

INTRODUCTION

Physical rehabilitation can be defined as the process assisting persons who are limited or restricted in their individual range of activities to achieve an optimal level of functional ability. The rehabilitation process includes the socio-economic and mental aspects of the person's limitations and restrictions. However, for the special purpose of this book and its focus on the rehabilitation of individuals with neuropathic limbs, the present chapter will concentrate on the physical and functional aspects of rehabilitation.

Neuropathic limbs present a complex situation of impairment and resulting disabilities, which cause limitations and restrictions.^{3,34} In most of the cases, this will result in a lifelong process of rehabilitative interventions, including ongoing activities for the prevention of further impairment and disability.^{26,27} However, an awareness of the person's self-understanding is critical to the rehabilitation success. Therefore, one should not forget that the person has the right of choice and is an essential contributor to the rehabilitation process.^{20,35}

In contrast to the classic therapeutic model, emphasizing diagnosis and treatment, physical rehabilitation comprises of multiple simultaneous interventions addressing both the cause and the secondary effects of the disease. Comprehensive rehabilitation therefore requires certain components such as defining specific potentials, plans, and goals and involves an interdisciplinary process, as shown in Table 1.^{15,20,31}

Table 1: Components of physical rehabilitation.

- A unique plan, formulated by an interdisciplinary team, with the participation of the individual.
- Goals derived and prioritized through an interdisciplinary process.
- Full participation of the individual person.
- Improvement of the individual's functional potential.
- Reduction of the individual's impairments and activity limitations.

Based on these components, the various aspects of rehabilitation of neuropathic limbs will be described with experience and evidence based recommendations.

Definitions

The terminology in the field of rehabilitation has been confusing for a long time. Recently, the new WHO Classification of Functioning, Disability and Health (ICF) has been published and helps to clarify the various terms used in the rehabilitation process. As a member of the WHO classifications, ICF describes health and health-related domains as body functions and structures, activities and participation.^{17,18,24} These definitions are listed in Table 2 and will be referred to in this chapter.

Table 2: WHO definitions

<p>In the context of health:</p> <ul style="list-style-type: none"> ■ Body structures are anatomical parts of the body such as organs, limbs and their components. ■ Body functions are the physiological functions of body systems (including psychological functions). ■ Impairments are problems in function or structure such as significant deviation or loss. ■ Activity is the execution of a task or action by an individual. ■ Activity limitations are difficulties an individual may have in executing activities. ■ Participation restrictions are problems an individual may experience in involvement in life situations. ■ Environmental factors make up the physical, social and attitudinal environment in which people live. ■ Disability is the 'umbrella' term for impairments, activity limitations and participation restrictions.
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Phases of rehabilitation

Comprehensive rehabilitation requires knowledge of the individual’s personal life situation, roles, and aims. Therefore, the first phase of rehabilitation focuses on the individual examination, assessment, and additional measurements, if required. The impairments and activity limitations as well as their restricting effects on the person are assessed and quantified. The person’s unique characteristics that allow for adaptive capacity or compensation are identified and targeted for specific therapeutic interventions.^{20,31}

The second phase of rehabilitation emphasizes treatment to arrest the process causing further impairment and preventing secondary impairments. This is the phase of medical and

surgical interventions such as the long-term use of anti-inflammatory drugs to reduce the impact of the inflammation and destruction, or corrective surgery such as tendon transfers to enable the affected limbs to perform movements that were lost due to the disease.^{26,27}

The third phase focuses on the enhancement of physical performance, which is usually at the time of post-operative treatment and exercises. Physiotherapy can prevent further shortening of tendons, ligaments and atrophy of muscles and improve function through strengthening exercises and re-education and facilitation of functional movements.^{3,34}

In the following phase of rehabilitation there is a focus on total personal adaptive techniques to minimize the final limitations. This can be the identification of “trick movements” to improve the performance of tasks or the strengthening of pinch and grip function to train “survival skills” or systematic exercises to improve certain activities of daily living. During this time prevocational assessments can take place.⁶

