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Effectiveness of Step Square Exercises to Prevent Falls in Patients with Multiple Sclerosis - 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. Multiple sclerosis patients are at an increased risk of falling, 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. Minimal literature on falls prevention there is scarcity of study which intervention among Step square exercises and Wii board exercises.

Keywords:Multiple sclerosis; Intervention; Equilibrium reactions; Integration impairment; Somatosensory conduction; Attention deficit; Motor cortex; Trunk stability; Trunk sway

Introduction

Due to the demyelination of different distributions throughout the Central Nervous System (CNS), Multiple Sclerosis (MS) patients frequently present with disorders of balance, sensation coordination, and strength[1]. As a result of the imbalance and frequent falls, these patients may experience fear of falling, which may have an adverse effect on their quality of life[2]. Sufficient balance depends on appropriate motor reactions and the integration. Even in individuals with limited clinical evaluation issues, patients with multiple sclerosis frequently experience poor balance control, which is one of the major risk factors for developing the disease[3,4].The200 new cases of multiple sclerosis are reported each week[5]. In the United States, where an estimated 2.5 million people have the disease [1.33/100000 persons in India were diagnosed with multiple sclerosis females are impacted more frequently than males by MS, which primarily affects young adults between the ages of 20 and 40[6]. Although people as young as 20 and as elderly as 75 have developed it, most cases are identified between the ages of 20 and 50[7]. Multiple sclerosis patients are at an increased risk of falling, 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[8,9]. 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[10]. 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[11,12]. 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[13,14]. Activegaming, sometimes known as "exergaming," such as the Wii Fit, is becoming increasingly well-liked among people of all ages, even the elderly. Yoga, strength training, aerobics, and balance games are all available on the Wii Fit[15].

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Table 1: Review of literature.

S. No	Tittle 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 M. Shafeek	2022	CoDuSe and Step square exercises on risk of fall in MS.	The combination of CoDuSe balance training and Step square exercises had a significant effect in reducing the risk of fall and improving balance in patients with multiple sclerosis.
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 thank walking in reducing fall risk factors, and it appears that it may be recommend as a health promotion exercise in older adults.
3	Effects of square stepping exercise on balance and depressive symptoms in older adults.	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	Home based, square stepping exercise program among older adults with multiple sclerosis.	Emerson Sebastiao, Edward McAauley, Rachel Bollaert	2018	12-week home based square stepping exercise program in older adults with multiple sclerosis.	The Feasibility, acceptability, and possible efficacy of a home-based SSE intervention for older adults with MS.
5	Fatigue management in Multiple Sclerosis.	Carmen Tur	2016	Physical approaches that have been evaluated include resistance training, electromagnetic field therapy, and cooling therapy. Whereas resistance training has shown a clear significant effect against placebo on MS-related fatigue the evidence behind the other two approaches is too low to emit recommendations in this regard significant effect against placebo on MS-related fatigue the evidence behind the other two approaches is too low to emit recommendations in this regard.	Publications suggest that the implementation of mixed approaches, which have a naturally comprehensive nature, may have excellent results in clinical practice, in relation not only to fatigue levels but also to more general aspects of MS.
6	Visual oscillation effects on dynamic balance control in people with 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 Commersive virtual environment.	Presence of visual motion processing errors in PwMS 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 Aruin	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 people with multiple sclerosis.	Fatih Soke, Mult scler rilat descord	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 PwMS. 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 Corrini, 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 on the effect of balance intervention to improve mobility.
10	Understanding walking activity in multiple sclerosis: step count, walking intensity and uninterrupted walking activity duration related to degree of disability.	Neven A, Annelien Vanderstraeten, Davy Janssens, Geert Wets, Peter Feys	2016	Number of steps persons with MS (PwMS) take; (2) the number of steps they take at low and moderate intensity; and (3) their walking activity duration for 2, 3, 6, 10, 12 and 14 uninterrupted minutes.	PwMS need to be encouraged to make steps at moderate intensity, and to make steps for longer periods of time (minimal ten uninterrupted minutes).
11	Predicting accidental falls in people with multiple sclerosis.	Ylva Nilsagård, Cecilia Lundholm, Eva Denison, Lars-Gunnar Gunnarsson	2009	Self-reported incidents during the three months following a standardized test procedure.	looking at the use of walking aids, investigating proprioception and spasticity, rating Expanded Disability Status Score and using Berg Balance Scale or Timed Up and Go cognitive all contribute when identifying fallers.
12	A novel square-stepping exercise program for older adults (StepIt): rationale and implications for falls prevention.	Eleftheria Giannouli, Tobias Morat, Wiebren Zijlstra	2020	Participants are presented with stepping patterns which they have to memorize and implement on a mat. In order to enable investigation of dose-response effects, the difficulty level systematically and gradually increases session by session based on four principles: execution speed, pattern complexity, pattern length and execution in dual-/multi-tasking conditions.	The presented concept can be used as a framework for the development of further prevention and/or rehabilitation stepping exercise programs. Further studies using this exercise regimen or modified versions of it are encouraged.

