

A Comprehensive Review of Physiotherapy Interventions in the Management of Leprosy

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Abstract:

Leprosy, a chronic infectious disease caused by *Mycobacterium leprae*, affects millions of people globally, leading to various physical impairments and disabilities. Physiotherapy plays a crucial role in the multidisciplinary management of leprosy-related disabilities, aiming to optimize functional outcomes and improve the quality of life of affected individuals. This review provides a comprehensive overview of the pathophysiology of leprosy-related disabilities and examines the evidence-based physiotherapy interventions employed in their prevention and management. From sensory rehabilitation and motor retraining to the prevention of deformities and psychosocial support, physiotherapy encompasses a wide range of strategies tailored to the individual needs of patients. By integrating physiotherapy into the broader framework of leprosy care, healthcare professionals can enhance the holistic management of this ancient disease and empower individuals to achieve maximal functional independence.

Introduction

Leprosy, also known as Hansen's disease, is a chronic infectious disease that primarily affects the skin and peripheral nerves. Despite significant advances in pharmacological treatment, leprosy continues to pose significant challenges due to its potential to cause physical impairments and disabilities. Physiotherapy plays a crucial role in addressing these challenges by focusing on rehabilitation, functional restoration, and disability prevention. This review aims to provide a comprehensive overview of the role of physiotherapy in the management of leprosy, highlighting the various interventions employed to optimize patient outcomes. With over 210,000 new patients diagnosed in the world each year, leprosy is still a public health problem in many low and middle income countries. To interrupt the transmission of *Myobacterium Leprae* and to reduce the number of new leprosy patients globally early detection

and prompt treatment with multi-drug therapy (MDT) are essential. Early detection is also necessary to reduce the physical and social consequences of the disease as the complications of leprosy depend on how timely in the disease process leprosy is diagnosed and treated. Prevention of disability thus begins with early detection of leprosy¹.

Leprosy, a disease caused by *Mycobacterium leprae*, remains a major public health problem in India.

India is the country most affected by leprosy, with an estimated 135,485 new cases diagnosed in 2017, accounting for over 63% of the worldwide burden. But it is still a stigmatized disease, mainly because it can cause disability in a small percentage of those affected and cause stigma and hatred. The physical disability caused by this disease leads to an increased likelihood of serious mental illness and a lower quality of life.

Perceived seriousness refers to how serious a person is about an illness or disease.

Perceived severity involves individuals perceiving the cause of serious health hazards or events (such as leprosy). Witte defines pain intensity as a person's belief about the importance or magnitude of a threat to health. The perceived severity of consequences may be related to expected future events or work, such as previous health problems.

Pathophysiology of Leprosy Related Disabilities:

Leprosy primarily affects the peripheral nerves, leading to sensory, motor, and autonomic dysfunction. The bacillus infiltrates Schwann cells, causing demyelination and subsequent nerve damage. As the disease progresses, patients may experience sensory loss, muscle weakness, and trophic changes, predisposing them to complications such as ulceration, contractures, and deformities. Understanding the pathophysiological mechanisms underlying these disabilities is essential for guiding targeted physiotherapeutic interventions.

Leprosy is a chronic, systemic granulomatous disease mainly involving the peripheral nerves and the skin. Less commonly affected areas include the mucus membrane of the upper respiratory tract, the anterior chambers of the eyes, and the testes. Diagnosis is primarily clinical. The cardinal signs of leprosy are hypopigmented or reddish patches of skin with a loss (or alteration) of sensation, enlarged peripheral nerves, and the demonstration of acid-fast bacilli on skin smears or skin biopsies. The presence of all three criteria has 97% sensitivity and 98% positive predictive value for a diagnosis of leprosy, with excellent validity².

The neurological manifestations occur as a result of any of the following mechanisms: involvement of the intracutaneous neural network, involvement of the larger nerves in cooler locations, or inflammation within the larger nerves during the course of the disease when leprosy reactions occur. The earliest manifestation of leprosy is the involvement of the cutaneous nerve,

resulting in a loss of thermal sensation as the initial deficit and then evolving to involve other modalities like pain and touch. Sensory modalities sub served by larger fibers are lost in more advanced stages of the disease. Motor manifestations also occur during the latter stages of the disease.

