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Review article

Evidence Based review of Physiotherapeutic management strategies in patients with Parkinsonism

Vanshika sethi

Research Scholar, Singhania University, Pachari Bari (Jhunjhunu), Rajasthan, MPT (Neurology) F.I.T. (M.R.E.S.) Faridabad, Section incharge Physiotherapy department, SCMAT, Kanpur

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ABSTRACT

Introduction: Parkinson's disease is a progressive neurological condition occurring due to loss of dopamine producing cells and patients with Parkinsonism have difficulties in initiating movements, tremors, Shuffling gait, balance impairments, dual task interference. Studies suggest that the characteristic motor symptoms of the disorder are frequently accompanied by impairments in cognition that are most profound in tasks of executive function. Management: Various Physiotherapeutic treatment strategies are utilized till date according to severity of the disease. Meg E. Morris et al. In 2010 in their study titled striding out with Parkinson's disease evidence based physical therapy for gait disorders concluded that comprehensive client centered physical therapy for people with Parkinson's disease is based on compensatory strategies to bypass the defective basal ganglia. Brief summary of other possible strategies used in management of Parkinson's disease have been included and forms the basis of this study.

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1. Introduction

Parkinson's Disease is a progressive neurological condition that occurs due to loss of dopamine producing brain and degeneration of both motor and non motor basal ganglia circuitry [1]. IPD is characterized by neuronal depletion in the substantia nigra, pars compacta and widespread occurrence of interneuronal inclusions the Lewy bodies [2-4]. People with PD are known to have a shuffling gait, difficulty initiating movements, a stooped forward posture, marked postural instability, bradykinetic movements, masked facial expression and tremors [5].

Horak et al described the difficulty people with this disease have in sequencing and executing strategies for postural correction. Disability eventually occurs with this disease due to the combined effects of many of these impairments [5].

Studies in patients with Parkinson's disease suggest that the characteristic motor symptoms of the disorder are frequently accompanied by impairments in cognition that are most profound in tasks of executive function [6].

There is some inconsistent evidence that a presentation without tremor (predominant bradykinesia/rigidity or postural instability) and increasing age may be predictors of more rapidly increasing disability but not of more rapidly increasing impairment [7].

In addition to experiencing difficulties with the performance of well learned movement sequences such as walking, turning, writing and transfers, some people with PD report falls, cognitive impairment and autonomic disturbances. Together these problems can affect quality of life and participation in societal roles [8].

2. Dual Task Interference

During many activities of daily living people need to perform more than one task at a time. The capacity to do a second task (dual task performance) is highly advantageous during walking because it allows for communication between people, transportation of objects from one location to another, and monitoring of environment so that threat to balance can be avoided.

Dual task performance also known as "concurrent performance" and involves execution of a primary task which is the major focus of attention and a secondary task performed at the same time [9].

* Corresponding Author : Vanshika sethi
Research Scholar,
Singhania University,
Pachari Bari (Jhunjhunu), Rajasthan,
E.mail: sethivanshika@gmail.com

Hollman et al. In 2004 proposed a study on age related differences in stride to stride variability during dual task walking and found that subjects, whether young or older walk more slowly in a dual task walking condition than in normal walking conditions. Older subjects walk in a dual task condition with greater variability in stride velocity, which indicates reduced stability [9].

Previous studies have shown that, with advancing age, performing an attention demanding task while walking interferes with gait performance and there is increasing evidence that a strong relationship exists between dual task related gait changes and risk of falling among older adults. Walking requires more attention among older adults as compared to young adults. Thus, for older individuals, walking while performing an attention demanding task represents a divided attention task and dual task related gait changes result from interference between gait and attention splitting task.

In their study by Beauchet Olivier et al. in 2005 it was found that in transitional older adults, a walking associated arithmetic task significantly interfered with lateral gait stability, whereas no lateral gait deviations were seen in association with a verbal fluency task therefore it was suggested that the choice of attention splitting task in dual task gait assessment among older adults must be made carefully [10].

Holtzer et al. in 2006 did a study to find out relation between cognition and gait velocity, performed with and without interference and have suggested that speed / executive attention and memory function are important when individuals have to walk in a busy environment and their findings suggest that gait velocity and cognitive functions may have both shared and independent brain substrates [11].

