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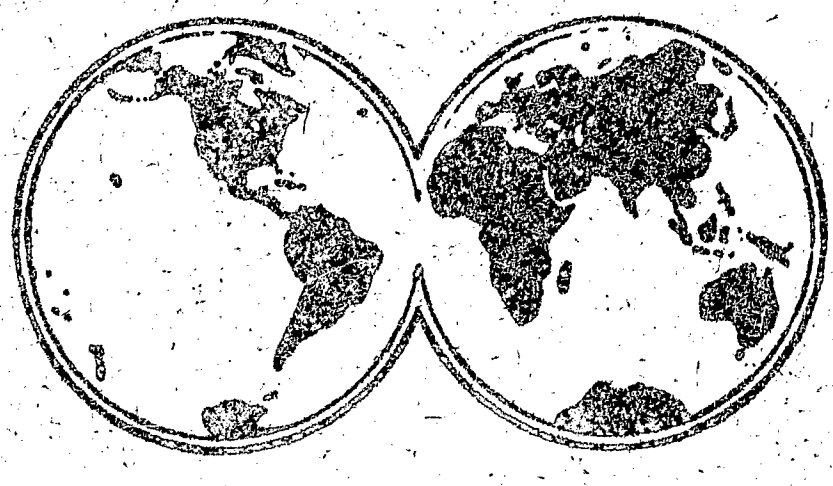
The purpose of this manual is to introduce the general concepts and techniques in leprosy rehabilitation to physical therapy aides. Because of the lack of well-trained, qualified, physical therapists, the committee on leprosy rehabilitation considers it necessary to publish a teaching manual outlining leprosy rehabilitation for those who work with leprosy patients in the field of physical therapy. This manual is to be used in conjunction with a training course for physical therapy aides under the direction of a qualified physical therapist or physician, and is not to be distributed as self-teaching material. Part I, "General Concepts," contains an outline of leprosy in general, common disabilities, deformities, and general orientation in rehabilitation. Part II, "Techniques," is devoted to a discussion of fundamental techniques which are commonly used in leprosy rehabilitation. Although the educational background for physical therapy aides may vary among nations, it is suggested that they should have completed at least grade 9 and preferably high school. Leprosy patients who are without serious disabilities and who meet the educational qualifications, may be trained as physical therapy aides. (CH)

INTERNATIONAL SOCIETY FOR REHABILITATION OF THE DISABLED

MANUAL FOR TRAINING LEPROSY REHABILITATION WORKERS

by

MASAYOSHI ITOH, M.D.
ALICE L. EASON, R.P.T.



Illustrated by

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

World Commission on Research in Rehabilitation

Committee on Leprosy Rehabilitation

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F O R E W O R D

When in 1960 the Council of the International Society for Rehabilitation of the Disabled established a Committee on Leprosy Rehabilitation under the chairmanship of the eminent Dr. Paul Brand of Vellore, India, it was implementing a recommendation of the World Health Organization urging that greater attention be given to the rehabilitation of the leprosy patient.

Within the past two decades the use of sulphone drugs has given new hope and new life to victims of leprosy. Continued research is necessary before all the problems in the pathology and treatment of leprosy deformities are solved. The International Society's Commission on Research in Rehabilitation has cooperated with the Committee on Leprosy Rehabilitation in supporting and encouraging research projects in this field in all parts of the world.

Rehabilitation techniques used in the treatment of deformities resulting from other disabling diseases can be effectively adapted for the leprosy victim. With this thought in mind, Dr. Mashoyoshi Itoh, a member of the Committee on Leprosy Rehabilitation, with the cooperation of Miss Alice Eason, A.P.T.A. has prepared this Manual which is intended to be used as a practical guide for non-professionals working under professional supervision.

The value of the Manual can be tested only by practical application. Its authors do not claim infallibility. Comments and criticisms are not only welcome, they are eagerly invited. All suggestions for improving or changing the material will be carefully considered and incorporated into a revised edition at a later date.

It is significant that the Pan American Health Organization of the World Health Organization has requested permission to translate the Manual into Spanish for distribution among its medical and paramedical staff in the Americas. We hope that it will impart new concepts of the rehabilitation potential of individuals suffering from leprosy among the dedicated professional and non-professional personnel working to ameliorate the effects of this ancient disease.

Howard A. Rusk, M.D., Chairman
Commission on Research in Rehabilitation
International Society for Rehabilitation
of the Disabled.

The publication of this Manual was made possible by the International Society's Commission on Research in Rehabilitation, Committee on Leprosy Rehabilitation, The Pope Foundation and American Leprosy Missions.

I N T R O D U C T I O N

In 1960, the Scientific Meeting on Rehabilitation in Leprosy, sponsored jointly by World Health Organization, Leonard Wood Memorial, and the International Society for Rehabilitation of the Disabled, was held at Vellore, South India. All participants in the meeting felt that the greatest need in leprosy rehabilitation is neither for building nor for equipment, but for trained personnel.

Concepts of modern rehabilitation are rather new, though techniques to treat disabled individuals were long ago established and practiced. Thus, the most important single need is the education of every leprosy worker in the fundamental principles of leprosy rehabilitation, both at present and in the future.

A well-trained, qualified* physical therapist may not always be available, even in institutions for leprosy treatment. In view of this fact, the Scientific Meeting recognized the need for the training of physical therapy aides** for leprosy rehabilitation.

The educational background for physical therapy aides may vary from one nation to the other. However, it was felt that they should have completed 9th grade or preferably be high school graduates in accord with United States public school standard. If a leprosy patient, without serious disabilities, meets this qualification, he too may be trained as a physical therapy aide.

Although there are a few pamphlets for orientation on leprosy for patients, their families, the general public, or for leprosy workers, there is no instruction manual in leprosy rehabilitation.

The Committee on Leprosy Rehabilitation of the International Society felt it was necessary to publish a teaching manual outlining leprosy rehabilitation, for those who work with leprosy patients in the field of physical therapy. The purpose of this manual is to introduce the general concepts and techniques in leprosy rehabilitation to physical therapy aides.

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* A physical therapist who graduated from a training school which meets the standard set by the World Confederation of Physical Therapy.

** The Scientific Meeting at Vellore recommended that the assistant in physical therapy be called an "Auxiliary Physical Therapist," although representatives of the International Society for Rehabilitation of the Disabled made a strong objection to this terminology. During the course of preparation for this manual, consultation was made with various authorities, and the authors felt "Physical Therapy Aides" was a more acceptable title than "Auxiliary Physical Therapist."

A qualified physical therapist who is familiar with leprosy rehabilitation is solely responsible for the training of physical therapy aides in leprosy rehabilitation. If the therapist is not available, the physician must undertake this task. This manual is to be used in conjunction with the training course for aides* by a therapist** or a physician and not to be a distributed as self-teaching material without instruction.

Part I, under the heading "General Concepts," contains and outline of leprosy, in general, common disabilities, deformities, and general orientation in rehabilitation. Part II, under the heading "Techniques," is devoted to a discussion of fundamental techniques which are commonly used in leprosy rehabilitation.

This manual is one of the outgrowths of the Scientific Meeting on Rehabilitation in Leprosy in Vellore, and is a product of the joint efforts of many specialists in rehabilitation and leprosy all over the world and the international Society's Committee on Research and Leprosy Rehabilitation.

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* In this manual, "aides" or "aide" refers to "Physical Therapy Aide(s)."

** In this manual, "therapist" refers to "qualified physical therapist."

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PART I

GENERAL CONCEPTS

1 : WHAT IS LEPROSY?

Leprosy is a contagious disease, caused by a germ called Mycobacterium leprae. This bacterium was found by Dr. Hansen in 1874. This is why leprosy is sometimes called Hansen's disease. This bacterium mainly attacks the skin, mucous membranes, and certain peripheral nerves. So far, man is the only known source of infection.

Clinically and pathologically, leprosy is divided into two major types: lepromatous and tuberculoid types. In addition to these, there are uncharacteristic and borderline forms.

Leprosy itself usually does not cause death. In the lepromatous type, several other complications shorten life, while in the tuberculoid type, the patient usually lives as long as a healthy person would.

The lepromatous type of leprosy is more frequent in males than females, while no sex differences have been found in the tuberculoid type.

2: IS LEPROSY AN INFECTIOUS DISEASE?

Leprosy is usually contracted in childhood, but exposure to the leprosy bacillus in adult life may cause infection. Leprosy is regarded as only slightly contagious, in most instances.

Persons suffering from the lepromatous type are regarded as the main source of infection, since myriads of bacilli are found in lesions of their skin, and often in their nasal discharge.

Leprosy bacilli are transferred from lepromatous patients to healthy persons either by direct contact, by inhalation of particles of sputum or nasal discharge, or by indirect contact with recently contaminated objects.

The period of latency from infection to signs of the disease varies from a few months to several years.

3: HISTORY OF LEPROSY IN THE WORLD

Much of the history of leprosy is little more than folklore, carried from one textbook to another. Leprosy is now a world-wide disease, and some authorities believe that leprosy was carried by infected travellers from tropical and subtropical countries. The word "LEPRA" in the Old Testament was vaguely applied to scaly skin erruptions, and does not necessarily mean present day leprosy, or Hansen's disease. The upper regions of the Nile have often been called the cradle of leprosy. Leprosy is believed to have originated in Africa, eventually spreading to Europe, Asia Minor, Asia and the American Continents.

4 : HOW MANY PATIENTS ARE THERE IN THE WORLD?

According to the latest reports, there are about 4.7 million* patients in the world. This means at least one in every thousand persons is a leprosy patient. There are at least 2.3 million patients in Africa, 1.5 million in India, 600,000 in Southeast Asia, and 200,000 in South America. There are a few countries, particularly in Europe, which reported fewer than ten patients.

5 : WHICH PARTS OF THE BODY ARE AFFECTED?

In advanced lepromatous cases, the skin of the whole body is affected. Under microscopic examination, abnormal changes of the skin tissue and leprosy bacilli are found everywhere, even in areas which appear normal. The skin of the palms and the soles are usually unaffected. The mucous membranes of the upper respiratory passages are eventually affected. Lymph nodes, liver, spleen, adrenals, bone marrow, and testicles are very often involved. Lungs, kidneys, and ovaries are seldom affected. Histologically, the leproma is characteristic of lepromatous type leprosy, and so-called "lepra cells", or globi, are common findings.

In the tuberculoid type of leprosy, the pathological change is more or less confined to the skin. Other organs are free from change, except for peripheral nerve involvement, and consequent trophic changes in soft tissues and bones.

The brain and spinal cord are not affected. The peripheral nerves in the extremities are always involved in both types of leprosy, particularly in the advanced stages. The ulnar, peroneal, and auricular nerves are characteristically enlarged. Nerves in the skin are always invaded in both types. These nerve involvements result in muscle atrophy, contracture, ulceration of the skin, lack of skin sensation, and bone changes.

6 : CLINICAL SYMPTOMS OF LEPROMATOUS TYPE LEPROSY

Nasal obstruction, nose bleeding, or disturbances in sensation are commonly reported, by the patient, as being the first symptoms. However, these conditions begin to develop long before the first complaint is made.

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* This figure is quoted from Leprosy Briefs Vol. 12, No.9 and No.10, 1961. Others estimate it as much as 12 - 20 millions. The actual population of leprosy patients in the world has not been known.

The first definite skin sign is a spot, or blotch, i.e., a macule, or plaque, or several of them. Later, widespread infiltration of the skin leading to thickening and exaggeration of the natural skin lines, and nodules are common in this type of leprosy. The hair of the eyebrows is lost.

Most patients with lepromatous-type leprosy have involvement of the nasal mucous membrane. Ulceration develops and causes destruction of the nasal septum, resulting in facial deformity. The term "leonine" has been used to describe the disfigurement of the face in advanced lepromatous leprosy.

Bacilli are always found in any involved skin or mucous membrane.

7 : CLINICAL SYMPTOMS OF TUBERCULOID-TYPE LEPROSY

The earliest sign most frequently seen in tuberculoid-type leprosy is the appearance of a patch, or macule, which is either pale or reddened in appearance. There is definite impairment of sensation in these skin areas. The patient may not notice any sign of skin changes in the early stage, until a leprosy reaction is indicated by widespread reddish skin patches, neuritis, fever, and joint pain. Bacilli are not commonly found in smears from the skin in this type of leprosy except during such reaction.

8 . IS IT EASY TO DIAGNOSE LEPROSY ?

It is extremely difficult to diagnose some types of leprosy in the early stages, particularly in the countries where leprosy rarely occurs.

In the early stages of the disease, even the patient himself does not notice various skin changes, or loss of sensation. Unless a complete physical examination including bacteriological study is done by a physician who is familiar with leprosy, a definite diagnosis cannot be made.

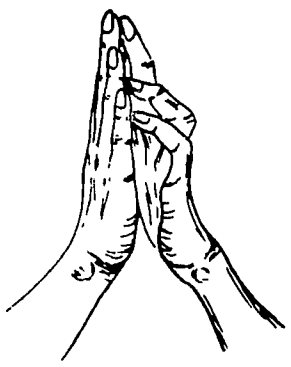
In the countries where leprosy is prevalent, advanced cases are usually diagnosed without difficulty.

The Mitsuda reaction reaction (late lepromin reaction) is usually negative in lepromatous leprosy and positive in tuberculoid type, but should not be relied upon for diagnosis.

Only a physician well experienced in leprosy should make a positive diagnosis. A member of a case finding team should take precautions in suspected cases, and arrange for an expert to see the patient as soon as possible.

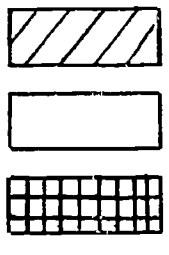
9 : ULNAR NERVE PARALYSIS

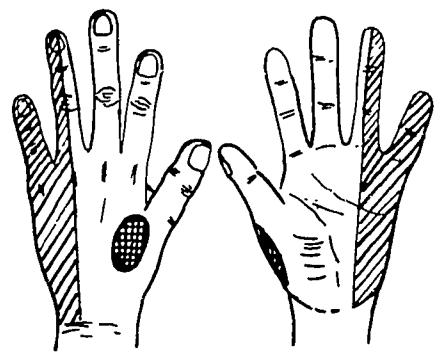
Fig. 1 - "Claw hand," deformity of the hand due to ulnar nerve paralysis. (Left side is a normal hand.)



"Claw hand" is the most characteristic deformity of the hand due to ulnar nerve paralysis (Fig. 1). The knuckles of the ring finger and small finger are hyperextended, with the top and middle joints of these fingers slightly flexed. Skin sensation of the small finger and half of the ring finger is lost (Fig. 2). Consequently, the patient finds difficulty in fine finger activities.

Fig. 2 - Sensory supply of the hand



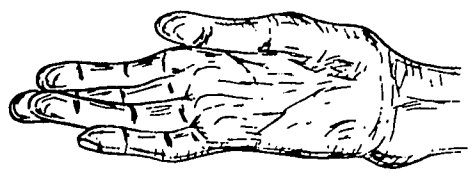


The ulnar nerve is the nerve most often involved in cases of leprosy.

10 : MEDIAN NERVE PARALYSIS

The most common site of damage on the median nerve in leprosy occurs just above the wrist, or just below the bend of the elbow. Median nerve paralysis is generally associated with a deformity known as the "monkey hand" (Fig. 3). Because of its flatness, due to wasting of the small muscles, and the characteristic position of the thumb, the appearance of the hand closely resembles a monkey's paw.

