

Systematic Review

Physical rehabilitation of the visually impaired and its implications for tactile modelling

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ABSTRACT

The aim of this study is to investigate the effect of tactile models in improving the health of visually impaired people. The main objective of the intervention is to improve mobility, muscle strength, flexibility and physical fitness. Longitudinal study, this study was approved by the research ethics committee "Naraina Medical College and Research Centre (NMCRC)" Kanpur, Uttar Pradesh. Convenience sampling was conducted over a three-week period from December 2021 to January 2022. The physical rehabilitation of the visually impaired (PP-PVI) process includes physical assessment, language selection, design structure and visually impaired language. A longitudinal study was conducted with youth and young adults with visual impairment. They received treatment twice a week for 12 months and their quality of life was assessed before and after treatment. Quality of life was assessed using the 30-item short form health questionnaire (SF-30). Mean scores improved in all domains except the quality of life questionnaire after PP-PVI. PP-PVI has proven to be a valuable, easy-to-understand, and reliable clinical tool. This product is for people with visual impairment. Implications for Professionals: PP-PVI exercise improves many aspects of your body and performance. This plays an important role in ensuring independence for people with low vision. Physical therapy is effective in improving visual and tactile motor skills. Physical therapists can help improve the overall function and quality of life of people with these problems through targeted exercises and activities.

Keywords: Visual impairment, Physical therapy modalities, Quality of life, Sedentary lifestyle

INTRODUCTION

Blindness or visual impairment, including visual impairment, is considered two disadvantages: blindness and visual impairment. Blindness means visual acuity is less than 0.05 or less than 10°. Pitch means that the eye-light is better than 0.3, more than 0.05, or less than 20°. The distribution of the curtain may include further distribution as the weight of the defects. This classification is defined as vision ranking, including mild or severe/severe, for ICD-10-CM code H54 (WHO, 2019).

Vision plays an important role in integrating perception and thinking in the brain. Therefore, hearing loss may occur even without visual impairment.²⁰ People with visual impairments often experience functional and physical impairments resulting from uncertainty and ambiguity.^{1,11,16,18,19} In addition, physical changes caused by blindness can lead to other disabilities such as decreased mobility, physical activity, muscle strength and function, work and physical and cognitive impairments.^{2,19,21}

Vision loss can have detrimental effects on many aspects of a person's life, including psychological, social, economic, and physical functioning. This can lead to a

decrease in overall quality of life.⁸ Common effects of vision loss include decreased self-esteem and social status, progressive decline in motor and functional abilities, and limited career opportunities. As a result, household income may decline. For people with visual impairment, physical therapy techniques play an important role in solving these problems. Targeted interventions may focus on developing autonomy, mobility, motor coordination, balance, body awareness, lateralization, posture, flexibility, strength, cardiovascular fitness, and overall health improvement. Children with visual impairment often have difficulty with motor skills. Therefore, it is important to provide effective interventions that prepare people for the demands of everyday life.¹⁹

The construction of verbal commands plays a crucial role in not only comprehending the objectives of each exercise proposed but also executing each movement accurately. Alongside verbal commands, tactile commands must be precise and objective, effectively rectifying any postural errors during the execution of movements. These two types of commands should be designed to be implemented simultaneously. Consequently, the development process of an audio-tactile protocol necessitates a cohesive team comprising professionals from various fields within the health and education sectors. Consequently, the implementation of health promotion strategies for individuals with visual impairments poses a challenge due to the scarcity of adapted physical exercise protocols tailored specifically for these individuals. These protocols are necessary to improve physical and functional status,

promote social interaction, and ultimately improve overall quality of life.^{20,21}

