



## RESEARCH ARTICLE

### PHYSIOTHERAPY METHODS FOR SPINAL CORD INJURIES EMPHASIZING SOCIAL INTEGRATION AND PARTICIPATION: A SYSTEMATIC REVIEW

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#### ABSTRACT

SCI has a profound impact on physical, emotional, and social functioning, and rehabilitation should cover all these dimensions. In this systematic review, the review of physiotherapy techniques, including motor function restoration and neuroplasticity-based interventions, and cardiorespiratory physiotherapy, in enhancing recovery with social integration of patients after SCI, is done. Techniques such as strength training, gait training, functional electrical stimulation (FES), and robotics-assisted therapies are those which bring about significant mobility and independence improvements and can boost psychological resilience. The review also focuses attention on social integration and participation in rehabilitation, discussing important barriers that include accessibility issues, stigma in society, and emotional challenges. The holistic management approach is emphasized through case studies and multi-disciplinary approaches, including contributions from occupational therapists, psychologists, and social workers. Assistive technologies and adaptive sports programs augment quality of life by promoting independence and community participation. Conclusions should be made to focus on patient-centered approaches that merge physical recovery with social inclusion to mean a man's living a fulfilled, active life with SCI.

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## INTRODUCTION

SCI is a life-threatening medical condition causing significant physical, emotional, and social problems. Injuries to the spinal cord are increasingly on the rise due to accidents, falls, and sports injuries around the world. People with SCI suffer from a loss of mobility, chronic pain, secondary health complications, and dependency on caregivers (1). A comprehensive rehabilitation approach requires the understanding of multifaceted nature of SCI. Physiotherapy is a vital component of SCI rehabilitation, where the goals include enhancing motor function, autonomy, and prevention of complications (2). It promotes neuroplasticity and has a beneficial effect on mental well-being. Social integration and participation are integral parts of rehabilitation, with goals including the rebuilding of self-esteem, purpose, and belonging. This approach guarantees a successful transition from clinical recovery to productive and independent living.

### PHYSIOTHERAPY TECHNIQUE FOR SCI

**Motor Function Restoration Techniques:** Restoring motor function should be the cornerstone of treatment of patients with SCI: It is essential to strengthen both within and below

the level of injury. Strength training builds power in preserved motor units and therefore needs to be done by giving patients resistance exercises, weight bearing activities, and other related functional movements. Strength training enables individuals to achieve the following important activities, such as transferring from a wheelchair, maintaining proper postures, and performing daily activities independently (8). Gait training is another important technique aimed at recovering the ability to walk. It includes methods such as body-weight-supported treadmill training (BWSTT) and overground training, often supported by assistive devices such as walkers, crutches, or robotic exoskeletons.

Gait training enhances mobility and balance and is a key element in rebuilding psychological confidence, enabling patients to move through their environments with greater independence. Another technique is Functional Electrical Stimulation (FES), which allows paralyzed muscles to be stimulated using electrical impulses. This would enable movement, prevent atrophy of the muscles, and allow for better circulation. Activities such as cycling or rowing are often combined with FES to enhance cardiovascular and muscular recovery.

**Neuroplasticity-Based Interventions:** Interventions that target neuroplasticity are based on remapping or rewiring existing neural pathways to enhance their recovery, and task-oriented training is considered one of its most basic methods (9). There is repeated practice of functional tasks or activities in the form of grasping, reaching, or walking because these can be mimicked in every day-life activities, influencing the brain and spinal cord toward adaptation to optimize neural relationships. Therefore, patients develop practical skill sets translating directly into enhancements in the independence of daily-life activities. This approach is modern and innovative. In addition to robotic exoskeletons and robotic arms, precise movement or controlled movements are facilitated for the patient during therapy. The technologies allow for the development of repetitive, high-intensity training tailored to a person's capabilities, therefore allowing maximum recovery potential. There are strong positive indicators towards this kind of therapy in relation to reducing the physical effort made on therapists while providing consistent efficient care. Robotics-assisted therapies have been shown to significantly facilitate functional improvements, making it part of contemporary SCI physiotherapy.

