

## Review Article

# Recent advances in physiotherapy management of multiple sclerosis: a scoping review

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### ABSTRACT

Multiple sclerosis (MS) is a chronic immune-mediated neurological disorder leading to progressive disability, fatigue, and reduced quality of life. Physiotherapy plays a crucial role in maintaining function and participation. Over the last decade, rehabilitation has evolved toward technology-assisted and neuroplasticity-based interventions. Objective was to map and summarize recent advances in physiotherapy management of multiple sclerosis. A scoping review was conducted according to PRISMA-ScR guidelines. Electronic databases (PubMed, Scopus, Web of Science, and PEDro) were searched for studies published between 2014 and 2025. Studies investigating physiotherapy or rehabilitation interventions in MS were included. Pharmacological-only studies were excluded. A total of 40 records were identified; 30 full texts were assessed and 18 studies were included. Major intervention categories were: combined exercise therapy, high-intensity interval training, virtual reality rehabilitation, exergaming, telerehabilitation, wearable-guided therapy, and cognitive-motor dual-task training. Technology-assisted rehabilitation demonstrated comparable or superior outcomes to conventional therapy in mobility, balance, and fatigue management. Physiotherapy management of MS has shifted from compensatory care to neurorestorative and technology-integrated rehabilitation. Hybrid care models combining in-person and remote therapy appear most effective for long-term management.

**Keywords:** Multiple sclerosis, Physiotherapy, Neurorehabilitation, Telerehabilitation, Scoping review

### INTRODUCTION

Demyelination and neurodegeneration of the brain are hallmarks of multiple sclerosis (MS), a chronic inflammatory disease of the central nervous system. Brain, spinal cord, and optic nerve, frequently resulting in cognitive and physical impairment.<sup>1</sup> MS is believed to be an immune-mediated reaction to one or more environmental triggers in a genetically predisposed person, even though the precise origin is unknown. MS affects people differently. A small number of people with MS will have mild symptoms with little disability, but others will experience worsening symptoms that will lead to increased disability over time.<sup>2-4</sup> Most people with MS have short periods of symptoms that resolve fully or partially after they appear. These periods are followed by long stretches without noticeable symptoms. Most people with MS have a normal life expectancy. Young adults are

affected by multiple sclerosis, a chronic inflammatory and neurodegenerative disease of the central nervous system that causes permanent impairment. Gait disruption, exhaustion, muscle weakness, balance issues, and cognitive dysfunction are common problems. Even though relapse rates are decreased by disease-modifying treatments, functional limitations still exist and rehabilitation is necessary. The management of physiotherapy has changed significantly in the last many years. While contemporary methods concentrate on neuroplasticity, functional restoration, and long-term self-management, traditional rehabilitation concentrated on compensation and the avoidance of problems.<sup>5-8</sup>

A scoping assessment is necessary to map the available data and spot new patterns because rehabilitation approaches are growing quickly.

**METHODS**

This scoping review followed the preferred reporting items for systematic reviews and scoping reviews (PRISMA-ScR) framework. A comprehensive literature search was conducted across the electronic databases PubMed, Scopus, Web of Science, and PEDro, CINHAL. The search strategy combined Medical Subject Headings (MeSH) terms and free-text keywords related to multiple sclerosis and physiotherapy interventions. The primary search string included: “multiple sclerosis” and “physiotherapy” or “rehabilitation” or “exercise therapy” or “telerehabilitation” or “virtual reality”. Studies published between January 2015 and December 2025 were considered for inclusion.

The search was limited to human studies and articles published in the English language. Studies were included if they involved adults diagnosed with multiple sclerosis and investigated physiotherapy or rehabilitation-based interventions. Eligible study designs comprised randomized controlled trials, clinical trials, and systematic reviews published in the English language.