This study aims to develop and implement an audio-tactile program to improve the health of visually impaired people. In this case, auditory-tactile techniques will become a suitable method for health intervention for visually impaired individuals. To achieve this goal, a group of blind experts developed a language model for speech and tactile instructions. Visually impaired people follow the exercises specified in the program over time and evaluate their quality of life before and after. We think that a program suitable for these individuals will improve their ability to learn new treatments. Physical therapy is often associated with recovery and improved mobility, but it can also affect other areas of health, including vision, experience, and tactile motor impairment. In recent years, there have been many studies investigating the relationship between physical therapy and improvements in visual and tactile motor skills. In this article, we discuss the latest findings and how physical therapy can benefit people with visual and tactile motor disorders. Even stroke convalescence is normally firmly fixed in the early weeks and months after the attack. Stroke rehabilitation must proceed to specify serious functional limitations, such as walking velocity, and intervals that allow group activities and superior use of a hemi paretic extremity. A vastly expanding understanding of the molecules and cellular study or physiology of neuroplasticity in the course of motor-skills learning has played a significant role in new stroke rehabilitation designs.

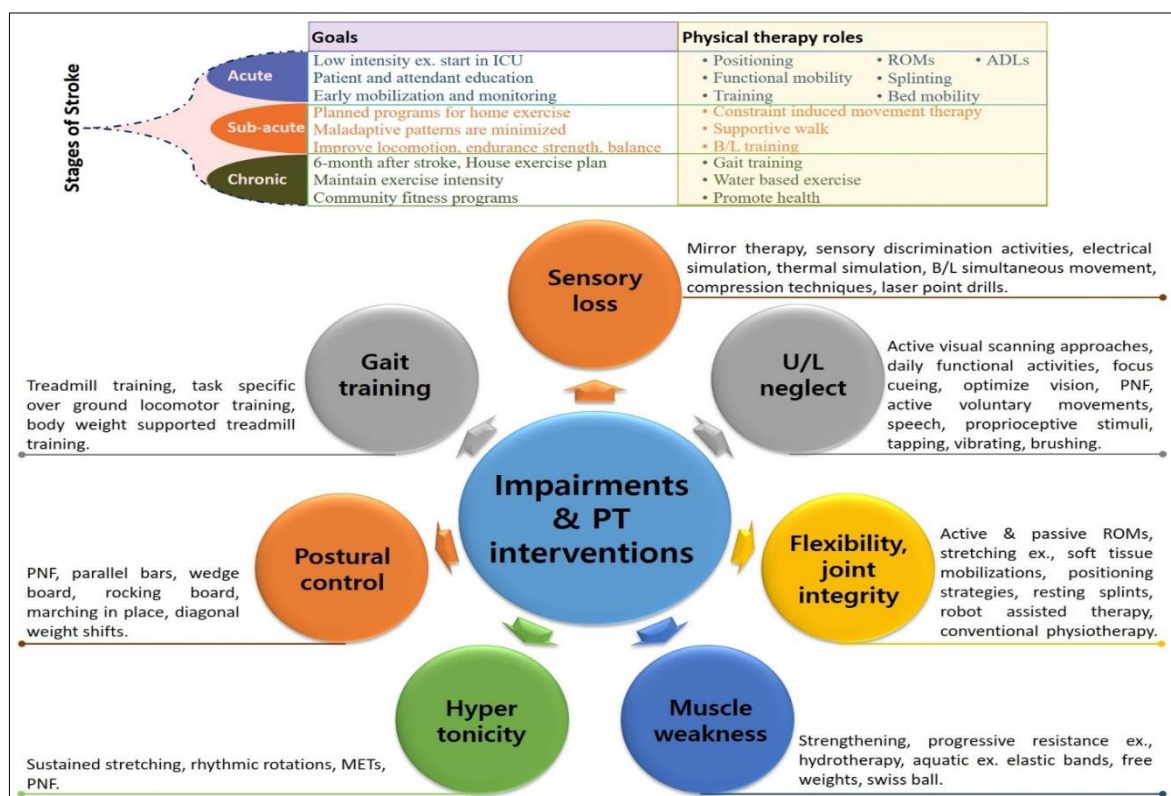


Figure 1: Physical therapy on stages of stroke.

METHODS

A total of eight people with visual impairment, including four adolescents and four young adults, participated in this longitudinal study. The purpose of the study was to develop and implement a therapeutic exercise protocol.