The last phase of rehabilitation directs efforts toward environmental enhancement to reduce limitations and restrictions.^{20,29} Provision of adaptive tools, prosthesis and orthoses as well as modification of the individual’s environment belong to this phase. A wheelchair can be an option as well as simple grip devices or braces. If appropriate, the whole environment can be adapted according to the individual needs. Examples are the building of a ramp instead of steps or the provision of an elevator and the modification of doorways, toilets and bathrooms, which allow a better performance for those otherwise restricted in their participation in daily life.^{12,28,35}

The various phases and interactions of rehabilitation processes as well as their implications for the individual can be illustrated by case studies, such as the one presented below.

CASE STUDY

A 35 year old, female multi-bacillary (MB) leprosy case is referred after 6 month of multiple drug therapy (MDT) for treatment of reversal leprosy reaction (type 1) and nerve function impairment (NFI). Physical examination, skin smear and voluntary muscle test (VMT) as well as sensory testing (ST) are done. Because of new nerve function impairment a steroid course is started. Taking into account the loss of protective sensation a self-care training and protective footwear are prescribed at this stage.

The same patient is referred again after one year for reconstructive surgery of a bilateral lagophthalmos and a mobile clawing of the right hand as there was only partial response to the steroid treatment. Furthermore, there are now socio-economic problems because of activity limitations and the social stigma. A team meeting is conducted, goals are set, and interventions planned. Accordingly, pre-operative exercises for the right hand are started and a socio-economic assessment is done. Secondly, after 5 days, an intrinsic replacement for the right hand is performed and during the immobilization period a temporalis muscle transfer for both eyes is completed. After post-operative physio-therapy, occupational therapy is started including a pre-vocational assessment and counseling. With progressing function of both, the right hand's grip and pinch movement and bilateral eye closure, the patient is discharged after a hospitalization period of 6 weeks only.

The patient comes back for follow up after 3 month and shows good functional outcomes with no lid-gap any more and good grip and pinch function of the right hand. After a recent home assessment, the social worker has initiated tailoring classes and linked the client to a self-help group in her area. Asked about her opinion, the client is satisfied with the interventions so far and optimistic regarding the outcome of the rehabilitation process.

The rehabilitation team

It remains a challenge for health professionals to work in a team approach for the benefit of patients. However, rehabilitation comprises many different aspects including type and process of disease, primary and secondary impairments, various functional levels and special individual needs. These, in most of the cases, cannot be managed by one specialty alone or handled by individual professionals separately. Especially working with people affected by neuropathic limbs, a team approach is crucial to successful rehabilitation of the individual (Fig. 24-1).^{3,4,15,34}



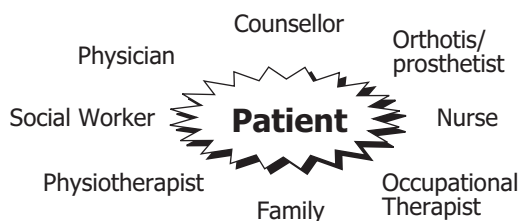
Figure 24-1 The rehabilitation team.

A health care team can be defined as a group of health professionals, each possessing particular expertise, who have a common purpose and goal (Fig. 24.2).^{23,31} The common purpose and goal of the rehabilitation team is the comprehensive medical and social rehabilitation of persons affected by disability. There is an organized division of work within the group. While all members share responsibility for the patient's well being, each individual is also responsible for making and implementing decisions in their own specific area within the framework of the whole plan. The members meet together to communicate, collaborate, and consolidate knowledge. From these meetings plans are made, actions determined, future decisions influenced, and results evalu-

ated. The ideal health care team is the interdisciplinary one wherein members of different disciplines are involved in formal and informal arrangements that produce integrated performance and service delivery.^{23,31}

Translated into the rehabilitation setting, the ideal rehabilitation team is the interdisciplinary team of professionals working in the various areas of the rehabilitation field being formally and informally connected through arrangements that maximize performance and outcome of the rehabilitation process.