Studies were excluded if they focused solely on pharmacological management without a rehabilitation component, involved surgical interventions, were case

reports, or included paediatric populations. Duplicates were eliminated and all records found by database searching were exported to a reference manager. Based on the eligibility requirements, the titles and abstracts of the remaining papers were screened. A full-text review was then used to evaluate potentially pertinent papers. In this scoping review, studies that satisfied all inclusion criteria were ultimately chosen for qualitative synthesis.

A structured form was used to extract data from the included research. The type of physiotherapy intervention, outcome measures employed, functional outcomes reported, and the existence of any technology or digital rehabilitation components were all included in the retrieved data. This procedure made it possible to track recent developments in multiple sclerosis physiotherapy management and classify approaches.

**RESULTS**

A total of 40 records were initially identified through database searching. After removal of duplicates, 35 studies remained for screening. Titles and abstracts of these 35 articles were reviewed, following which 30 studies were considered eligible for full-text assessment. Based on the predefined inclusion and exclusion criteria, 18 studies were finally included in the review.

**Table 1: Categories of physiotherapy advances.**

Category	Evidence trend	Key outcomes
<b>Combined exercise</b>	Strong	Improved mobility and fatigue
<b>HIIT</b>	Emerging strong	Improved endurance
<b>Virtual reality</b>	Rapidly growing	Improved balance
<b>Exergaming</b>	Moderate	Improved adherence
<b>Telerehabilitation</b>	Strong post-COVID	Comparable to clinic therapy
<b>Functional rehabilitation focus</b>	Rapidly growing	Treatment prioritizes task-specific training, such as repetitive, functional movements for the upper limbs, utilizing, when needed, specialized robotic systems; improves balance cognition
<b>Dual-task training</b>	Emerging	Cognitive-motor improvement

**DISCUSSION**

Transitioning to neuroplastic rehab adaptive brain restructuring and motor learning are the main goals of modern MS rehabilitation.

Cortical remodelling and functional recovery are stimulated by task-specific training, repetition, and increasing overload.<sup>9,10</sup>

**Physical activity as a disease-modifying treatment**

According to recent research, exercising lessens weariness Enhances cognitive function, maintains the volume of the brain when resistance and aerobic exercise are combined, the results are better than when they are done separately.<sup>11,12</sup>

**Rehabilitation assisted by technology**

Digital rehabilitation is the MS physiotherapy field with the biggest growth. Virtual reality improves motor learning and engagement. Exergaming enhances compliance. Lifelong therapy is made possible by telerehabilitation.

Wearables enable customized recovery for managing chronic diseases, hybrid rehabilitation strategies seem to be the most viable.<sup>13-16</sup>

**Clinical consequences**

Physiotherapists ought to move away from: continuous management through episodic care, clinic-based versus hybrid delivery, and rehabilitation that is participation-focused rather than impairment-focused.

### Future directions

Future physiotherapy management of multiple sclerosis is expected to incorporate advanced digital and neurotechnological innovations. Emerging rehabilitation approaches include artificial intelligence–guided therapy for personalized exercise prescription, brain–computer interface–assisted training to enhance motor control, and adaptive virtual reality environments that dynamically respond to patient performance. In addition, remote monitoring ecosystems using wearable sensors and digital platforms are likely to support continuous assessment, long-term engagement, and individualized progression of rehabilitation programs, facilitating lifelong management of the disease.

### Limitations

This scoping review has several limitations. Considerable heterogeneity was observed among the included studies with respect to intervention types, intensity, duration, and outcome measures, which limits direct comparison of findings. Variability in disability levels and disease stages among participants may also influence rehabilitation outcomes and generalizability of results. Furthermore, many studies lacked long-term follow-up, restricting conclusions regarding the sustained effects of advanced physiotherapy interventions in individuals with multiple sclerosis.

### CONCLUSION

Physiotherapy management of multiple sclerosis has experienced a paradigm change toward neuroplasticity-driven and technology-assisted rehabilitation, as this scoping review shows. The best evidence for increasing function and involvement comes from telerehabilitation, virtual reality, and combined exercise regimens. To promote MS management throughout life, future rehabilitation models should incorporate digital health technologies with traditional physiotherapy.

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