Participants were recruited through convenience sampling within 3 weeks, following a selection process that set specific inclusion criteria. These criteria included blind or low vision individuals aged 18–59 years with or without cognitive autonomy assessed using the mini-mental state examination checkpoint.⁷ Cardiovascular disease or disorder of the musculoskeletal system. Additionally, participants who demonstrated difficulties in understanding the questionnaire at any point during the study were also excluded. After examining these criteria, a total of ten individuals were initially included, but four were subsequently excluded, resulting in a final analysis of six individuals with visual impairments. The participants were provided with verbal information regarding the study's purpose and procedures and gave informed consent. The study was conducted in the physiotherapy room at the ICBC, utilizing appropriate materials and equipment for assessments and interventions. The development of the physiotherapy protocol for people with visual impairment (PP-PVI) involved five steps, namely physiotherapy evaluation, linguistic selection, protocol design, linguistic adequation for people with visual impairments, and linguistic adequation for the English language.

This longitudinal study involved four adolescents and four young adults with visual impairment. The main objective of this study was to develop and implement a therapeutic exercise protocol. This study was approved by the research ethics committee of “Naraina Medical College and Research Centre (NMCRC)” Kanpur U.P. Convenience sampling was conducted over a three-week period, from December 2021 to January 2022, during which a screening process was used to determine inclusion criteria. These criteria included blind or partially sighted individuals aged 16–65 years whose cognitive autonomy was assessed using Mini-Mental State Examination scores. Participants were also required to have no neurological, cardiac or disabling musculoskeletal conditions. Exclusion criteria for this study included subjects who missed three or more consecutive physical therapy sessions, subjects who missed five sessions during the protocol period, or both. After evaluating these criteria, a total of 15 subjects were included in the study and 4 were subsequently withdrawn. As a result, only eight visually impaired individuals were effectively analysed in this study. Before participation, participants were verbally informed about the purpose and procedures of the study and gave their informed consent. The study took place in the physiotherapy department of the GSVM, where the necessary materials and equipment for research and interventions were available.

PP-PVI is based on a process that includes four main steps: performing a comprehensive physical examination, carefully selecting appropriate content, designing the program itself, and ensuring that the message is appropriate for the visually impaired. to ensure. First, a full physical therapy evaluation was conducted to determine the characteristics of the model and provide guidance for protocol development. A verbal survey was administered to each person to gather important information and understand participants' blind spots. Physical therapy evaluations, including medical history, vital data collection, anthropometric measurements, static physical assessment, and strength and flexibility testing, were followed. The 30-item short form health survey (SF-30) was used to evaluate the participants' quality of life.¹⁰ However, since most participants cannot read the Braille alphabet, the measurement process needs to be evaluated carefully. 30 survey items were distributed across eight roles: physical activity, role limitations due to physical health problems, physical illness, general mental health, development, social functioning, role limitations due to emotional problems, and mental health.

Vision therapy

Vision therapy is a type of physical therapy that focuses on improving visual skills and abilities. It is often used to treat conditions such as amblyopia (lazy eye), strabismus (eye turn), and convergence insufficiency (difficulty focusing on near objects). Vision therapy involves a series of exercises and activities designed to improve eye movement, coordination, and visual processing. These exercises can be done in a clinical setting with a therapist or at home with the guidance of a therapist.

Research has shown that vision therapy can be effective in improving visual function in both children and adults. A study published in the *Journal of Optometry* found that vision therapy was successful in improving visual acuity, eye movement control, and visual processing in children with amblyopia. Another study published in the *Journal of the American Optometric Association* found that vision therapy was effective in improving visual function in adults with convergence insufficiency.

Tactile motor research

Tactile motor skills refer to the ability to use touch and movement to interact with the environment. These skills are essential for daily activities such as writing, typing, and grasping objects. Physical therapy techniques can be used to improve tactile motor skills in individuals with conditions such as cerebral palsy, stroke, and spinal cord injuries. A study published in the *Journal of Physical Therapy Science* found that physical therapy interventions, such as task-oriented training and constraint-induced movement therapy, were effective in improving tactile motor skills in children with cerebral palsy. Another study published in the *Journal of Rehabilitation Medicine* found that physical therapy interventions, such as functional

electrical stimulation and robotic-assisted therapy, were effective in improving tactile motor skills in individuals with spinal cord injuries.

