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ORIGINAL ARTICLE

EFFECTIVENESS OF LSVT BIG EXERCISE TO IMPROVE BALANCE IN MILD TO MODERATE STAGE PARKINSON'S PATIENTS

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ABSTRACT

Background and objective: Parkinson's disease is a condition in which balance problem is one of the debilitating sign which is not responsive to treatment with medication. Several researches that examined the effect of LSVT big have recommended benefits relevant to a variety of outcomes. Nonetheless, very little consensus reviews have synthesized research findings across the spectrum of balance. The objective of the study is to find the effectiveness of LSVT BIG exercise to improve balance in mild to moderate stage Parkinson's patients. **Methods:** 30 patients with idiopathic PD fulfilling the inclusion criteria were recruited after obtaining an informed consent. The subjects were divided into two groups i.e., experimental and control group. Pre & Posttest measures were taken using Berg Balance Scale. The experimental group subjects received LSVT BIG training & conventional exercises and control group received conventional group of balance exercises. The intervention spanned for 1 hour session, 4 consecutive days a week for 4 weeks. **Result:** Both the experimental and control group showed improvement in balance performance after receiving the intervention. But the experimental group showed greater improvement (P=0.005) as compared to the control group with constant practice in the BIG training of Parkinson's patients as determined by the Berg Balance scale. **Conclusion:** The study documented the impact of LSVT Big training, on balance parameter. The study postulates that it is powerful in its ability to improve balance in mild to moderate Parkinson's patients.

Keywords: LSVT Big exercise; Parkinson's disease; Balance; Berg Balance scale; Neurorehabilitation.

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INTRODUCTION

Parkinson's disease (PD) is a long term devitalizing neurodegenerative disease with deteriorating health[1]. PD patients show impairments in many facet of postural control including: rigidity affecting biomechanics, festinating gait with freezing, bradykinesia of postural responses and anticipatory postural modifications, limited automaticity of gait and balance and defective kinesthesia for sensory integration[2]. In most cases both clinicians and the patients overlook the crucial components such as postural instability and functional mobility and focus mainly on gait impairments. However, balance problems and falls resulting from it are leading components determining quality of life, morbidity, and mortality in individuals with PD[2-6]. Control and coordination of movement will be effected predominantly due to the destruction of dopamine secreting neurons of basal ganglia. Patients will face an escalation in the deficit of motor function during the course of the disease, which will further aggravate their disabilities[7].

According to the study conducted by Louis CS Tan the burden of PD in Asia will rise significantly in the years to come as a result of an increased life expectancy and an ageing population. There is therefore a need to train more doctors and health care professionals in the region to better manage and care for the increasing numbers of PD patients[1].

Evidences exemplify that exercise is neuroprotective and if done regularly, can help the brain produce growth factors protect dopamine producing neurons from early death[8]. Recent advances in physiotherapy for PD are based on external cueing and compensatory behavior to circumvent defective BG function[9-13].

Lee Silvermann Voice Treatment (LSVT) Big.

Lee Silvermann Voice treatment (LSVT) BIG is a global approach towards the treatment of PD. The development and evaluation of LSVT Big are based on the concept of learning and training big, which was established from the principle neuroplasticity by Dr. Gail Koshland and Dr. Becky Farley. The initial treatment target of LSVT Big was amplitude[14].

In order to complete the task Parkinson's patients amplify their ability by achieving it through inaccurate perception of movement. They often do not step, reach, or walk far enough without visual or verbal feedback. The primary goal of LSVT Big is to carry forward and maintain bigger movements in their day to day activities. Consequently LSVT Big is constructed to treat the deficits in movement pattern, including akinesia or bradykinesia[14, 15].

The neurophysiological changes that occur following the BIG intervention is that it normalizes the movement pattern by aiming the basal ganglia through constant activation over the motor regions within the brain[8, 14, 16]. The LSVT Big approach exclusively incorporated the shaping techniques by adapting therapist techniques or visual/tactile cues, improvising self-perception which led to improved movement pattern[7].

Previous studies exemplified the effectiveness of LSVT BIG in improving motor response, mobility and speed for people with PD in a variety of stages of the disease[7, 22,24]. The main purpose of this study is to find the effectiveness of LSVT BIG in improving balance in mild to moderate Parkinson's disease

patients. Currently there is a little known study that exclusively focuses on this single subset.

