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Comparative Study to Check the Effectiveness of Lee Silverman Voice Treatment (LSVT) BIG Technique versus Balance Training to Improve Balance in Patients with Parkinson's Disease

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Abstract: ***Introduction: Parkinson's disease (PD) patients have progressive impairments in balance and walking function. Patients exhibit a delayed, reduced postural response when standing in order to regain stability from balance disturbances. Patients take small, shuffling steps with increased stride-to-stride variability when walking. Impaired balance and walking function increase the patient's risk of falling and have a significant impact on their quality of life. The purpose of the study is to provide with an integrative overview of the rationale for and efficacy of balance training and the LSVT BIG to enhance balance in people with Parkinson's disease. Method: It is a comparative research which included 40 Parkinson's disease patients, of which 20 received LSVT-BIG therapy and 20 received balance training, chosen randomly. Prior to beginning the program, a comprehensive balance assessment was performed using BBS. The patients were then given 16 individual 1-hour sessions (four times a week for four weeks). The balance performance of both groups was re-analysed at the end of each week using BBS. Result: Intragroup analysis of both the groups showed significant difference in pre and post test data, hence showed the effectiveness of both the interventions in improving balance of Parkinson's patients. Intergroup analysis indicated that Group A, which underwent LSVT BIG therapy, showed significantly greater improvement in balance compared to Group B, which received conventional balance training. This conclusion is based on the quantitative measures obtained from the Berg Balance Scale (BBS). These results suggest that LSVT BIG therapy is more effective in improving balance in Parkinson's Disease patients than traditional balance training methods. Conclusion: The study demonstrates that LSVT BIG therapy is significantly more effective in improving balance in patients with Parkinson's Disease compared to conventional balance training, as evidenced by the superior gains in Berg Balance Scale (BBS) scores in Group A. These findings highlight the potential of LSVT BIG therapy to enhance stability and reduce fall risk in this patient population. Consequently, incorporating LSVT BIG into therapeutic regimens for Parkinson's Disease patients may lead to better balance outcomes and improved overall quality of life.***

Keywords: Parkinson's disease, balance training, LSVT BIG therapy, postural control, fall prevention

1. Introduction

Parkinson's disease (PD) is a chronic, progressive neurodegenerative condition of unknown origin, first described by James Parkinson over 200 years ago.[1] It is the second most common neurodegenerative disease, typically affecting older individuals, and profoundly impacts patients' daily lives and social interactions, leading to significant reliance on caregivers.[2,3] Motor symptoms, including disturbances in postural control, manifest early in the disease, with notable static deformities such as the stooped simian posture and more severe abnormalities like camptocormia, antecollis, Pisa syndrome, and scoliosis.[4]

The incidence of PD is approximately 16-19 cases per 100,000 individuals annually, increasing with age. Prevalence is higher in men and varies across regions, being more common in Europe, North America, and South America compared to Africa, Asia, and the Arab world. [5,6] The number of PD cases is projected to nearly double by 2030.[5] Global disability and mortality due to PD are rising faster than for other neurological disorders, with over 8.5 million individuals affected as of 2019.[7]

Pathologically, PD involves neurodegeneration primarily in the substantia nigra pars compacta, leading to dopamine depletion and subsequent motor and non-motor symptoms. Braak et al. proposed that PD pathology begins in the lower brain stem and olfactory bulb, progressing to the substantia nigra and eventually the cerebral cortex.[8] Both genetic and environmental factors contribute to PD etiology, with known risk factors including cigarette smoking, caffeine consumption, and exposure to pesticides and heavy metals.[9]

PD's cardinal motor features include tremor, bradykinesia, rigidity, and postural instability.[10] Secondary motor symptoms, such as muscle weakness, fatigue, and gait disturbances, significantly impair patients' functional abilities.[11] Non-motor symptoms, including behavioral, cognitive, and autonomic dysfunctions, further complicate the disease.[10] Diagnosis relies on clinical evaluation and observation of symptoms, with levodopa responsiveness being a key diagnostic criterion.[5]

Current treatments focus on managing symptoms rather than curing the disease. Pharmacological options include levodopa/carbidopa, dopamine agonists, anticholinergics, and MAO-B inhibitors. Dietary adjustments and surgical interventions, such as deep brain stimulation, are also employed to manage PD symptoms.[11]

Walking difficulties are a hallmark symptom of Parkinson's disease (PD).[12] Patients with PD experience progressive challenges in balance and walking.[13] Balance disturbances in PD encompass several aspects, including biomechanical limitations on the width of the support base, postural misalignment, and muscle weakness at the ankles and hips, particularly notable during standing. Additionally, patients have restricted limits of stability (LoS), perception deficits regarding verticality, absence or delay of anticipatory postural adjustments, impaired sensorimotor integration, inadequate control of the center of pressure (CoP), diminished dynamic balance during walking, and decreased gait speed.[14]

