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To Determine the Effectiveness of Balance Training on Balance and Fear of Fall in Idiopathic Parkinson's Subjects

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Abstract

Nine subjects out of 10 were selected for study based on inclusion and exclusion criteria. The subjects were explained about the purpose of the study and the informed consent was taken from the subjects and also from the attendees. Baseline values of these subjects were assessed with berg balance scale and falls efficacy scale. The subjects received strengthening exercises, balanceexercises for a period of 6 months for duration of 5days/week, 60 minutes each session. Outcome data Assessments were performed bythe berg balance scale and fall efficacy scale were negatively correlated before and after treatment but the strength of negative correlation after treatment was weak. The post–test values of all the subjects of berg balance scale and falls efficacy scale shows greater improvement with p value <0.0001 considered extremely significant.Within group analysis revealed that there is a significant improvement in balance (p value<0.0001) and reduction of fear of fall (p value < 0.0001) in subjects with Parkinson's disease after balance training. The correlation between the scores of Berg balance scale and fall efficacy scale are strongly negative (-0.921) before treatment and after treatment also there is a negative correlation (-0.699) but it is weak statistically.

Keywords: Berg balance scale; Fall efficacy scale; Strengthening exercises.

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Introduction

Parkinson's disease (PD) is degenerative disorder of central nervous system. It is estimated that 6.3 million people suffer from PD worldwide. The World Health Organization gives an "estimated crude prevalence" (the total number of existent cases each year, old and new) of 160 per 100,000, and an estimated incidence (the number of new cases each year) of 16-19 per 100,000.[1] The incidence of PD varies across the globe. However, this distribution may not be as simple as a geographical or ethnic factor. It is known that the PD is more prevalent in North America and Europe than in Asia and West Africa. Among the movement disorders, epidemiology of Parkinson's disease has been better studied than other disorders in India. Population based surveys (excluding Parsis) have shown a crude prevalence rate (CPR) of Parkinson's disease varying from 6-53/100000.[2]Age-specific prevalence rates for PD increase with advancing age and are as high as 247/100000 above age of 60. In most studies sex-specific prevalence rates were higher in men than in women with the exception of studies from Eastern India which reported that women were more commonly affected than men and this was attributed to longer life expectancy in women. The incidence rates were much higher in

developed countries including United Kingdom (MacDonald-2000) Japan (Harada 1983) and Rochester (Rajput 1984) and lower in China (Li 1985B, Wang 1996) compared to India[3]. Falls are leading cause of accidental death and seventh leading cause of death in people older than 65years. Major problem amongst people with PD40% of older individuals have fear of falling, with half avoiding activities behind essential activities of daily living.Age related factors contributing to falls in PD patients like changes in postural control, gait abnormality, Up to 68% of people with PD fall each year, with around 50% falling repeatedly.Falls are a common problem in PD and some of the major risk factors are potentially modifiable.

There is a need for future studies to look at interventions to prevent falls in PD. In the general population risk factors for falls include muscle weakness, visualimpairment, polypharmacy (the use ofat least four medications), neurocardiovascular instability, andenvironmental factors. Many falls have a multifactorial etiology like gait impairment, and postural instability canlead to an increased risk of mortality and morbidity in PD.Fractures, particularly of the femoral neck, are among themost devastating complications of falling in Parkinsonianpatients.

Falls in PD can lead to increased dependency and risk of nursing home admissions along with a deleteriouseffect on quality of life. Fear of future falling has also been described in PD.[4] The motor symptoms of Parkinson's disease result from the death of dopamine generating cells in the substantia nigra, a region of the midbrain; the cause of this cell death is unknown. Theprimary motor symptoms of Parkinson's, such as rigidity (stiffness) and bradykinesia (slowness of movement), along with associated changes in posture, all contribute to risk of falling.

Axial rigidity, which is reduced flexibility and adaptability in the neck and trunk, results in postural instability (loss of balance), increasing a person's chances of falling. Problems with center of mass, or center of gravity, can also contribute to falls. Falls may also occur due to impaired postural reflexes (a complex set of movements that we make automatically to maintain our balance when we stand up and walk); postural change (a propensity to lean forward, with stooped posture and shuffling gait); and freezing (the inability to initiate movement, as though one's feet were stuck to the floor).

Another risk factor for PD-related falls stems from the problem some people with PD have with their vision. For instance, it is common for a person with PD to experience low blood pressure when arising from sitting or lying down, which in turn produces lightheadedness and can cause a fall. Then there is constipation, which increases the risk of bathroom falls because it can lead a person to strain for a bowel movement. This, in turn, can stimulate a vasovagal (drop in heart rate) response and increased or decreased blood pressure sometimes resulting in dizziness and falls.