Figure 24-2 Potential members of the rehabilitation team.



The formal structure of rehabilitation team meetings comprises three main parts and issues. First, defining the individual's rehabilitation potential. This potential is based on the functional ability of the individual but includes the aspects of possible improvement through various interventions. It is more or less the realistic question of what could be achieved through medical treatment, surgery, physiotherapy, occupational therapy, orthopaedic devices, counselling and socio-economic support for the affected individual. The second part is the setting of the individual's rehabilitation goal. Goal means the functional outcome or level of participation one aims for. It is important though, to discuss the individual potential and goal with the individual patient to elicit their opinion on the process and especially on the goal and outcome. Having determined the potential and goal, it is then essential to create an individual and specific

rehabilitation plan.^{15,20,31} Practically speaking, taking into account rehabilitation potential, rehabilitation goal and the patient's perspective, which interventions will be done, at what point of time and by whom?

Functional potential

Functional outcome measurements provide a baseline against which changes in function can be measured and monitored over time. These data are useful in determining the effectiveness of a particular intervention, such as surgery, physiotherapy or mobility devices.^{10,12,20}

In the context of rehabilitation, functional assessment has typically been applied to measuring what an individual is able to do for himself or herself, most commonly in self-care (activities of daily living, ADL) and mobility. Other areas of function frequently assessed include homemaking skills (cooking, cleaning, and laundry) and related instrumental skills, also referred to as community survival skills (telephone, managing finances, shopping). An activity scale used in our setting (GPAS) is based on 40 standardized questions, which measure the functional ability in our context. Most other functional assessment scales include an indicator of level of function, or degree of assistance needed to complete a particular task. The need for physical assistance ranges from indicators such as "care-taker" and "minimal assist" to "moderate assist" and "maximal assist" (Table 3).^{12,32}

However, measuring rehabilitation potential means more. Apart from assessing impairment and limitations, it also includes the future: "What can be achieved with the assessed functional ability taking into account additional conservative and operative interventions?" It needs the special gift or ability of starting a process, and at the same time, having the result already in mind, in order to coordinate the process efficiently. It also requires an

updated knowledge on possible rehabilitative interventions and a combined assessment of various professionals. The aim is nothing less than the optimal level of functional outcome according to the existing limitation and environment.

Interdisciplinary goal setting and planning

In the interdisciplinary approach, each distinct profession evaluates the person separately and interacts together at team meetings, where assessments, short-term and long-term goals are shared. The goals of each discipline are coordinated into a unified plan through the interaction of the team. The whole outcome therefore is more than the sum of the component parts. In our context, a team consisting of a surgeon, a physician, a physiotherapist, a nurse, an occupational therapist and an orthotist, will run assessment clinics. Decisions from these clinics determine the type of interventions to be performed, the sequence of the various activities, and the specific time frame for the individual rehabilitation process.^{4,15}

Protocols with fixed time frames for certain procedures are helpful,⁵ but should not be seen as the ultimate basis for the rehabilitation planning. If, for example, several interventions need to be planned, prepared and performed at the same time, one needs a good deal of management skills and common sense to provide the best quality of care in the shortest period of time. In the day to day management of a case, the physician and nurses have to be aware of the indications and contra-indications for the various interventions in order to guide the patient accordingly through all related medical and nursing procedures.

