain-Barré. The paralytic conditions in hands and feet due to Hereditary Motor Sensory Neuropathy can often also be surgically corrected.

We emphasise that for tendon transfer surgery to be successful the surgeon needs to have the necessary training. Likewise, surgery will only be successful if the therapist has the necessary understanding and skill in re-educating muscles whose distal tendon is transferred or re-routed to substitute for weak or lost functions.

First, the pre-and post-operative care of tendon transfers for the hand will be discussed, followed by a discussion of the care related to tendon transfer for the paralytic foot. No distinctions will be made to specific functions or responsibilities of the physiotherapist or occupational therapist in the rehabilitation of the corrected paralysed hand or foot. Work setting and availability of expertise determine pre- and postoperative responsibilities. Assessment forms are given in the appendices of the book. For a good understanding of the subject matter of this chapter the reader may want to review the chapters on functional anatomy of the hand and foot.

SELECTION CRITERIA

Patients should be willing and motivated for tendon transfer surgery. Many patients may have become 'used' to splints or have accepted the condition and have 'adjusted '. Surgery will involve 3-4 weeks of postoperative immobilisation and another 4-6 weeks of rehabilitation before the patients will have full use of the hand or foot again.

Ideally, there should be no secondary impairments present at the time of surgery (Chapter 5). Advanced age is a relative contra-indication. Good results are also attainable in older patients when there are no secondary impairments and the patients are very motivated.

A slow progressive neuromuscular condition is also a relative contra-indication. If the use of splints can be delayed, or if the functionality of the hand or foot can be maintained/improved for some more years, it is worthwhile considering tendon transfer surgery.

It is important that the patients know and understand what the operation and postoperative rehabilitation is about. This will ensure postoperative compliance with the therapy. A useful question to ask the patient before opera-

tion is: "What do you expect from the surgery"?

It is important to know that the patient's expectations are realistic and that it is explained to the patient what can be expected, taking, of course, into account the present condition of the hand or foot.

With respect to leprosy, the ILEP guidelines about "identifying patients for reconstructive surgery" should be consulted.[13]

Assessment

It is essential to use specific assessment forms. If we want to know to what extent surgery has been beneficial in correcting the impairment and enhancing functional use, we need to have baseline (pre-operative) data against which postoperative data can be evaluated (see appendices in this book).

Essential in the pre-operative assessment is an evaluation of the muscle status.[7-9] Often the improvement in tendon transfer surgery for claw fingers is only judged on the basis of improved extension angles (less clawing). There are to date no data available to show how the function of the hand may have improved following claw finger correction. It is advisable to assess the angles of the hand on a weekly basis for as long as the patient is hospitalised and then do a functional evaluation at the time of discharge. Ideally the patients should be seen a few months postoperatively and 1-2 years later to see if the results obtained by the surgery are sustained.

Also for tendon transfer surgery for footdrop the success of surgery is often only based on the range of active dorsiflexion only. Few data are available on aspects such as restored gait or prevention of ulceration.

A. PRE- AND POSTOPERATIVE CARE FOR THE PARALYSED HAND

The ideal hand for tendon transfer in ulnar and/or median palsy is the hand with full mobility of all finger joints. The mobile claw hand is defined as the hand with full assisted extension in the IP joints. Exercises and splinting are indicated for the stiff hand to overcome contractures (Chapter 5). The tendon transfer will not overcome pre-existing joint stiffness or other secondary impairments.

1. Ulnar Palsy: 'Clawing'

The main functional defect is 'clawing' which is due to the paralysis of the interosseus muscles. The main purpose of a tendon transfer for clawfinger is to restore primary MCP flexion.

The postoperative surgical cast is usually removed 3 weeks after the surgery. Sometimes the cast is bivalved and one half is used to maintain the wrist/fingers in the 'lumbrical position' in between exercise sessions. We do not recommend this as there will not be a snug fit from the operation cast when bulky bandages have been used, immediately postoperative and prior to immobilisation.

A new slab should be made to support fingers and wrist in a position in which there is no undue tension on the sutures/grafts. Often the fingers will be immobilised in cylindrical Plaster of Paris bandages for the initial 2-3 weeks of postoperative re-education, but the 'cylindrical' plaster splints should be taken off for short periods daily for supervised 'isolation' exercises. The plasters serve two purposes:

- In the exercise session immobilisation of the IP joints will help in isolating the transferred muscle/tendon by preventing IP flexion;
- Any remaining joint stiffness or lag in assisted active extension can be further corrected (Chapter 5).

