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Original Research Article

Effect of Lee Silverman Voice Treatment-Big Vs Hibalance on Gait and Balance In Patients with Parkinson's Disease

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ABSTRACT

Background: Parkinson's disease is a progressive neurodegenerative disorder that commonly leads to impairments in gait and balance, and increasing the risk of falls by affecting mobility and quality of life. As these deficits emerge early in the disease course, they therefore require timely assessment and appropriate targeted intervention.

Aims and Objectives: This study aims to compare the effects of LSVT-BIG and the Hibalance program on gait and balance in individuals with Parkinson's disease and to determine which intervention provides greater benefits for this population.

Methodology: A total of 56 participants with Parkinson's Disease were recruited for a two-group, parallel, open-label, randomized controlled trial (RCT) using Convenience Sampling with Simple Random Method. Group 1 received the LSVT-BIG exercises while Group 2 received the Hibalance exercises during 16 sessions over 4 weeks. Outcome measures included the MiniBest, Dynamic Gait Index, 10 meter walk Test (10MWT) and 5 Times Sit to Stand test. Data were analysed using paired t-tests, with statistical significance set at $p < 0.05$.

Results: Significant improvements were observed post-intervention in all outcome measures. MiniBest scores increased (15.39±2.62 to 17.43±2.15 and 16.18±3.06 to 16.93±3.04), while Dynamic Gait Index scores improved (16.61±2.78 to 18.96±2.38 and 17.43±2.74 to 18.57±2.54) in Groups 1 and 2, respectively ($p< 0.05$). Self-selected gait velocity increased (0.758±0.09 to 0.828±0.08 m/s and 0.782±0.12 to 0.810±0.11 m/s), fast-paced gait velocity improved (0.826 ±0.10 to 0.881±0.10 m/s and 0.855±0.13 to 0.878±0.13 m/s), and 5 Times Sit-to-Stand times decreased (15.75±2.33 to 13.82±1.96 s and 14.43±2.21 to 13.4±2.23 s) in Groups 1 and 2, respectively ($p<0.05$). Group 1 showed greater improvement across all outcomes, with significant differences in mean change scores between groups ($p< 0.05$).

Conclusion: This study concluded that both LSVT-BIG and the Hibalance program were effective in improving balance and functional mobility in individuals with Parkinson's disease. LSVT BIG is more effective as shown by the by the larger mean improvements.

KEYWORDS: Lee Silverman Voice treatment Big, HiBalance, Parkinson's Disease.

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INTRODUCTION

Parkinson's disease is a progressive neurodegenerative disorder characterized by motor symptoms including bradykinesia, postural instability, tremor, and rigidity, along with a range of non-motor manifestations. The disease is associated with the accumulation of alpha-synuclein and degeneration of dopaminergic neurons [1]. Globally, approximately 8.5 million individuals were living with Parkinson's disease in 2019, representing a 39.34% increase compared to 2016 [2].

Although postural instability has traditionally been considered a feature of advanced disease, evidence suggests that balance impairments are present even in the early stages (Hoehn and Yahr stages I–III). Deficits in anticipatory postural adjustments and reactive postural responses contribute to impaired balance control, reduced gait performance, and an increased risk of falls [3,4]. Falls are highly prevalent among individuals with Parkinson's disease, with nearly 60% of patients reporting at least one fall within the preceding year [5].

Physiotherapy plays an important role in addressing gait and balance impairments associated with Parkinson's disease. LSVT-BIG and Hibalance are two interventions that are gaining more attention in rehabilitation specifically for Parkinson's disease.

LSVT-BIG is an intensive, task-specific exercise program that emphasizes high-amplitude movements to address bradykinesia and hypokinesia. By encouraging larger and more purposeful movements, it aims to improve movement speed, accuracy, postural control, stability limits, and agility. Previous studies have reported significant improvements in gait and balance following LSVT BIG intervention [6].

The HiBalance program is designed to improve dynamic balance by targeting key components of postural control, including sensory integration, anticipatory postural adjustments, motor agility, stability limits, and gait adaptability. By progressively challenging these balance systems, the program aims to enhance postural control and reduce the risk of falls in individuals with Parkinson's disease [7].

Even though there is evidence of both programs individually, there is limited literature which directly compares both. Therefore, comparing these two approaches may help identify the most effective rehabilitation strategy for improving mobility and balance in this population.

MATERIALS AND METHODS

Study Site: Nanavati Max Superspeciality Hospital

Sampling Method: Convenience Sampling with Simple Random Method (ODD EVEN METHOD)

Duration of Study: 1 year

Duration of Data Collection: 6 months

Sample Size: 56

Study Population: Patients with Parkinson's Disease

Inclusion criteria:

1. Patients diagnosed with Parkinson's Disease between the Stage 1 to Stage 3 on modified Hoen and Yahr Scale. *(presenting unilateral/ bilateral symptoms, midline involvement or postural instability with mild/moderate functional disability)

2. Patients who score >/= 26 on the Montreal Cognitive Assessment Scale

3. No Walking Aids

4. On stable medication 4 weeks prior to and during the study

Exclusion Criteria:

1. Uncontrolled visual/ auditory disturbances

2. Uncontrolled other medical conditions like Diabetes/ Hypertension

OUTCOME MEASURES

Table 1: Outcome Measures.

