



# EFFECTIVENESS OF STEP SQUARE EXERCISES TO PREVENT FALLS IN MULTIPLE SCLEROSIS PATIENTS – A NARRATIVE REVIEW

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## ABSTRACT

*In this study the literature review focus on the available evidence for the physiotherapy intervention to prevent falls in among multiple sclerosis. Research involved a computerized data base pertaining to studies that include the physiotherapy among multiple sclerosis patients 15 articles that showed outcomes relative to falls, physiotherapy intervention to prevent falls among selected multiple sclerosis patients with multiple sclerosis are more likely to fall, especially when walking, due to their slower proactive equilibrium reactions, decreased ability to maintain balance when reaching, central integration impairment, slow somatosensory conduction, fatigue, delayed reaction, attention deficit, difficulty maintaining stability in the presence of external disturbances, and overload fatigue of the motor cortex. Stand-related trunk instability was observed in MS patients, a rise in trunk sway, and a rise in postural sway when performing two tasks at once. Minimal literature on falls prevention there is scarcity of study which intervention among Step square exercises and Wii board exercises.*

*AIM: The study aimed to find the effectiveness of Step square exercises to prevent falls in MS patients.*

**KEY WORDS:** Multiple sclerosis, intervention, equilibrium reactions, integration impairment, somatosensory conduction, attention deficit, motor cortex, trunk stability, trunk sway,

## SEARCH METHOD

By applying key words (Multiple sclerosis- definition, incidence, aetiology, pathophysiology, trunk disability, increase in sway, step square exercises, Wii board exercises on search bar in Google Scholar, PubMed, Scopus index.

## SELECTION CRITERIA

### INTRODUCTION

Because of the demyelination of different distributions throughout central nervous system (CNS), multiple sclerosis (MS) patients frequently present with disorders of balance, sensation coordination, and strength<sup>1</sup> Because of the imbalance and frequent falls, these patients may experience fear of falling, which may have a negative impact on their quality of life<sup>2</sup>. Sufficient balance depends on appropriate motor reactions and the integration. Even in individuals with limited clinical evaluation issues, Patients suffering from multiple sclerosis often report poor balance control, which is one of the primary risk factors for acquiring the disease<sup>3,4</sup>. 200 new cases of the multiple sclerosis are reported each week<sup>5</sup>. In the United States, where an

estimated 2.5 million people have the disease [1.33/100000 persons in India received a multiple sclerosis diagnosis. Females are impacted more frequently than males by Mostly affecting young adults, MS between the ages of 20 and 40<sup>6</sup>. Although people as young as 20 and as elderly as 75 have developed it, majority of instances are found between the ages of 20 and 50<sup>20</sup>. Multiple sclerosis Patients are more likely to tumble, especially when walking, due to their slower proactive equilibrium reactions, decreased ability to maintain balance when reaching, central integration impairment, slow somatosensory conduction, fatigue, delayed reaction, attention deficit, difficulty maintaining stability in the presence of external disturbances, and overload fatigue of the motor cortex. Individuals with MS experienced a decrease in trunk stability when standing, an increase in trunk sway, and an increase in postural sway when performing two tasks at once<sup>7,9</sup>. The risk of falling increases in MS because people with the disease frequently exhibit decreased capacity to move approach the limits of stability, swaying while standing, slowness in both gait and reactions to postural sway. Physical treatment for MS patients focuses mostly on improving balance<sup>10</sup>. The Square Stepping Exercise (SSE) is therefore considered a form of deeply



explicit equilibrium training to prevent falls that primarily depends on the protective execution strategy to maintain balance in various activities and situations and also increases intellectual fall risk factors<sup>11,12</sup>. The SSE contains a number of directional advance step pattern examples that are applied to a thin mat that is divided into squares and incorporate a progression of various modified and complex step patterns. As a result, the SSE can speed up reaction times by using restorative stepping patterns, which is in line with its goal of raising the bar for proactive and reactive reactions<sup>13,14</sup>. There is minimal literature available currently to say whether step square exercises help elderly people with their balance and prevent risk of falls.