**Cardiorespiratory Physiotherapy:** Cardiorespiratory physiotherapy is very important in maintaining and enhancing the general health of a patient with SCI. Since these patients are usually immobile, their cardiovascular health is often compromised. Thus, aerobic exercises such as arm ergometry, swimming, or adaptive cycling are essential for improving endurance. These activities enhance cardiovascular fitness and also reduce the risk of comorbid conditions such as heart disease (10). Preventing respiratory complications is the other significant aspect of this approach. Inspiratory muscle training, coughing exercises, and methods of secretion clearance (e.g., suctioning) are used in order to maintain optimal lung function and prevent infections such as pneumonia. Cardiorespiratory physiotherapy also enables better circulation, increases energy levels, and increases participation in rehabilitation programs, thus improving the quality of life of the patient.

**Social Integration and Participation Post-SCI:** Social integration is still one of the most challenging issues for individuals with spinal cord injuries. One of the biggest barriers for SCI patients is physical accessibility. Many people find it difficult to move around public spaces, workplaces, and homes that do not have ramps, elevators, or other accessibility aids. The social isolation is due to these physical restrictions. Individuals with SCI will be less likely to attend social gatherings, participate in community-based events, and participate in education and job opportunities. Another significant problem with SCI is the psychological effect (11). A loss of independence and mobility will make people feel helpless, depressed, and of little worth. Social stigma and misconceptions regarding disability also lead to social exclusion or discrimination in many societies, further hindering people with SCI from integrating into society. This is further challenged by the lack of adequate support networks, which can render people without the emotional and practical resources needed to overcome these challenges (12). Physiotherapy facilitates increasing social participation for any persons with SCI, putting up the emphasis on mobility improvement with subsequent independence and psychoneural well-being. The specific forms of physiotherapy-invasive strength training, ambulative training, and FES for restoration of motoric activities-will help regain maximum functionality

and independence in patients and increase their ability to independently achieve desired goals. The ability to move about, whether independently in a wheelchair or with the aid of walkers or canes, increases self-esteem and reduces dependence on caregivers to participate in social activities. Physiotherapy also contributes to emotional resilience by making the patient feel that he is progressing and achieving something. In physiotherapy, there is an element of structure which assists the individual in setting goals and, therefore, achieving them to improve their mental health. Mobility and independence generally enable people to more extensively participate in social, professional, and leisure activities, enhancing the quality of life and a sense of community-based belonging. Many case studies and success stories document the positive results of SCI patients when physiotherapy is included in the rehabilitation process. For instance, some such patients who had been severely hampered by their mobility have restored significant functions with regular rehabilitative efforts, such as to walk using an exoskeleton or robotic aids. One example is a patient with a cervical SCI who could walk again only short distances, using an exoskeleton, which made a drastic improvement not only in physical mobility but also in his social participation. This was to go from largely being house-bound to very actively involved with family events, work, and other community activities that significantly helped improve his mental well-being. Another case is the woman who had a thoracic SCI, lost her mobility and, after intense physiotherapy, successfully used a wheelchair, could participate in adaptive sports and even return to work. These examples show how physiotherapy, when combined with proper social support, can change the lives of SCI patients and help them reintegrate into society and live full, meaningful lives despite the challenges that their injuries pose.

## MULTIDISCIPLINARY APPROACH IN SCI REHABILITATION

A multidisciplinary approach aims at collaboration between different disciplines, of which each provides a unique level of expertise for the recovery from SCI. Physiotherapists are the central figures around whom the process of restoring function, improving mobility, and averting complications revolves (13). While occupational therapists focus on allowing individuals to adapt to carrying out their daily tasks through the recovery of functional independence. Occupational therapy interventions can take the form of training in adaptive dressing, bathing, and cooking techniques or suggesting alterations of the home or work settings to enhance accessibility. Psychology is essential in the emotional/mental health management problems caused by SCI, including management of depression, anxiety, or trauma. Counseling and stress-coping techniques enable these individuals to adapt better with their new circumstances and achieve greater psychological resilience. Support of social integration is given through a social worker, facilitating interaction for patients with the health service provider, accessing resources and the general community services. Together these people coordinate to provide integrated comprehensive care that covers the SCI patients' physical, emotional, and social needs. Peer support and community programs are key components in the rehabilitation journey of individuals with SCI (14). Both in-person and online support groups offer a forum through which people can share their experiences, seek advice, and find emotional support from others who understand the specific challenges of living with SCI.