Following the tendon transfer the fingers should ideally be immobilised in full extension in the IP joints and full flexion in the MCP joints. This is often not achieved in the operating room. The serial casting then will also cor-

rect the mild flexion contractures that may have occurred.

Some surgeons will also do a separate tendon transfer to improve pinch strength, to restore adduction power to the thumb. This does not need specific care when done simultaneously with the tendon transfer for the correction of clawing. This transfer is not always needed (chapter 6).

A Guideline: Rehabilitation of the Hand with Ulnar Nerve Paralysis

This is a *Guide-line*. In individual cases, depending on such things as progress made and occurrence of complications, deviations of the guidelines can/should be made. Reasons for deviating from the guidelines should always be recorded in the progress notes.

Loss of motor function of the ulnar nerve may result in clawing of all the fingers of the hand. Usually clawing is more obvious in the ulnar fingers. 'Hidden' or *latent* clawing will usually be present in the fingers that may not show *overt* clawing (usually the index and middle fingers). Clawing in these fingers will become evident in functional activities and weakness will be revealed in the so-called 'lumbrical' test.[7-9]

Even the thumb may 'claw' (Froment's sign) or show a Z-deformity due to paralysis of the ulnar innervated intrinsic muscles of the thenar. (Hyperflexion of the thumb IP joint with hyperextension of the thumb MCP joint). As a routine, usually all four fingers are corrected in an ulnar palsy. The thumb may need correction depending on the presence and severity of the deformity and functional demands of the hand.

The following is an outline of the important points in the rehabilitation of the hand that will undergo surgical correction of the deformity (tendon transfer(s)). Basic knowledge of the anatomy and (patho) kinesiology of the hand with paralysis of the intrinsic muscles is assumed.

No distinction is being made of the relative and often complementary roles and function of occupational therapist (OT) versus physiotherapist (PT) (or OT-PT assistants/technicians). Local circumstances and arrangements will often determine whether specific activities are the main or sole responsibility of one professional.

The distal tendon of a 'donor' muscle (commonly PL, FDS, or ERCL) is detached from its insertion. In case of use of PL or ECRL the distal tendon is lengthened with a free graft to be able to reach the fingers.

The distal tendon or the free graft is split into four tails, one for each finger. The tendon slip is attached to the lateral band of the extensor mechanism through the lumbrical canal or is attached to the A[1-2] pulley of a finger ('Lasso') insertion (chapter 6).[2-4]

Tendon Transfer for Ulnar Palsy

Aim of the Operation and Rehabilitation:
To restore function and appearance of the hand to its fullest potential.

With an 'open' hand the fingers are straight; in closing the hand there is a proper sequence of flexion of the finger joints. This is achieved by restoring primary flexion of the MCP joints.

The clawing position of the fingers is a *cosmetic* impairment (deformity); the inability to

close the finger joints sequentially is a *functional* impairment.

The final outcome of surgery/rehabilitation may depend on such factors as:

presence of secondary impairments prior to surgery, duration of palsy, age of patient, skill and experience of the surgeon and the therapist, and motivation and perseverance of patient and therapist.

Tendon Transfer (TT) Surgery
Surgery will mainly address the problem of finger clawing and finger closure. The fingers will be adducted following surgery, but active ab-and adduction will not be possible. The arch is usually not restored and little is known about the possible effect of TT surgery on pinch- and grip strength.

Assessment:

- *It is highly recommended that specific forms be used to assess and monitor impairments and activity limitations of the hand. The use of graph paper is recommended to evaluate changes in finger extension/flexion angles. Graph paper can also be used to monitor changes in hand volume to evaluate oedema. Only when records are kept is one able to tell to what extent surgery/rehabilitation may have benefited the patient.*

Pre-operative goals:

a) to achieve optimal skin condition;
b) to reduce, if present, secondary impairments as much as possible;
c) to treat and manage other health problems that could prevent or delay reconstructive surgery;
d) to assure that the patient understands the procedure and postoperative rehabilitation involved and to obtain his co-operation.