The clinical assessment should include a detailed examination of the skin for hypopigmented areas and of the superficially located nerves for enlargement and tenderness. Nerves that are commonly enlarged include the supraorbital nerve, the greater auricular nerve, and the ulnar nerve including its deep ulnar branch, the superficial radial cutaneous nerve, and the peroneal nerves.

Sensory Rehabilitation:

Sensory impairment is a common sequelae of leprosy, resulting in loss of protective sensation and altered proprioception. Sensory rehabilitation aims to enhance sensory awareness, reduce the risk of trauma, and promote self-care behaviors. Techniques such as sensory re-education exercises, tactile stimulation, and proprioceptive training are utilized to improve sensory function. Additionally, the provision of protective footwear and orthotic devices helps prevent ulceration and deformities, facilitating optimal foot care and mobility.

Since sensory loss increases the risk of injury, individuals should be educated about the importance of protective measures such as checking for injuries regularly, using appropriate footwear and protective gear, and avoiding harmful activities that may result in injuries.

A leprosy affected person should have to check their hands during work; if they see redness in their hands they must take a break from their work and take rest for a while.

They have to stop the smoking habits and keep them away from the heat and stay from bonfire during winters. They always have to check their footwear before put him on because a small stone particles or hard object can cause wounds in the foot.

Motor Rehabilitation:

Muscle weakness and paralysis resulting from nerve damage contribute to functional limitations and disability in leprosy patients. Motor rehabilitation focuses on restoring strength, range of motion, and motor control through therapeutic exercises, manual therapy techniques, and functional training. Strengthening exercises target specific muscle groups affected by nerve impairment, while stretching and joint mobilization techniques aim to maintain or restore joint mobility and flexibility. Task-specific training and functional retraining enable patients to perform activities of daily living independently and participate in social and vocational activities.

For the motor rehabilitation a healthcare provider should have monitor the disability level according to WHO guidelines.

The progression of the disorder over time can be tracked using the World Health Organization (WHO) classification of disability. WHO can also be used as an epidemiological indicator to facilitate reporting of injuries in certain areas. Studies have shown that the WHO rating has good inter-rater reliability when administered by a small number of healthcare professionals. These operational procedures improve the understanding and interpretation of injuries as they help medical professionals classify injuries effectively.

The WHO grading system has separate components for hands, feet, and eyes. Therefore, hands, feet, and eyes are graded separately based on the impairments present. The scale has a maximum score of two and a minimum score of zero. The World Health Organization grading system is an effective and widely used tool for grading injuries and assessing the effectiveness of management systems to identify patients in the early stages of disease. However, it is not necessary to measure improvement in individual patients.

The Eye, Hand and Foot (EHF) score was created to easily document an injury in a patient.

Studies have shown that the EHF score is very important in leprosy diagnosis.

The EHF score is calculated as the sum of the WHO score for each eye, hand and foot.

For example, a patient with grade 2 disability in the eyes, hands, and feet would have a maximum EHF score of 12, or a maximum of 2 points for each eye, hand, and foot.

Prevention and Management of Deformities:

Deformities such as claw hand, foot drop, and lagophthalmos are common complications of untreated or inadequately managed leprosy. Early recognition and timely intervention are essential in preventing the progression of deformities and minimizing functional impairment. Physiotherapists employ a variety of modalities, including splinting, stretching, and strengthening exercises, to address contractures and deformities. Orthotic devices and assistive technologies provide external support and facilitate optimal positioning of affected limbs, thereby preventing secondary complications and promoting functional independence. Loss of manual ability: Paralysis can cause loss of dexterity.

Many deformities occurring in patients with leprosy cause a serious loss of ability to do daily activity of life with the help of hand.

Locomotors Disability:

The presence of a foot deformity can cause mobility problems.

Patients may have abnormal posture or may not be able to walk. Deformities such as foot drop can cause a high stepping gait, which can lead to abnormal body shape and instability.

Foot drops and anesthesia increase the risk of plantar ulceration.

Visual Impairments:

Visual impairment can cause an inability to maintain personal care, grooming, or good hygiene, as well as interfere with work and many daily activities

Assistive Devices:

Assistive devices must adapt to the daily and environmental needs of the individual affected with leprosy.