In PD patients, the neural control of posture is compromised. Automatic postural responses can be influenced by cortical processing related to learning, past experiences, and initial postural conditions. The basal ganglia play a vital role in controlling axial tone, postural responses, and interpreting somatosensory information.[15] Theoretically, postural instability in PD may stem from faulty processing in three distinct processes: sensory organization, involving the integration of orientational senses (visual, vestibular, and somatosensory) within the basal ganglia; motor adjustment processes that provide properly scaled neuromuscular responses; and background muscle tone, which is known to be hypertonic in PD patients.[4]

The purpose of the study is to determine which technique is more effective (LSVT BIG or balance training) in improving balance in patients with Parkinson's disease.

2. Materials and methods

Study design

This comparative study involved a sample size of 40 subjects, both male and female, selected from the Neurology Department and Physiotherapy OPD of Mahatma Gandhi Hospital, Jaipur. Using a random sampling method, these subjects were divided into two equal groups: Group A, which received LSVT BIG training, and Group B, which received balance training. Each group consisted of 20 subjects.

Inclusion/exclusion criteria

The inclusion criteria required participants to be adults over 50 years old, on a stable dose of anti-Parkinson's medication, capable of giving informed consent or having a legal representative do so, and having sufficient knowledge to understand the participant information sheet. They also needed to be able to follow commands and not be involved in any other physiotherapy treatment. Exclusion criteria included having bradycardia (less than 50 bpm), being unable or unwilling to comply with study procedures, having other diseases that affect balance and gait, having previously participated in LSVT BIG treatment, or planning to start new treatments during the study period.

Procedure

The study procedure began with determining candidate eligibility based on the inclusion criteria. Forty individuals with mild to moderate Parkinson's disease were randomly selected. After acquiring informed consent, they were divided into two groups of 20 each. Patient balance was evaluated using the Berg Balance Scale before and at the end of each week, which lasted four weeks. Group A underwent 16 one-hour sessions of LSVT BIG training, which included exercises focusing on multidirectional movements with maximal amplitude and targeting specific movement deficiencies relevant to daily activities. Group B received 16 one-hour sessions of balance exercises. The experiments reported were performed in accordance with the ethical standards of the Helsinki Declaration.

Outcome measures

Berg Balance Scale

The Berg Balance Scale (BBS), developed by Berg et al., is a clinical tool for assessing balance issues in individuals with Parkinson's disease (PD). It evaluates static and dynamic balance through 14 tasks, such as sitting, standing, reaching, and turning. Each task is scored on a five-point scale from 0 (unable to perform) to 4 (independent). The maximum score is 56 points.[11] BBS is reliable and correlates with PD severity via the Unified Parkinson's Disease Rating Scale (UPDRS), but it has limitations like ceiling effects and category redundancy.[16]

Statistical analysis

The data was coded and entered into Microsoft Excel Spreadsheet. Analysis was done using Microsoft Excel. Descriptive statistics included Mean, Mean Difference and Standard Deviation. Data collected from each patient within the same group were analyzed by using “paired t-test” and between groups with the help of “Independent t-test”. Level of significance was set at $p<0.05$.

3. Results

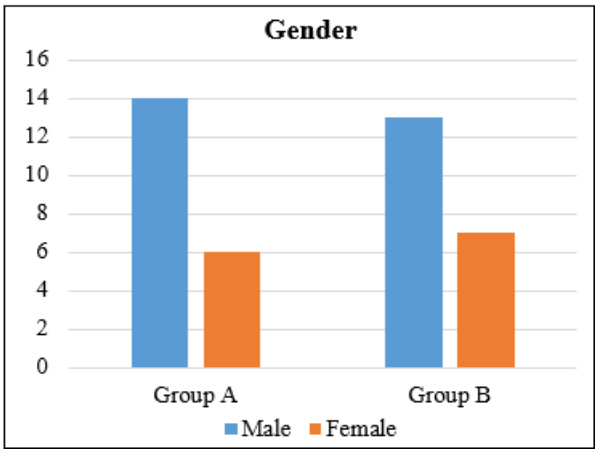
Demographic Data

Distribution of Gender in Group A and Group B

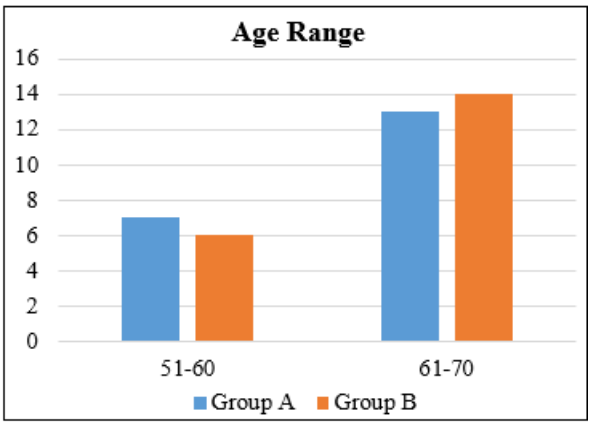
In this study 40 subjects were randomly selected and were allocated in group A and group B, out of which 27 were males and 13 were females.