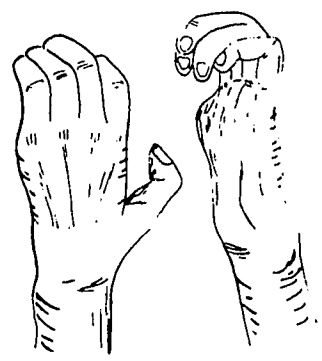
Fig. 3 - "Monkey hand," deformity of the hand due to median nerve paralysis.



There is a hyperextension deformity of the knuckles of the index and middle fingers. Grip between the fingertips is weak, and the patient has difficulty in many fine hand activities. Median nerve paralysis leads to difficulty in picking up both small and large objects. Because skin sensation is lost over the fingers, not affected by ulnar nerve damage (Fig. 2), the patient cannot feel objects placed in his grasp until he looks at them.

The combination of ulnar and median nerve damage is rather common in leprosy, and causes serious impairment of the function of the hand (Fig. 4).

Fig. 4 - Deformity of the hand due to the combination of ulnar and median nerve paralyses.



11 : RADIAL NERVE PARALYSIS

The characteristic deformity in radial nerve paralysis is "wrist drop" (Fig. 5). The patient is not able to extend the wrist or fingers, and has very poor grip. Sensory changes of the fingers is minimal (Fig. 2). This paralytic condition in leprosy is less common than the ulnar and median nerve varieties.

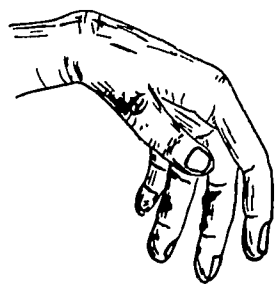


Fig. 5 - "Wrist drop," deformity of the hand due to radial nerve paralysis.

12 : OTHER DEFORMITIES OF THE HAND

After the above-mentioned paralyses have developed, lack of preventive treatment results in shortening of the skin and flexor tendons. These deformities must be considered irreversible, unless surgical correction techniques are employed. A patient does not often recognize slight injuries such as burns because of lack of skin sensation. Unless treated immediately, such injuries always become infected, and osteomyelitis (infection of bone) may follow. It is a known fact that leprosy affects bones frequently. In addition to the infectious process, inability to grasp evenly with the entire surface of the hand and exertion of excessive pressure on the fingertips due to anesthesia promote the absorption of the fingers.

13 : PARALYSIS OF THE COMMON PERONEAL NERVE

This condition in leprosy is the most common finding in the lower extremity, and is the counterpart of the ulnar nerve paralysis of the upper extremity, characterized by "drop foot." The patient is unable to dorsi-flex his ankle, and walks with a "steppage gait."

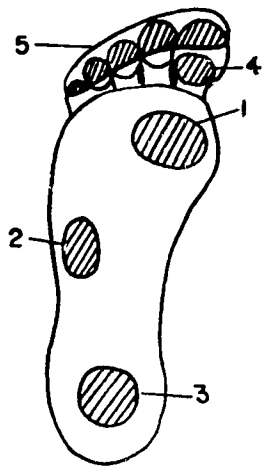
Clawing toes are the resulst of varying degrees of damage to the posterior tibial nerve. Combination of foot drop and claw toes are frequent. Prolonged cases of foot drop, without adequate treatment and preventive measures, causes shortening of the Achilles tendon. Common peroneal nerve paralysis may result in inversion of the foot.

14 : PLANTAR ULCER

The plantar ulcer, which is commonly seen on the sole of the leprosy patient's foot, is the result of injury to the anesthetic foot. This occurs in other diseases besides leprosy. Figure 6 shows the common sites of the

plantar ulcer on the undeformed foot.

Fig. 6 - Common sites of the plantal ulcer on the undeformed foot.
1. The I & II metatarsal heads
2. The tubercle at the base of V metatarus
3. The calcaneal tubercles at the heel
4. The head of the proximal phalanx of the great toe
5. The terminal phalanges of toes



The major mechanical causes are the shearing strain and abnormal walking pressure. The lack of sensation allows the patient to walk on sharp objects without feeling pain, and use ill-fitting footwear, which cause blisters and breaks in the skin without discomfort. Such injuries will not cause chronic ulcers, if treated promptly and the foot placed at rest by an appropriate orthopedic appliances.

Before an ulcer develops, the foot may present a small, well defined area which is tender to deep pressure, and swollen. Burning pain, especially at night in bed, is the usual complaint.

As the damage proceeds, the necrotic (dead) materials increase in volume, and a dark, reddish blister is formed. If the blister is not treated or protected, the necrotic materials finally break through the skin and an ulcer develops.

The recurrence of a plantar ulcer is a serious matter, since it shows that more damage of the foot is likely to occur in the absence of treatment.

15 : BLINDNESS

Blindness, a serious disability even for the average person, is a disaster for the leprosy patient who has lost sensation in his hands and feet.

The important eye lesions in leprosy are: (1) in the tuberculoid type, damage to the eyeball, by drying and trauma, due to lid paralysis, which may range from the simple drying and hardening of the corneal epithelium leading to corneal ulceration, and later to infection of the inside of the eyeball; (2) in the lepramatous type, direct invasion of the tissue of the front part of the eye by Myco. leprae, resulting in serious damage and in untreated cases eventually to blindness.

During leprosy reaction, involvement of the eye is greatly aggravated.

16 : DISFIGUREMENT OF THE FACE

Most disfigurements of the face are the result of lepromatous leprosy, except for lid paralysis (lagophthalmos) and facial paralysis, which are more common in the tuberculoid type.

Destruction of nasal framework has been discussed (see Page 3).

Lid paralysis is caused by paralysis of one branch of the facial nerve. This results in an inability to close the eyelids for protection of the eyeball. This condition leads to injury to the eye and may result in blindness. Paralysis of the lower facial muscles may occur in advanced tuberculoid leprosy making it difficult for the patient to take food and drink.

The loss of eyebrows is the result of lepromatous destruction of the hair follicles. Lepromatous infiltration affects the elasticity of the skin. Typical wrinkling and sagging of the skin develops, leading to the condition known as "sagging face." "Hanging lobule," which is distention of the ear lobe, is caused in the same way as "sagging face."

17 : HOW OFTEN DO LEPROSY PATIENTS BECOME DISABLED?

It is rather difficult to determine how many leprosy patients become disabled. A study conducted by several investigators, consisting of approximately 24,000 patients (with all types of leprosy), showed that nearly 30% had some degree of disability.

Disability is more common in older patients and in the advanced stages of the disease.

18 : WHAT IS THE TREATMENT FOR LEPROSY?

Since 1943, sulfone drugs have been found to be the most effective, and have taken the place of chaulmoogra oil preparations which were used for many years. Except for promin which is given intravenously, all other sulfone preparations, e.g., DDS, Diazone, and promizol sulphetrone, are usually given by mouth. Unfavourable side reactions, such as anemia, may occur but usually are not serious.

Known anti-tuberculosis drugs, such as streptomycin, or dihydrostreptomycin, are also found to be effective. PAS is also said to have some effect. Some researchers claim that aureomycin is useful.

Cortisone is useful for acute reactions in leprosy and is effective, although it is not useful in leprosy per se. Cortisone ointment for eye disorders due to leprosy is invaluable.

The study of B.C.G. inoculation for the prevention of leprosy has not yet produced conclusive results.

19 : WHAT IS REHABILITATION?

Rehabilitation is the restoration of the handicapped to the fullest physical, mental, social, vocational and economic usefullness of which he is capable. To achieve this, treatment of the physical disability is obviously necessary, but it must be accompanied by the education of the patient, his family and the public, so that not only can he take his normal place in life but society will also be willing to accept him and assist in his complete rehabilitation. Rehabilitation must start when the diagnosis is made and continue until the patient returns to full and normal life in the community again.

Rehabilitation can best be accomplished by the joint efforts of a "rehabilitation team," consisting of a physician, a surgeon, a physical therapist, an occupational therapist, a social worker, a vocational counselor, a psychologist, a speech therapist, and sometimes a religious counselor. No one member of the team is more important than another. Although every member of the team may not be available in many instances, team work of available staff is the most effective way to rehabilitate disabled individuals.

20 : WHY IS REHABILITATION OF LEPROSY PATIENTS IMPORTANT?

Leprosy manifests itself in nerves controlling sensation and motor activities of the hands, fingers, feet and face. This results in deformity and disability. Many patients lose their jobs because of these conditions, and become dependent upon relatives or the community for support.

Since the sulfone drugs have proven to be effective, leprosy will not develop to the advanced stage if detected early and properly treated. The centuries-long "dark ages" for leprosy patients should by now have come to an end. Nevertheless, more than a million persons in the world are now disabled from leprosy and disabilities will continue as long as leprosy exists.

Knowledge and skill for improving some disabling conditions caused by other diseases than leprosy have long been employed in the branch of medicine known as Physical Medicine and Rehabilitation. This knowledge and skill must be applied to leprosy patients; education will enable them to be more independent in self-care, more comfortable in daily living, more productive for themselves and, finally, to allow them to enjoy their lives.

In the very early phase of leprosy, the patient has no or minimal deformity. This is the best time to start rehabilitation. Early application of preventive rehabilitation care can minimize the extent of deformity and disability. One must remember that the most important aspect of rehabilitation is prevention of deformity.

Public education is very important in promoting rehabilitation of leprosy patients. Unless the community is willing to accept these rehabilitated patients, some efforts by the rehabilitation team will not be as useful as would be.

21 : THE ROLE OF THE PHYSICIAN AND SURGEON

The position of the physician in the rehabilitation team is unique. He diagnoses the disease and treats the patient, and in addition is the co-ordinator of the team. It is his responsibility to guide the team and utilize all its potential for the rehabilitation of the disabled.

Conservative treatments given by a physical, or occupational therapist may lessen the patient's disability a great deal. However, one must recognize the limitations of conservative treatment. After a reasonable trial with these treatments, if the patient's condition shows no improvement, the physician in charge of the rehabilitation team must re-evaluate the effectiveness of the treatment. When it is warranted, the patient should be referred to a surgeon for reconstructive surgery.

Even if skillful surgery is performed, post-operative results will be useless unless the patient is subsequently treated by the staff that may be limited but comprises the rehabilitation team. Thus, without the co-operation of the surgeon and the team, the patient would not have an opportunity to develop his maximum function.

22 : THE ROLE OF THE PHYSICAL THERAPIST AND PHYSICAL THERAPY AIDE

Physical therapy is one of the professions ancillary to medicine and physical therapists treat patients as directed by the physician. Together with other professions, such as nursing, occupational therapy and social service, physical therapy plays an important and dynamic role in the medical, social and economic rehabilitation of the physically handicapped.

Physical therapy is the art and science of physical treatment by means of therapeutic exercise, heat, cold, light, water, massage and electricity. Among the aims of treatment are the relief of pain, the increase of circulation, the prevention and correction of disability, and the maximum return of strength, mobility and co-ordination. Physical therapy also includes the performance of electrical and manual tests to determine the amount of impairment of nerve supply and the strength of muscles; tests to determine functional abilities; measurement of range of joint movement (Range of Motion), and measurement of vital capacity as diagnostic aids for the physician and for record progress.

The main objectives of physical rehabilitation for leprosy patients is (a) prevention of deformities, (b) correction of deformities, and (c) restoration of function. In order to obtain these objectives, rehabilitation of leprosy patients requires long term and continuous physical therapy. A vast number of leprosy patients need physical rehabilitation. These facts

prove that a large number of qualified physical therapists are essential for leprosy rehabilitation.

The demand for physical therapists is enormous in most countries and a universal shortage of therapists exists. It is probable that a very limited number of qualified physical therapists will be available for leprosy rehabilitation.

Thus, well trained physical therapy aides are expected to play a great part in leprosy rehabilitation. The aides are to assist the qualified therapist and treat patients under the supervision of the therapist.

23 : THE ROLE OF THE OCCUPATIONAL THERAPIST

The role of the occupational therapist is to carry out a treatment plan prescribed by the physician to attain previously established psychological, physical, and vocational objectives. The types of occupational therapy provided to achieve these objectives are supportive, functional, and pre-vocational treatment.

Very often, occupational therapy is mistaken for vocational training. Functional treatment is designed to increase muscle power and range of motion of the joints, to improve co-ordination and dexterity, and to increase endurance through the process of producing certain objects with tools or machines and sometimes through games. Pre-vocational testing and pre-vocational training are done by an occupational therapist.

Proper application of occupational therapy in conjunction with physical therapy may be useful for the restoration of function.

Frequently, an occupational therapist engages in the production of splints and self-help devices. In addition, the occupational therapist often trains the patient in activities of daily living when necessary.

24 : THE ROLE OF THE VOCATIONAL COUNSELOR

Physical restoration of the disabled leprosy patient is only a part of total rehabilitation. Upon completion of physical rehabilitation the patient will have acquired more physical ability and will meet the requirements of a wider variety of occupations for the support of himself and his family. The vocational counselor determines the patient's vocational potential and refers him to the available appropriate employment services. If it is indicated, the patient may undergo vocational training for a new trade which can be continued after his return to the community. When the patient is severely deformed or disabled, he may not be able to live in the community independently, even though he may be able to engage in a productive life. In this case, the individual must be placed in a sheltered workshop to continue a productive life. In order to provide a permanent home and job, the vocational counselor must work closely with the social worker. The other members of the rehabilitation team can be most helpful in assisting the vocational counselor to measure the patient's physical capabilities in terms of a specific job.

25 : THE ROLE OF THE SOCIAL WORKER

The social worker assumes the responsibility for social guidance and planning with the patient, his family, and the rehabilitation team so that the patient can live most effectively in his environment.

The worker should first obtain as complete a history of the individual and his family as is possible. A knowledge of his past adjustment to the stresses of life, emotional, cultural, family, and living patterns, education, and working skills are most necessary. This information will help the worker gain insight into the positive strengths of the social situation which can be utilized in later planning. Likewise, negative factors in the social stituation can often be reduced to facilitate total rehabilitation.

The social worker should help the patient to achieve:

1) complete co-operation with the rehabilitation program,
2) a realization of his ability to reach his rehabilitation goal,
3) a realization of his worth as an individual in society,
4) understanding of his physical limitations and plans to utilize his remaining abilities.

When the patient is to return to or remain in the community, the worker must arrange for the following: 1) suitable housing and living arrangements, 2) financial support if necessary, 3) family counselling and community education to help them adjust to the changing responsibilities.

If the patient remains in the leprosarium, the social worker should encourage him to function maximally and to develop his full potential in all areas.

When a vocational counselor is not available, the social worker should take the responsibility for vocational rehabilitation services.

26 : THE ROLE OF OTHER MEMBERS OF THE REHABILITATION TEAM

Regardless of the cause of the disability, the psychological problems of a disabled person may prevent him from gaining full benefit from a total rehabilitation program. These problems may be resentment, regret, withdrawal from reality, inferiority complex (a feeling that he is less valuable than other people), or depression. These conditions discourage the patient and he may lose his interest in his rehabilitation. In such cases, a psychologist determines the patient's mental outlook, and helps him to find his inner strength for restoration of his physical, social, and mental abilities. If it is necessary, the psychologist gives psycho-therapy to the patient.

Missionary workers of various faiths have been working with leprosy patients for the past centuries. Recently, chaplains have joined rehabilitation teams of a few non-sectarian institutions. Religious teachers can assist the patient in regaining human dignity and self-respect through spiritual interpretation and can give him spiritual strength to face reality. It

must be clearly understood that a religious teacher is neither a psychologist nor a social worker, although he may play a similar role in some instances.