Timing for surgery is ideally done by the surgeon himself. But neuropathic limbs often present with conditions, where medical interventions, such as steroid treatment in leprosy reactions, are required first in order to prevent deterioration of the condition. The planning for

surgical interventions should also include consideration of the self-care needs of patients. It is no good planning interventions for both hands at the same time, when the patient will be immobilized for 3 weeks after the operation and might therefore be unable to perform even the simplest activities of daily living. The surgeon will also consider other, perhaps conservative, alternatives to surgical interventions and find ways to consult the physiotherapist, occupational therapist, and orthotist, who can be quite innovative in these cases.^{3,34}

It is well known that apart from the surgical procedure itself, physiotherapy and occupational therapy are the most important components of reconstructive interventions. There is no functional ability after a tendon transfer without pre- and post-operative exercises and re-education of muscle activities. The transfer of movements into usual settings and activities as well as successful application of the new activities into the vocational environment, is the challenge of occupational therapy. Without these techniques there is anatomical correction but no functional gain.

Orthoses and prostheses can replace functions that are impossible to achieve through other conservative or operative interventions. In the final phase of rehabilitation these adaptive devices should be considered and applied.

In summary, the interdisciplinary team approach is an exciting challenge and provides a comprehensive pathway for the rehabilitation of persons having neuropathic limbs.^{15,23,31}

Self-care and self-help: the participatory approach

People with neuropathic limbs are often limited in their activities of daily living. Deformities and disability also lead to psychosocial problems. Affected persons may not be able to get a job or may even quit their job due to the negative attitude of others against the disease or deformity. In this way the whole family may

suffer.

Prevention of impairment and disability is therefore of utmost importance to people with peripheral neuropathies and neuropathic limbs. It has also become clear that institutional activities alone are not sufficient to prevent further disabilities for such risk groups. Our own hospital data has shown that many admissions could have been prevented by simple but timely care at home. Sensory and motor impairments are often life-long and therefore need an approach that is sustainable over a long period of time and minimises social disruption due to long hospitalization. The strategy that is widely believed to be most effective is known as self-care.^{11,21,33}

Self care is based on the principle of transferring the prevention activities from the health professionals to the individual. It involves training individuals to be responsible for looking after their own affected body parts. This requires a transfer of knowledge, skills and motivation, which cannot be achieved by health education alone. It requires teaching as well as practice in a setting similar to the home situation. In such a setting people can learn to anticipate and overcome difficulties, using appropriate solutions under supervision and without risk of deterioration.

There have been very encouraging reports on the positive effect of self help groups in African and Asian communities. The World Health Organisation (WHO) encourages and supports community mobilisation and so called community based rehabilitation (CBR) programmes, since the overwhelming needs of those affected by disabilities and participation restrictions around the world cannot be met by institutions, programmes, and organisations only.

It has also been shown that self-help groups are a very successful tool for the reintegration of persons affected by leprosy into the community and for the continuing prevention of fur-

ther impairment. Apart from the reduction of foot ulcerations, qualitative outcomes include increased confidence to participate in society, restored dignity and self-respect and a sense of belonging to the community.^{2,11}

The role of assistive devices

A wide range of assistive devices are available to improve performance of the so called "community survival skills" or activities of daily living when there is a lasting impairment, which cannot be cured completely. In most cases simple devices improving grip function are sufficient to overcome activity limitations. These are foam padding for combs, cutlery and pens, which improve the grip function by simply increasing the contact area between hand and tool and decrease pressure through materials such as foam (Fig. 24-3). Special designed scissors can replace intrinsic function of the hand by integrating a spring or a plastic loop into the scissors, which then automatically will open after every cut (Fig. 24-4). Cutting boards are used to keep things fixed in place when cutting work needs to be done with a single hand only. For situations with severe deformity, such as complete loss of digits, the wrist cuff is helpful (Fig. 24-5 a-b). The pinch function, i.e. for writing, can be improved by simple writing aids as shown in the illustrations. Functional outcome assessment should take into account the avail-



FIGURE 24-3 Comb enveloped in microcellular rubber.



FIGURE 24-4 Scissors 'padded' and with a spring device to facilitate opening.