O'shea et al. in 2002 did a study to identify whether the type of secondary task (motor/cognitive) determines the severity of dual task interference in people with Parkinson's disease and concluded that although the performance of simultaneous motor / cognitive tasks compromised gait in people with Parkinson's disease, the type of secondary task was not a major determinant of severity of dual task interference [12].

According to a study done by Bowen et al. in 2001 on dual task effects of talking while walking on velocity and balance following stroke it was shown that many activities in everyday life require the person to complete several tasks concurrently (e.g. walking & talking), when the processing requirements of two tasks exceed the capacity of the cognitive system, interference across tasks occurs and one or both of the tasks will be impaired. However another school of thought argues that impaired functioning results from two tasks competing for the same resources because they have similar processing demands [12].

Kramer et al. in 2005 did a study to find out whether dual task performance of 2 discrimination tasks with similar motor requirements can be moderated by training. The results indicated that, even when the 2 tasks required similar motor responses, both

older and younger adults could learn to perform the task faster and more accurately. Moreover, the improvement in performance generalized to new task combinations involving new stimuli. Therefore it appears that training can substantially improve dual task processing skills in older adults [13].

In light of research indicating that inability to perform concurrent tasks is a contributing factor to instability and falls in many older adults, it has been suggested that training balance under both single and dual task conditions is necessary to optimize functional independence & reduce falls in elderly people.

Udo Eversheim and Otmar Bock investigated the change of resource demand during acquisition of sensorimotor skill and have suggested that acquisition of sensorimotor skill proceeds in distinct stages, for e.g. Fitts (1964) proposed a verbal cognitive stage, in which subjects strive to comprehend task requirements and strategies, a motor stage in which response patterns are gradually formed with the help of sensory feedback, and an autonomous stage, in which those patterns are integrated into larger sequences that can be run off with little demand on attention and have concluded that resources related to spatial attention and sensory transformations are in highest demand early during skill acquisition those pertinent to movement preparation somewhat later [14].

Anne Shumway Cook et al. in 1997 did a study to find out the effects of two types of cognitive tasks on postural stability in older adults with and without history of falls and concluded that when postural stability is impaired, even relatively simple cognitive tasks can further impact balance and results further suggest that the allocation of attention during the performance of concurrent tasks is complex, depending on many factors including the nature of both the cognitive and postural task, the goal of the subject and instructions [15].

Chen et al. in 1996 did a study to find out how divided attention during stepping over an obstacle would affect older & younger adults and found that both young and old adults had a significantly increased risk of obstacle contact while negotiating obstacles when their attention was divided. But divided attention degraded obstacle avoidance abilities of the old significantly more than it did in the young. Diminished abilities to respond to physical hazards presenting the environment when attention is directed elsewhere may partially account for high rates of falls among elderly [16]. Holtzer et al. in 2005 examined the relation of dual task performance to individual differences on neuropsychological tests and concluded that compromised central executive may underlie age related decline in dual task performance [17].

Silsupodol et al. in 2006 did a study on training of balance under single and dual task conditions in older adults with balance impairments and compared the effectiveness of whole/dual task training under various sets of instructions (fixed priority vs. variable priority). The results showed increased accuracy of task and decreased verbal response time with variable priority training compared to fixed priority training.

3. Interventions to improve Balance and Functional recovery in Parkinsonism

- Albert C Lo et al. in 2010 did a study to see the effect of repetitive robot assisted treadmill training on 4 individuals with Parkinson's disease and concluded that robot assisted gait training may be feasible and effective method of reducing Freezing of gait and improving gait. Videotaped scoring of FOG has the potential advantage of providing additional data to complement FOG self report [18].

- M Capecci et al. in 2005 did study to find out the efficacy of bilateral subthalamic stimulation to improve functional status of PD and concluded that STN-S is an effective therapeutic option in advanced PD. It induced a consistent improvement of functional abilities over 2 years to an extent that was not achieved with drug therapy alone [19].

- Meg E. Morris et al. in 2010 in their study titled striding out with Parkinson's disease evidence based physical therapy for gait disorders concluded that comprehensive client centered physical therapy for people with PD is based on compensatory strategies to bypass the defective basal ganglia.