When a patient has speech difficulty, a speech therapist evaluates the condition and gives appropriate therapy. Speech difficulty which requires a speech therapist is rare in leprosy.

27 : WHAT IS EXPECTED OF THE PATIENT IN REHABILITATION?

The most important role in successful rehabilitation is played by the patient. Unless the patient wants to improve his handicapped condition, nothing can be done through rehabilitation medicine. This is why all members of the rehabilitation team must help the patient physically, socially, and psychologically to motivate him (make him desire to do) toward his rehabilitation goal. The patient must not only be co-operative, but must play an active part in his rehabilitation.

In many instances, the rehabilitation team for leprosy may not have all the previously mentioned staff members. In this case, all existing members of the team must work together to close the gap. Even if every therapist and other para-medical workers are present on the team, the number of patients is always far greater than can be cared for by available personnel. This is particularly true in the case of physical therapists.

When a home care program is applied to these patients, they may live in a wide-spread geographical area. Although essential for the best results, it is impossible for a therapist or an aide to give daily exercises to each individual patient. The only alternative is that the therapist or the aide teaches the patient self-exercises. The therapist or the aide must explain the objectives of the treatment, outline the details of technique, give demonstrations, indicate the minimal frequency of exercises, and give mandatory precautions. The therapist or the aide must stay with the patient until he understands how to perform the exercises adequately without supervision.

It is very difficult to admit all disabled leprosy patients to a rehabilitation center and very often it is not desirable. Even if patients are in a rehabilitation center, it is an extremely difficult task to motivate them toward their rehabilitation. Unless a patient is really willing to improve his disabilities, all efforts of a rehabilitation team will be fruitless. This is more true of a home care program patient. As old saying says, "You may lead a horse to water, but you can not force the horse to drink." Without his willingness and participation, no rehabilitation can be done.

PART II

TECHNIQUES

.1 : WHAT IS RANGE OF MOTION (R.O.M.)?

R.O.M. can be defined as the amount of movement present in a joint passively and actively, and it is measured in degrees. R.O.M. in a normal joint is approximately the same passively, and it may decrease or increase depending on the patient's disabling condition.

1. Active R.O.M.: R.O.M. which is performed by the patient.

2. Passive R.O.M.: R.O.M. which is performed by the examiner and the patient does not participate.

It is useful to know active R.O.M. as well as passive R.O.M. because:

1. Active R.O.M. never exceeds passive R.O.M..

2. If both active and passive R.O.M. are normal, this indicates that there is no abnormality in joint motion and muscle power is functional (see Page 20).

3. If active R.O.M. is the same as passive R.O.M., but is less than normal R.O.M., this indicates that the muscle power is functional within the limited range, a contracture exists, or some pathology is present in the joint.

4. If active R.O.M. is less than passive R.O.M., this indicates

   a. Muscle power is non-functional (see Page 20), or
   b. Discomfort exists during joint movement, or
   c. Combination of a. and b.

A gonimeter is a device marked in degrees which is used to measure an angle. This is customarily used to measure R.O.M. by a physical therapist. This equipment may not be available in many areas. It is possible, however, to measure the degrees by looking at the angle that is formed between the starting point and the end point of a movement. THIS METHOD WILL BE USED IN THIS MANUAL. If possible, every physical therapy aide should be instructed in the accurate method of measuring R.O.M. with a gonimeter.

The R.O.M. test is done upon initial examination of the patient and should be repeated periodically to find any increase or decrease of the range. The comparison of the R.O.M. tests, before and after a reasonable period of exercise, is most helpful in evaluating the effectiveness of the exercise and determining the need for surgical correction of the joint which has been treated.

When a person becomes disabled from a disease or an accident, his muscles often become weak, tight or both. The joint becomes stiff from weeks, months, or years of inactivity. These weak or tight muscles and stiff joints are apt to cause a decrease in R.O.M. of joints. If this decrease in R.O.M. persists over a period of time, a contracture or ankylosis may develop.

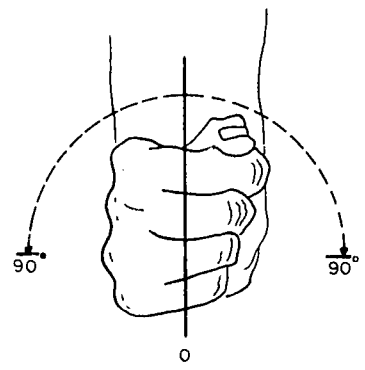
A contracture which is a condition that limits R.O.M., is caused by shortening of a tendon, muscle, joint capsule (sack covering the joint), or skin and sometimes by scar tissue. If the muscle on one side of a joint is stronger than one on the other side, the stronger muscle will tend to pull the weaker toward its side. Thus, muscle imbalance develops, limits the R.O.M., and results in a contracture.

R.O.M. can be increased by stretching the contractures. If stretching is unsuccessful, a tenotomy which is a surgical operation to cut tendons, or tendon lengthening may be performed to increase the R.O.M.. If nerve damage and stiffness of the joint are rather fresh, manipulation is possible and there is a good possibility of increasing or maintaining the existing R.O.M. with the proper exercises.

An ankylosis differs from a contracture in that bony changes occur in the joint which cause it to be locked or fixed. This does not respond to stretching. Though bone diseases in the joints are the main cause of ankylosis, an extremely long standing contracture may develop into ankylosis.

2 : R.O.M. OF FOREARM

Fig. 7 - Pronation & Supination



I. SUPINATION Fig. 7, Range: 0 - 90 degrees

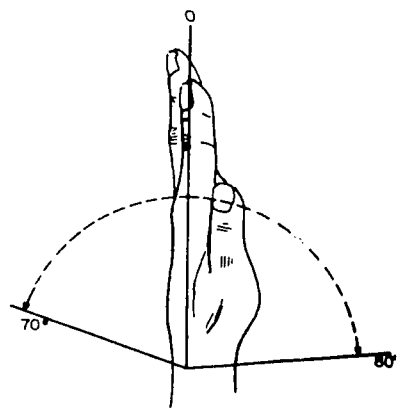
Instructions: Have the hand in the position as shown in Fig. 8. The examiner turns the hand over as far as possible, so that palm of the hand and curled fingers are facing upward. Measure the angle.

II. PRONATION Fig. 7, Range: 0 - 90 degrees

Instructions: Same as supination except the examiner should turn the hand over in opposite direction so that the back of the hand is upward, and measure the angle.

3 : R.O.M. OF WRIST

Fig. 8 - Flexion & Extension



I. FLEXION Fig. 8, Range: 0 - 80 degrees

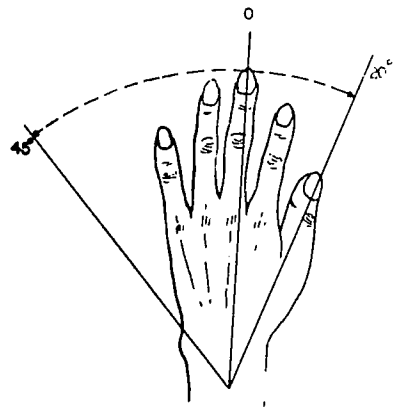
Instructions: The examiner holds the patient's forearm with one hand, and the other hand is used to bend the wrist. Bend the wrist down as far as possible, and measure the angle.

II. EXTENSION Fig. 8, Range: 0 - 70 degrees

Instructions: The position of the examiner's hands are the same as in flexion of the wrist. Bend the wrist back as far as possible, and measure the angle.

III. ABDUCTION Fig. 9, Range: 0 - 20 degrees

Fig. 9 - R.O.M. of wrist
Abduction &
Adduction



Instructions: Have the hand flat with palm of the hand down. If the right hand is tested, swing the wrist to the left, and if the left hand is tested, swing the wrist to the right as far as possible. Measure the angle using the third finger as a guide. All movement should take place in the wrist and not in the fingers.

IV. ADDUCTION Fig. 9, Range: 0 - 45 degrees

Instructions: The starting position of the wrist and the hand is the same as in abduction. Swing the wrist to the left on the left hand, and to the right on the right hand. Measure the angle in the same manner as in abduction.

4 : R.O.M. OF FINGERS

Fig. 10 - R.O.M. of 1st joints of fingers
Flexion,
Extension &
Hyperextension

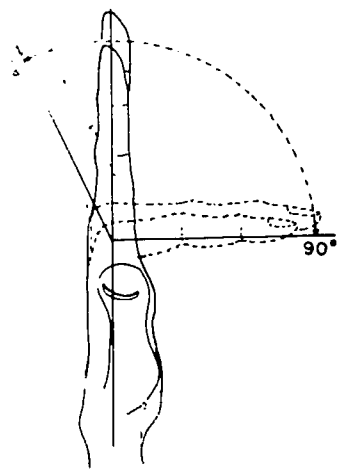
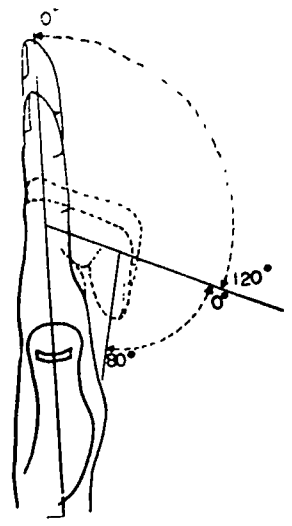


Fig. 11 - R.O.M. of 2nd & 3rd joints of fingers.
Flexion &
Extension



I. FLEXION Fig. 10, Range: 1st joints 0 - 90 degrees
Fig. 11, 2nd joints 0 - 120 degrees
Fig. 11, 3rd joints 0 - 80 degrees

Instructions: Bend each joint down separately and measure the angle.

II. EXTENSION Fig. 10 & 11, Range: Opposite of flexion

Instructions: Straighten each joint out from the flexed position as far as possible, and measure the angle.

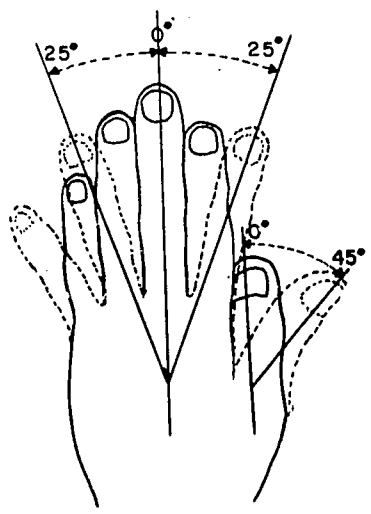
III. HYPER-EXTENSION OF 1ST JOINTS Fig. 10, Range: 0 - minus 20 or 30 degrees

Instructions: Have fingers straight (0 degrees in Fig. 10), and the examiner bends fingers back as far as possible and measures the angle.

IV. ABDUCTION OF FINGERS Fig. 12 Range: 0 - 20 or 25 degrees

Instructions: Place the hand flat on a table and spread the fingers apart as far as possible and measure the angle between each finger.

Fig. 12 - R.O.M. of fingers
Abduction &
Adduction

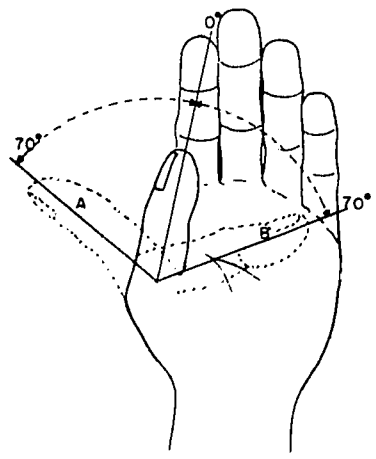


V. ADDUCTION OF FINGERS Fig. 12, Range: 25 or 20 - 0 degrees

Instructions: The examiner spreads fingers apart and places the hand flat on a table. Then move the fingers as close as possible and measure the angle.

5 : R.O.M. OF THUMB

Fig. 13 - Flexion & Extension



I. FLEXION Fig. 13, Range: 0 - 60 or 70 degrees

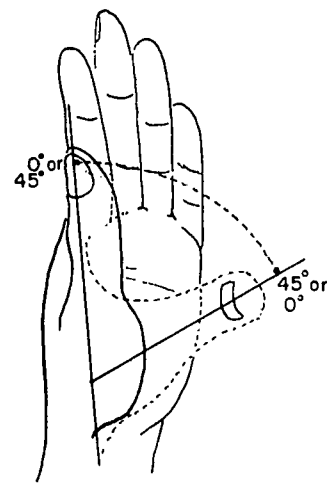
Instructions: Bend the thumb into the palm of the hand as far as possible and measure the angle.

II. EXTENSION Fig. 13, Range: 70 or 60 - 0 degrees

Instructions: Bend the thumb out as far as possible and measure the angle.

III. ABDUCTION Fig. 14, Range: 0 - 45 degrees

Fig. 14 - R.O.M. of thumb Abduction & Adduction



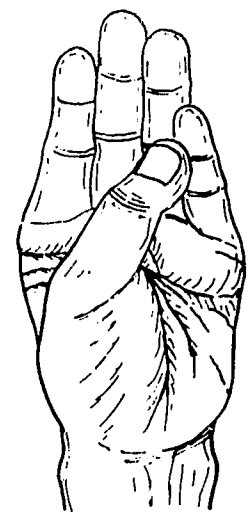
Instructions: Bend the thumb straight away from the 2nd finger and measure the angle.

IV. ADDUCTION Fig. 14, Range: 45 - 0 degrees

Instructions: The thumb is straight away from the 2nd finger. Move the thumb from this position to the palm side of the 2nd finger and measure the angle.

V. OPPOSITION Fig. 15

Fig. 15 - R.O.M. of thumb Opposition

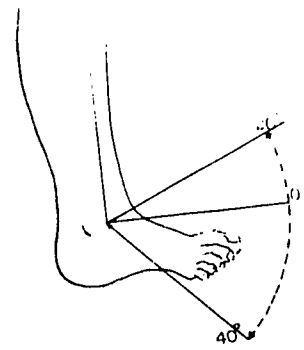


Instructions: Bring the thumb and the little finger together keeping each one straight. This angle is not usually measured.

6 : R.O.M. OF FOOT

Place the patient on a table on his back with his legs on the table.

Fig. 16 - R.O.M. of Ankle & Foot Plantar flexion & Dorsi-flexion



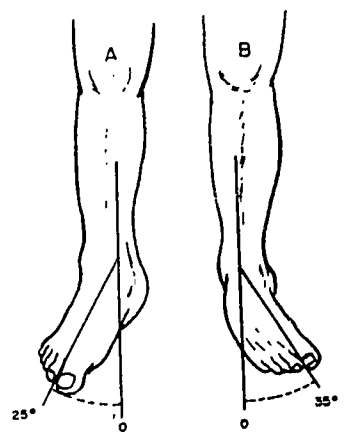
I. PLANTAR FLEXION Fig. 16, Range: 0 - 40 degrees

Instructions: Bend the patient's foot down as far as possible, and measure the angle from 0 degrees (neutral or mid-position).

II. DORSI-FLEXION Fig. 16, Range: 0 - 20 degrees

Instructions: Bend the patient's foot up as far as possible and measure the angle from 0 degrees.

Fig. 17 - R.O.M. of Ankle & Foot
Inversion &
Eversion



III. EVERSION Fig. 17, Range: 0 - 25 degrees

Instructions: The examiner turns the foot outward as far as possible and measures the angle between the starting and final position using the 2nd toe as a landmark.
There should be no movement in the leg but only in the ankle.

IV. INVERSION Fig. 17, Range: 0 - 35 degrees

Instructions: The examiner turns the foot inward as far as possible. Measure the angle as above by the 2nd toe. No movement should take place in the leg.