13	Balance exercise program reduced falls in patients with multiple sclerosis.	Ylva Elisabet Nilsagård et al. Arch Phys Med Rehabil	2014	Seven weeks of twice-weekly, physiotherapist-led 60-minute sessions of group-based balance exercise targeting core stability, dual tasking, and sensory strategies.	This program reduced falls and proportion of fallers and improved balance performance in people with mild to moderate MS but did not significantly alter perceived limitations in walking and balance confidence.
14	novel square-stepping exercise program for older adults.	Eleftheria Giannouli et al. Front Med (Lausanne).	2020	stepping training that aims to maximize training effects by taking into account recent research evidence and a precise dosing of training ingredients.	The presented concept can be used as a framework for the development of further prevention and/or rehabilitation stepping exercise programs.
15	Feasibility study design and methods for a home-based square stepping exercise program among older adults with multiple sclerosis.	Emerson Sebastião et al. Contemp Clin Trials Commun.	2017	Participants in the intervention group will have biweekly meetings with an exercise trainer in the Exercise Neuroscience Research Laboratory and receive verbal and visual instruction on step patterns for the SSE program.	This is effectiveness of a home-based exercise program for older adults with MS.
16	Balance and mobility in individuals with multiple sclerosis.	Mult Scler Relat Disord	2021	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.
17	Effects of square stepping exercise on balance and depressive symptoms in older adults.	Jessica Rodrigues Pereira, Sebastio 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.	Ryosuku Shigematsu, Tomohira 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 outdoor supervised walking sessions conducted weekly.	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.
19	Effect of Coduse and Step square exercises on risk of fall in multiple sclerosis.	Lama Saad El-Din Mahmoud, Sobhy Mahmoud Aly, Marian M. 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.

For the video monitor to give the participant information about their alignment and balance control during the activities, the player stands on the Wii Balance Board, which tracks and monitors the position of the player's center of pressure on the board[16]. There is minimal literature available currently to say whether Wii Fit exercise helps elderly people with their balance.

Need of the study

The primary focus of the current investigation is to ascertain the effect of Wii exercise training and SSE on the risk of fall in multiple sclerosis. This is because the primary goal of the rehabilitation program in multiple sclerosis with the risk of fall is to improve the interactions between sensory-motor integration and proactive equilibrium reactions to regain the ability to perform a complex step pattern with an adequate reaction. There is a wealth of material on balance and coordination in MS, and it will be useful in MS rehabilitation procedures[1]. Numerous studies have been done on multiple sclerosis to prevent falls but limited studies on the step square and Wii board exercises. Therefore, I sought to be comparative study of step square and Wii board exercises to prevent falls in patients with multiple sclerosis(Table 1).

Methodology

Inclusion

Definite relapsing - remitting multiple sclerosis diagnosed by Neurologist.

No evident signs of an exercitation, or corticosteroid treatment in the past 3 months

Subjects aged 18 to 70.

Subjects who can follow the instructions during this study.

Exclusion

Severe cognitive impairment

Bilateral visual impairment

Severe upper limb function impairment

Primary sleep disorders

History of trauma or fractures

Osteoporosis

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 one of the most common issues in MS patients. Accordingly, the current study demonstrated that there was a significant improvement in fall risk reduction in the research group that participated 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 programs 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 programs 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, because it enhances balance and eliminates fear of falling[7,13,16,17]. Improved lower limb fitness, functional ability, and fall prevention in older adults are all facilitated by the SSE[18]. 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[7]. Sebastian et al.[17] reported that the SSE program 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. [7]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 programs since they enhanced balance and decreased the chance of falling. As a result, they should be included in the program for balance training in neurological conditions, particularly in MS patients undergoing rehabilitation.

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