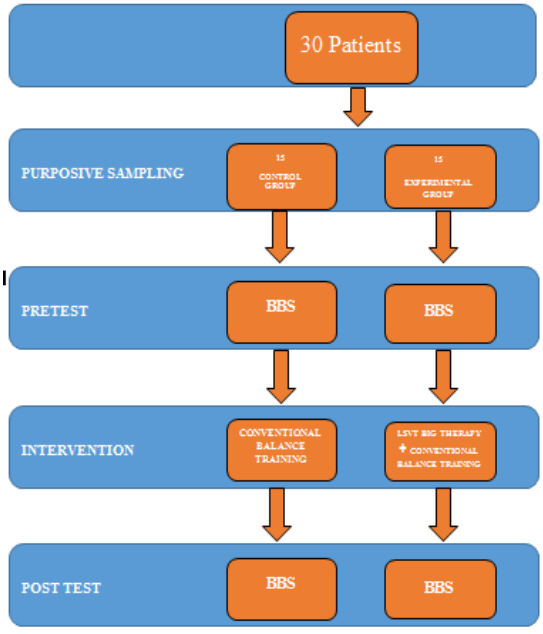
Aim of the study: The aim of this study is to find the effectiveness of LSVT BIG exercise in improving balance in mild to moderate Parkinson's disease patients.

Objectives of the study: To determine the effectiveness of LSVT BIG exercise in improving balance by measuring with Berg Balance Scale (BBS) on mild to moderate Parkinson's disease patients.

Alternate hypothesis: There will be significant difference in balance following the application of LSVT Big exercise in Parkinson's disease patients.

Null hypothesis: There will be no significant difference in balance following the application of LSVT Big exercise in Parkinson's disease patients.

METHODOLOGY



Study design: Pre versus posttest experimental design.

Study setting: Hospitals and Physiotherapy Clinic in and around Thiruvananthapuram and Bethany Navajeevan Physiotherapy Clinic, Nalanchira, Thiruvananthapuram.

Sample size: 30 samples of the population who satisfied the inclusion and exclusion criteria were selected.

Inclusion criteria:
Diagnosed as Idiopathic PD, Hoehn and Yahr Stage 1-3, , Timed Up & Go Test > 7.95 seconds, Mini-Mental State Examination (MMSE) score >25, UPDRS III Score > 40 out of 108, outpatient treatment and stable medication 4 weeks prior to inclusion.

Exclusion criteria:
Dementia (MMSE < 25), severe depression, disabling dyskinesia's, postural hypotension, comorbidity affecting mobility or ability to exercise, any medical or musculoskeletal contraindications to exercise and existing cardiorespiratory disease and Red flags.

Sampling: Purposive Sampling.

Study duration: The study was conducted over a period of 9 months.

Outcome measure: Berg Balance Scale.

Statistical analysis: Wilcoxon Signed Rank Test and Mann-Whitney U Test.

Procedure: 30 patients clinically diagnosed as Idiopathic PD by a Neurophysician referred from local outpatient clinic and hospitals were enrolled in the study. Participants were

required to fulfill the inclusion and exclusion criteria. A written informed consent from each subject was obtained. All patients were informed as to the experimental nature of the study and gave their consent for participation. During treatment, patients did not undergo any form of physiotherapy, other than that scheduled in the study protocol.

15 patients were assigned through purposive sampling method into each GROUP A (Experimental group) & GROUP B (Control group). Prior to the treatment each and every subject underwent Pretest using the Berg Balance Scale. The Berg Balance Scale is a 14-item (0-4 points per task; high=best performance) validated scale that evaluates balance abilities during sitting, standing, and positional changes.

Control Group: The patients in the control group (Group B) received conventional balance training. Patients repeated exercises belonging to 3 different predetermined groups of exercises[30].

First group of exercise: Includes 4 exercises in which the patients performed voluntary motor actions in static or dynamic conditions, such as transferring the body weights from heel to toe, maintaining stance from wide to narrow base of support, bouncing ball & tandem walking.

Second group of exercises: Includes 4 tasks that externally induce destabilization of the center-of-body mass, such as, giving external perturbations, standing on foam support and its progression.