7 : R.O.M. OF TOES

I. FLEXION Range: 1st joints 0 - 25 or 35 degrees
2nd joints 0 - 50 to 90 degrees

Instructions: Bend the toes down as far as possible and measure the angle of each joint.

II. EXTENSION OF 1ST JOINTS Range: 0 - 80 degrees

Instructions: Bend the toes as far back as possible and measure the angle.

III. ABDUCTION Range: 0 - 15 to 20 degrees

Instructions: Spread the toes apart as far as possible and measure the angle.

IV. ADDUCTION Range: 15 - 0 degrees

Instructions: From a spreaded position, the examiner moves toes to closed position so as to touch one another.

8 : WHAT IS MUSCLE TESTING?

Every day movements such as walking, opening a door, or eating can be done if our muscles are strong. If for any reason these muscles become weak, it would be difficult or impossible to perform such activities.

Weakness in muscle power in leprosy patients indicates that there is damage to the nerves that control those muscles. It may also indicate disuse atrophy or both. Muscles that are weak from not being used (disuse atrophy) usually respond to exercises more than the muscles that have nerve damage.

There can be many degrees of weakness in muscle power. Therefore, there must be some means of determining the extent of the weakness. This is done by doing a muscle test.

A muscle test is useful:

1. for determining which muscle or muscles are weak,
2. as a guide to the progress or regression of the condition,
3. for the physician to prescribe strengthening exercises
4. to the surgeon in planning reconstructive surgery.

In testing muscles, the extremity being tested should be placed in such a manner that it can do its maximum work with or without resistance. Resistance can be defined as any force that works against another to prevent it from moving or to slow it down. The examiner provides the resistance.

For the purpose of this manual, the specific grades of muscles which are customarily used will not be given. To attempt such in this manual would be too complicated and involved. Instead, the strength of the muscles will be classified as either 1) Functional or 2) Non-functional.

1. A functional grade would indicate that a muscle or muscle group is able to perform a movement through complete R.O.M. against gravity with or without resistance applied. (Gravity is a downward force that gives weight to everything on the earth. Gravity is considered as one type of resistance in muscle testing).

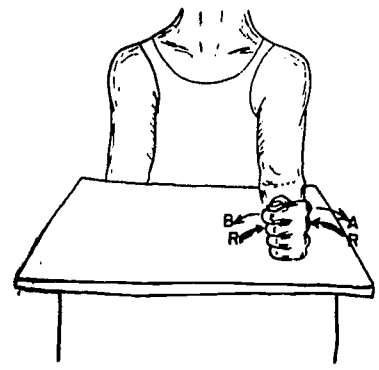
2. A non-functional grade would indicate that a muscle or muscle group is able to perform a movement through the complete R.O.M. or through part of the R.O.M. with gravity elimated and without resistance applied. Gravity must be eliminated in the non-functional testing position to enable a weakened muscle to do its maximum work. This is done by changing the position of the part of the body being tested.

The test for a functional grade of a muscle or muscle group should be performed first. If the patient is unable to do the movement asked or able to do it only once, then the non-functional test should be done. Each movement in each test should be repeated from three to five times before recording the grade.

Tests for muscle weakness in the forearm, hand and foot will be described in this manual as these muscles are the ones usually involved in leprosy.

9 : MUSCLE TESTS FOR FOREARM MOTION

Fig. 18 - Muscle Tests for Wrist Motion.
A: Supination
B: Pronation
R: Resistance



I. SUPINATION Fig. 18

A) Starting Position

Hand is on a flat surface resting on the border of the little finger with the thumb on top. Fingers are bent to form a fist. Elbow is bent and held against the side of the body.

B) Instructions

Ask the patient to turn the hand over so that the bent fingers and the thumb are visible. Movement should take place in the forearm and not in the shoulder.

C) Resistance

The examiner should hold the forearm firmly just above the wrist and with the other hand he pushes against the patient's hand as it is turning.

D) Grades

1. Functional: The patient is able to turn the hand over through the complete R.O.M. with or without resistance applied.

2. Non-functional: The patient is able to turn the hand through partial R.O.M. with no resistance.

II. PRONATION Fig. 18

A) Starting Position

The same as supination.

B) Instructions

Ask the patient to turn the hand down so that the back of the hand can be seen.

C) Resistance

Apply in the same manner as in supination, but the direction of resistance is opposite.

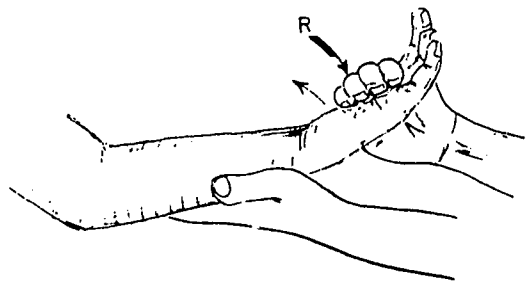
D) Grades

1. Functional: The patient is able to turn the hand down through the complete R.O.M. with or without resistance applied.

2. Non-functional: The patient is able to turn the hand through a part of the R.O.M. without resistance applied.

10 : MUSCLE TESTS FOR WRIST MOTION

Fig. 19 - Muscle Tests for Wrist Flexion
Functional grade test.



1a) FLEXION - Functional muscles

A) Starting Position

The arm is in a position with palm of the hand face up.

B) Instructions

Ask the patient to bend the wrist upward as far as possible. Make sure he bends only the wrist and not the fingers. The palm of the hand should now be toward patient's shoulder. The fingers will be curved slightly.

C) Resistance

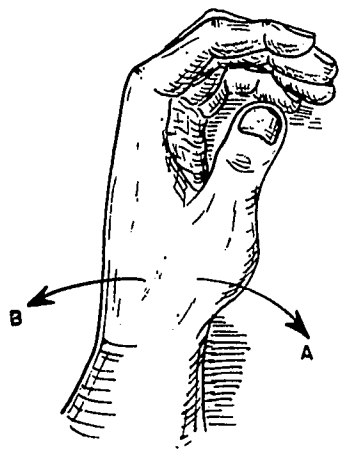
Applied to the palm of the hand in opposite direction (downward) to the motion.

D) Grade: Functional

The patient is able to bend the wrist through the complete R.O.M. with or without resistance applied.

1b) FLEXION - Non-functional Muscles Fig. 20

Fig. 20 - Muscle Tests for Wrist Flexion (A) & Extension (B) Non-functional grade tests



A) Starting Position

The hand should be on a flat surface, resting on the border of the little finger.

B) Instructions

Ask the patient to bend the wrist as much as possible. Fingers will be slightly curved.

C) Resistance

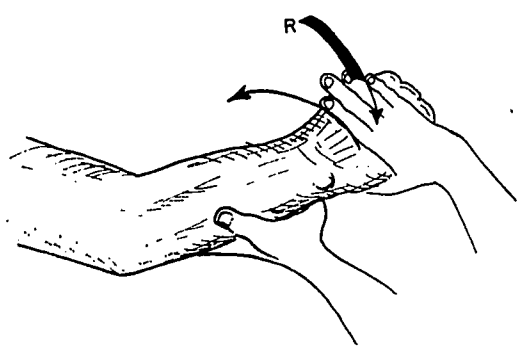
None

D) Grade : Non-functional

The patient is able to bend the wrist through the complete or partial R.O.M.

IIa) EXTENSION - Functional Muscles Fig. 21

Fig. 21 - Muscle Tests for Wrist Extension Functional Grade Test



A) Starting Position

The arm is in a position in which the back of the hand is visible and palm is down. The forearm is held or supported by the examiner.

B) Instructions

Ask the patient to bend the wrist back as far as possible with fingers slightly bent or curved.

C) Resistance

Try to push the patient's hand down in opposite direction.

D) Grade: Functional

The patient is able to bend the wrist back through the complete R.O.M. with or without resistance applied.

IIb) EXTENSION: Non-functional muscles Fig. 20

A) Starting Position

The hand is resting on the border of the little finger.

B) Instructions

Ask the patient to bend the wrist back as far as possible

C) Resistance

None

D) Grade: Non-functional

The patient is able to bend the wrist back through the complete or partial R.O.M.

III) ABDUCTION Fig. 22

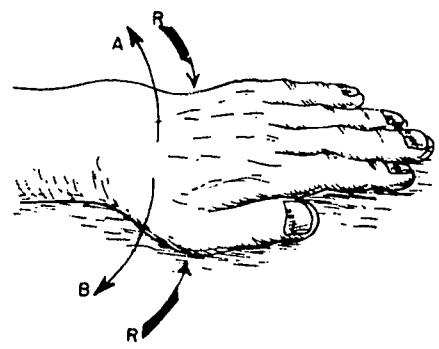


Fig. 22 - Muscle Tests for Wrist Abduction(A) & Adduction(B), R: Resistance

A) Starting Position

The hand is flat on a table and the back of the hand is visible.

B) Instructions

The examiner holds the patient's arm to keep it still during movement. If examining the left hand, ask the patient to bend the wrist to the right, to the left if examining the right hand. Movement should be in the wrist only and not in the forearm.

C) Resistance

Applied on the thumb border of the hand in the opposite direction to the motion.

D) Grades

1. Functional: The patient is able to bend the wrist to the right on the left and, to the left on the right hand, through the complete R.O.M. with resistance.

2. Non-functional: The patient is able to bend the wrist through the complete or partial R.O.M. without resistance applied.

IV) ADDUCTION Fig. 22

A) Starting Position

The same as abduction.

B) Instructions

The same as abduction except the patient bends the wrist to the left if examining on the left hand and to the right on the right hand.

C) Resistance

Applied on the little finger border of the hand in the opposite direction to the motion.

D) Grades

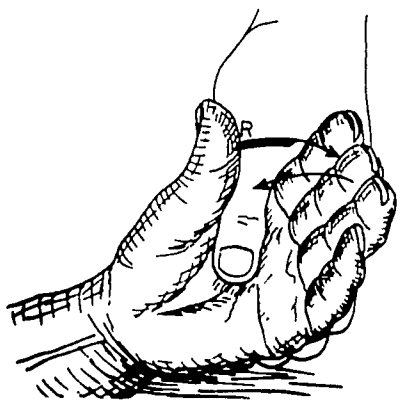
1. Functional: The patient is able to bend the wrist of the left hand to the left side through the complete R.O.M. with resistance applied.

2. Non-functional: The patient is able to bend the wrist of the left hand to the left side through the complete or partial R.O.M. without resistance applied.

II : MUSCLE TESTS FOR FINGER MOTION

Ia) FLEXION OF 1ST JOINT (KNUCKLE): Functional muscles Fig. 23

Fig. 23 - Muscle tests for flexion of 1st joints of fingers R: Resistance Functional grade tests.



A) Starting Position

The hand is resting on a table with the palm side up.

B) Instructions

Ask the patient to keep his fingers straight and to bend only his knuckles. To keep him from bending his wrist, the examiner grasps the middle of the hand placing his thumb in palm, fingers on the back and holds the hand in a neutral or mid-position.

C) Resistance

Applied against the fingers in opposite direction to the motion.

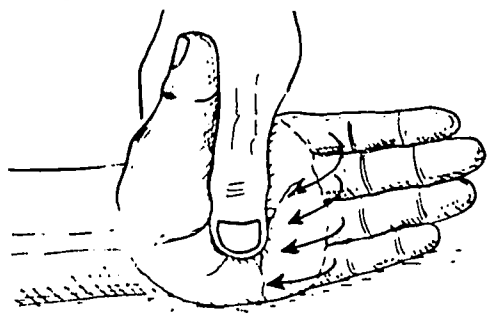
D) Grade: Functional

The patient is able to bend fingers at knuckles while holding fingers straight through the complete R.O.M. with or without resistance.

Ib) EXTENSION OF IST JOINTS: Functional muscles

Fig. 24 - Muscle tests for flexion of lst. joints. Non-functional grade tests.

Fig. 24



A) Starting Position

The hand and arm in the mid-position and resting on the border of the little finger.

B) Instructions

Ask the patient to bend the knuckles and keep the fingers as straight as possible.

C) Resistance

None

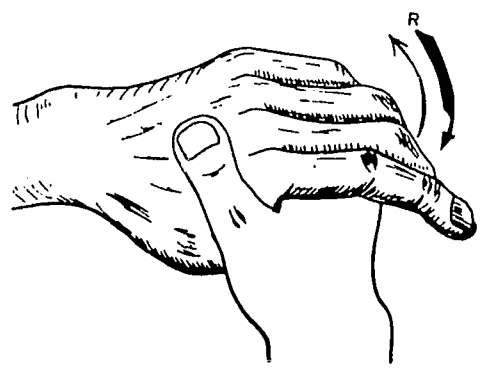
D) Grade: Non-functional

The patient is able to bend the knuckles through the complete or partial R.O.M.

IIa) EXTENSION OF IST JOINTS: Functional muscles

Fig. 25

Fig. 25 - Muscle tests for extension of lst joints of fingers. Functional grade tests. R: Resistance



A) Starting Position

The arm relaxed, the hand is supported and the back of the hand is visible. Fingers should be bent.

B) Instructions

Ask the patient to keep the fingers bent and bring them back as far as possible. The movement should take place in the knuckles only.

C) Resistance

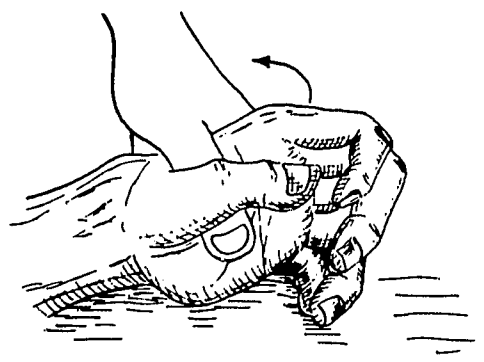
Applied to the back of the fingers in a downward direction.

D) Grade: Functional

The patient is able to bend the fingers back at the knuckles through the complete R.O.M. with or without resistance.

IIb) EXTENSION OF 1ST JOINTS : Non-functional muscles Fig. 26

Fig. 26 - Muscle tests for extension of 1st joints of fingers
Non-functional grade tests



A) Starting Position

The hand is in the mid-position or resting on the boder of the little finger. The examiner grasps the palm of the hand and holds it in this position without interferring with the motion of the 1st joints.

B) Instructions

Ask the patient to keep fingers bent or curled and then bring them back as far as possible. The movement must take place in the knuckles only.

C) Resistance

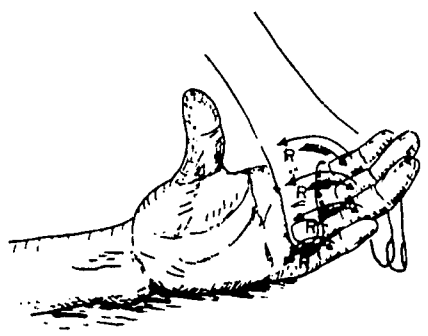
None

D) Grade: Non-functional

The patient is able to bend the fingers through the complete or partial R.O.M..

IIIa) FLEXION OF 2ND JOINTS - Functional muscles Fig. 27

Fig. 27 - Muscle tests for flexion of 2nd joints. R: Resistance.
Functional grade tests



A) Starting Position

The arm is in a resting position with palm of the hand up. All fingers are straight.

B) Instructions

The 1st joint should not move. The examiner holds the 1st joints with his thumb across the back side of the 1st joints. His other fingers across the back side of the 1st joints. Ask the patient to bend the 2nd joints as far as possible. Do each finger separately.