## METHODOLOGY

### SEARCH METHOD AND ELIGIBILITY CRITERIA

PubMed, Google Scholar, Medline, and Pedro were utilized to conduct a comprehensive literature search. Papers that weren't

released in English were eliminated. Here, the articles were searched with the keyword's multiple sclerosis, intervention, equilibrium reactions, integration impairment, somatosensory conduction, attention deficit, motor cortex, trunk stability, trunk sway. Inclusion and exclusion criteria are filtered and finally, 20 articles were obtained for the examine articles that weren't published in English were eliminated.

### INCLUSION

Articles discussing about Multiple sclerosis

Articles published most recent years.

Full-text articles.

Articles published in English.

### EXCLUSION

Articles explaining surgical interventions.

Articles discussing Apart from multiple sclerosis excluded.

## REVIEW OF LITERATURE

S No.	Title of the article	Name of the Author	Year of Publication	Mode of intervention	Results
1	Effect of Coduse and Step square exercises on risk of fall in multiple sclerosis.	Lama Saad EI-Din Mahmoud, Sobhy Mahmoud Aly, Marian Shafeek	2022	Coduse and Step square exercises on risk of fall in MS.	Patients with multiple sclerosis saw a significant reduction in their risk of falling and an improvement in their balance when they combined Coduse balance training with Step square exercises.
2	Square Stepping Exercise and fall risk factors in older adults.	Ryosuke Shigematsu, Tomohiro Okura, Masaki Nakagaichi	2008	Step square exercises and low-cost indoor program and walking for improving the fitness of lower extremities.	SSE is more effective than walking in reducing fall risk factors, and it appears that it may be recommended as a health promotion exercise in older adults.
3	Exercise with square steps and its effects on depression symptoms in older persons' balance.	Jessica Rodrigues Pereira, Sebastiao Gobbi, Florindo Stella	2014	Square Stepping exercises on depressive symptoms, balance and functional mobility in older adults.	SSE is an important tool for improve balance, prevent falls and reduce depression symptoms.
4	workout regimen for older persons with multiple sclerosis that involves square stepping at home.	Emerson Sebastiao, Edward Mcauley, Rachel Bollaert	2018	12 weeks home based square stepping exercise program in older adults with multiple sclerosis.	The viability, acceptance, and potential effectiveness of a home-based SSE intervention for elderly MS patients.
5	The control of fatigue in multiple sclerosis.	Carmen Tur	2016	The physical methods of cooling therapy, electromagnetic field therapy, and resistance training have all been	According to publications, the application of mixed approaches—which are inherently comprehensive—may produce outstanding outcomes in clinical practice regarding fatigue levels as well as more



				studied. The evidence supporting the other two techniques is insufficient to provide recommendations in this regard, but resistance training has demonstrated a clear and substantial benefit against placebo on fatigue related to multiple sclerosis.	general features of multiple sclerosis.
6	Visual oscillation effects on dynamic balance control among those who multiple sclerosis	Lara Riem, Scott A. Beardsley, Ahmed Z. Obeidat and Brian D. Schmit.	2022	participants performed a series of walking tasks designed to characterize the contribution of visual feedback to balance control of gait using a commissive virtual environment	essence of visual motion processing errors in PW MS that reduced dynamic stability. Specifically, object motion (via tree sway) was not effectively parsed from the observer's self-motion
7	Enhancement of balance and mobility in individuals with multiple sclerosis using visual cue guided multidirectional step training.	Mohan Ganesa, Alexander S Aurin	2021	Five individuals with relapsing-remitting MS participated in the 4-week training involving stepping in eight directions in response to a visual cue. Balance, gait, and mobility were assessed before and after training	Balance, gait, and mobility in individuals with MS could be improved after 4 weeks of visual cue guided multi-direction stepping training. Outcomes from this feasibility study could help to refocus conventional rehabilitation strategies aimed at aiding individuals with MS to achieve maximal independence in mobility
8	Effects of backward walking training on balance, gait and functional mobility in those suffering with MS.	Fatih Soke, Mult sclera rialto discord	2023	experimental group (n=10) and the control group (n=9). The experimental group received BWT in addition to conventional walking training (CWT) while the control group only received CWT. Both groups performed training three times a week for 8 weeks	BWT in addition to CWT is an effective way to improve balance, gait, and functional mobility for PW MS. These results suggest that BWT may be a potentially useful treatment approach when added to CWT in the rehabilitation of MS