Table 5.1: Comparison of Gender in Group A and Group B

	Male	Female
Group A	14	6
Group B	13	7



Graph 5.1: Comparison of Gender in Group A and Group B



Graph 5.2: Distribution of Age in Group A and Group B

It is identified that there is presence of greater number of males in the study than females. In Group A there were 14 males and 6 females and in Group B there were 13 males and 7 females.

Distribution of Age in Group A and Group B

Table 5.2: Distribution of Age in Group A and Group B

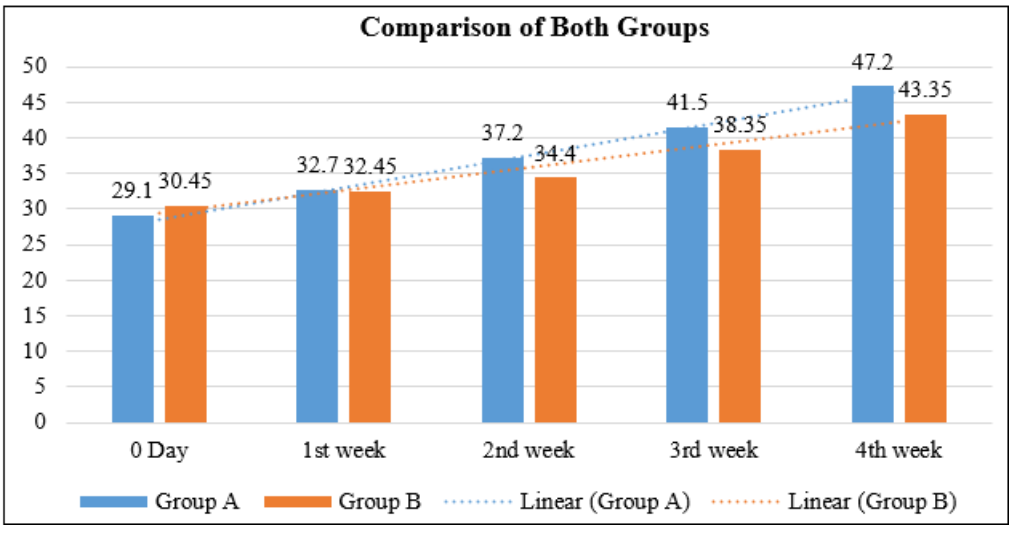
Age Range	Group A	Group B
51-60	7	6
61-70	13	14

Table 5.3: Data for LSVT Big Technique

	Mean	SD	N	SEM
0 Day	29.1	1.3379	20	0.3069
1st week	30.45	1.2554	20	0.3345
2nd week	37.2	1.1661	20	0.2675
3rd week	41.5	1.1542	20	0.2454
4th week	47.2	1.1469	20	0.3371

Table 5.4: Data for Balance Training

	Mean	SD	N	SEM
0 Day	30.45	3.9175	20	0.8987
1st week	32.45	3.6721	20	0.9365
2nd week	34.4	4.1036	20	0.9414
3rd week	38.35	3.845	20	0.8867
4th week	43.35	3.915	20	0.8981



Graph 5.3: Comparison of BBS scores in Group A

The graph represents that LSVT BIG outperforms Balance Training in improving balance in Parkinson's patients.

4. Discussion

Parkinson's disease (PD) is the most prevalent neurodegenerative movement disorder, affecting 70 out of every 100,000 people in India. The primary motor symptoms include tremor, rigidity, bradykinesia/akinesia, and postural instability, which significantly impair postural adjustments needed to anticipate perturbations or recover from instability.

This study examined the impact of LSVT BIG therapy and balance training on the balance of PD patients. Forty participants were randomly divided into two groups: Group A received LSVT BIG therapy, and Group B underwent balance training. The Berg Balance Scale (BBS) was used to assess balance. The study was a randomized controlled

comparative trial conducted over one year, with treatment administered for four weeks. Outcomes were measured on Day 1 and at the end of each week to compare the effectiveness of both therapies in improving balance.

The study included 40 participants, with a predominance of males (67.5%). Group A (LSVT BIG Therapy) had 70% males and 30% females, while Group B (Balance Training) had 65% males and 35% females. Participants were aged 51-70 years.