C) Resistance

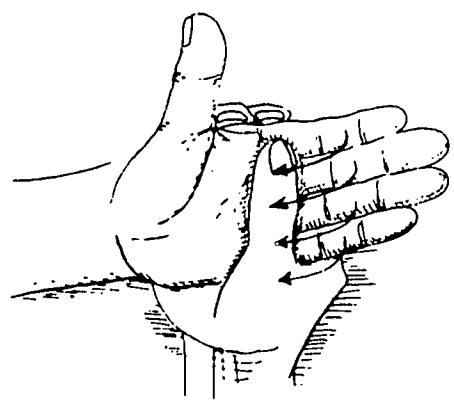
Applied on the palm side of fingers between the 2nd and 3rd joints in the opposite direction of the movement.

D) Grade: Functional

The patient is able to bend the 2nd joints through the complete R.O.M. with or without resistance.

111b) FLEXION OF 2ND JOINTS: Non-functional muscles Fig. 28

Fig. 28 - Muscle tests for flexion of 2nd joints. Non-functional grade tests.



A) Starting Position

The hand is resting in the palm of the examiner's hand. The fingers are out straight.

B) Instructions

The examiner holds the 1st joints in the same manner as in the functional test instructions, and then asks the patient to bend the 2nd joints as far as possible.

C) Resistance

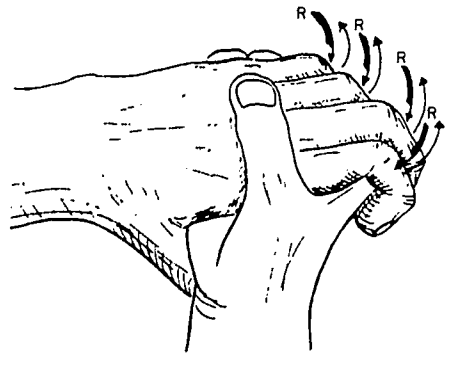
None

D) Grade: Non-functional

The patient is able to bend the 2nd joints through the complete or partial R.O.M..

lVa) EXTENSION OF 2ND JOINTS: Functional muscles Fig. 29

Fig. 29 - Extension of 2nd joints of fingers
Functional grade muscle tests
R: Resistance



A) Starting Position

The arm is in a resting position. The back of the hand is visible and the palm is down. Fingers are relaxed and slightly curved. The hand is supported.

B) Instructions

The examiner holds the lst joints with his thumb across the back of fingers and his index finger across the palm side of fingers. Ask the patient to straighten or bend back the fingers of the 2nd joints. Each finger can be tested separately which may be easier.

C) Resistance

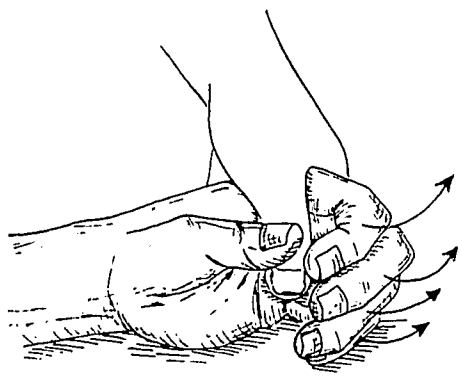
Applied to the back of fingers between the 2nd and 3rd joints in the downward direction.

D) Grade: Functional

The patient is able to straighten fingers out from the relaxed position through the complete R.O.M. with or without resistance applied.

IVb) EXTENSION OF 2ND JOINTS: Non-functional muscles Fig. 30

Fig. 30 - Muscle tests for extension of 2nd Joints of fingers
Non-functional grade tests



A) Starting Position

The hand is resting on the border of the little finger with the fingers relaxed.

B) Instructions

The examiner holds the first joints between his thumb and index finger and keeps the lst joints from moving. Ask the patient to straighten his fingers out as far as possible.

C) Resistance

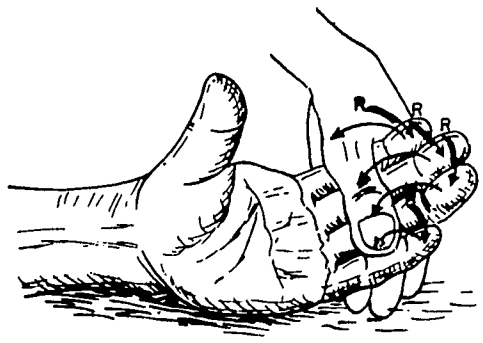
None

D) Grade: Non-functional

The patient is able to straighten the fingers through the complete or partial R.O.M..

Va) FLEXION OF 3RD JOINTS: Functional muscles Fig. 31

Fig. 31 - Muscle tests for flexion of 3rd joints of fingers,
R:Resistance
Functional grade tests.



A) Starting Position

Same as flexion of the 2nd joints, functional muscles.

B) Instructions

The examiner places his thumb across the 2nd joints on the palm side, and his other fingers on the back of the 2nd joints to prevent the 2nd joints from bending. Ask the patient to bend the ends of his finger. Each joint can be tested separately.

C) Resistance

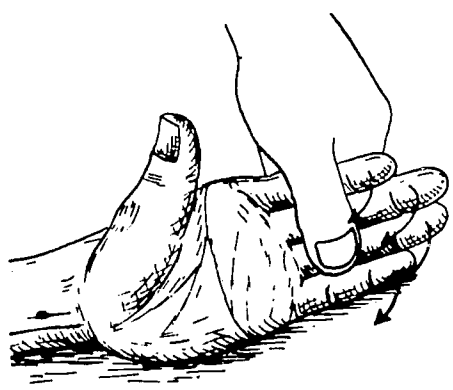
Applied to the end of the fingers in the opposite direction

D) Grade: Functional

The patient is able to bend the 3rd joints through the complete R.O.M. with or without resistance applied.

Vb) FLEXION OF 3RD JOINTS: Non-functional muscles Fig. 32

Fig. 32 - Muscle tests for flexion of 3rd joints of fingers.
Non-functional grade tests.



A) Starting Position

The same as flexion of the 2nd joint, non-functional test (Page 28).

B) Instructions

The examiner holds the 2nd joints in the same way as for functional muscle test (Va). Ask the patient to bend the ends of the fingers as far as possible.

C) Resistance

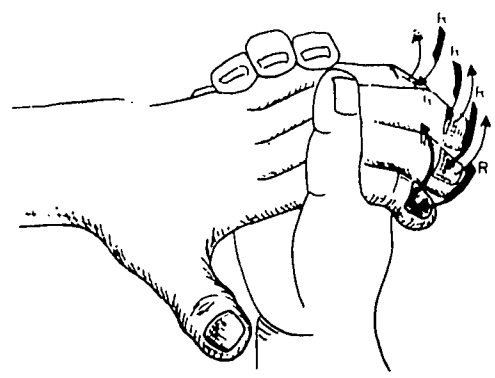
None

D) Grade: Non-functional

The patient is able to bend the fingers through the complete or partial R.O.M..

VIa) EXTENSION OF 3RD JOINTS: Functional muscles Fig. 33

Fig. 33 - Muscle tests for extension of 3rd joints of fingers.
R: Resistance
Functional grade tests



A) Starting Position

The same as extension of the 2nd joints, functional (Page 29).

B) Instructions

The examiner has his thumb across the 2nd joint on the back side and his other fingers on the palm side to prevent the 2nd joint from moving end of fingers. Ask the patient to straighten the end of fingers as far as possible. This test can be done on each finger separately or jointly.

C) Resistance

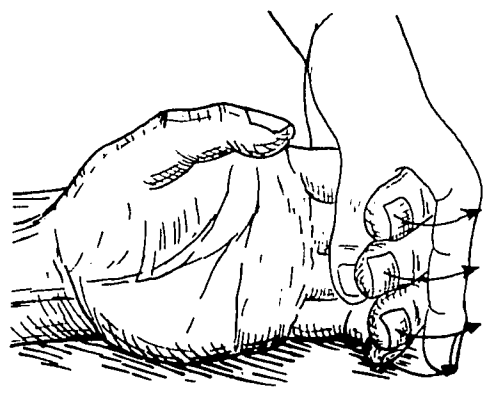
Applied in the area of the nails in the opposite (downward) direction.

D) Grade: Functional

The patient is able to straighten the ends of the fingers through the complete R.O.M. with or without resistance applied.

VIb) EXTENSION OF 3RD JOINTS: Non-functional muscles Fig. 34

Fig. 34 - Muscle tests for extension of 3rd joints of fingers.
Non-functional grade tests.



A) Starting Position

The same as extension of the 2nd joints, non-functional test (Page 29).

B) Instructions

The examiner holds the 2nd joints in the same way as in functional test (VIa). Ask the patient to straighten the ends of the fingers as far as possible. It is suggested that each finger be tested separately.

C) Resistance

None

D) Grade: Non-functional

The patient is able to straighten the fingers through the complete or partial R.O.M..

VII) ABDUCTION Fig. 35

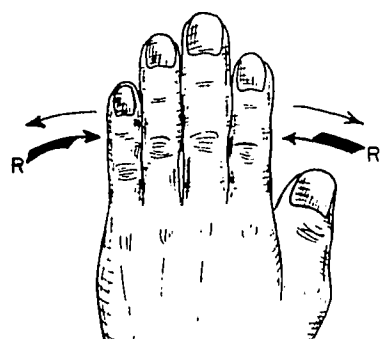


Fig. 35 - Muscle tests for finger abduction
R: Resistance

A) Starting Position

The hand should be flat on a table with the palm down and the fingers close together.

B) Instructions

Ask the patient to spread fingers apart like a fan.

C) Resistance

Try to (1) Push the 2nd, 4th and 5th fingers in toward the middle (3rd) finger, and, (2) Push the 3rd finger in both directions.

D) Grades

1. Functional: The patient is able to spread fingers through the complete R.O.M. with resistance applied.

2. Non-functional: The patient is able to spread the fingers through the partial R.O.M., or is not able to spread the fingers at all without resistance applied.

VIII) ADDUCTION Fig. 36

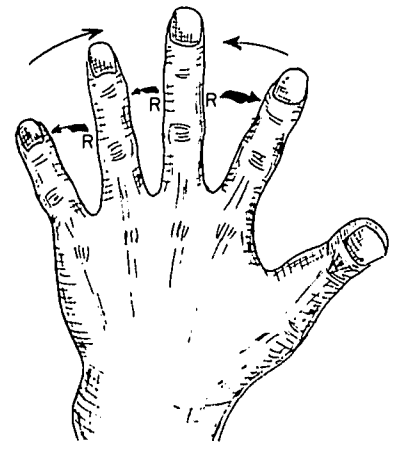


Fig. 36 - Muscle tests for finger adduction
R: Resistance

A) Starting Position

The hand is flat on a table, and the palm is down with the fingers spread apart as far as possible.

B) Instructions

Ask the patient to pull fingers together so that they touch one another and hold them tightly.

C) Resistance

Try to pull the 2nd, 4th, and 5th fingers away from the middle finger.

D) Grades

1. Functional: The patient is able to pull fingers together through the complete R.O.M. with resistance applied.

2. Non-functional: The patient is able to pull fingers together through the part of R.O.M., or can not pull fingers at all without resistance.

12 : MUSCLE TESTS FOR THUMB MOTION

I. FLEXION Fig. 37

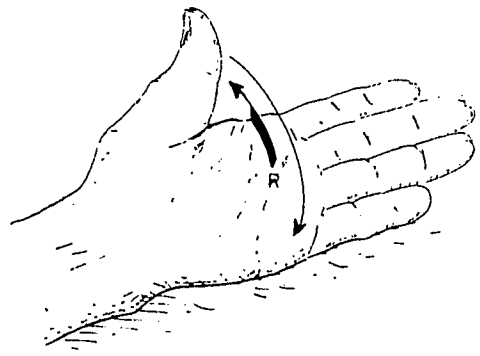


Fig. 37 - Muscle test for flexion of thumb.
R: Resistance

A) Starting Position

The hand is resting on a table in the relaxed position, the palm is up, and the thumb is pointing outward, away from the 2nd finger.

B) Instructions

Ask the patient to draw or bring the thumb in toward the base of the little finger.

C) Resistance

Try to push the thumb back into the outward position. The patient attempts to hold bent position while resistance is applied.

D) Grades

1. Functional: The patient is able to bend the thumb toward the base of the little finger against resistance through the complete R.O.M..

2. Non-functional: The patient is able to bend the thumb toward the base of the little finger without resistance.

IIa) EXTENSION: Functional muscles Fig. 38

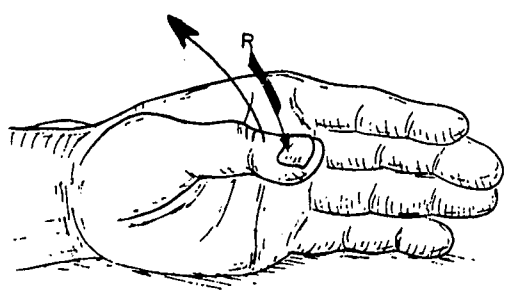


Fig. 38 - Muscle test for thumb extension
R: Resistance
Functional grade test.

A) Starting Position

The hand is resting on the border of the little finger and the thumb is relaxed.

B) Instructions

Ask the patient to bring his thumb back as far as possible and then hold it in this position as though pointing outward.

C) Resistance

Applied on the back of the thumb in the direction of the base of the little finger.

D) Grade: Functional

The patient is able to bend the thumb back through the complete R.O.M. with or without resistance applied.

IIb) EXTENSION: Non-functional muscles Fig. 39

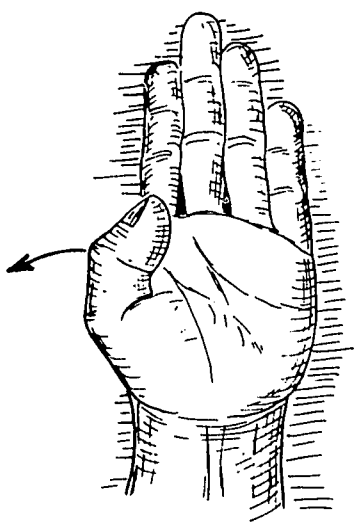


Fig. 39 - Muscle test for thumb extension
Non-functional grade test

A) Starting Position

The hand is flat on a table and the palm is up. The thumb is resting on the edge of the hand.

B) Instructions

Ask the patient to bring the thumb back, as pointing outward.

C) Resistance

None

D) Grade: Non-functional

The patient is able to bring the thumb back through the complete R.O.M., or through part of R.O.M.

IIIa) ABDUCTION: Functional muscles Fig. 40

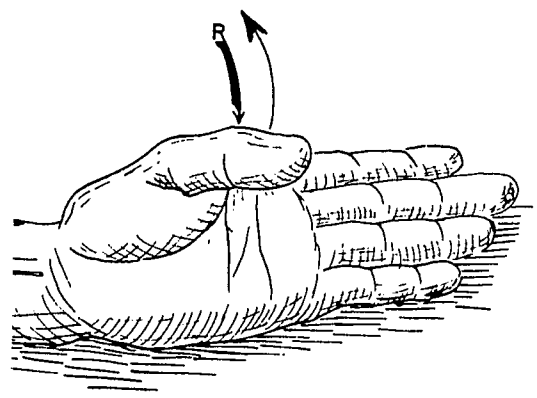


Fig. 40 - Muscle test for thumb abduction
R: Resistance
Functional grade test

A) Starting Position

The hand is resting on a table with palm up. The thumb is relaxed and in line with the 2nd finger.

B) Instructions

Ask the patient to raise the thumb straight up and away from the 2nd finger toward the sky, and bring it back as far as possible but still in line with 2nd finger.

