

Need of Comprehensive Physiotherapy in Multiple Sclerosis: A Narrative Review

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Abstract

Multiple Sclerosis is a chronic progressive and debilitating disease of adults which attacks myelin sheath in brain and spinal cord, leading to problems with coordination, balance, spasticity, muscle control, disability, gait disturbances and other basic bodily functions. The course of disease is highly unpredictable which greatly vary among MS patients. In majority MS attacks young adults which significantly affect the quality of life at an early stage of life. As far there is no known cure has been established for MS and patients are profoundly depends on DMDs to improve their physical as well as mental symptoms although the treatments are very expensive. Patients with MS usually do not involve in physical activity due to afraid of worsening of pre-existing symptoms or might get a relapse. Physicians now believe that exercises can play a crucial role in preventing deconditioning and to improve physical and mental symptoms as well as may have possible neuroprotective role in MS. This article reviews the effects of Physical therapy interventions on pathophysiology and on specific impairments in MS patients, and emphasizes a productive role of physical rehabilitation in PwMs.

Methods

A comprehensive literature search was done by formulating the research questions such as effects/role /benefits of exercises in MS (PubMed, SweMed, NCBI, Cochrane, Elsevier, Wiley online Library, Hindawi)

Key words- *Physical Activity, Multiple Sclerosis, Balance, Neuroprotection,*

1. INTRODUCTION

Since few decades a conventional beliefs held with Multiple Sclerosis patients (MS) that exercises or strenuous training can lead to exacerbations and temporarily worsen sign and symptoms. A physical exertion can thus lead to overheating while exercising in most MS patients which can temporarily exaggerated symptoms. Lacks of physical activity in MS can actually results into substantially development of co-morbidities such as weight gain. A concerned regarding importance of exercises becoming more clear since last decades which can prevent serious consequences such as deconditioning. There is significant data on importance of exercising not only prevent the risk for developing MS but after disease develops.

Multiple Sclerosis is a chronic debilitating disease with no known cure. The disease course is highly unpredictable and greatly varied among patients. In majority of patients, initially this condition is identified by episodes of attacks of which sign and symptoms are usually reversible, which is further followed by progressive neurological damages over time in which sign and symptoms becomes irreversible, combination of disease modifying drugs and

physical rehabilitation, speech therapy, occupational therapy, rest, lifestyle and diet may improve or relieve major symptoms and hence improve a satisfactory quality of life significantly [1]. A revised version of classification of the MS has been proposed in 2014. In this two main forms of the disease are revised: The relapsing remitting form of MS (CIS and RRMS) and the progressive type of MS (SPMS and PPMS) [2]. One study showed from nine trials which provide prefatory support for the benefits of physical therapy interventions in respect to fitness, symptoms, and improvements in the quality of life in terms of outcomes in people with progressive Multiple Sclerosis [3]. A review in which 26 randomized, controlled trials (RCTs) of physical training in people with multiple sclerosis showed that exercises reduced the rate of relapse around 6.3% and 4.6% for control group and physical training was not correlated with an increased risk of relapsing rate in MS patients [4]. In study effects of water immersion exercises in Patients with MS were systematically investigated. In this study BDNF (Brain Derived Neurotrophic Factor) resting and post- concentrations of CPET showed a noteworthy increase and in NGF after training. Short-term effects were seen on increase BDNF at the start and significantly afterwards in training [5]. Majority of People with MS are generally inactive physically as compared to non MS population. However in order to prevent unrealized complications due to sedentary lifestyle, for example deconditioning, osteoporosis, weight gain or other secondary co-morbidities, physical training can significantly play a crucial role in preside over some symptoms in people with MS and possibly yield neuroprotection [6]. MRI studies suggesting that cardiorespiratory fitness emerges protective effects on brain function and its structure in multiple sclerosis, degree of association between exercises or physical activities and progressiveness of disease (expressed as signs and symptoms, functional hindrance and associated disability) or rate of relapse provide an affirmation of relationship that physical activity can induce brain protection in various aspects [7]. A study showed promising affirmation of benefits of physical rehabilitation in persons with multiple sclerosis with severe mobility and disabilities. Positive effects of conventional exercises resistance training reported remarkable improvements in fitness and physical functions symptomatically and outcomes related to patients participation [8]. Persons with MS can be clearly benefited from exercise. Physical Exercises in MS people respond the same way as in general population: it make them more active and fit. These improvements certainly depends upon the type of training implemented: persons with multiple sclerosis who involved in aerobic exercises develops aerobic fitness, and thus those were involved in progressive resistive training exercises showed improvements in their strength and persons those involved in respiratory rehabilitation improved in terms of respiratory endurance and strength. None of the studies were concluded that physical activities or exercise was associated with the worsening of the disease activity, and thus exacerbations or relapses did occur because of natural behavior of the disease in its course, not due to impact of exercises in MS [9]. In a study thirty-four MS patients were involved in sedentary control group and 2 exercise groups that were involved in 12 weeks of high intensity cardiovascular training (continuous), in which both groups were combined with resistance training exercises. Results showed High intensity cardiovascular physical training combined with resistance training was proved to be not only safe but was well tolerated which improved muscle contractions and endurance in these multiple sclerosis subjects [10].