Constipation also causes physical pressure on the bladder, which contributes to urinary incontinence. This can result in falls as a person rushes to the bathroom and/or slips on lost urine. Fatigue and exhaustion due to the disturbed sleep or lack of sleep that are so common in PD, are also hidden risk factors, as are stress and emotional reactions to life's events. While stress tends to worsen symptoms overall, many people with PD also develop increased and sometimes incapacitating fear and anxiety related to falls. Lastly, there are problems with executive function that is, the ability to select, inhibit, organize and sequence information and related functions that is often impaired in PD.

For reducing the risk of falls, exercises that specifically challenge and strengthen a person's balance, address axial rigidity and improve flexibility are ideal. They help a person maintain the postural stability and mobility needed to prevent falls. Exercise also enhances a person's awareness of the location of his or her center of mass, which can improve balance.[5] Maintaining balance is a necessary requirement for all the activities of human performance. Most of the Parkinson's patients have deficits in trunk balance affecting functional activities, co-ordination and gait abnormalities because of postural instability. Patients with PD improve their physical performance and activities of daily living through exercise.[6]

In literature there are various studies regarding balance training, but none of the studies didn't correlate the change in berg balance scale with change in fall efficacy scale. So, the purpose of study was to evaluate the effects of balance training on fear of fall where patients commonly prone for injuries in idiopathic Parkinson's patients.

Methodology

Study design: Experimental study.

Study setting: Uttaranchal (PG) College of Physio -therapy Outpatient Department, Dehradun.

Sample size: 10 subjects who were diagnosed as Parkinson's disease.

Study duration: 6 months

Sampling technique: Convenient Sampling.

Inclusion criteria

- Subjects with age group between 50-65 years.
- Both male and female subjects were included.
- Subjects who are Clinically diagnosed as Parkinson's subjects.
- Subjects who are co-operative and comprehending (mini mental scale 18-23).
- Subjects with on stable medication.
- Subjects with Hoehn-Yahr scale 2-3.

Exclusion criteria

- Subjects who are having visual, hearing and vestibular impairments.
- Subjects with fixed deformities of vertebral column.
- Subjects with severe stage of Parkinson's disease.
- Subjects who are having involuntary movements such as tremors.
- Subjects who are having other neurological/ orthopedic conditions.

Outcome measures

- Berg balance scale.[7]

Reliability of Berg balance scale with test re test reliability from 0.87 to 0.97, and the interrater reliability from 0.96 to 0.99[8] minimally detectable change of 3.3 for BBS score of 45-56.[9]

Validity of the BBS with internal consistency of Conbrach's alpha =0.92.[10]

- Fall efficacy scale

Reliability of FES with test re test reliability Pearson correlation 0.71.[11]

Concurrent validity with geriatric fear of fall measurement γ= -0.57.[12]

Procedure

Nine subjects were selected for study based on inclusion and exclusion criteria. The subjects were explained about the purpose of the study and the informed consent was taken from the subjects and also from the attendees. Baseline values of these subjects were assessed with berg balance scale and falls efficacy scale. The subjects received strengthening exercises, balanceexercises for a period of 6 months for duration of 5days/week, 60 minutes each session. The subjects received strengthening exercises thatincludes sit to stand, Heelraises, semi squats and side stepping .Initially advice the subject to sit comfortably in a chair for few minutes following that make the subject to do sit to stand exercise then heel raises in standing position, side stepping without support of railing andfinally semi squats.

Instruct the subjects to do semi squats without any support if he feels any discomfort he can take support. Each exercise was performed for 10 repetitions with appropriate rest periods between sessions. Balance training includes both Static and dynamic balance exercises.

The subjects were made to do standing with narrow base of support , weight transfers with intact vision and altered vision with goggles. Afterwards make the subjects to walk on flat ground , foam bed and sand simultaneously advice the subject to do dual tasks movements such as changing the ball from one hand to other while walking. Post test values of these subjects were re -assessed with Berg balance scale and fall efficacy scale.