C) Resistance

Apply resistance to the thumb by trying to push it down toward the 2nd finger.

D) Grade: Functional

The patient can bring the thumb to the position as instructed through the complete R.O.M. with or without resistance applied.

IIIb) ABDUCTION: Non-functional muscles Fig. 41

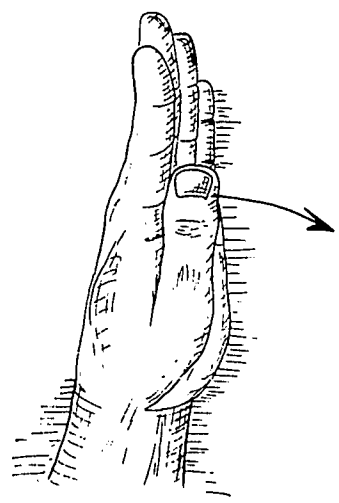


Fig. 41 - Muscle test for thumb abduction
Non-functional test

A) Starting Position

The hand is resting on the border of the little finger, and the thumb is in front of the 2nd finger on the palm side.

B) Instructions

Ask the patient to move the thumb straight away from the 2nd finger as far as possible.

C) Resistance

None

D) Grade: Non-functional

The patient is able to move the thumb away from the 2nd finger as instructed through the complete or partial R.O.M. without resistance applied.

IVa) ADDUCTION: Functional muscles Fig. 42

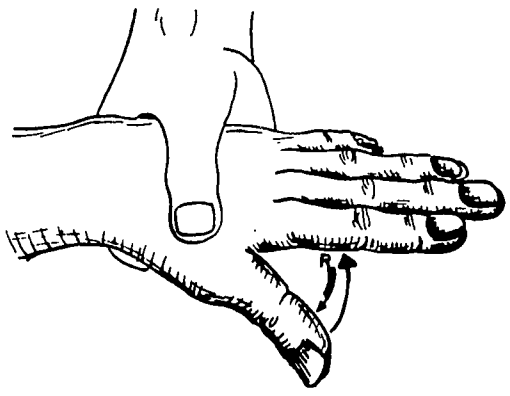


Fig. 42 - Muscle test for thumb adduction
R: Resistance
Functional grade test

A) Starting Position

The patient's hand is supported by the examiner's hand and the back of the hand is visible. The thumb is relaxed and away from the 2nd finger.

B) Instructions

Ask the patient to move the thumb to the palm side of the 2nd finger.

C) Resistance

Trv to pull the thumb down and away from the 2nd finger.

D) Grade: Functional

The patient is able to pull the thumb up to the 2nd finger on the palm side through the complete R.O.M. with or without resistance applied.

IVb) ADDUCTION: Non-functional Fig. 43

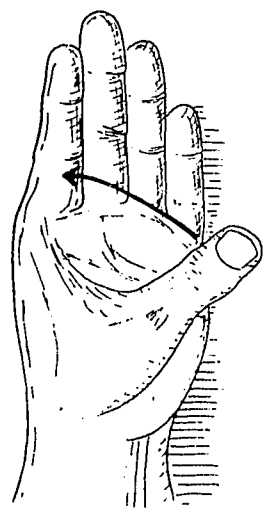


Fig. 43 - Muscle test for thumb adduction
Non-functional grade test

A) Starting Position

The hand is resting on the border of the little finger, fingers are out straight, and the thumb is away from the 2nd finger.

B) Instructions

Ask the patient to pull the thumb toward the 2nd finger, not on the border but on the palm side of the 2nd finger.

C) Resistance

None

D) Grade: Non-functional

The patient is able to pull the thumb to the palm side of the 2nd finger through the complete or partial R.O.M..

V) OPPOSITION Fig. 15 - Page 18.

A) Starting Position

The hand is resting on a table and the palm of the hand is up.

B) Instructions

Ask the patient to pull the thumb toward the little finger, keeping the little finger as straight as possible. Do not bend the little finger. Let the palm side of the thumb touch the palm side of the little finger.

C) Resistance

Try to pull the thumb and the little finger apart.

D) Grades

1. Functional: The patient is able to touch the little finger with the thumb and hold them together when resistance is applied.

2. Non-functional: The patient is able to pull the thumb and little finger together, but cannot keep them together when resistance is applied, or he cannot reach the little finger with the thumb.

13 : MUSCLE TESTS FOR ANKLE AND FOOT

1a) PLANTAR FLEXION: Functional muscles

A) Starting Position

1. Have the patient stand.

2. If the patient is unable to stand, have him stretched out on a table or bed on his stomach with his foot off the end of the table.

B) Instructions

1. (Standing): Ask the patient to rise up on his toes with his knee straight, and then, knee bent.

2. (On table): Ask the patient to push the foot down against the examiner's hand which is on the sole of the foot and ask him to hold that position as the examiner applies resistence.

C) Resistance

1. (Standing): The body weight supplies enough resistance in this position.

2. (On table): Apply resistance with pressure of the hand against the sole of foot.

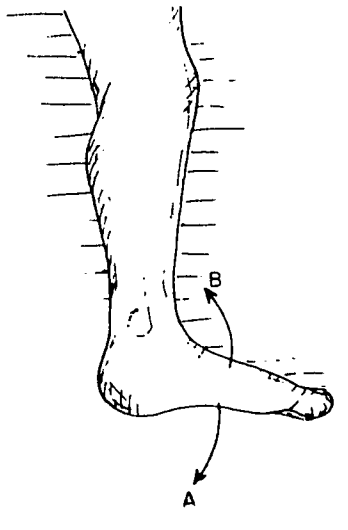
D) Grade: Functional

1. (Standing): The patient is able to rise up on his toes three or four times with knee straight, and then, with knee bent.

2. (On table): The patient is able to keep the foot pressed down when resistance is applied.

1b) PLANTAR FLEXION: Non-functional Fig. 44

Fig. 44 - Muscle tests for ankle plantar flexion(A) & dorsi-flexion(B) Non-functional grade



A) Starting Position

Have the patient lie on his side.

B) Instructions

Ask the patient to press his foot down.

C) Resistance

None

D) Grade: Non-functional

The patient is able to move his foot through the complete or partial R.O.M..

IIa) DORSI-FLEXION: Functional

A) Starting Position

Have the patient sitting on the edge of a bed or table with leg hanging over the edge.

B) Instructions

Ask the patient to pull his foot up. Ask him to hold this position while resistance is applied.

C) Resistance

Try to pull foot down by holding the ankle with one hand and pulling down on the foot with the other hand.

D) Grade: Functional

The patient is able to pull the foot up through the complete R.O.M. with or without resistance applied.

IIb) DORSI-FLEXION: Non-functional Fig. 44 (Page 38)

A) Starting Position

The patient is lying on his side.

B) Instructions

Ask the patient to pull the foot up.

C) Resistance

None

D) Grade: Non-functional

The patient is able to pull the foot through the complete or partial R.O.M..

III) INVERSION Fig. 45

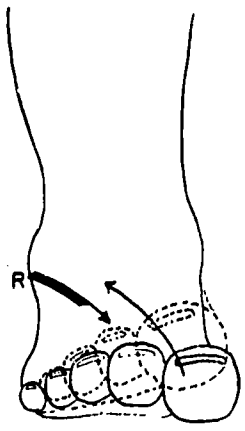


Fig. 45 - Muscle tests for ankle inversion
R: Resistance

A) Starting Position

Have the patient lying on his back on a table.

B) Instructions

Ask the patient to relax as much as possible. Hold the leg to keep it from turning. Then, ask him to turn the foot inward.

C) Resistance

Apply on the inside of the foot in an outward direction.

D) Grades

1. Functional: The patient is able to turn the ankle or foot in toward the other leg through the complete R.O.M. with or without resistance applied.

2. Non-functional: The patient is able to turn the foot in through the partial R.O.M. without resistance applied.

IV) EVERSION Fig. 46

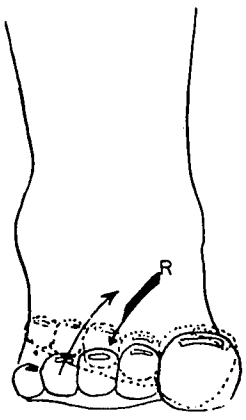


Fig. 46 - Muscle tests for ankle eversion
R: Resistance

A) Starting Position

The same as inversion (Page 40)

B) Instructions

Let the patient's foot relax. The patient is to move only his foot. Ask the patient to turn the foot outward, away from the body.

C) Resistance

Try to push the foot inward.

D) Grades

1. Functional: The patient is able to turn the foot to the side through the complete R.O.M. with or without resistance applied.

2. Non-functional: The patient is able to turn the foot out to the side through only the partial R.O.M. without resistance applied.

14 : MUSCLE TESTS FOR TOES

1) FLEXION OF 1ST JOINTS OF TOES

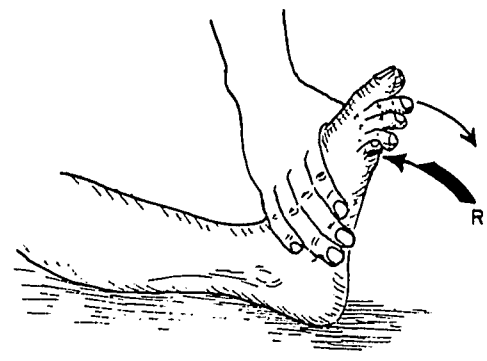


Fig. 47 - Muscle tests for flexion of 1st joints of toes.
R: Resistance

A) Starting Position

The patient is lying on his back with legs straight and feet resting on the bed.

B) Instructions

Ask the patient to bend his toes (not foot) down as far as possible. To keep the patient from bending his foot, hold it with one hand just above the toes.

C) Resistance

Applied under the toes in the opposite direction. Try to push toes up or back.

D) Grades

1. Functional: The patient is able to bend toes through the complete R.O.M. with or without resistance applied.

2. Non-functional: The patient is able to bend toes down only through the partial R.O.M. without resistance applied.

II) FLEXION OF 2ND JOINTS

A) Starting Position

The same as for flexion of the 1st joints of toes (Page 41).

B) Instructions

The examiner holds the 1st joints with one hand so they will not bend. Then ask the patient to bend the end joints down as far as possible.

C) Resistance

Applied to the bottom of the toes in upward direction.

D) Grades

1. Functional: The patient is able to bend toes down through the complete R.O.M. with or without resistance applied.

2. Non-functional: The patient is able to bend toes through the partial R.O.M. without resistance applied.

III) EXTENSION OF TOES Fig. 48

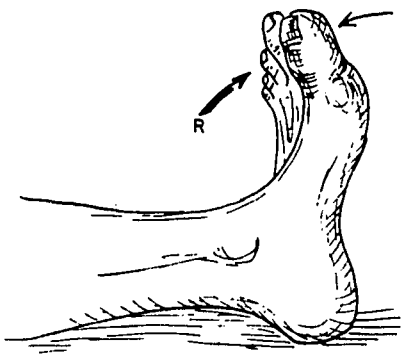


Fig. 48 - Muscle tests for extension of toes.
R: Resistance

A) Starting Position

The same as flexion of the 1st joints of toes (Page 41).

B) Instructions

Ask the patient to bend all toes back as far as possible

C) Resistance

Applied on top of the toes in the downward direction.

D) Grades

1. Functional: If the patient is able to bend toes back through the complete R.O.M. with or without resistance applied.

2. Non-functional: The patient can bend toes back through partial R.O.M.

IV) ABDUCTION OF TOES

A) Starting Position

The same as flexion of the 1st joints of toes (Page 41).

B) Instructions

Ask the patient to spread all toes apart as far as possible.

C) Resistance

1. Try to push big toe, the 3rd, 4th, and 5th toes into the 2nd toe.

2. Push the 2nd toe in both directions.

D) Grades

1. Functional: The patient is able to spread toes apart through the complete R.O.M. with or without resistance applied.

2. Non-functional: The patient is able to spread toes through the partial R.O.M. without resistance applied.

V) ADDUCTION OF TOES

A) Starting Position

Toes should be spread apart by the examiner.

B) Instructions

Ask the patient to pull toes in together.

C) Resistance

Try to pull toes away from one another.

D) Grades

1. Functional: The patient is able to pull toes together through the complete R.O.M. with or without resistance applied.

2. Non-functional: The patient cannot pull toes together

15 : SKIN SENSATION TESTS

There are many methods for testing skin sensation. The leprosy patient must, of necessity, be thoroughly tested for any signs of reaction to touch, warmth, coldness, and pain.

During the test, the patient is asked to keep his eyes closed. He is instructed to locate and tell the nature of the sensation that he feels to the examiner. For the sensation of touch, the skin to be tested may be lightly touched with a feather, thin piece of paper, cotton, or a small piece of soft, light cloth. A straight pin is usually used for testing pain sensation. It is not necessary to insert the pin forcefully or deeply. Depressing the surface of the skin with the point of a pin is enough to test for pain. An object that is too hot will cause a burn. Warm water in a test tube, or cold water in a test tube is most often used. To prevent the patient from guessing while being tested, location of skin area and testing material must be changed frequently. The result must be recorded on the patient's chart. If it is necessary, these tests must be repeated periodically.

16 : EXERCISES TO INCREASE MUSCLE POWER

These exercises are voluntary movements of a part of the body which helps to maintain or increase muscle power in functional or non-functional graded muscles. It is also called strengthening or power building exercises.

The strengthening exercise should be done against gravity and resistance. The resistance may be applied by the therapist (manual resistance), or by using articles of different weight such as a sand bag, water bag, wood block or other available material. The amount of resistance should be increased over a period of time. A sudden or rapid increase of resistance causes over loading of muscles and cannot increase muscle power as desired.

I. For Functional Grade Muscles

The muscle power must be tested by a therapist prior to exercise. The therapist applies resistance as indicated in the muscle tests for each functional muscle. When a therapist applies resistance, the patient is instructed to try to move that part of the body with all his strength. This movement should be repeated seven to ten times. When the patient is able to exercise against some resistance, then the therapist gradually increases the amount. Once muscle power increases, resistance should no longer be increased, but the patient should exercise to maintain this maximum muscle power.

II. For Non-functional Grade Muscles

The part of the body to be exercised should be placed in the non-functional muscle testing position as shown in the section on muscle tests.

The therapist should help the patient move the part of the body

to be exercised through the complete R.O.M. if he cannot do it himself. During this motion, the patient is instructed to move the part himself as much as possible. This exercise should be continued until he is able to complete the full R.O.M. alone. This may take weeks or months. When he is able to do this exercise, or if he is already able to do it, then a minimal (very small amount) of resistance may be applied by the therapist either while the movement is taking place or at the end of the movement. Thus, the muscle power may be increased. After a period of time, the therapist should see if the patient can perform the movement in the functional testing position. If he can, then the exercise should be given in the functional testing position to increase the muscle power as described above. If not, the exercise for non-functional grade muscles should be continued.

17 : EXERCISES TO MAINTAIN MUSCLE POWER

If a part of the body is not used because of muscle weakness or pain upon movement, these muscles will become weaker. In order to prevent this, an exercise must be given to keep the muscle strength at the present level. The patient should be instructed to exercise against maximum resistance to maintain the present muscle power. Amount of resistance does not necessarily have to be increased. The position of the patient will be determined by the strength of the muscle.

18 : EXERCISES TO INCREASE R.O.M.

When restriction of R.O.M. is found through the R.O.M. tests, it must be increased as close to normal as possible. The physical therapist does this by stretching tendons, muscles, skin, joint capsules and other soft tissue, little by little.