2. Overview of Benefits of Exercises in Specific Impairments and Pathophysiology in MS

This section will present a valuable consideration of review studies of the effectiveness of exercises related to associated impairments and in overall dimensions of pathophysiology in MS.

2.1 Role of Exercises on Immunity in MS

Autoimmune origin of MS coexists reportedly. One study with records of 828 patients with diagnosis of definite MS found that 4.8% people had a past or presented with associated condition in which autoimmune mechanisms assumably play an important role. A significantly higher prevalence ($p < 0.01$) of low titers more than one autoantibodies was present in serum in multiple sclerosis. These autoantibodies in serum of multiple sclerosis patients reflected the existence of a nonspecific B cell overactivity which can be linked to autoimmune reactivity or responses [11]. Physical training induces the release of IL-6 from the muscles which function as a myokine and this can induce anti-inflammatory response through the secretion of IL-10 and inhibition of IL-1 β . Besides it Physical activities has been proved to be productive and safe in many of autoimmune diseases such as in SLE and RA [12]. One study showed the acute and long term benefits of exercises on immune system, Regular exercise training can induce anti-inflammatory effects intervene through various pathways, epidemiological studies maintained to show that higher levels of physical activities and fitness and can decrease inflammatory biomarkers in adults [13].

2.2 Physical Activity and Remyelination

Remyelination process can restore electrical conductivity in axons thereby restoring neurological function) and is increasingly believed to have a neuroprotective role on neurons. Remyelination occurs in early MS lesions but becomes increasingly incomplete/ inadequate as disease progress. Urge to understand the factors which can lead for this failure of regeneration have fueled researchers into the biology of remyelination process [14]. A research study showed remyelination process in young mice immediately following a neurological insult which is a critical therapeutic target in demyelinating diseases such as MS. This study prove that physical exercises/activity following a demyelinating episode directly enhance the process of remyelination in young mice. Additionally, both molecular and cellular mechanisms through remyelination can be induced by exercises [15]. However further research work required on remyelination process in MS of which exercise plays an important role.

2.3 Physical Activity and Neuroplasticity in MS

One study demonstrates the associations between individual's structural and functional variations in brain structure and in motor learning. Imaging of brain regions showed behaviorally-related plasticity in healthy brain, as well as in brains affected by disease. This work suggested that therapeutic interventions can improve adaptive functional neuroplasticity after brain damage [16]. Motor function rehabilitation should be an integral component of multiple sclerosis management that is supported by Neuroplasticity mechanism in which the brain may able to adapt to MS induced damages and associated disability [17]. Another study showed a short-term benefits of effectiveness of motor rehabilitation program on gait variables in MS groups, which was marked by reorganization of the sensory-motor neuronal network in functional brain [18].

2.4 Role of Exercises on Chronic Fatigue in MS

Chronic disabling fatigue is experience by around 53% to 92% of MS Patients [19]. The results of one study confirm the role of physical rehabilitation effectively reduces fatigue in multiple sclerosis subjects thus a specific regular exercise program is strongly suggested to be an integral part of management program in MS patients [20]. Positive effects on fatigue can

be induced potentially by exercise therapy [21]. A study showed that telephonic consulting exercises may be an effective method of delivery that emphasizes the care for these patients at home, where a reduction in fatigue observed in random groups [22]. A 32 weeks rehabilitation exercise program showed significant improvements among MS patients in 6MWT, gait velocity, TUG, fatigue, and QOL and self confidence [23].