The connection between physical therapy and visual impairment/tactile motor skills

The link between physical therapy and improvements in visual impairment and tactile motor skills lies in the concept of neuroplasticity. Neuroplasticity refers to the brain's ability to reorganize and form new connections in response to changes in the environment or injury. Physical therapy techniques, such as repetitive exercises and sensory stimulation, can help stimulate neuroplasticity and improve visual and tactile motor function.

The main goals of this intervention were to increase mobility, strengthen muscles, improve flexibility and correct posture. The main focus was to address reduced flexibility, which was identified as the most serious barrier. The intervention lasted approximately 40 minutes and consisted of a total of 13 exercises. Of these exercises, two were chosen to improve mobility, four were chosen to strengthen muscles, six were chosen to improve flexibility, and one exercise was aimed at general postural retraining. Specific verbal and tactile commands have been developed for each exercise to perform them correctly. The team was created in collaboration with visually impaired physical therapy students. Two visually impaired participants

completed exercises based on these commands and reported on the challenges they encountered understanding certain terms.

The protocol was applied biweekly for 12 months with a 1-month break in between due to institutional holidays. Each session lasted 40 minutes and ended with a 5-minute warm-up walk, a 30-minute exercise protocol, and a 5-minute relaxation period that included diaphragmatic breathing and passive movement exercises. For each session, background music plays to match your exercise type. Materials needed for the activity included a sleeping mat, rubber bands, a plastic ball (30 cm in diameter), and a stereo system. To assess the impact of this protocol on participants' quality of life, a quality of life questionnaire (SF-30) was administered by the same before and after a specified period.

Statistical analysis

The Shapiro–Wilk test showed non-normal data. Descriptive statistics (median, maximum, and minimum values) and inferential analysis (Wilcoxon signed-rank test) were based on the scores of the SF-30 questionnaire before and after the period (12 months) of the physiotherapy intervention. Statistical analyses were carried out using the statistical package 10.0, with a significance level of 0.05.

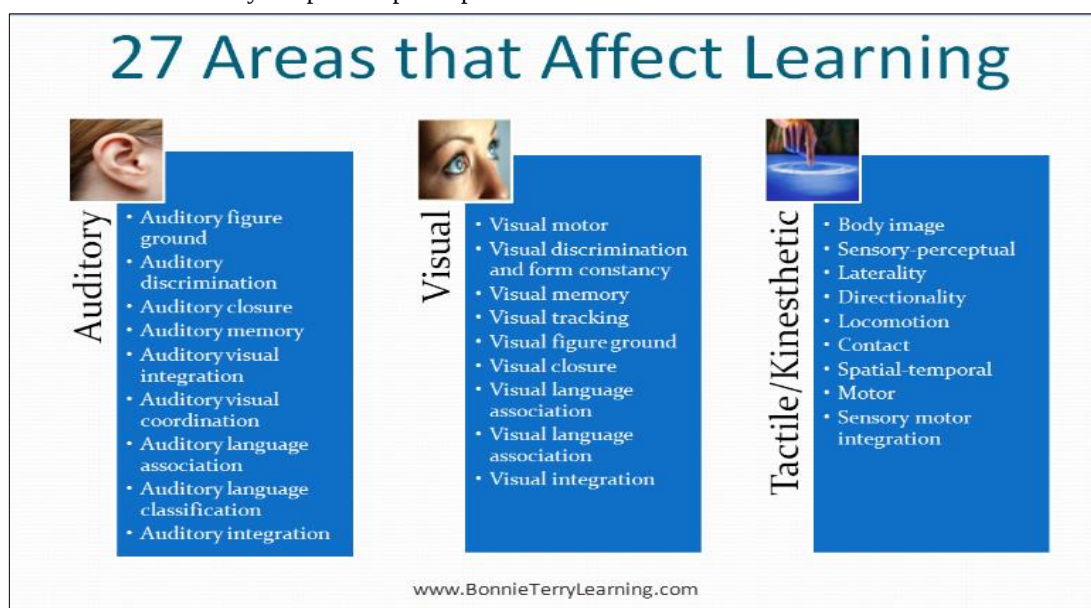


Figure 2: Effect of auditory, visual impairment and tactile motor skills.