AUTHOR	TITLE	SOURCE	FINDINGS
Müller, R., Peter, C., Cieza, A., &Geyh, S. (2012) [4]	The role of social support and social skills in people with spinal cord injury—a systematic review of the literature	Spinal Cord, 50(2), 94-106	The study emphasizes the importance of social support and social skills in improving the quality of life of people with SCI. Social skills and support networks play a key role in enhancing social integration and participation in various activities.
Levins, S. M., Redenbach, D. M., & Dyck, I. (2004) [5]	Individual and societal influences on participation in physical activity following spinal cord injury: a qualitative study	Physical Therapy, 84(6), 496-509	This study identifies both individual and societal factors that affect participation in physical activities post-SCI. It highlights the role of personal motivation, social support, and societal attitudes in influencing engagement in physical activity.
Razzaghi, V., Ostadhashemi, L., Arshi, M., & Sabzi Khoshnami, M. (2022) [6]	Exploring the facilitators and barriers of social integration of patients with spinal cord injuries in Rofeideh Rehabilitation Hospital: A qualitative study	Archives of Rehabilitation, 23(4), 482-501	This study identifies key facilitators (e.g., emotional support, rehabilitation) and barriers (e.g., lack of accessibility, societal stigma) to social integration for SCI patients. The study emphasizes the importance of structured rehabilitation and societal acceptance.
Ravenek, K. E., Ravenek, M. J., Hitzig, S. L., & Wolfe, D. L. (2012) [7]	Assessing quality of life in relation to physical activity participation in persons with spinal cord injury: a systematic review	Disability and Health Journal, 5(4), 213-223	This review highlights the positive correlation between physical activity participation and improved quality of life in individuals with SCI. It suggests that engaging in physical activities enhances physical health, emotional well-being, and social integration.

It can significantly reduce feelings of isolation and foster a sense of belonging and empowerment. In addition, adaptive sports programs, such as wheelchair basketball or para-athletics, enable individuals with SCI to participate in physical activity, enhance their fitness, and socialize with others. These programs not only benefit the individual physically but also mentally and emotionally, through confidence building, team spirit, and a sense of achievement. The societal connections made in such environments are invaluable in helping returnees reintegrate into society, enlarge their social circles, and lead a more energetic and fulfilling lifestyle. Assistive technologies have transformed the nature of SCI rehabilitation, and now people can achieve much independence and mobility. In fact, wheelchairs, either manual or powered, are the most important assistive devices for mobility that can help people with SCI access their environment and engage in their daily activities. Developments in wheelchair design, such as comfort, functionality, and accessibility, allow a better adaptation to changing terrain and user needs (15). Orthotics that involve braces or splints prevent deformity and pressure sores by providing stability and maintaining alignment in patients with an SCI. This also gives these patients better functional competency because their ability to perform these movements is improved. It provides a possibility of acquiring previous functions in the case of individuals who opt for using a prosthetic arm, a prosthetic leg. These technologies, besides standing frames or exoskeletons, make enormous contributions toward the enhancement of the quality of life in SCI, restoring a reasonable degree of independence in everyday living and engaging in social, recreational, and work-related activities considered impossible with injury.

## CONCLUSION

In conclusion, the SCI rehabilitation process is multifaceted and requires a holistic approach to address the various aspects of physical, emotional, and social challenges facing persons with SCI. It represents a critical role for physiotherapy in restoring motor functions, enhancing mobility, fostering neuroplasticity, and contributing to psychological resilience and quality of life.

Therefore, social participation and community reintegration play a significant role in restoring self-esteem while creating the feeling of being part of society. By integrating such rehabilitation programs at cross-disciplinary levels of physiotherapy, occupational therapy, psychology, and social work, patients receive their specific rehabilitative care based on their personal needs. Assistance from peer support, use of adaptive sports, and assistive technologies helps raise rehabilitation performance to levels necessary to lead effective, productive lives. By addressing both physical recovery and social integration, SCI rehabilitation improves the quality of life for the individual and promotes their successful reintegration into society.

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