2.5 Impact of Physical Exercises on Poor Balance, Coordination and Gait in MS

A study that compares changes in balance in RRMS patients over a period of time conclude that in remitting phase patients showed unstable balance worse at onset of relapse. Gait tasks showed a significant decline in cadence and trunk sway and gait instability at a normal speed [24]. Significant balance deficits, trunk sways observed during stance phase with normal Romberg and tandem gait tests in MS patients correlated with EDSS score [25]. Another study showed the impact of spasticity on motor functions in MS patients who tremendously reduce balance and mobility in MS subjects [26]. In 15 weeks of core rehabilitation program among 15 subjects with EDSS less than 4.5, a study showed significantly improvement in both static and dynamic balance [27]. A significant improvement was seen in clinical Berg balance scales under tailored rehabilitation based on individual impaired sensory system in MS patients [28]. In Female MS patients, Yang style Tai Chi Chuan exercise sessions subjected to twice a week for the period of 12 weeks program suggested improvements in balance [29].

2.6 Role of Physical Activity on Cognition in MS

A declination in cognition can be seen in 50 to 60% population of multiple sclerosis patients over the course of this condition which can greatly impact social acceptability, employability and involvements, therefore potentially disturbed the QOL in MS [30]. A cognitive training along with motor rehabilitation can improve emotions, anger, anxiety, memory, attention in people with MS [31]. One study found Neuropsychological rehabilitation reduces cognitive symptoms such as improvement in memory span, attention, immediate verbal memory [32].

2.7 Role of exercises on MS Exacerbations

MS is associated with relapses which can be trigger by precipitating and predisposing factors such as low vitamin D levels, bacterial infections, genetically and environmental interactions, rate of relapses are higher in females in terms of sensory and visual symptoms whereas men are associated with cerebellar relapses, attacks can lead to increased health-care costs [33]. Research shows 85% of MS patients start with RRMS type, clinical features of relapses are main determinant of disease treatment [34]. A review study showed that exercises can have disease modifying effects in EAE animals models of MS, also impact of cardiorespiratory fitness seen that can influence brain function and structure, some patients-reported data supports the disease modifying effects of exercises [35]. A randomized controlled 24-week cross-over trial study showed the effects of progressive resistance training may facilitate cortical thickness and percentage brain volume change (PBVC) in 19 subjects out of 74 [36]. Animal studies demonstrated in a mouse model of MS, that is experimental autoimmune encephalomyelitis (EAE), neuronal dendritic preservation, less synaptic defects, and overall nervous preservation were observed through endurance training [37].

2. DISCUSSION

MS is a chronic progressive disease with typically onset between 20 and 40 years affecting millions of people around the world. As far there is no known cure for multiple sclerosis. The primary line of disease management focuses on Pharmacological treatment. Until now there are no known DMTs that can affect non-inflammatory drivers of the disease [38]. Physical therapy is shown to have positive benefits on quality of life (QOL) in MS. This review study suggested potential benefits of exercises on nervous structures, induces neuroprotective role and with some evidence of facilitating remyelination process in animal models. Physical therapy is shown to be effective in improving cadence, mobility, TUG, spasticity, balance and coordination in PwMs. However, the interventions methods used greatly varied among MS population. Study groups were diverse and often too small sample sizes. Implementing an exercise routine can empower patients with MS and thus can promote self-care, self confidence and self-efficacy.

3. CONCLUSION

Physical Rehabilitation should be considered to be effective and safe method of management along with pharmacological treatment in MS individuals. Existing evidences has shown the exercises can facilitate physical independence, fitness, quality of life, gait parameters in MS population. However guidelines interventions are lacking for individuals with advanced course of disease with severe disability, particularly for non-ambulatory MS patients. There is desperate need to understand the benefits of exercises as per age groups, gender, and in MS types. There is scarce of study understanding exercise effectiveness in SPMS and PPMS groups. Due to heterogeneity in study groups and endpoints many questions yet to be answered such as will early rehabilitation interventions could impact prognosis of the course of disease? It is important that study should be designed on exercise program which depends on patient's capabilities, impairments, MS subtypes, age groups and environmental barriers.

Conflict of interest

The author has no potential conflicts of interests.

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