Secondary impairments: Secondary impairments should all have been eliminated or reduced to the extent where further improvement is not shown.[6] When there is no further improvement (no change for two weeks) surgery could be planned but additional procedures may have to be done at the time of tendon transfer surgery or even prior to tendon transfer surgery to correct the secondary impairment.

The best results with tendon transfer surgery are obtained in the hand without secondary impairments. This is the hand with mobile 'clawing'.

Definition: *Mobile clawing*
When the patient is asked to extend the fingers there is full/complete IP extension when hyperextension of the MCP joints is prevented.

Hyperextension can be prevented by the patient's own hand or the hand of the examiner (Bouvier's test), or by a splint.

Exercises and Splinting: For exercises to prevent or overcome joint stiffness see Chapter 4.

Serial cylindrical Plaster of Paris finger splints have been shown to be very effective and safe in the release of PIP contractures.[10,11] Other splints could be used when available.[12] More expertise/supervision is usually then needed and compliance may be lower.

Isolation exercises: Often the patients are taught how to isolate the muscle, which is selected as a donor. This may help the patient in finding the muscle again in the postoperative rehabilitation phase, usually 3 – 4 weeks after surgery.

Isolation exercises for this purpose are not essential. If a patient cannot find the muscle after surgery, it may be helpful to isolate the muscle on the non-operated arm and then 'transfer' the exercise to the operated side. Strengthening of a donor muscle is not a realis-

tic objective. The possible effect of strengthening (if any) will be lost in the 3 – 4 weeks of immobilisation.

NOTES

a) Generally speaking, splinting is not needed for the hand with mobile clawing. The exercises will prevent the development of secondary impairments. In some cases a splint may enhance the function of the hand. A splint could also be considered when compliance with exercises is not expected.

b) Habitual wrist flexion when opening the hand is a major problem. Wrist flexion will enhance opening of the hand. This habit needs to be addressed prior to surgery. Continuation of this habit after surgery will compromise the outcome.

c) Flexor tightness, when severe, could also be addressed with specific splints.

d) Some surgeons experiment in the 'Lasso' operation with a cast that is open at the volar side of the hand. This will allow for 'unresisted' finger flexion. The patient can also do active extension exercises against the cast. Such cast may reduce duration of post – operative stiffness. Care should be taken that the patient will not use the hand (e.g., to carry something). It is advisable that during the postoperative rehabilitation period the hand is bandaged in extension against the cast, at least for the night.

Postoperative goals:

a) to protect tendon sutures during healing phase;
b) to prevent, or reduce and eventually eliminate swelling;
c) to obtain control of transferred muscle/tendon;
d) to regain pre-operative range of motion;
e) to integrate new function(s) in functional activities.

➢ assessment and progress notes to be written weekly!

Week 1 (3 – 4 weeks after surgery):
Concentrate on contraction ('isolation') of the donor muscle. Protect tendon sutures for at least the first 2–3 weeks following removal/bivalving of the surgical cast. Exercise sessions should be supervised: 3–5 short sessions daily rather than 1–2 longer sessions.

Cylindrical plasters for the fingers during the first 1 – 2 weeks may help the patient to isolate the muscle whose tendon is transferred. It will also be a 'reminder' for the patient not to use the hand, except when supervised in exercise sessions, and may prevent recurrence of contracture when contractures have been present preoperatively.

The plasters should be removed regularly for supervised exercises to see how well the transfer is working.

Be aware of trick movements and habitual wrist flexion!
Care for skin: soaking and oiling!

Week 2
Continue as in week 1 but add finger flexion when there is good control of the transferred muscle/tendon.

When patient shows good control of TT practice isolation with and without visual control.

Patient can be weaned off cylindrical plasters when there is good control of TT and no indication for recurrence of contractures.

Week 3 – 5
During this time, provided that the patient shows good 'control' of the transferred tendon, contraction of the transferred muscle/tendon should be integrated in functional activities.

Where FDS has been used one should be alert for the development of a checkrein deformity. Timely intervention (cylindrical cast) can prevent the development of a progressive flexion contracture of the donor finger!