Third group of exercises: Includes 2 exercises coordination between leg and arm movements during walking as well as locomotor dexterity over an obstacle course and other potentially destabilizing activities, such as, crossing over the rope from different directions.

During each treatment session, the patient was challenged with these 10 exercises: 4 from the first group of exercises, 4 from the second group, and 2 from the third group. Each single exercise was repeated several times (from 10 to 15 times, according to the patient's clinical condition) in 10 minutes. The patients received treatment sessions of 1 hour each day, 4 days a week for 4 consecutive weeks. Each exercise was individualized to the patient's balance ability. The therapist gave verbal instructions and, when required, assisted the patient in maintaining balance by providing support at the pelvis or chest.

Figure 1: Patient performing conventional balance training.

Experimental Group: In the experimental group (Group A) the patients were given the standard protocol of LSVT BIG training and conventional balance training. The patient and therapist had face to face interaction throughout the treatment session[14]. A high-force, eccentric resistance training of the lower

extremities 16 individual 1-hr therapy sessions 4 consecutive days a week for 4 weeks. Briefly, 50% of exercises consist of standardized whole-body movements with maximal amplitude, repetitive multidirectional movements and stretching. The second half of exercises depended on patient's preferred goal directed exercises based on their activities of daily life. Sit to stand exercise was chosen as the hierarchical exercise as it's one of the important aspect of free ambulation and was performed with full amplitude. LSVT BIG is administered one by one with thorough motivation and feedback. Patients are constantly encouraged to work on every repetition. Patients are taught to use bigger movements in routine activities to provide continuous exercise in everyday movements.

Target: BIG

Intensity: Standardized

Dosage: 4 consecutive days a week for 4 weeks (16 sessions in one month)

Repetitions: Minimum 8–16 repetitions/ task.

Effort: Push for maximum patient-perceived effort each day.

Task 1: Maximum sustained movements: seated

- Floor to Ceiling
- Side to Side

Task 2: Repetitive/Directional Movements: standing

- Forward Big Step
- Sideways Big Step
- Backward Big Step
- Forward Big Rock and Reach
- Sideways Big Rock and Reach

Hierarchy: Functional Component Movement

- Sit to Stand

Figure 2: Backward Big Step

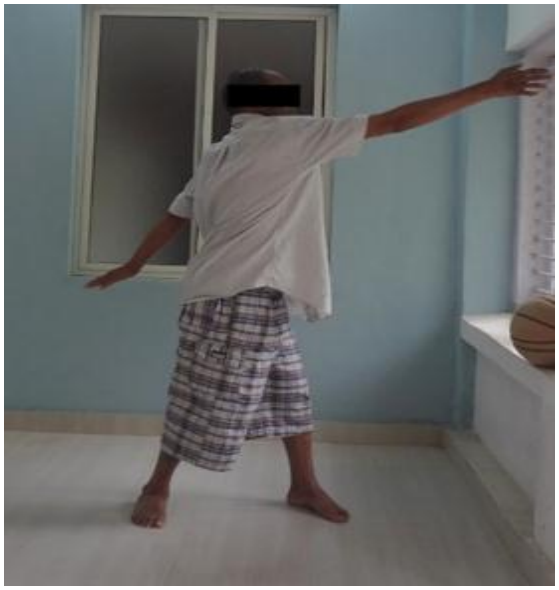


Figure 3: Sideways Big Rock and Reach

RESULT

Comparison of pretest vs post test scores of experimental group of Berg Balance Scale.

Descriptive Statistics

GROUP A	N	Min	Max	Mean	Std. Deviation	Mean difference	z value	p value
A PRE BBS	15	29	49	42.20	6.167	5.47	-3.443	0.001
VALID N (List wise)	15							
A POST BBS	15	36	55	47.67	5.972			
VALID N (List wise)	15							

Table 1: Comparison between pre and post test scores of experimental group.

Comparison of pretest vs posttest scores of control group of Berg Balance Scale

GROUP B	N	Min	Max	Mean	Std. Deviation	Mean difference	z value	p value
B PRE BBS	15	20	44	38.47	6.490	2.06	-3.477	0.001
Valid N (List wise)	15							
B Post BBS	15	22	45	40.53	6.523			
Valid N (List wise)	15							

Table 2: Comparison between pre and post test scores of control group.

Comparison between posttest scores of experimental group vs posttest scores control group of Berg Balance Scale.