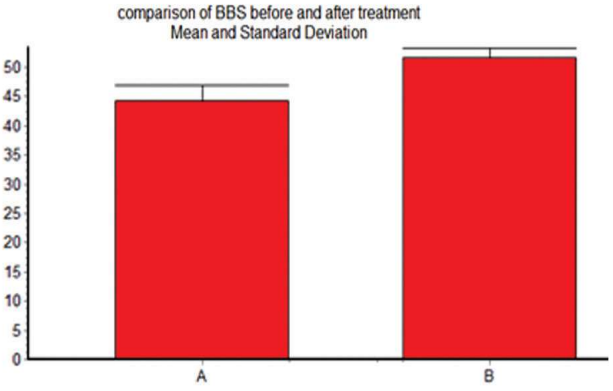

Fig. 1: Comparison of Mean and SD values of BBS before and after the treatment.

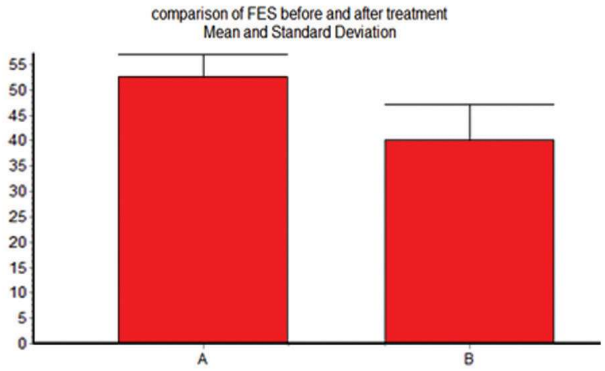

Fig. 2: Comparison of Mean and SD values of FES before and after the treatment.

Table: Statistical data of Berg balance scale and fall efficacy scale.

Out-come		Mean	SD	P value	t value
BBS	Pre-Test	44.33	2.646	<0.0001	7.811
	Post-Test	51.55	1.740		
FES	Pre Test	52.55	4.391	<0.0001	7.2798
	Post Test	40	7.194		

Discussion

Parkinson's disease is associated with high risk of falls due to balance deficits which in turn depends on postural instability. So the exercises designed in this study include various challenges that are meeting change of center of mass over base of support. Studies have stated that striatum is very much involved in learning motor sequences particularly in the consolidation phase, predicting that motor learning is affected in Parkinson's disease (PD) and the improvement in the brain activity and formation of different neuronal pathways confirming the effects of exercises on Parkinson's disease subjects.[13]

So in this study, the exercises were targeted for motor re-learning process which demands the brain to work more actively thereby recruiting more neural networks. The post–test values of all the subjects of berg balance scale and falls efficacy scale shows greater improvement with p value <0.0001 considered extremely significant.There is abundant evidence that additional sensory information and cueing helps to achieve better movement performance and that these effects are retained immediately after withdrawal, possibly indicating the first signs of consolidation.

However, the effect of longer periods of cued training on retention of cued and uncued performance is not well established and some studies suggest that learning effects may be cue-dependent. Based on these studies visual cues are included in this studies more over additional sensory stimulus was given by making the subjects to walk on different textures of ground. This might be reason for improvement of balance in Parkinson's disease.

The minimal detectable change for berg balance scale was found to be 3.3 and all the subjects showed true change with their improvement. Where as in fall efficacy scale almost all the subjects showed true change with their fear of fall levels. A simple balance training and strengthening techniques to lower extremities will show a greater improvement in dynamic balance.[11] Also, automatization of cued learning was demonstrated, as cues not only enhanced dual-task performance but these increments were retained after cue withdrawal. Although research on the effect of balance training under dual–task conditions is limited. Studies have reported with dual task training the positive influence of targeted interventions for motor training, whether for different cognitive components, including level of attention, processing speed, flexibility and alternating sequential, or for neuromotor issues, mainly in terms of muscle resistance, coordination, balance, and agility.[12]

There is great evidence that dual task interference has showed that few portion of basal ganglia is well activated compared to single task activities.[13] Balance training will improve the fear of fall in Parkinson's disease patients. There is a strong correlation in negative direction was noticed before treatment and when the improvement in both scales was measured after treatment the negative correlation still exists but weaker statistically.

Conclusion

The study has concluded that balance training place a role in improving balance and thereby reduced fear of fall in subjects with Parkinson's disease. The berg balance scale and fall efficacy scale were negatively correlated before and after treatment but the strength of negative correlation after treatment was weak. So there is a need to evaluate other causes for fear of fall and further studies should take those factors when dealing with fear of fall in Parkinson's disease subjects.

Limitations and Recommendations

- Small sample size
- Long term follow up is not there
- Treatment duration is very less
- Functional problems are more seen in severe Parkinson's subjects but they were not included in the study.

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Ethical Clerence: It is abonafide work done by meand I have not taken any part of thesis from anywhere.

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