NOTES

a) *If patients have had pre-operative secondary impairments, which took a long time to correct/minimize, then the postoperative rehabilitation period should be proportionally longer. Up to 6 – 8 weeks. Contractures recur easily! These patients need also to be called for review earlier after discharge so that when recurrence of secondary impairments occurs immediate action can be taken.*
b) *Especially where severe contractures have been present pre-operatively it is advisable that night splinting is continued for a longer time post- operatively.*
c) *Electrostimulation is usually not required to either strengthen a transferred muscle or to help the patient 'find' a transferred muscle.*
d) *When adherence (scarring down) of a transferred tendon is suspected gentle friction may be useful. To be done 2 – 3 times daily for 5 – 10 minutes followed by active contractions. The supposed benefits of ultrasound in the breaking down of scar tissue have not been proven.*
e) *Failure to progress, or deterioration of any finger should be shown to the surgeon promptly.*

➢Follow-up

The patient is called for review/reassessment after discharge from the hospital. Changes may occur after discharge (further improvement, but also late complications and recurrence of contractures). As a guideline, it is advisable to re-assess the hand 2 – 3 months post surgery and again 1 –2 years after surgery. After this period changes due to the surgical intervention are not likely to occur.

Comment on 'Static' Corrections

Tendon transfers are often considered to be 'dynamic' procedures as opposed to static procedures by which MCP hyperextension will be 'passively' restricted. The most common procedure is often combined with an advancement of the pulley to enhance the moment arm of the long flexors on the MCP joint. Postoperatively MCP extension should be protected for a long time. No specific re-education is required! This operation restores the appearance of the hand (straight open hand/fingers) but does not restore the sequence in closing the hand. The operation is often performed in centres where expertise for dynamic corrections and post-operative rehabilitation may not be available.

The Thumb in Ulnar Palsy

Depending on the innervation pattern of the thenar muscles (FPB), the mobility of the thumb MCP joint and the use of the hand, a patient may develop a Z-deformity or complain of a weak thumb in pinching. In a Z-deformity of the thumb there will be MCP hyperextension in addition to the often present thumb IP flexion (Froment's sign).

Various operations can address this problem. They can be done as a separate operation but are often done in conjunction with the tendon transfer that corrects the claw deformity. Besides the normal protection for the first 3 weeks, no specific rehabilitation is usually needed for this additional procedure.

2. Median Palsy: Loss of Opposition

A combined ulnar and median palsy is common in leprosy. Many surgeons prefer to correct the 'claw' deformity and loss of thumb

opposition at the same time. In the authors' experience this can be done safely provided the surgeon feels confident about this and the expertise is available for postoperative re-education. There are definite advantages of combining the two operations in one session: cutting down on the hospitalisation period and, in functional re-education, the thumb and fingers can work together in functional activities.

The thumb should ideally be corrected first if the surgeon prefers to correct the hand in two separate sessions.

Re-education of the transferred tendon is relatively easy. The donor finger may develop secondary impairments and these are often not recognised.[5] An important complication is the development of a progressive flexion contracture of the PIP joint (checkrein deformity). If timely recognised the finger should be splinted in extension. This may have to be continued for a longer time. The patient could at some time be given a removable night splint only and then be weaned off the splint being aware that the contracture does not recur.

We have not (yet) developed a specific pre-postoperative guideline for median or radial nerve paralysis as presented in this chapter for ulnar paralysis. In leprosy isolated median nerve paralysis is relatively rare.

Postoperative rehabilitation for tendon transfer in connection with median palsy requires the same sequence and timing of interventions as outlined in more detail for ulnar nerve palsy.

For the first 3-4 weeks the tendons need to be protected by splint(s) to protect tendon sutures and unwanted use of the hand. The first two weeks will focus on isolation of the muscle(s) whose tendon(s) is/are transferred, gradually building up the frequency and duration of sessions. The new function of the transferred muscle(s) needs to be integrated in purposeful activities, usually by the end of the second or third week.

Flexor digitorum superficialis transfer

The best transfer for opposition-abduction replacement for the thumb with consistent good results is a transfer of a flexor digitorum superficialis (FDS) tendon. This transfer is also the easiest to re-educate. Asking for flexion of the PIP joint from which the tendon has been removed, the 'donor' finger, will result in abduction-opposition of the thumb. Sometimes when patients find it difficult to isolate the muscle it may be helpful to isolate PIP flexion on the non-operated hand and then transfer the exercise to the operated hand.