For example, gloves (gloves made of soft fabric) will be provided to protect the anesthetic hand from heat associated injury.

The tools generally used or recommended by leprosy affected individuals are dishwashers, bugs, shovels, hammers, screwdrivers, etc.

It is packaged with soft materials to protect hands from damage.

For ADL, adding the soft pad on spoon, fork, toothbrush, razor, comb, etc. to improve your personal ability.

The padding not only protects the hands from pressure injuries, but also provides a better grip when using the tool.

Leprosy affected individuals need to be educated to use these tools in their daily lives.

Exercises play a key role in recovery from disability to some extent and keep the muscle active for performing function.

Many studies suggest that the exercise can improve the impaired function. Muscle weakness of lesser duration will recover with appropriate exercise and a course of steroid.

Splinting in leprosy cases serves several purposes, primarily aimed at preventing deformities and promoting functional independence in affected individuals. Leprosy can lead to muscle weakness and loss of sensation, which increases the risk of joint contractures. Splinting helps to maintain proper joint alignment, preventing contractures from developing.

In cases where deformities have already developed, splints may be used to gradually correct them. This process requires careful assessment and planning by healthcare professionals to design appropriate splints tailored to the individual's needs.

Anesthetic limbs are prone to developing pressure ulcers due to lack of sensation. Splints can redistribute

pressure and provide cushioning, reducing the risk of ulcer formation.

Motor impairments caused paralysis and limit the hand function like grasp, pinch and prehension. Loss of mobility can be regained to some extent through tendon transfer surgery.

Self care Practices

Self care practices are playing the major role in keeping a leprosy patient far from being impaired. Self care practices are essential for the leprosy affected individuals.

A leprosy affected person who has corneal anesthesia or Lagophthalmos always has to keep goggles and have to keep a clean cloth on his/her eyes while sleeping.

Wash the eye with clean water at least twice a day to flush out dirt and to prevent dryness.

In self care of hand and foot a person should keep an eye on his hand while work to check out redness in hands. Keep the handle padded of utensils and tools used by them in work.

Soak the hand and foot in water to maintain the hydration in hand and apply the moisturizer oil or cream in hand for being dried and cracked.

Always use a micro cushion rubber sole for the footwear to prevent the risk of thermal and repetitive pressure injuries.

Physiotherapy in Leprosy

Physiotherapy plays a crucial role in recovery of a leprosy affected individual from the disability or prevent them away from the disability. A very few studies were executed on leprosy affected individuals.

Swapna Jawade and Sugat Jawade in his case study on a leprosy affected individual they stated that the modified physical therapy rehabilitation protocol has been used in borderline tuberculoid Hansen disease with partial Ulnar clawing in regaining range of motion, sensory re-education and muscle strength and improve hand grasp and functional activities. Lumbrical blocking Splint helps in reverse of functional impairment and restores the ROM without compromising day to day activities. Low-frequency transcutaneous electrical nerve stimulation restores healing of leprosy ulcer by release of endogenous corticosteroids discussed by Kaada, Birger. K Leanne et al. observed that early sensory reeducation along with mirror therapy and late sensory reeducation were equally effective. In this case mirror therapy along with sensory education started immediately which helped the patient to restore the sensation. Santhosh Rath studied that immediate joint mobilization is safe and reduced deformity and increased ROM of fingers than immobilization. Myofascial release technique was applied with foam

roller lasting to reduce tightness of shortened muscle. Strengthening of hand muscle done with manual and mechanical load to restore functional grasp. In this case modified physiotherapy rehabilitation aid in early regain of sensation, ROM and hand muscle strength and restore functional grasp.

Pain Management:

Chronic neuropathic pain is a significant source of morbidity in leprosy patients, adversely affecting quality of life and functional outcomes. Physiotherapeutic interventions play a key role in pain management, employing modalities such as transcutaneous electrical nerve stimulation (TENS), ultrasound therapy, and manual techniques to alleviate pain and improve comfort. Additionally, patient education and psychosocial support are essential components of pain management programs, empowering patients to cope with pain and engage in meaningful activities.