Each joint should be stretched separately in order to avoid undesirable complications. This is particularly true in the contracture of finger joints. Forceful stretching of the finger is not only painful and ineffective, but may result in dislocation of the joint or fracture of the bone.

In order to stretch a joint, the therapist should grasp the area to be stretched above* and below** the joint. By doing this, he is able to stabilize the joint (to hold steady). The extremity should be pulled slightly and then stretched. Thus, he can stretch the desired joint. For example, the 2nd joint of a finger is contracted. Hold the finger above and below the 2nd joint. The part below is stabilized, and the part above is straightened out gently and slowly causing the 2nd joint to be stretched.

Many leprosy patients may not feel pain during stretching because of sensory changes. Therefore, the therapist must be aware of this and

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* Near to the head.
** Near to the end of limb.

avoid overstretching of the joint. This exercise should be done slowly and gently over a period of time until the full R.O.M. is obtained. Once the R.O.M. has been increased to the desired point, it should be maintained. Application of heat is useful prior to stretching if pain is present.

19 : EXERCISES TO MAINTAIN R.O.M.

Once R.O.M. has been increased, or if R.O.M. is normal, it should be maintained or kept at its present state. This is done by moving each joint through the full R.O.M., if possible, four or five times daily by the therapist.

This exercise may or may not be done by the patient depending on the muscle strength. If one hand is functional, the therapist may instruct the patient as well as the patient's family in how to carry out these exercises. This is very beneficial to the patient due to the fact that many times the physical therapy aide may not be able to visit him daily for each exercise session, or there may be to many patients and individual exercises can not be given. Classes of ten or more patients is a valuable and practical method of treating patients if there is a shortage of therapist.

20 : FREQUENCY & LENGTH OF EXERCISE SESSIONS AND TERM OF TREATMENT

If at all possible, it is most desirable to give exercises twice daily. Due to a shortage of personnel in many areas, this may not be possible. Therefore, the method of self-exercise must be taught (Page12, Part I).

The exercise session should be at least an hour. During this period, exercises are interrupted for rest periods. This gives the patient time to relax as well as the muscles, especially the non-functional graded ones. The patient must be instructed to carry out these exercises even when the therapist is not present. If patient is unable to do the exercise alone, a healthy member of the family should be instructed how to carry out the exercise.

21 : THERAPEUTIC HEAT - Paraffin Bath

The paraffin bath is one of the many types of therapeutic heat. Many other types require special electrical equipment. Though this may be useful for treatment of deformities of the hand and foot in rehabilitation centers, it is not practical for use in the field.

Paraffin bath is useful to mobilize stiff hands, particularly hands that are contracted and painful. It is prepared with paraffin and paraffin oil in a ratio of 8:1. If paraffin or paraffin oil is not available, locally available wax which has the same melting point as paraffin can be used. Paraffin

oil can be replaced with mineral oil, olive oil, or other oils.

Paraffin wax used for therapy is solid at room temperature and melts at 43 - 45 C degrees (109 - 113 F degrees). It is heated in a metal container which contains an electric heating element. If an electric heating element is not available, paraffin can be heated in a double boiler or pot placed in another with water in it on a charcoal braizer. It must be stressed that it is dangerous to heat paraffin directly on an open fire.

Wax is applied at 45 - 52 C degrees (113 - 126 F degrees) directly to the limb to be treated by painting with brushes. In order to avoid burning an anesthetic limb, dipping into melted paraffin should be avoided. It also should always be tested on a non-anesthetic part. Several layers should be applied by repainting. The limb covered with paraffin is wrapped with towels for 20 - 30 minutes. The wax is then easily removed and can be re-used.

When a contracture is present, or the skin is stiff, stretching exercises or massage of the skin with paraffin oil is very useful for treatment of the deformed hand.

Hot packs, hot towels, or hot sand may also be useful for local therapeutic heat. Mineral oil or other oils may be used to lubricate the skin after applying a hot towel.

The most important precaution for therapeutic heat is to prevent burning the skin in areas which lack sensation. When therapeutic heat is applied, it is imperative that the aide or a member of the patient's family carefully check the temperature of the object used before each application. It should be comfortably warm and not too hot.

22 : EXERCISES AS A PREPARATION FOR RECONSTRUCTIVE SURGERY

Conservative treatment (non-surgical treatment) is not always effective for a severely deformed and disabled hand or foot. In this case, reconstructive surgery is indicated to correct these conditions. Deformity in a hand or foot is caused by contractures, changes in the bone or bony part of a joint (see Page 2 & 3). If the deformity is caused by changes in bone structure, no exercise is effective.

If no exercise is given to the deformed part of the body in cases where exercise can be effective, unnecessary extensive surgery must be performed to correct it and the result of surgery may not be as good as desired.

The main objectives of pre-operative exercises are:

1. to increase R.O.M. of the joint which is involved,
2. to increase muscle power which will be necessary for movement of the part of the body after surgery, and sometimes,
3. to maintain the R.O.M.

Very often, a surgeon transplants a tendon of a strong muscle to that of a weak muscle in order to replace the function of a weak muscle. Because of this operation, the strong muscle must be able to perform more than its original function. Therefore, strengthening exercises for the muscle or muscles to be used is most important before surgery.

When a therapist receives a physical therapy prescription, he must fully understand the objectives of these exercises and the results to be obtained. Unless the therapist understands the forthcoming surgical treatment and the purpose of exercises as preparation for surgery, effective treatment can not be given. As soon as the patient's condition is improved to the point desired, the aide should immediately notify the supervising therapist or the physician in charge so that he may proceed with the surgical operation. The prescribed exercise should not be discontinued before surgery unless the therapist receives a doctor's order to stop the treatment.

23 : EXERCISES AFTER RECONSTRUCTIVE SURGERY

After reconstructive surgery, the hand or foot is usually in a plaster of paris cast. While the cast is on, usually no exercise is done on the involved part, but may be done on areas above and below the cast.

When the cast is removed, the exercise must be started immediately. If the surgical procedure is a simple tenotomy, rather strenuous exercises can be applied. If a tendon has been transplanted to another tendon or other complicated surgical techniques have been performed, the therapist must be extremely careful in the amount of force he uses during exercises. Rough handling of the operated area may cause a rupture of a tendon and re-operation will be necessary. If done with great care, gentle stretching or gentle resistance or both can be applied, particularly during the early period of post-operative treatment. A beginner should not engage in this treatment without strict supervision.

After a reasonable period, with a physician's permission, force in stretching and the amount of resistance may be gradually increased. Sudden movement of the operated area or sudden application of resistance must be absolutely avoided.

Exercises should not be stopped until the physician orders it. During these treatments, a therapist must watch the operated area very carefully. If any unusual signs, such as swelling, change in color of skin, condition of skin, bleeding or presence of pain are noticed, the physician must be notified immediately.

24 : SOME USEFUL EXERCISES FOR HAND AND FOOT

The basic techniques to increase muscle power and R.O.M. have been discussed on Page 45-46 . There are some exercises or games which help to strengthen muscles and to increase the R.O.M. as well as being a diversion. The shadow game is a good example for all types of finger motion exercises.

A creative therapist may apply many other activities to suit the purpose of exercises. Following are a few examples for these exercises. Some occupational therapy is also included for convenience.

I. Flexion of fingers

Flexion of the 1st and 2nd joints of the fingers are more important for hand function than the 3rd joint motion. If the motion of the 3rd joint is also obtained, the hand function is more improved.

1. Ask the patient to roll two marbles around each other in the palm of the hand using his fingers and thumb.

2. Picking up various sizes of beans. It is better to start with a bigger bean and proceed to a smaller bean.

3. Squeeze a tennis ball with all fingers.

4. Give patient a stick, with a smooth surface and no spinters, and ask him to hold the stick tightly to prevent the stick from being withdrawn by the therapist. The size of the stick should be large in the beginning, and as the condition improves, proceed gradually to a thinner one such as a pencil.

5. Ask the patient to make an O with the thumb and each finger.

6. Wood work, pottery, basket making, playing piano, and tapping a drum with the fingers are effective occupational therapy techniques. Activities chosen should be culturally suited and economically feasible for the patient.

II. Extension of fingers

1. Flick a piece of paper until the paper flips with a sound, or flick a cotton ball. As the flicking power increases, give the patient marbles and let him flick them. The size and weight may be increased as the condition improves.

2. Give the patient a tennis ball and ask him to bounce it.

3. Passive stretching of fingers can be obtained by holding down an object or pottery using a mold and pressing the clay into it. Some forms of finger weaving and adapted games will give active extension.

III. Abduction and adduction of fingers

1. Put a rubber band around the 3rd joints of fingers and ask the patient to spread his fingers apart. As strength improves, increase the number of rubber bands.

2. Cross one finger over another and repeat.

3. Ask the patient to grip a pencil between his fingers and prevent the pencil from being withdrawn by the therapist. As the condition improves, make the object thinner such as a piece of strong paper.

IV. Extension of thumb

1. Ask the patient to flip a coin.

2. Flick a piece of paper, cotton-ball, or marbles with thumb in the same manner as extension of fingers.

3. Put a rubber band on the patient's 1st joint of the index finger and 2nd joint of the thumb, and ask the patient to pull the band back with the thumb in an extended position.

V. Flexion of thumb

Ask the patient to hold his hand in the prayer's position and roll thumbs inward to index fingers.

VI. Adduction of thumb

1. Ask the patient to make an 0 with his thumb and 2nd and 3rd fingers.

2. Ask the patient to hold a roll of bandage between his thumb and index finger without bending these two fingers. The patient trys to prevent the roll from being withdrawn by the therapist. As the condition improves, change to a thinner role of bandage, a pencil or a piece of paper.

VII. Opposition

1. Make an 0 with thumb and little finger.

2. Pick up any small object between thumb and little finger.

VIII. Abduction of thumb

Put a rubber band on the 1st joint of the index finger and 1st joint of the thumb and ask the patient to pull the rubber band with his thumb in an abducted position.

IX. Flexion and extension of ankle (Dorsi and Plantar Flexion)

1. Ask the patient to tap the floor with foot.

2. Let the patient ride a bicycle.

25 : AMPUTATION - AMPUTEE - PROSTHESIS (ARTIFICIAL LIMB)

Improper management of plantar ulcers causes bacterial infection of the foot and its bones. This may develop necrosis of a part of, or the whole foot and sometimes causes sepsis (Page 5-6, Part I). When this condition develops, the part must be amputated (cut off) by a surgeon for life saving purposes.

Unless there are some complications, the site of amputation almost always is either below the knee, level of the malleoli, or at some part of the foot. Seldom is an above knee amputation done on a leprosy patient. When a part of the foot is amputated, there is a possibility of developing another plantar ulcer on the other fool because of increased pressure during standing and walking. Treatment of the partially amputated foot is the same as that of a deformed one. After this type of amputation, there is a great tendency to develop a shortening of the heel cord, even though all muscles about the ankle are normal in strength. Therefore this type of operation is a poor choice for leprosy patients. When this operation is performed, R.O.M. of the ankle joint must be maintained by stretching the heel cord daily to prevent shortening.

The below knee (B.K.) amputation is a better choice for a leprosy patient. When the post operative course is uneventful, the stump shrinkage may start in four to six weeks after surgery. The purpose of stump shrinkage is to encourage the natural course of stump shrinkage, and make a conical shape of the stump. An ace bandage or an elastic nylon stump shrinker is ideal for this purpose. If these are not available, tight wrappings of cotton roll bandages on the stump, without disturbing blood circulation, can be used, but with great caution. At least six weeks of stump shrinkage is necessary before measuring and fitting the prosthesis (artificial limb).

During this period, full range of motion of the hip and knee joints in the involved leg must be obtained and muscles in all the extremities should be strengthened. The patient is trained to ambulate (walk) with a pair of crutches. If disabilities in the hand exist, specially constructed crutches may aid the patient in using them.

There are two types of B.K. protheses: a conventional wood socket B.K. prothesis with thigh corset (Fig. 49), and a Patella Tendon Bearing (P.T.B.) prosthesis (Fig. 50).

Fig. 49 - Conventional B.K. prosthesis
- A: Stump sock
- B: Waist belt suspension
- C: Thigh corset
- D: Wood socket

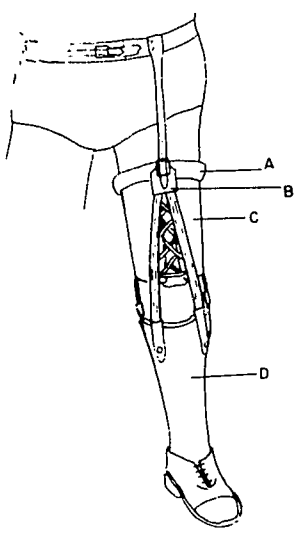
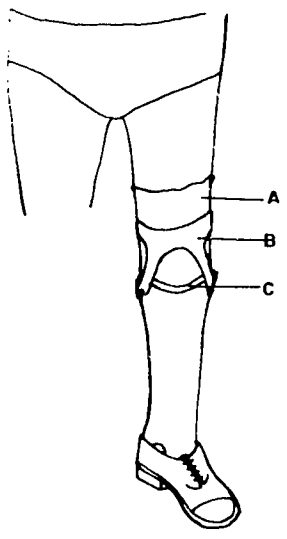


Fig. 50 - P.T.B. B.K. prosthesis
- A: Stump sock
- B: Thigh cuff
- C: Soft insert



The conventional B.K. prosthesis is sometimes very difficult for a leprosy amputee (a person who lost a limb) to manage. A considerable amount of functional power in the hand and fingers is required to lace the thigh corset. A leprosy patient very often lacks this power. When this prosthesis is used, very heavy stump socks must be worn to protect the anesthetic stump from abrasions due to friction and pressure from inside the socket.

A P.T.B. prosthesis has been used for leprosy patients and was found to be more favourable for the anesthetic stump. It requires less functional power in the hand and fingers to put on.

Manufacturing these prostheses requires a high technical skill and very often such a highly skilled prosthetist (limb maker) is not available in many areas. In such cases, an imaginative physical therapist can make a very functional and practical pylon (peg-leg) by applying the principles of these prostheses with locally available material in co-operation with an occupational therapist.

The amputee should be instructed by a therapist to inspect the stump daily for any injuries and how to keep his stump very clean. At the end of the day, if no change is found on the stump, the patient should wash the stump with soap and water, dry it and, if it is possible, apply baby powder or talcum powder. When any wound is found, the patient should not wear the prosthesis until the wound is completely healed and the prosthesis must be checked very carefully to find any pressure spots inside the socket. The wound must be treated accordingly. Stump hygiene is particularly important in the tropical and sub-tropical areas, since sweating of the patient's stump occurs while he is wearing the prosthesis. This weakens the skin resistance and easily creates a wound. Stump socks must be kept clean always.

26 : SPLINTS

Splints are generally divided into two groups, static and dynamic splints. A static splint is a device which is applied to a part of the body to hold the part in one position, and is used to prevent contractures. A dynamic splint is one with movable parts and is used not only to maintain a part of the body in one position, but also to stretch the contracture or to correct the deformity. Sometimes, a dynamic splint may replace or assist a certain simple function of a part of the body. In this case, the splint is called a functional splint.

Material for splints may vary; light weight metal, wood, plaster of paris, certain types of plastics, bamboo, paper, leather or any locally available material can be used. These materials must be light in weight, easy to handle, durable, harmless to the skin, inexpensive, and locally easily available.

Production of a dynamic splint requires many tools and high skills. Certain material may not be useful for this. Therefore, this splint is usually made by a highly skilled occupational therapist or a splint maker.