The therapist and surgeon should be aware of secondary defects that may develop following removal of the FDS on the donor finger.[9] Timely intervention, prolonged splinting, should prevent or correct the development of a rigid flexion contracture that may develop following FDS removal.

Other transfers: Extensor indicis, palmaris longus, and extensor pollicis longus (Chapter 7).

Extensor indicis transfer, in my experience, gives less consistent good results when compared to a FDS transfer. Re-education should be relatively easy especially when the transfer is done in an isolated median palsy or prior to, or following, tendon transfer for ulnar palsy. In such cases isolation of the muscle-tendon can be asked for from a clenched wrist position by asking for index finger extension only. This would not be possible in a combined ulnar-median transfer when both fingers and thumb are corrected at the same time. A full fist will only be possible after several weeks of therapy. The EIP transfer is a weaker transfer than FDS

but should be of sufficient strength for positioning the thumb for pinch actvities.[2]

Palmaris tendon is rarely used in reconstruction of the thumb in leprosy affected persons. It is often a 'muscle of choice' in the very mobile Asian hand for reconstruction in ulnar palsy. If used, re-education should be relatively easy as wrist flexion and cupping of the hand will result in contraction of the palmaris longus. Extensor pollicis longus rerouting is a definite third choice in hands that often have severe secondary defects and when few motors are available. Re-education should be relatively easy as the tendon is only re-routed but attached again to its own distal stump. Thumb IP extension should result in abduction-opposition of the thumb. Often the wrist will have to be immobilised in maximal flexion to facilitate approximation of the tendon ends. Postoperatively, the wrist will have to be gradually moved into extension again by modifying the splint regularly (2-3 times a week).

3. Radial Palsy: Wrist Drop

A radial palsy is relatively uncommon in leprosy. When present it is usually associated with an ulnar and median palsy. The operation of choice is a Pronator Teres transfer for wrist correction. There are several options to correct finger and thumb extension (Chapter 8).[2]

The radial motor impairments need to be corrected prior to correction of possible ulnar and median motor nerve impairments. Re-education of wrist extension is relatively easy. Active pronation of the forearm will result in active wrist extension. Following flexor carpi radialis to extensor digitorum transfer, asking the patient to initiate radial wrist flexion will produce finger extension.

For median and radial tendon transfer re-education, the same goals and principles apply as listed for the ulnar palsy (see above):

Post cast removal, usually 3 weeks after surgery:

- protect the tendon suture site for the first 2-3 weeks in a splint;
- ask for active contractions without resistance for the first 2-3 weeks;
- gradually mobilise the joints again that have been immobilised for a few weeks to get the tissues to heal and
- integrate transferred tendon/muscle contractions in purposeful activities.

B. PRE- AND POSTOPERATIVE CARE FOR THE PARALYSED FOOT

A footdrop correction is relatively easy when compared to tendon transfer surgery in the hand. Re-education is also less demanding and chances for postoperative complications are less. It is a procedure that is very rewarding and it will help in reducing stress on the anterior/lateral side of the foot, the site of the foot where patients are likely to develop ulcers if they have concomitant paralysis of the posterior tibial nerve.

Motivation and age are only relative contraindications for footdrop surgery. Even if the muscle-tendon unit is not working, the foot will still be in a better position. Gait will be better and the risk for (re) ulceration will be reduced.

One of the main outcome measures for footdrop correction has been the range of active dorsiflexion. More importantly, it is the placement of the range that is important and that will show whether the patient will be able to clear the ground. What is the range of active dorsiflexion as it relates to the neutral position of the foot?

An assessment form to evaluate the outcome of tendon transfer surgery for footdrop correction is given in Appendix H.

A Guideline: Rehabilitation of the Foot with Common Peroneal Nerve Paralysis

This is a Guide-line. In individual cases, depending on such things as progress made and occurrence of complications, deviations of the guidelines can/should be made. Reasons for deviating from the guidelines should always be recorded in the progress notes.

Common peroneal involvement in leprosy may result in paralysis of the anterior tibial and/or peroneal muscles. The common peroneal nerve (lateral popliteal) consists of two branches: the deep peroneal nerve and the superficial peroneal nerve. The ***d***eep branch innervates the ***d***orsiflexors (tibialis anterior, extensor hallucis and extensor digitorum longus), and the superficial branch the evertors (peroneus longus and brevis).

