



## The Role of Adaptive Technology in Spinal Cord Injury Rehabilitation

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## DESCRIPTION

Spinal cord rehabilitation is often overshadowed by more publicly visible aspects of medical care, yet it represents one of the most profound journeys in healthcare both physically and emotionally. It's not just a response to injury, but a critical, ongoing process that can determine whether a person regains independence or faces a lifetime of dependency. Spinal cord rehabilitation is not given the recognition, resources, or research it truly deserves, despite its central role in the lives of those affected by Spinal Cord Injuries (SCI). It is more than a program it is a path to dignity, function, and hope.

The importance of spinal cord rehabilitation lies not just in physical recovery, but in its capacity to rebuild a life. Most spinal cord injuries are permanent to varying degrees, and the goal of rehabilitation is rarely a complete return to prior function. Rather, it focuses on maximizing what is possible through mobility training, strength development, adaptive technology, and above all, empowerment. In many cases, rehabilitation makes the difference between being confined to bed and being able to live independently, work, or re-engage with society.

There is also a pressing need to start rehabilitation early. Studies have shown that initiating physical and occupational therapy as soon as the patient is stable can significantly improve outcomes. Early rehabilitation helps prevent complications such as muscle contractures, pressure sores, deep vein thrombosis, and respiratory issues. It also gives patients and families hope when they need it most. Waiting weeks or months to begin meaningful rehabilitation is not just a missed opportunity it's a tragedy that can lead to irreversible secondary complications.

One aspect of spinal cord rehabilitation that is deeply personal and often overlooked is the emotional and psychological dimension. SCI is a traumatic event, and patients commonly experience depression, anxiety, post-traumatic stress, and a deep sense of loss. Losing the ability to walk, use one's hands, or perform daily tasks is not only physically limiting it strikes at the core of identity and self-worth. Therefore, mental health support must be a pillar of any rehabilitation program. Unfortunately, mental health services are often the first to be cut in underfunded rehab programs, which is both short-sighted and inhumane.

Reintegration into society is another crucial yet underestimated component of rehabilitation. For many patients, the end of inpatient rehab is just the beginning of the real challenge. Returning home, resuming work or education, and navigating public spaces with a wheelchair or assistive device is daunting. Rehabilitation should not end at the hospital door it should follow the individual into the community. Vocational training, peer support, access to assistive technologies, and legal advocacy for accessibility rights must be extended well beyond discharge. Without this continuity, all the progress made during formal rehab can be lost to the frustrations of a society that remains largely inaccessible.

Technology has played a transformative role in modern spinal cord rehabilitation, but it still hasn't reached its full potential. Robotic exoskeletons, brain-computer interfaces, neuromodulation, and Functional Electrical Stimulation (FES) are no longer science fiction they are real tools offering tangible improvements in mobility and quality of life. Yet these technologies remain out of reach for many, largely due to cost and insurance limitations. We must challenge the notion that these innovations are luxuries. For someone with SCI, being able to stand, walk a few steps, or use a robotic glove to hold a fork isn't a luxury it's life-changing. Access to such technology should be viewed as a right, not a privilege.

Research must also continue, and it must diversify. Most clinical trials in SCI focus on the acute phase and the possibility of a cure. While cure research is undoubtedly important, it must not come at the expense of rehabilitation science. There is a tremendous need for studies on long-term rehab outcomes, community integration, mental health interventions, and the real-world efficacy of new technologies. We need to understand not just how to extend life after SCI, but how to make that life worth living.

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