A static splint is more useful to a physical therapist. When there is muscle

imbalance, there is a tendency for contractures to develop. In this case, early application of a splint can prevent further development of contractures. After stretching exercises have been given, this splint is useful in maintaining the obtained R.O.M.

Take any material which meets the above mentioned qualifications. Cut the material to a size to fit the part of the body to be splinted. When the entire fingers and wrist are to be splinted, the splint must be from below the elbow to the tips of the fingers. Splints that are too short or long are not effective and are not only inconvenient but disturbs the motion of other joints which should be free in motion. The cut material must be bent and well fitted to the part without giving even minimum discomfort. The inner surface of the splint, which is directly against the skin, may be covered with a soft material for the patient's comfort. Once the position of the splint is as desired, a few straps may be needed to hold the splint to the part of the body. If too much correction is attempted with the splint, it may interfere with the blood circulation, and the patient may not wear it because of discomfort.

The aide must learn the correct technique of applying the splint under the qualified therapist before he applies it to a patient in the field.

27 : ACTIVITIES OF DAILY LIVING (A.D.L.) PROGRAM

In the rehabilitation of a disabled individual, it is important for him to know his abilities in order to cope with the common demands of daily living in his home, at work, or at play. These demands are the Activities of Daily Living (A.D.L.).

A set of task activities is performed by a patient on initial examination. A follow-up examination after an A.D.L. program is given. This is called A.D.L. test.

An A.D.L. program is set up to train the patient to perform, within his physical limitations, his maximum in daily activities in his normal living condition. Physical demands for A.D.L. may range from a simple activity to more complex ones. The patient must be trained in activities which he is not able to perform on the initial test. Abilities in A.D.L. are generally improved when muscle power, R.O.M., and endurance increase, and co-ordination and skill improve. These can only be achieved by repetition of activities in which he is lacking. For these purposes, physical and occupational therapy must be applied as well as an A.D.L. program. Since the physical ability is a basic factor in capability of performance, not every patient can be made independent in all A.D.L. by this program. Thus, when A.D.L. is lacking in certain areas, in spite of the program, the therapist must find a way to compensate for this disability by means of gadgets (self help devices) and splints.

In the case of a leprosy patient, the most important areas in A.D.L. are any activities which require hand and finger motion. When the disease is still in progress, there is a great possibility that a patient may lose his present ability in A.D.L. in due time. Proper treatment for leprosy must be given to

halt the progress of the disease. All preventive measures for deformities must be applied to maintain the present ability. When already established non-progressive disabilities exist, preventive measures against development of other disabilities and improving the abilities in A.D.L. must not be forgotten.

28 : TREATMENT OF LEPROSY PATIENT'S HAND

The therapist should test muscle power, R.O.M. and skin sensation in the hand. If there is the slightest sign of muscle weakness and limitation of R.O.M. strengthening exercises and stretching exercises to the particular muscle and joint should be given. Close observation to detect further progression of weakness and limitation of R.O.M. is necessary.

When sensory changes are detected, the patient must be instructed to check his hand daily as often as possible, to search for open wounds and blisters due to burns or friction, splinters, unusual swelling, and redness of the skin in the hand and fingers. If any of these conditions are found, they must be treated. Furthermore, the therapist must instruct the patient not to hold objects with his bare hands by actual practical demonstrations as how hot, sharp and rough objects should be handled.

A pot holder, a wooden handle for cooking and eating utencils are useful for prevention of burns. The patient with anesthetic hands must be encouraged to wear gloves contantly even in the summer time and use his eyesight to compensate for his lack of sensation. If gloves are not available, some type of object such as a cloth, or towel, or any protective coverage that will avert damage to the skin should be used. He must be constantly aware of his lack of sensation.

When he grasps the handles of tools, there is a tendency to hold them too tightly. This may cause damage to the bones of the fingers. Therefore, he should be taught not to hold the handles too tightly. Providing the patient with tools with handles large in diameter is quite helpful. Sometimes the skin of the hand is injured by the patient's own finger nails, therefore, he must keep his finger nails cut short.

If a certain nerve is obviously damaged, several selected functions of the hand and fingers are disturbed (Appendix III) and sensory changes occur. There is a characteristic deformity in the hand and this condition will lead to other undesirable deformities (Page 3 - 5, Part I).

All necessary exercises (Page 44-46) must be given, and if it is so indicated, a splint should be applied. Some dynamic splints are specially designed for ulnar, median, and radial nerve paralyses (Fig. 51, 52, 53).

Fig. 51 -
Functional splint for
ulnar nerve paralysis

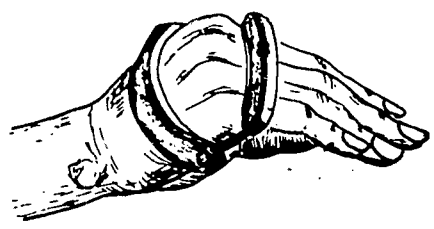


Fig. 52 - Functional splint for median nerve paralysis

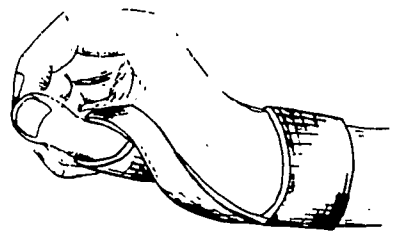
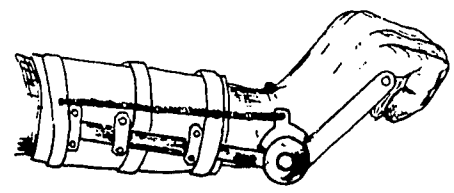


Fig. 53 - Functional splint radial nerve paralysis



If the condition is not improved by conservative treatment, reconstructive surgery may be indicated. Exercises for pre-surgery and post-surgery have been discussed on Page 44 to 48.

29 : TREATMENT OF LEPROSY PATIENT'S FOOT

Detection of slight weakness of muscle power in the very early stage and prescribed exercises are means of preventing deformities of the foot.

When sensory changes are present, daily inspection of the foot should be done by the patient or his family. If the local custom is to walk with bare feet, the need for daily inspection is greater. In this case, it is advisable to encourage the patient to wear some kind of footgear to protect the foot from injury. If the patient wears footgear, the inside of it must be checked daily to find rough surfaces or sharp objects such as nails.

Long before a plantar ulcer appears on the surface of the skin, it can be detected by means of pain or discomfort upon hard pressure with the examiner's finger on the suspected area. This pre-ulcerative stage (Page6) will subside in ten to 12 days if the foot is completely rested. When walking is resumed, further damage can be prevented by using rigid-sole footwear.

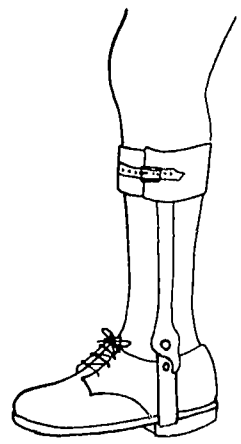
The initial ulcer can be treated at home as long as the patient is aware of the seriousness of the ulcer. The simplest treatment is bed rest, but this will take four to five weeks. Equally effective is the use of rigid sole footwear after a preliminary period in bed for three or four days, so that edema can be reduced and secondary infection can be cleared up. A common procedure is the use of a below knee walking plaster cast on a wooden sole with rocker, or with a walking iron. In this way, the ulcer will heal within four to six weeks.

After complete healing of the ulcer, the patient should wear footwear with rigid-soles with a rocker and soft insole. When a recurrent ulcer is found, the patient must be seen by a orthopedic surgeon for further treatment.

Drop foot (inability to pull the foot up) should be treated promptly, otherwise, walking becomes difficult and later the heel cord will be shortened. Drop foot in leprosy is caused by weakness of muscles for dorsi-flexion of the foot.

An attempt should be made to strengthen the weak muscles. If this is not successful, a short leg brace with a 90 degree ankle stop (Fig. 54) should be given to the patient. This brace holds the foot in position as the weak muscles would have done and enables the patient to walk easier.

Fig. 54 - Short leg brace with 90 degree ankle stop.



If the heel cord is tight, stretching exercise should be given. Often contractures may have developed and stretching is unsuccessful. In this case, tendon lengthening surgery can be performed and a short leg brace may be prescribed to assist weak muscles. When there is a severe deformity in the foot, a special footwear should be made which fits the surface of foot well, and avoids the concentration of pressure in one spot while walking.

30 : TREATMENT OF FACIAL DEFORMITIES

Early detection and treatment of leprosy may prevent the onset of facial deformities. Because there is no loss of skin, all these deformities lend themselves readily to reconstructive surgery, with dramatic improvement. This is of utmost importance for the social rehabilitation of the patient. The operation can be successfully performed only in a center properly staffed and equipped for plastic surgery.

31 : PREVENTION OF BLINDNESS

A qualified physical therapist of aide in a leprosy hospital is not primarily responsible for the prevention of blindness, since a physician or an ophthalmologist (eye doctor) or both are available for this care.

When the aide is working in the field, he must be aware of the need for prevention of blindness. Thus, whenever he comes in contact with patients, he must record their eye conditions in the following points.

1. Does the patient complain of burning, watering, pain, or any other unusual sensations in his eyes?
2. Is he unable to close eyes?
3. Is the eye red?
4. Is the cornea cloudy?
5. Is the pupil immobile in either eye?

If any of these conditions are present, the case must be referred to the physi-

sician or the center immediately for further examination and treatment.

If the policy of the leprosy control program in some countries is such that the responsibility of the initial treatment falls to the therapist, then each must be well trained at the institution by an ophthalmologist before he assumes this responsibility.

32 : THE THERAPIST WHO WORKS IN THE FIELD

Exercises and other treatment in rehabilitation have quite often been done at the rehabilitation center in a hospital. When a patient is treated in such a center, he can enjoy the benefits of various facilities and the physical therapy aide can receive better supervision and guidance from a qualified physical therapist.

The physical therapy aide in leprosy rehabilitation may not always be able to treat patients at a rehabilitation center. The number of patients who need rehabilitation is usually much larger than can be accommodated in the centers that are available. Unless hospitalization is absolutely necessary for special treatment, patients should not be kept at the rehabilitation center.

If the patient is allowed to remain at his home and to continue his job, his family is united, and he can provide financial support for them. When people in the community have the opportunity to live with a leprosy patient, who is not dangerous or infectious, understanding and co-operation will develop. Thus, the home program must be encouraged as much as possible in the areas of social and economic welfare, and public education.

Before home treatments are started, a physician must examine the patient and prescribe a program for rehabilitation as well as medication. When the physician examines the patient, the physical therapy aide dealing with the case reports the results of muscle test and R.O.M. test. The therapist should receive a written prescription. He must understand the prescription, its objectives, results to be obtained, frequency of visits, precautions, and contraindications. Unless the therapist fully understands the physician's intentions in the case, he should not begin treatments.

A physical therapy aide assigned to home treatment programs, has less supervision from a qualified physical therapist and a physician than one working in a hospital or rehabilitation center. Therefore, his techniques must be accurate and he must be experienced. Thus, the qualified physical therapist is advised that the less trained and less experienced physical therapy aide should remain in the rehabilitation center until he masters correct techniques and gains enough experience under the supervision of a qualified physical therapist.

The therapist must make a schedule for home visits since patients may live in geographically wide spread areas. The therapist teaches the patient how to exercise, how often and how long the exercises should last. At the beginning, demonstration of the exercises is the easiest way for the patient to understand.

If there are any precautions, the therapist not only explains but also shows what not to do on his own hand or foot. During the demonstration, the therapist should not use the patient's hand or foot, because this demonstration itself may damage the patient's body.

If the patient has a family, the therapist is advised to teach the exercises to them. In this way, more frequent exercises can possibly be given to the patient. If any type of therapeutic heat is prescribed, the family member who does not have sensory changes in his hands should prepare the heated material. This is very important to prevent burning. The methods of daily inspection of hands and feet and preventive measures against burns and wounds must be taught even though these are not prescribed.

Before the therapist leaves the patient's home, he should tell the date and time of his next visit to the patient and his family. The daily visit is ideal, of course. Exercising alone or with the help of the family should be done even when the physical therapy aide is not present.

After the initial visit, follow-up visits must be made regularly and must be on schedule. Irregularity in visits or visiting time discourages the patient, results in distrust of the therapist, and finally, the patient may give up the treatment.

On each visit, the therapist examines the treated area to determine the effect of exercises or detect any abnormal condition. The therapist also inspects the eyes, hands and feet to find any injury, infection or signs of progress of the disease. These findings must be recorded accurately on the progress record sheet. Even if there is nothing to report, the record should indicate this. On these visits, ask the patient to show how he has been exercising. In this way, the therapist determines whether or not the patient has been doing the exercises in the correct way. The effect of these exercises may not be too remarkable in a short period, and the patient may tend to become discouraged. On such occasions, warm, encouraging words from the therapist is the best treatment. Under no circumstances is the therapist allowed to talk about the prognosis of the disease or the condition to the patient.

At any time if the aide finds abnormal or unusual signs, he must report such findings to the qualified physical therapist at once and wait for further instructions.

33 : DEDICATION

This manual is dedicated to our fellow men who are ill, handicapped, and discouraged by leprosy; and to the courageous, compassionate people who struggled through the centuries to alleviate the suffering of their brothers so afflicted.

It is hoped that this manual will promote rehabilitation of leprosy patients in every country of the world.

"The true test of civilization is,
not the census, nor the size of
cities, nor the crops, ... but
the kind of man the country turns
out"

- Ralph Waldo Emerson -

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APPENDIX I.

MUSCLE TESTS & R.O.M. CHART (PROPOSED)

NAME_____ EXAMINER_____ DATE_____

LEFT		MOTIONS	RIGHT	
R.O.M.	MUSCLE POWER		MUSCLE POWER	R.O.M.
		FOREARM SUPINATION		
		PRONATION		
		WRIST FLEXION		
		EXTENSION		
		ABDUCTION		
		ADDUCTION		
		FINGERS FLEXION		
		1st joint		
		2nd joint		
		3rd joint		
		EXTENSION 1st joint		
		2nd joint		
		3rd joint		
		ABDUCTION		
		ADDUCTION		
		THUMB FLEXION		
		EXTENSION		
		ABDUCTION		
		ADDUCTION		
		OPPOSITION		
		ANKLE FOOT PLANT.FLEX.		
		DORSI.FLEX.		
		INVERSION		
		EVERSION		
		TOES FLEXION 1st joint		
		2nd joint		
		EXTENSION		
		ABDUCTION		
		ADDUCTION		

APPENDIX II.

NERVE CONTROL OF HAND MOTION

PART OF BODY	MOTION	ULNAR NERVE	MEDIAN NERVE	RADIAL NERVE
FOREARM	SUPINATION			PARTLY X
	PRONATION		X	
WRIST	FLEXION	PARTLY X	PARTLY X	
	EXTENSION			X
	ABDUCTION		PARTLY X	PARTLY X
	ADDUCTION	PARTLY X		PARTLY X
FINGERS 1ST JOINT	FLEX.*	X		
	FLEX.**		X	
	EXTENSION			X
FINGERS OTHER JOINTS	FLEXION	PARTLY X	PARTLY X	
	EXTENSION	MOSTLY X	PARTLY X	
	ABDUCTION	X		
	ADDUCTION	X		
THUMB	FLEXION	PARTLY X	PARTLY X	
	EXTENSION			X
	ABDUCTION		PARTLY X	PARTLY X
	ADDUCTION	X		
	OPPOSITION	PARTLY X	PARTLY X	

* 2ND AND 3RD FINGERS
** 4TH AND 5TH FINGERS

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