The site of predilection for common peroneal nerve involvement is at the head of the fibula. At this site the common peroneal nerve divides into its two branches. Depending on the extent of damage therefore, the patient may present with a complete foot drop in which both branches are affected or an incomplete/irregular footdrop, usually paralysis of the anterior tibial muscles with sparing of the evertors. Even among the anterior tibial muscle group there may sometimes be isolated weakness or paralysis of the extensor of the big toe only.

Aim of the Operation and Rehabilitation:
The goal is to obtain active dorsiflexion of the foot and restore normal gait pattern as much as possible.

The surgeon should also aim to get the right balance/position of the foot between in- and eversion. When the function/position of the foot is restored a near normal gait pattern can be expected (no high stepping gait) and the foot will be less prone to injury. Many patients have concomitant damage of the posterior nerve also and therefore may have paralysis of intrinsic muscles of the foot and loss of protective sensation of the sole of the foot.

NOTES

Some surgeons/therapists do not expect active dorsiflexion to take place after tendon transfer in elderly patients. Even if active dorsiflexion is not achieved, the better position of the foot may still result in an improved gait pattern and the foot is less prone to injury. It is therefore still worthwhile considering footdrop correction in elderly patients.

When surgery is not available or wanted

For many patients with a footdrop, surgery is not available. Others, for different reasons, may not want to have surgery done when it is available. These patients could benefit from a footdrop spring or an orthoses that can be worn in a shoe.

The 'classical' footdrop spring has a cuff that starts from above the knee. It is often difficult for patients to adjust the strap in such a way that a spring is effective. It is also difficult to wear the spring under a pair of trousers. This may explain why compliance with a classical foot drop spring is often low. An alternative footdrop spring starts from below the knee.[14] The distal end of the cuff needs to be modified to prevent undue pressure on the dorsum of the foot.

Assessment

Pre- and postoperative assessments are mandatory if one is to say something about the end result of footdrop surgery or if modifications of techniques are to be compared (e.g. between centres or techniques). Assessment should be done pre-operative and weekly post-operative until discharge.

It is strongly recommended that specific forms be used which will facilitate the assessment of the outcome for an individual patient or cohort of patients.

Pre-operative goals:

a) to achieve optimal skin condition.
b) to reduce, if present, secondary impairments as much as possible e.g. tight Achilles tendon.
c) to assure that the patient understands the procedure and postoperative rehabilitation involved, and to obtain his co-operation.

Joints: Patients with a footdrop may develop some shortening of the Achilles tendon (AT). Activities of daily living such as squatting and walking up hill usually will prevent the development of shortening of the AT. Specific exercises to 'stretch' the heel chord are therefore usually not needed. Most surgeons prefer a lengthening of the AT during surgery, which will correct some tightness if present. At the same time a lengthened AT may 'disadvantage' the transferred TP for some time, as some surgeons/therapists believe.

Tibialis Posterior Transfer (TPT) for footdrop correction

The tibialis posterior tendon is rerouted, either through the interosseus membrane or circumtibially, to the anterior side of the foot/leg where it usually will usually be attached to the tendon(s) of the anterior tibial group. The site of insertion is determined by the extent of the paralysis.

'Isolation' exercises: Often the patients are taught how to isolate the posterior tibial muscle before surgery. This may help the patient in 'finding' the muscle again in the post operative rehabilitation phase, usually 4–6 weeks after surgery. Isolation exercises for this purpose are not essential. If a patient cannot find the muscle after surgery, it may be helpful to isolate the muscle on the non-operated foot and then 'transfer' the exercise to the operated side. Strengthening of a donor muscle is not a realistic objective. The possible effect of strengthening (if any) will be lost in the 4 – 6 weeks of immobilisation.

Post-operative goals:

a) to protect tendon sutures during healing phase;
b) to prevent/reduce/eliminate swelling;
c) to obtain control of transferred muscle;
d) to regain pre-operative range of motion and
e) to integrate the new function in gait/walking.

Post-operative immobilisation will be from 4 – 6 weeks depending on the surgeon's preference and possible additional surgical procedures.

