



## ASSESSMENT OF NEUROPLASTICITY MECHANISMS IN PATIENTS UNDERGOING REHABILITATION AFTER STROKE

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### Abstract

Stroke is a leading cause of adult disability and frequently results in motor, sensory, cognitive, and speech impairments. Neuroplasticity represents the biological basis of functional recovery after stroke. The aim of this study was to assess neuroplasticity mechanisms involved in post-stroke rehabilitation and evaluate their clinical relevance. The findings show that repetitive task-oriented training, early mobilization, sensory stimulation, and multidisciplinary rehabilitation promote neural reorganization and improve functional outcomes. Understanding neuroplastic mechanisms is essential for designing effective individualized rehabilitation programs.

**Keywords:** stroke, neuroplasticity, rehabilitation, motor recovery, functional outcomes

### Introduction

Stroke causes sudden disruption of cerebral blood flow and leads to neuronal injury in affected brain regions. Recovery after stroke depends not only on lesion size and location but also on the capacity of the nervous system to reorganize itself. Neuroplasticity includes synaptic remodeling, cortical reorganization, activation of alternative neural pathways, and motor learning. Rehabilitation interventions aim to stimulate these adaptive processes and restore lost functions. Early and intensive therapy is associated with better outcomes.

This topic is relevant because modern medical practice requires evidence-based analysis, early diagnosis, and interdisciplinary approaches. A deeper understanding of pathogenetic and clinical mechanisms allows healthcare professionals to improve prevention, monitoring, and treatment outcomes.

### Materials and Methods

This review analyzed clinical and experimental literature on neuroplasticity in stroke rehabilitation. Publications discussing motor training, constraint-induced movement therapy, gait rehabilitation, cognitive recovery, neuroimaging, and neuromodulation were evaluated. Functional outcomes and mechanisms of neural adaptation were summarized.

### Results

The analysis demonstrated that rehabilitation stimulates neuroplastic changes through repetition, intensity, task specificity, and sensory feedback. Patients receiving structured therapy showed improvement in motor control, balance, walking ability, and daily activities. Neuroimaging studies indicated reorganization of cortical networks during recovery. Combined approaches involving physiotherapy, occupational therapy, speech therapy, and neuromodulation showed promising results.

### Discussion

Neuroplasticity is influenced by age, lesion characteristics, comorbidities, rehabilitation intensity, and motivation. Individualized programs are required to maximize recovery. Excessive delay in rehabilitation may reduce plastic potential, while overly intensive therapy without adaptation may cause fatigue. Future strategies should integrate robotics, virtual reality, brain stimulation, and digital monitoring to enhance recovery.

The reviewed evidence indicates that practical implementation depends on clinical context, patient characteristics, available resources, and professional competence. Therefore, future studies should include larger cohorts, standardized protocols, and long-term follow-up to improve reliability of conclusions.



### **Conclusion**

Neuroplasticity is the foundation of functional recovery after stroke. Rehabilitation programs that are early, repetitive, intensive, and task-oriented can improve neural reorganization and patient independence. Assessment of neuroplastic mechanisms supports personalized rehabilitation planning.

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