The extent to which strategies exercises and health education are used varies according to individual needs and changes over time as the person ages and the disease progresses. Overall the aim is to enable the person with PD to live well by providing effective physical therapy interventions at optimal times to promote health and wellbeing and by educating the individual regarding long term self management strategies [8].

- Madeleine E. Hackney in 2007 in their study titled Effects of Tango on functional mobility in Parkinson's Disease : A preliminary study have concluded that the tango group showed a trend toward improvement on the Timed Up & Go test that was not observed in the exercise group [20].

- Jennifer R. Sage et al.(2003) in their study on analysis of probabilistic classification learning in patients with Parkinson's disease before & after Pallidotomy surgery have shown that cue combinations contribute significantly to probability learning [21].

- Alexandre Eusebio et al. in 2008 in their study on effects of low-frequency stimulation of the subthalamic nucleus on movement in Parkinson's disease have suggested that the susceptibility of basal ganglia networks to the effects of excessive synchronization may be elevated across a broad low frequency band in parkinsonian patients, although the nature of the consequent motor impairment may depend on the precise frequencies at which synchronisation occurs [22].

- Claudio Pacchetti et al. in 2000 did a study titled Active Music therapy in Parkinson's Disease: An integrative Method for motor and Emotional Rehabilitation and have concluded that music therapy is effective on motor, affective and behavioural functions and reported that active music therapy as a new method for inclusion in PD rehabilitation programs [23].

- Fernandez del olmo et al. in 2003 did a study titled A simple procedure using auditory stimulation to improve movement in Parkinson's Disease : A pilot study and have concluded that Auditory stimuli represents a novel and inexpensive tool to help people afflicted by PD in daily motor performance [24].

- Nieuwboer A et al. in 2007 in their study on cueing training in the home improve mobility in Parkinson's disease have concluded that cueing training in home improves mobility in patients with PD [25].

- Georg Ebersbach et al. in 2008 in their study titled Whole body vibration versus conventional physiotherapy to improve balance and gait in Parkinson's Disease have concluded that Equilibrium and gait improved in patients with PD receiving conventional WBV or conventional Pt in the setting of a comprehensive rehabilitation program [26].

- Selvakumar somasundaram in 2008 in their study titled The importance of external cueing strategies in improving balance and gait in idiopathic Parkinson's disease have concluded that the use of external rhythmic auditory and visual cueing strategies has a significant impact in improving balance and gait performance among IPD patients [27].

- Frank M. Skidmore et al. in 2008 did a pilot study titled pilot safety and feasibility study of treadmill aerobic exercise in Parkinson disease with gait impairment and have found that Treadmill aerobic exercise (TMAEX) significantly improved the subject's to the unified Parkinson's disease rating scale scores and peak ambulatory workload capacities [28].

- Burcu Duyur Cakit et al. in 2007 did a study titled The effects of incremental speed –dependent treadmill training on postural instability and fear of falling in Parkinson's Disease and have concluded that specific exercise programmes using incremental speed dependent treadmill training may improve mobility reduce postural instability and fear of falling in people with Parkinson's disease [29].

- Beth E. Fisher et al. in 2008 in their study on The effects of Exercise training in improving Motor performance and corticomotor excitability in persons with Early Parkinson's Disease have concluded that High intensity group subjects demonstrated postexercise increase in gait speed, step and stride length, hip and ankle joint excursion during self selected and fast gait and improved weight distribution [30].

- Sara Varanese et al. in 2010 in their Reviewed study on Treatment of Advanced Parkinson's Disease have concluded that A well designed interdisciplinary intervention can in most cases, resolve many problems and render the care of patients much more manageable at home [31].

- Ryan J. uitti, in year 2000 in their study on surgical treatments for Parkinson's disease have concluded that surgery in PD can be effective in reducing disability. Proper selection of patients and targeted surgery increase the likelihood of significant benefit [32].

· R.J.st. George et al. in 2010 in their study titled A meta-regression of the long term effects of deep brain stimulation on balance and gait in PD have concluded that GPi DBS in combination with levodopa seemed to pressure PIGD better than did STNDBS, although more studies of GPi DBS and randomized controls are needed [33].

· Nicola Smania et al. In 2011 in their study titled effects of Balance training on postural instability in patients with idiopathic Parkinson's disease have concluded that A program of balance training can improve postural instability in patients with PD [34, 35].

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