Week 1

Non weightbearing. Patient is asked to activate/contract the tibialis posterior muscle. This is best achieved by asking the patient to sit cross-legged with the operated foot crossing the non-operated foot. Asking the patient to 'lift' invert the operated foot will now result in dorsiflexion of the foot.

In patients who have difficulty in isolating the posterior tibial muscle the therapist could start with asking for inversion of the non-operated foot and then transfer this exercise to the operated side.

In between exercise sessions the foot is protected in a posterior splint/back slab. This should be the bivalved surgical cast. During the first two weeks no active plantar flexion is allowed to protect the tendon suture site(s).

Make sure you have the patient also practice with his eyes closed or looking away from the operated foot.

Week 2
As for week 1. When there is good control of the TP the patient could start with partial weight-bearing. (This is best done in parallel bars.)

Weeks 3 – 4
The patient should be ready for full weight bearing. When the foot cannot be moved beyond 80-90 degrees into plantar flexion careful active plantar flexion could be initiated.

Follow-up

Ask the patient to come for review 2 – 3 months after discharge and again 1 – 2 years after discharge from the hospital. Measure angles again and comment on gait and any abnormalities, if present, in gait and position of the foot. The final outcome of foot drop surgery will only be known after 1– 2 years follow up.

NOTES

a) *Unlike TT in the hand, a footdrop correction is often considered relatively easy with respect to the procedure itself and the postoperative rehabilitation. Often a TP transfer maybe the only TT procedure that is done in some hospitals. Isolation of the TT is easily taught.*
b) *In the circumtibial route the tendon becomes often adherent with the skin. Nothing to worry about! It is a good 'check' on the function of the muscle. Possible benefits of Ultrasound and/or friction to break the scar have not been shown and in our opinion do not compromise the excursion of the TP.*

C. PRE- AND POSTOPERATIVE CARE FOR THE PARALYSED FACE

The most common paralytic condition in the face is lagophthalmos, usually as a result of an isolated paralysis of the upper branch of the facial nerve. There are different surgical procedures available to correct a lidgap. The most common procedure is a lateral or medial partial suturing of the eyelids. No therapy is needed for this procedure.

A partial transfer of the temporalis muscle will restore the possibility for active eye closure again. Little re-education is needed for this procedure. Patients usually are on a liquid diet for the first week and gradually are allowed more solid food. Biting, closing the jaws actively, will result in voluntary eye closure. Patients will not develop involuntary eye closure, or an 'unconscious', integrated, use of the transfer as in footdrop surgery or surgery for paralysis of the intrinsic muscles of the fingers.

Whether a patient should be recommended a temporalis muscle transfer should depend on the sensory status of the eye itself and if the patient makes use of the so-called Bell's phenomenon: patients with protective sensation of the eye (trigeminal nerve) will regularly 'flip up' their eyeballs. This may be sufficient to protect their eyes.

In total facial palsy additional slips of the temporalis muscle and masseter muscle can restore the facial asymmetry. No specific exercises or re-education are needed. Little is known about long-term results of eyelid surgery. An assessment form to evaluate the outcome of tendon transfer surgery for footdrop correction is also given in the appendix of the book.

Mime-therapy seems promising in idiopathic facial palsy (Bell's palsy) when there is weakness of facial muscles.[1] There are no reports of the use of this therapy in facial palsy due to leprosy neuropathy.

PHYSICAL THERAPY MODALITIES

Electrotherapy may sometimes be indicated in tendon transfer surgery to help patients 'find' a muscle whose tendon has been transferred. If patients have problems finding a muscle then the first thing to do is to ask for contraction of that muscle on the contralateral side and then transfer this exercise.

Sometimes stimulation of the muscle may also be useful to find out if the muscle/tendon may have become adherent or detached (less common) in which case there will also not be an effective pull of the tendon.

Ultrasound is sometimes used to break down adhesions that may have occurred between tendons or tendon and skin. These could limit full excursion of a tendon. There is no evidence that this may be the case. Gentle friction and lengthening-shortening exercises will enhance the excursion of a tendon.[2]

SUMMARY

Tendon transfer surgery is very rewarding in well-selected individuals with paralytic sequelae due to peripheral neuropathy. Most functional and cosmetic impairments can be corrected and they will often enhance the quality of life. It is mandatory that a surgeon experienced in the various procedures performs the procedures and that postoperative therapy by therapists familiar with these procedures is available.

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