RESULTS

Eight visually impaired individuals were subjected to these features. The main characteristics of the participants are shown in Table 1. The average age was 20 ± 5.5 years, four women and two men. According to the medical records of the institution's ophthalmologist, four participants had profound low vision and four were blind. The causes of

visual impairment were various. After the implementation of the exercise protocol, mean scores for all domains increased, indicating improvement in participants' health outcomes. However, the body pain-related domain remained unchanged. Statistical analysis revealed no significant difference in any SF-30 domains before and after the PP-PVI intervention at a significance level of 0.05.

Table 1: Characteristics of the participants.

Subject	Sex	Age in years	Visual impairment	Be the cause of
1	Female	17	Blindness	Acquired (incubator)
2	Female	19	Profound low vision	Congenital (toxoplasmosis drug pregnancy)
3	Female	19	Blindness	Liber's congenital amaurosis
4	Female	32	Profound low vision	Retinitis pigmentosa
5	Male	21	Blindness	Retinal detachment
6	Male	26	Profound low vision	Incomplete cornea and retinal disorder

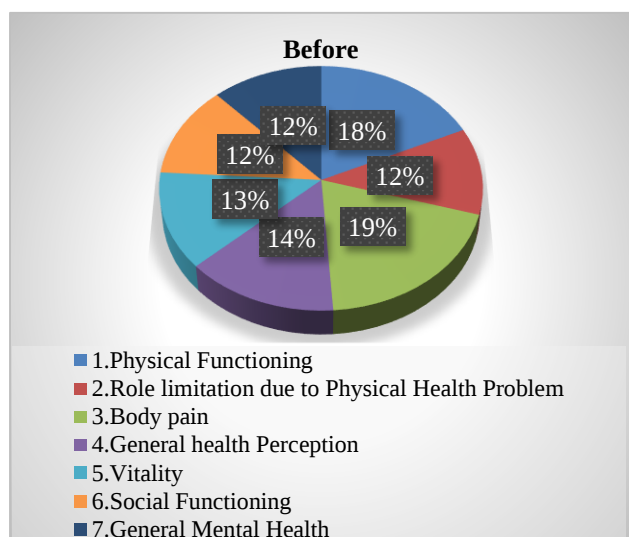


Figure 3: SF-30 quality of life survey before intervention.

Table 2: Median score (minimum and maximum) of the SF-30 quality of life survey before and after intervention.

Domain	Before	After	P value
Physical functioning	82	85	0.92
Role limitation due to physical health problem	52	87	0.06
Body pain	88	86	0.59
General health perception	65	74	0.67
Vitality	58	80	0.17
Social functioning	55	65	0.78
General mental health	54	70	0.06

P value: Wilcoxon test before and after intervention, with a significance level of 0.05

DISCUSSION

The development of the protocol took into account both the clinical and functional conditions of the sample, as well as the educational requirements for learning physical exercises. A physiotherapy evaluation was conducted to assess the physical impairment of each individual and create a profile of the group with visual impairments, which guided the protocol development. The therapeutic exercises were chosen based on both clinical goals and the

cognitive-motor learning process of people with visual impairments, with extensive research conducted on exercises specific to physical and functional deficits. The participation of a person with blindness was crucial in identifying terms that were not known to individuals with visual impairments and determining which terms needed to be explained. Working with an individual with visual impairment also helped us understand the importance of familiarizing individuals with the terms in the protocol to improve their participation in the exercises.