9	Mobility and balance rehabilitation in multiple sclerosis.	Chiara Corrine, Elisa Gervasoni, Gloria Perini	2023	Intervention, method of rehabilitation interventions; Comparison, experimental (specific balance intervention) vs control (no intervention/no specific balance).	Our analyses provide level 1 evidence about the impact of balance intervention to improve mobility.
10	Comprehending the relationship between walking activity and impairment in multiple sclerosis: step count, walking intensity, and length of uninterrupted walking activity.	A Neven, Annelien Vandestreek, Davy Janssens, Geert Wets, Peter Feys	2016	How many steps people with MS (PW MS) take; (2) how many steps they take at a low to moderate effort; and (3) how long they walk for in a continuous manner 2, 3, 6, 10, 12, and 14 minutes	PW MS should be motivated to walk for extended periods of time (at least ten unbroken minutes) and at a moderate intensity.
11	predicting inadvertent falls in patients suffering with multiple sclerosis.	Ylva Nilisa Gard, Cecilia Lundholm, Eva Denison, Lars-Gunnar Gunnarsson	2009	Self-reported events that occurred in the three months after a standard test methodology.	examining how walking aids are used, looking into When identifying fallers, various factors are taken into consideration such as proprioception and spasticity, the Expanded Disability Status Score, the Berg Balance Scale, or Timed Up and Go cognition.
12	An innovative square-stepping training regimen for senior citizens (Step it): justification and potential benefits for preventing falls	Eleftheria Giannouli, Tobias Morat, Wieben Zijlstra	2020	The participants are shown stepping patterns that they need to learn by heart and practice on a mat. Based on four principles— execution speed, pattern complexity, pattern length, and execution in dual- or multi-tasking conditions—the difficulty level methodically and steadily increases session by session to allow for the evaluation of dose-response effects.	The idea that has been provided can serve as a foundation for the creation of further stepping exercise regimens for preventive and/or rehabilitation. It is recommended that this exercise program, or modified variations thereof, be used in more research.
13	A balance exercise program helped multiple sclerosis patients have fewer falls.	Ylva Elisabet Nilisa Gard et al. Arch Phys Med Rehabil	2014	60-minute group-based balance exercises guided by physiotherapists twice a week for	People with mild to moderate MS experienced fewer falls and a lower percentage of fallers, as well as better balance performance; however,