Rank

GROUP	N	Mean Rank	Sum of Ranks	Mann Whitney U	SIGNIFICANCE (P)
POST BBS A	15	19.93	299.00	46.000	0.005
POST BBS B	15	11.07	166.00		
Total	30				

Table 3: Comparison of post BBS scores of experimental group & control group.

The pre-test and post-test mean value tables (Table-1, 2 & 3) shows that both group have significant improvement. Although improvement was seen in both groups, Group A improved better compared to Group-B. Therefore the study rejects the null hypothesis and accepts the alternate hypothesis.

DISCUSSION

The purpose of this study was to examine the effectiveness of LSVT Big to improve balance in mild to moderate stage Parkinson's patients.

30 subjects fulfilling the inclusion criteria were included in the study. A written informed consent from each subject was collected. 15 subjects were assigned to both experimental and control groups via purposive sampling method. Pretest & posttest scoring using BBS was done before and after the intervention in both the groups.

The Experimental group was allotted with LSVT Big Exercise & conventional balance training and control group was allotted with conventional balance training. All subjects well tolerated the intervention and none of them dropped the study in the middle.

Patients who faced difficulty while doing the exercise were provided guidance in overcoming them. To achieve constancy with home exercise, the successful participation with

proper routine and schedule should be monitored by a reliable method.

In current understanding, deficient speed-amplitude regulation leads to an under scaling of movement amplitude at any given velocity. Multiple repetitions, high intensity, and complexity are used in training BIG to restore speed-amplitude regulation. As a measure to improve balance in PD, continuous feedback on motor performance and training of movement perception was used to counterbalance the reduced gain of motor achievements resulting from disrupted sensorimotor processing. Finally, the goal of LSVT big is to develop the bigger movements in daily activities to provide sustained training in everyday movements[17, 18, 19].

In the present purposive sampling method study, LSVT Big led to improved balance performance in patients with mild to moderate PD patients.The degree of change in BBS score (P= 0.005) is considered as clinically relevant. The mean value with a standard deviation of the pretest value of the experimental group was 42.20±6.167and of posttest value of experimental group was 47.67±5.972, mean difference was 5.47 and p value was 0.001. The test result shows that there is statistically significant difference between pretest and posttest values of the experimental group (z = -3.443 and p value = 0.001).

In the control group the BBS score was improved but not more than the LSVT Big group following conventional balance training, with the same amount of supervised session. The mean value with a standard deviation of the pretest value of control group was 38.47±6.490and of posttest value of control group was 40.53±6.523, mean difference was 2.06 and p value was 0.001. The test result shows that there is statistically significant difference between pretest and posttest values of the control group (z = -3.477 and p value = 0.001).

Based on the statistical analysis using Mann-Whitney U test to compare the posttest results of BBS in both experimental and control group, the mean rank for the experimental group was 19.93 and for control group was 11.07.The sum of rank for the experimental group was 299.00 and for the control group was 166.00, Mann Whitney U value was 46.000, and the P value was 0.005. The result of the study shows that there is a statistically significant difference between the posttest mean rank of BBS in experimental Group and control Group. The posttest mean rank of BBS shows that Experimental Group (Group A) shows significant improvement in Berg Balance Scale than Control Group (Group B).

According to UB Muthane et al, nearly, 33 million Indians have neurological disorders, of which 20% had movement disorders and PD was the third most common neurological disorder and the commonest movement disorder (86.5%). Despite methodological differences across various studies and in different settings, PD is a common neurological problem in India. There are few neurologists to handle this large neurologically ill Indians as there is one neurologist for 200,000 population against 8,000 in Italy and 18,000-50,000 in the USA, and most neurologists (70-80%) work in urban areas[20].

According to Pratibha Surathi et al, postural imbalance forms one of the important features of PD. Till date, there are only a few studies that addressed the quantitative evaluation of balance impairment in PD[29]. Nallegowda et al., in their pilot study demonstrated that the

combined effect of visual sense, reduced muscle strength, narrow base of support and deteriorated proprioception impacts the functioning of balance[21].