The PP-PVI exercises were designed using a block format. Each block includes carefully selected physical, functional and cognitive requirements to enhance physical abilities and functional skills. For example, exercises 1 and 2 focus on mobility and can be done passively. However, active participation was necessary to develop body awareness. This approach facilitated motor learning, especially in core muscles that play a crucial role in maintaining proper posture. These exercises also contributed to the separation of the pelvic and shoulder girdle during walking. On the other hand, exercises 3, 11, 12 and 13 are aimed at improving strength without using resistance weights. Instead, callisthenics exercises were performed using body weight resistance. This approach reduced the risk of injuries and allowed for gradual and progressive strength gains throughout the application. Flexibility benefits were prioritized through exercises 4-9, while active exercises to improve flexibility were also available. These exercises had secondary objectives, such as promoting balance and coordination, which are particularly important for individuals with visual impairments. Exercise 10 focuses on breath control and engages all the muscles involved in maintaining proper posture. This extensive stimulation significantly improved body awareness, which is often compromised in people with visual impairments. Additionally, it not only promotes postural correction but also increases stability.

The protocol applied in this study showed improvement in various aspects of quality of life, including physical condition, overall health, vitality, social and emotional aspects, and mental health. Although the results were not statistically significant, they support the findings of a previous study that used an audio-tactile method for teaching aquatic therapeutic exercises to people with visual impairments.¹⁵ However, a more extensive study is necessary to confirm the positive impact of the PP-PVI on the quality of life of people with visual impairments. The

proposed protocol was effective due to adherence, learning, and practice of the audio-tactile exercises. Implementing the PP-PVI could help break the cycle of inactivity, which is associated with various health risks.^{9,16,20} Ensuring accessibility to physical exercise through architectural adaptations, communication facilitation, professional training, and specific protocols like the PP-PVI can promote physical, social, and psychological gains for people with visual impairments. Table 2. This study is part of a larger project that aims to provide comprehensive health care for people with visual impairments in partnership with an institution specializing in visual impairment. The project has been running without interruption.

Overcoming sedentary lifestyle

Visual impairment can often lead to a sedentary lifestyle, impacting both physical and mental health. Through targeted physical therapy modalities, individuals can overcome the barriers to physical activity, promoting an active lifestyle and reducing the risk of associated health concerns. By incorporating regular physical activity and engaging in tailored exercise programs, individuals with visual impairment can experience improved physical function, enhanced mobility, and a greater sense of overall well-being. Physical therapy modalities play a crucial role in improving the quality of life for individuals with visual impairment. By addressing physical limitations, promoting independence, and supporting engagement in physical activities, physical therapists empower individuals to live active, fulfilling lives, despite the challenges posed by visual impairment.

CONCLUSION

In addition, the exercises outlined in this protocol were conducted twice a week over an extended period of time, resulting in significant alterations to the sedentary lifestyles of the participants. This transformation has the potential to prevent numerous diseases and promote overall well-being. Furthermore, the implementation of PP-PVI represents a fundamental shift in how visual impairment is perceived. The initial change involves boosting the confidence of individuals with visual impairments in their ability to engage in physical activities. A lack of confidence in this regard often leads to a sedentary lifestyle and a decline in health. The second change pertains to society's perception of individuals with visual impairments, as adjustments and modifications can be made in social settings to ensure their inclusion. It is crucial to recognize that spaces can be easily redesigned or adapted to accommodate individuals with visual impairments, enabling them to participate in physical exercises and other activities. Additionally, society's mindset should be re-evaluated to explore new approaches to living, treating, and preventing illnesses, while prioritizing overall well-being. By doing so, true inclusion of individuals with visual impairments can be achieved. Physical therapy is valuable in improving visual

impairment and tactile motor skills. Through targeted exercises and activities, physical therapists can help individuals with these challenges improve their overall function and quality of life. As research in this area continues to grow, we can expect to see even more innovative and effective physical therapy techniques being developed to address these issues. If you or a loved one is struggling with visual impairment or tactile motor challenges, consider consulting with a physical therapist to see how they can help.

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