In Group A, BBS scores increased from 29.1 to 47.2, indicating significant improvement in balance. In Group B, BBS scores increased from 30.45 to 43.35, also showing significant improvement. However, Group A showed a statistically significant advantage with a mean BBS score of 47.2 compared to 43.35 in Group B (p-value = 0.000272).

The study highlights the effectiveness of both therapies, with LSVT BIG therapy demonstrating a statistically significant advantage. The male predominance aligns with existing literature on PD prevalence. The findings suggest that structured therapeutic interventions can significantly benefit PD patients, with LSVT BIG therapy showing more pronounced improvements due to its intensive, high-amplitude approach.

5. Limitations and Future Scope

The study's limitations include a small sample size and a short research duration, which may affect the generalizability of the findings. Data collection from a single geographical area limits the ability to assess variations due to geographical settings. Relevant predictors such as socioeconomic conditions and premorbid housing were not evaluated, potentially influencing the study outcomes. Additionally, there is insufficient information on the LSVT BIG technique, and the exercise regimen duration was not standardized. Future research should focus on longitudinal studies to determine long-term effects, include larger and more diverse sample populations for enhanced generalizability, explore combination therapies for comprehensive treatment, and investigate neurophysiological and biomechanical changes induced by the intervention. Further studies should also consider including subjects from different geographical areas and assessing the broader impact of the LSVT BIG technique on quality of life measures.

6. Conclusion

The study aimed to compare the effectiveness of the Lee Silverman Voice Treatment (LSVT) BIG technique versus balance training in improving balance in Parkinson's disease patients. Both interventions led to improvements in balance, but the LSVT BIG technique showed significantly better results compared to conventional balance training. Patients in the LSVT BIG group exhibited greater enhancements in Berg Balance Scale scores, indicating the technique's effectiveness in addressing Parkinson's motor symptoms affecting balance. Overall, the LSVT BIG technique emerges as a superior option for improving balance in Parkinson's disease, offering a promising approach to alleviate balance-related issues and enhance overall quality of life for patients.

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Conflicts of interest
The authors declare no conflict of interest.

References

[1] Chia SJ, Tan EK, Chao YX. Historical Perspective: Models of Parkinson's Disease. 2020 Apr 2.
[2] Beitz JM. Parkinson's disease: a review. 2014 Jan 1.
[3] Radder DLM, Sturkenboom IH, van Nimwegen M, Keus SH, Bloem BR, de Vries NM. Physiotherapy in Parkinson's Disease: A Meta-Analysis of Present Treatment Modalities. 2020 Oct.
[4] Rinalduzzi S, Trompetto C, Marinelli L, Alibardi A, Missori P, Fattapposta F, et al. Balance Dysfunction in Parkinson's Disease. 2015 Jan 14.
[5] Hankey GJ. Hankey's Clinical Neurology. CRC Press; 2014.
[6] Radhakrishnan DM, Goyal V. Parkinson's disease: A review. 2018 Mar 1.
[7] World Health Organization. Parkinson's Disease. 2022 Jun 13. Available from: who.int/news-room/fact-sheets/detail/parkinson-disease
[8] Stokes M, Stack E. Physical Management for Neurological Conditions. Elsevier; 2011.
[9] Kouli A, Torsney KM, Kuan WL. Parkinson's Disease: Etiology, Neuropathology, and Pathogenesis. 2018 Dec 21.
[10] McGregor MM, Nelson AB. Circuit Mechanisms of Parkinson's Disease. 2019 Mar 20.
[11] O'Sullivan SB. Physical Rehabilitation. F.A. Davis Company; 2014.
[12] Tramontano M, Medici A, Iosa M, Chiariotti A, Manzari L, Caltagirone C, et al. Blindfolded Balance Training in Patients with Parkinson's Disease: A Sensory-Motor Strategy to Improve the Gait. 2016 Feb 9.
[13] Yang WC, Wang HK, Wu RM, Lo CS, Lin KH. Home-based virtual reality balance training in Parkinson's disease: A randomized controlled trial. 2016 Sep 9.
[14] Monleón Guinot S, Albinyana-Sánchez A, Compta Y, Valls-Solé J, Valldeoriola F, Fernández Del Olmo M. Functional Balance training in people with Parkinson's disease: a protocol of balance HOME randomized control trial over crossover. 2023 Apr 26.
[15] Teixeira da Costa Capato T, Christofoletti G, Domingos J, Almeida LR, Santos SM. Randomized controlled trial protocol: balance training with rhythmical cues to improve and maintain balance control in Parkinson's disease. 2015 Sep 7.
[16] King LA, Priest KC, Salarian A, Pierce D, Horak FB. Comparing the Mini-BESTest with the Berg Balance Scale to Evaluate Balance Disorders in Parkinson's Disease. 2011 Aug 18.