Along with motor dysfunction some important non-motor symptoms also impacts balance. Psychological factors and disturbances of balance are related to each other. Some research has found that one's balance confidence, which is the extent of confidence individuals have in doing specific activities, emotional well-being can impact balance. Mak and Pang found that a person's belief about his or her ability to maintain good balance is indeed an important determinant of functional walking capability in patients with PD. They trust that enhancing balance certainty could be significant in advancing better strolling capacity[23]. Other research has discovered that depression is one of the factors that may affect balance disturbance in PD patients[22, 24].

Maurer and partners found that coupling amongst upper and lower body developments amid unperturbed position was anomalous vast off treatment, however, under levodopa treatment speed, recurrence and coupling measures were lessened and sway amplitude increased. More falls are probably going to happen in the on than in the off state. Walking, turning, rising, and bending forward have been accounted for regarding falls. In these activities, expectant alterations, which are weakened in PD patients, assume a noteworthy part. Medical treatments may incomprehensibly irritate falls, since the enhancement of different side effects enhances versatility without particularly enhancing anticipation and coordination[25]. Therefore, the study suggests that even with medications the balance problem in PD is least restored.

Most patients are not referred for Physiotherapy until the point when they are encountering falls or have a huge change in their functional capacity. Educating the care providers about the potential part of an exercise in PD is critical in bringing issues to light to reduce the side effects and quality of life[26].

As indicated by Cynthia Fox et al., Recent advances in neuroscience have recommended that activity based behavioural treatment may enhance function and potentially slow progression of motor effects in people with PD. They clarified the one of a kind parts of the LSVT Programs which incorporate the combination of a selective focus of increased amplitude, an emphasis on sensory recalibration to enable patients to perceive that developments with increased amplitude are within the normal limit, regardless of the possibility that they feel "too big," and preparing self-cueing and attention regarding activity to encourage long-term maintenance of treatment results. In addition, the intensive mode of delivery is consistent with the principles that drive activity-dependent neuroplasticity and motor learning[14].

Liotti and associate's result of the PET investigation passed on that, more automatic motor activation occurs with the application of LSVT Big, resulting from the shift of cortical motor initiation towards subcortical region. They additionally reported that following the LSVT, the subjects with mild PD, made the utilization of unconstrained, less effortful mechanism and they performed well on the uncued errand of LSVT. Whereas in case of moderately affected PD subjects require to be more conscious and attentive while doing the big movements[27]. When correlating with

Nallegowda's study LSVT will improve muscle strength in the spine, hip, and ankle, along with impaired proprioception, visual sense, and smaller base of support, which are the main causes of postural instability in PD patients. A recent study comparing physiotherapist supervised and self-supervised home exercise reported equal improvements after 8 weeks of training[28].

The majority of individuals that endured LSVT Big Training believe that they have noticed an improvement with balance, transferring from one place to another, and ability to turn directions. The findings of this study convey the effectiveness of LSVT Big for improving balance of mild to moderate PD patients and the techniques is easy to apply. The result can be readily implicated to clinical practices where therapists can rehabilitate patients using LSVT Big Exercises for the wellbeing of PD patients.

Limitations

1. The maintenance and enhancement of long-term treatment effects were not studied.
2. The understanding of neural mechanism of treatment related changes using investigative procedures to learn the concept of balance was not studied.
3. Only one outcome measure was used to evaluate balance parameter.
4. Effect of LSVT Big on balance during different stages of the disease was not conducted.
5. Psychological aspect of balance impairment in PD after LSVT Big Training was not studied.

Further Recommendation

1. Additional studies should be done with more number of participants.
2. Further study should be conducted with other methods, specific test and measure that are appropriate for testing the balance.
3. Randomized controlled trial should be done.
4. The study should be repeated as a double or single blinded study.
5. Studies considering other impairments affected by Parkinson's diseases could be of interest for further research.

CONCLUSION

Based on the statistical analysis using Wilcoxon signed rank test & Mann-Whitney U test with the help of SPSS 16 version, the result of the present study shows that there is statistically significant difference in balance between pretest and posttest in both the groups. Experimental group shows greater improvement in Balance while measuring Berg Balance Scale than control group in subjects with mild to moderate Parkinson's patients.

After analysing this study, the following conclusions were drawn:

- LSVT Big exercise improves Balance in mild to moderate Parkinson's patients.
- LSVT Big exercise are more effective than Conventional exercises in mild to moderate Parkinson's patients.

Thus the study concludes that LSVT Big exercises is very effective for balance in mild to moderate Parkinson's patients.

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