FIGURE 24-5 Wrist cuff as a writing aid (a) and an eating aid (b).

ability of assistive devices. Furthermore, in the process of planning surgical interventions one is advised to consider seriously whether the functional benefit of the operation really improves the functional ability more than the use of a simple assistive device.

Orthoses

Orthoses and braces, as external devices applied to certain body parts, provide support, improve function, correct flexible deformities, and prevent progression of fixed deformities. A temporary orthosis is referred to as a splint.

Orthoses can be constructed from metal, plastic, leather or any combination of these basic materials. Thermosetting materials develop a permanent shape when heat and pressure is applied.²⁹ For the prevention of further impairment and disability in neuropathic limbs, orthoses can play a major role. Apart from healing plantar ulcerations by immobilizing the involved feet, ankle foot orthoses (AFO) or patella tendon bearing braces (PTB) can be utilized for advanced stages of the neuropathic foot, when bone disintegration is imminent

(Fig. 24-6).^{11,8,34} Furthermore, protective footwear using micro-cellular rubber (MCR) inlays, can prevent plantar ulceration and related impairments.^{3,34} Different types of braces and orthoses can also be used to compensate limited ability or lost function. These devices are manufactured in our setting using high density polyethylene (HDPE) pipes that are heat moulded onto a plaster last. High density foam rubber covers the interior parts to provide adequate comfort. The resultant devices are rigid but lightweight, provide stability and protection, and costs of material are normally less than those for plaster bandages.⁸



FIGURE 24-6 Modified patella bearing prosthesis.

Physical modalities

Physical modalities that use physical energy for their therapeutic effect include thermotherapy (heat and cold), hydrotherapy, electrotherapy, light therapy (ultraviolet and laser), traction, and massage. Effects of general application of heat include relief of pain and muscle spasm, reduction of joint stiffness, and increase in joint range of motion.^{3,30,34} Superficial heating agents, such as paraffin or wax, are used in our setting to heat joints with relatively little tissue covering (hand and foot). Electrotherapy, the therapeutic use of electricity, can be used to transcutaneously stimulate nerves or muscles with surface electrodes. Its physiologic effects include muscle group contraction, which can increase joint range of motion (ROM), re-educate muscles, retard muscle atrophy and increase muscle strength. Its use in neuropathic limbs is limited due to the risk of electrochemical burns in skin with decreased sensation.^{20,30} The systematic effect of massage by means of rhythmically applied pressure and stretching of soft tissues can either be mechanical (lymphatic drainage, breaking of adhesion and softening scars) or reflexive (vasodilatation, relaxation and sedative effects). The “laying of

hands” also has psychological effects and can promote a sense of well-being.²⁹

Vocational assessment and guidance

For some patients it is impossible to resume their old profession, and retraining and vocational guidance are needed. Retraining should take into consideration the impairments and disabilities of the patient, including anaesthesia, so that in performing work there is no increase of impairment. Vocational guidance should consider the opportunities in the society and other local factors. It is no good training a person in a skill for which there is no opening, nor for a type of work that caste or ethnic group forbids. Direct client assistance and long-term interventions include also the risk of dependency on a specific programme or organisation. This does often prevent a sustainable income. Socio-economic interventions should therefore be carried out carefully and in a participatory approach including clients and their families in the decision making process as early as possible. Assistance should be offered after an extensive socio-economic assessment only, including a home visit. It has been shown however, that micro business skills training for people with disabilities provide opportunities for reintegration and income generation without creating too much dependency on the institution.^{6,9,14}