Psychosocial Rehabilitation

In addition to physical impairments, leprosy often takes a toll on the psychological and social well-being of affected individuals. Stigma, discrimination, and social exclusion further compound the psychosocial burden of the disease, leading to feelings of isolation, low self-esteem, and depression. Psychosocial rehabilitation aims to address these complex issues through counseling, peer support groups, and community reintegration initiatives. By fostering resilience, promoting self-advocacy, and enhancing social support networks, psychosocial rehabilitation empowers leprosy patients to reclaim their dignity and lead fulfilling lives. Government of India initiated various activities to remove the stigma of leprosy from the society. Society considers this disease as the curse of god due to evils done by the individual in previous life.

Interdisciplinary Collaboration

Effective management of leprosy-related disabilities requires close collaboration between physiotherapists, physicians, nurses, and other healthcare professionals. Interdisciplinary team-based care ensures comprehensive assessment, individualized treatment planning, and coordinated rehabilitation services. Regular communication and shared decision-making facilitate continuity of care and optimize patient outcomes. Furthermore, collaboration with community organizations, non-governmental organizations (NGOs), and disability rights groups enhances access to resources and promotes advocacy efforts on behalf of leprosy-affected individuals.

Discussion

The delay in early detection and confirmation of diagnosis and treatment, the condition become more critical and in consequences of that disabilities of patients are originated.

Stigma present in the society regarding the leprosy resist the individual to reach the community health centre for treatment.

Despite many health announcements and government programme, society is still uninformed about the disease and holds false beliefs, fears, and prejudices. The free availability of treatment at community health centre had a highly curative treatment is not enough to eliminate the stigma of this disease. The health care professional who have to guide the population had inadequate information about the disease.

Professionals who do not have adequate training do not feel safe caring for or coming into contact with leprosy patients and tend to promote attitudes that encourage stigmatization and discrimination against people.

The research data available for evidence based physiotherapy treatment and rehabilitation in leprosy disease is inadequate for the prolong relief in disability. This may be of various treatment protocol applied in treatment by many researchers.

Future study is needed for establish a proper physiotherapy treatment protocol for person affected with leprosy.

Cases registered for study belongs from a non specific group of individuals who having disability due to consequences of leprosy disease.

Physiotherapy treatment deliver with adjunct to self care practices are beneficial in terms of prolong period.

A lot of systematic reviews have concerned that physiotherapy can be better choice of rehabilitation of a leprosy affected individual and the specified optimum treatment doses needed to achieve the effective treatment and goals. Hence it is not valid to include study trials in systematic reviews with no optimal treatment doses. In order to make sure proper methodology in terms to balance the effective evidence for physiotherapy and medical intervention used for treatment and rehabilitation of leprosy affected individuals.

Conclusion

Physiotherapy plays a crucial role in the comprehensive management of leprosy-related disabilities, addressing the physical, functional, and psychosocial consequences of the disease. By employing evidence-based interventions tailored to the individual needs of patients, physiotherapists strive to optimize functional

independence, enhance quality of life, and promote social participation.

Through interdisciplinary collaboration and community engagement, healthcare professionals can harness the collective expertise and resources necessary to address the complex rehabilitation needs of leprosy-affected individuals. By integrating physiotherapy into the broader framework of leprosy care, we can ensure holistic support and empower individuals to overcome the challenges posed by this ancient disease.

Physiotherapy interventions encompass a variety of techniques, including exercises, manual therapy, splinting, and education, tailored to the specific needs and limitations of each patient. These interventions target various aspects of leprosy-related impairments, such as muscle weakness, sensory loss, joint contractures, and deformities, with the overarching goal of promoting mobility, independence, and social participation.

By implementing evidence-based strategies, physiotherapy can effectively manage symptoms, prevent complications, and enhance the overall well-being of individuals living with leprosy. Moreover, physiotherapists play a crucial role in educating patients, caregivers, and communities about the importance of rehabilitation and self-management strategies, empowering individuals to actively engage in their care and achieve optimal outcomes.

In summary, physiotherapy serves as an integral component of the multidisciplinary approach to leprosy care, working in collaboration with other healthcare professionals to address the complex needs of patients and facilitate their journey towards improved function, independence, and quality of life.

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