				seven weeks that focus on core stability, dual tasking, and sensory methods	perceived walking and balance confidence limitations were mostly same.
14	innovative square-stepping workout regimen for senior citizens.	Giannouli Eleftheria et al. Front Med (Lausanne).	2020	stepwise training, which considers current research findings and exact dosage of training components to optimize training results.	The idea that is being provided can serve as a foundation for creating further stepping exercise regimens for prevention and/or rehabilitation.
15	methodology and design of a feasibility study for a home-based square stepping exercise program for multiple sclerosis patients in their later years.	Emerson Sebastião et al. Contempt Clin Trials Commun.	2017	Biweekly sessions with an exercise trainer at the Exercise Neuroscience Research Laboratory will be provided to participants in the intervention group. They will also receive both verbal and visual guidance on step patterns for the SSE program.	This is how well a fitness regimen at homework for elderly MS patients.
16	Multiple sclerosis patients' mobility and balance.	Mult Sclar Ralat Discord	2021	Stepping in eight directions in response to a visual cue is part of a four-week training program. Mobility, gait, and balance were evaluated both before and after training.	After four weeks of visual cue guided multi-direction stepping training, people with MS may have better balance, gait, and mobility. The results of this feasibility study may contribute to reorienting traditional rehabilitation approaches for the purpose of assisting people with MS to reach their highest level of mobility independence
17	Effects of square stepping exercise on balance and depressive symptoms in older adults.	Jessica Rodrigues Pereira, Sebastiao Gobbi, Camila Vieira Ligo Teixeira.	2014	Trained Group (TG), who performed a 16-week intervention with SSE and Control Group (CG), who performed only evaluations	Conclude that the SSE is an important tool for improve balance, prevent falls and decrease depression symptoms.
18	Square Stepping Exercise and Fall Risk Factors in older adults	Ryosuke Shigematsu, Tomohiro Okura, Masaki Nakagaichi.	2008	SSE group participated in 70 minutes exercise sessions twice a week at a local health care centre and the Wii group participated in	SSE is apparently more effective than walking in reducing fall risk factors and it appears that it may be recommend as a health promotion exercise in older adults.





				outdoor supervised walking sessions conducted weekly.	
19	Effect of Coduse and Step square exercises on risk of fall in multiple sclerosis.	Lama Saad EI-Din Mahmoud, Sobhy Mahmoud Aly, Marian Shafeek.	2022	The study group that received CoDuSe balance training and SSE combined with the selected exercise program for four weeks, while the control group received only the selected exercise program	The combination of CoDuSe balance training and SSE had a significant effect in reducing the risk of fall and improving balance in patients with MS,

## DISCUSSION

Balance is a complicated process that involves both the planning and execution of movements and the receiving and integration of sensory inputs, it is thought to be among the most prevalent issues in MS patients. Accordingly, the current study demonstrated that there was a notable enhancement in fall risk reduction in the research group that took part in the Step Square workout regimen. Improving muscle power and joint flexibility, lowering environmental risk factors, or strengthening the base of support are typically the goals of MS patient rehabilitation programmes aimed at reducing the risk of falls, this study contributes to our understanding of the combined functions of feedback cues as somatosensory and proprioceptive stimulation during standing and walking on uneven surfaces over small obstacles.

Because the risk of fall prevention exercise programmes depends on the participant's capacity for a variety of movement amplitude, speed, complexity, and added cognitive load, stepping square exercise (SSE) training that incorporates these elements have a notable reduction in falls<sup>16,17</sup> because it enhances balance and eliminates fear of falling<sup>18</sup>. Improved lower limb fitness, functional ability, and fall avoidance in senior citizens are all facilitated by the SSE<sup>19</sup>. Therefore, SSE training for fall-prone patients who consistently have neuromuscular, sensory, and cardiopulmonary deficiencies may benefit from increased movement speed, which increases the demands on these systems and ultimately leads to improved outcomes.

Stepping exercises also improve functional result by making it easier to perform fall prevention activities in real life. Moreover, several high intensity stepping workouts increase walking speed and other aspects of walking kinematics in neurological patients<sup>20</sup>. Sebastian and others<sup>18</sup> reported that the SSE programme for MS was practicable and safe; as a result, the SSE training clearly improved MS patients' cognition, balance, gait, and ability to prevent falls. Due to improvements in reaction and response times, gait, and equilibrium performance, both voluntary and reactive stepping training reduced falls in older persons by almost half, according to the results of a prior study by Okubo et

al.<sup>18</sup>. Stepping training for fall prevention should include multidirectional steps as well as.

## CONCLUSION

The study's conclusions indicated that step square exercises are regarded as a crucial component of MS rehabilitation programmes since they enhanced balance and decreased the chance of falling. As a result, they should be included in the programme for balance training in neurological conditions, particularly in MS patients undergoing rehabilitation.

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