Outcome assessments

A number of functional assessment instruments have been developed over the last several decades, beginning with Rankin in 1957. These measurements vary in their purpose, scope, detail, and often the type of setting for which they were developed. The Barthel Index (1965) is one of the best known and most frequently used functional assessment scales. It has been extensively studied, showing its high degrees of validity, reliability and sensitivity to changes in function over time, and its use

across many types of physical disability. It has been used in our setting since 1997, but mainly for disabilities not related to leprosy. The original Barthel Index rates 10 aspects of function with a score ranging from 0 (dependent) to 100 (independent) (Table 3). The most commonly used instrument today is the Functional Independence Measure (FIM) consisting of 18 categories of function, each scored on a scale from 1 to 7. The FIM incorporates components of the Barthel Index but is more sensitive and inclusive.^{10,12,20,28,29}

related treatment. High ranked items for a good quality of life (QoL) include health care, faith in God, spouse, family, emotional support, friends, home, standard of living, children and family health.²⁸ Several factors that modulate QoL are influenced by interventions such as counselling. The techniques, which promote healthy coping, include discussion of different perceptions, stress management and guidance in changing perceptions to being useful and experiencing ways of enjoying life. Family members play a critical role in promoting such

TABLE 3: Categories of the modified Barthel Index.¹¹

	1 1QA\	2 Attempts task but unsafe	3 Moderate help required	4 Minimal help required	5 Full independent
Personal hygiene	0	1	3	4	5
Bathing self	0	1	3	4	5
Feeding	0	2	5	8	10
Toilet	0	2	5	8	10
Stair climbing	0	2	5	8	10
Dressing	0	2	5	8	10
Bowel control	0	2	5	8	10
Bladder control	0	2	5	8	10
Ambulation	0	3	8	12	15
Chair/bed transfers	0	3	8	12	15

Converted Score:

- 0-20 Total dependence
- 21-60 Severe dependence
- 61-90 Moderate dependence
- 91-99 Minimal
- 100 Independent of assistance from others.

Quality of life

Quality of life has become a slogan for assessing the outcome of all types of diseases and

behaviour change and should be included in interventions to facilitate healthy coping. Since depression and social support are the two most important predictors of QOL they must be addressed in the rehabilitation process. Other variables such as optimism, cognitive appraisal of the significance of disability, coping skills and family functioning are also predictive of QOL. A high score for activities of daily living (ADL) on discharge is another variable indicating good QOL. It has been suggested recently that it is better to talk about health related

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QoL.¹ Table 4 shows an example for a health related QoL assessment instrument.

TABLE 4: Dimensions of Quality of life (EQ-5D self-classifier)²²

- Mobility (no problem, some problems, confined to bed)
- Self-Care (no problem, some problems, unable for self-care)
- Usual Activities (no problems, some problems, unable to perform)
- Pain / Discomfort (no pain, moderate pain, extreme pain or discomfort)
- Anxiety / Depression (not anxious, moderately anxious, extremely anxious)

Patient satisfaction

Patient satisfaction appears to be influenced by numerous demographic and socio-economic factors, such as age, gender, race, social and educational level. All these are considered to affect the degree of satisfaction. In general, older patients tend to demand less and to be more satisfied with the services received. It should be acknowledged however, that the relationship between physical health and satisfaction with medical attention varies according to whether an individual's physical health is self-evaluated or whether it is medically evaluated.⁷

Summary

Rehabilitation is a process of combined actions rather than a single intervention. The rehabilitation process itself is divided in separate phases, which can be monitored and evaluated by certain instruments. Actions for rehabilitation are carried out by teams rather than by independent individuals and goal setting and planning are ideally also done in an interdisciplinary approach. The person affected by dis-

ability or activity limitation should actively participate and become the owner of the individual process as soon as possible and as much as possible under the given circumstances. In some cases rehabilitation can become a life-long process and continuing interventions are necessary. In other cases a single rehabilitative procedure can make a life-changing difference. However, medical interventions and social reintegration may eventually lead to the adaptation of a new fulfilling role for the individual in family and society. Evaluation of the individual's quality of life and satisfaction are needed to define the final outcome of the rehabilitation. With the full commitment to reach the optimal level of functional ability for the individual, rehabilitation can be quite a challenge but also a rewarding process for all involved.

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