Measure	To assess	Timeline
MiniBest	Ability to maintain balance during movements including gait, transitions and response to external perturbations	Baseline and Post intervention
Dynamic gait index	Test's ability to maintain walking balance while responding to different task demands, through various dynamic conditions	Baseline and Post intervention
5 times sit to stand test	Balance and postural control while transition	Baseline and Post intervention
10-meter walk test	Performance measure used to assess walking speed in meters per second across 10 meters	Baseline and Post intervention

Fig. 1: Sustained BIG "stretch" Floor to ceiling

Fig. 2: Sustained BIG "stretch" Side to Side

Fig. 3: Forward Step & Reach

Fig. 4: Sideways Step & Reach

Fig. 5: Backward Step & Reach

Fig. 6: Forward Rock & Reach

Fig. 7: Sideways Rock & Reach

Fig.8: Sit to Stand

Procedure

Study was commenced after obtaining approval from the departmental research committee. This was followed by patient selection and screening for the trial. Informed Consent was obtained after patient education. Baseline assessment and demographic data collection were completed. There were sixteen sessions of the assigned intervention. An assessment followed a four-week intervention.

The two groups underwent different exercise interventions for improving balance and gait, as follows:

Group 1 –LSVT-BIG Exercises: This group performed LSVT-BIG exercises.

Dosage: 4 consecutive days a week for 4 weeks, which results in 16 sessions in one month. The first half of exercises (30 minutes or more) encompass whole body exercises. The second half (30 minutes or less) consists of functional,goal directed activities of daily living. Task repetitions vary from 8-16 repetitions, and 5 repetitions for functional movements. Each treatment session lasts 60 minutes. Homework – Practice daily exercises at home – on treatment and non-treatment days and incorporation of Functional Component Movements (e.g.: Walking–BIG) in activities of daily living.

TASK 1- MAXIMUM SUSTAINED MOVEMENTS:

· Exercise 1- Sustained BIG "stretch" Floor to ceiling

· Exercise 2- Sustain BIG "stretch" Side to side

TASK 2- DIRECTIONAL MOVEMENTS IN STANDING:

· Exercise 1: Forward Step & Reach

· Exercise 2: Sideways Step & Reach

· Exercise 3: Backward Step & Reach

· Exercise 4: Forward Rock & Reach

· Exercise 5: Sideways Rock & Reach

TASK 3- FUNCTIONAL COMPONENTS:

· e.g.: Sit to Stand- 5 Repetitions

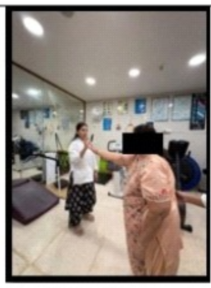
Group 2 – Hibalance Exercises:

• Dosage: 4 consecutive days a week for 4 weeks, which results in 16 sessions in one month.

Table 3: Hibalance exercises.

Week	Focus	Component	Exercises
1	**Learn exercises; ensure correct technique. Basic exercises targeting individual balance components.**	Sensory Integration	Tandem stance with eyes closed; Walk on foam with eyes open
		Anticipatory Postural Adjustments	Sit-to-stand with cueing; Lateral step initiation drills
		Motor Agility	Step-over obstacle course; Backward walking with feedback
		Stability Limits	Controlled leaning forward; Reaching in diagonal planes
2	**Increase difficulty; introduce dual-tasking (cognitive and motor). Increased complexity, multitasking begins.**	Sensory Integration	Walk on foam while counting backward; Stand on uneven surface while identifying colours
		Anticipatory Postural Adjustments	Step and reach while solving math problems; Lunge and name city names
		Motor Agility	Obstacle navigation while carrying objects; Rapid foot taps with memory tasks
		Stability Limits	Reaching to targets under time limit; Extended reach while listening to music
3	**Combine all components, integrate and switch tasks dynamically. Mixed exercises targeting all components in one session.**	Sensory Integration	Unpredictable surface walking while responding to questions; Reactive walking with sudden verbal cues
		Anticipatory Postural Adjustments	Dual-task sit-to-stand with object manipulation; Throw/catch while alternating tasks
		Motor Agility	Quick directional changes; Step over hurdles
		Stability Limits	Lean to light stimuli from different angles; Reach and rotate while alternating tasks
4	**Combine all components, integrate and switch tasks dynamically. Mixed exercises targeting all components in one session.**	Sensory Integration	Obstacle navigation with verbal cues; Random object targeting on surface
		Anticipatory Postural Adjustments	High-stepping march with throw/catch; High-step marching with metronome
		Motor Agility	Quick directional changes under time constraints; Speed Walk and stop with command
		Stability Limits	Multi-directional reaching with reaction lights; Controlled lunges with metronome

Table 4: Hibalance exercises.

	Week 1	Week 2	Week 3	Week 4
Sensory Integration	 **Fig. 9:** Tandem stance with eyes closed	 **Fig. 13:** Stand on uneven surface while identifying colors	 **Fig. 17:** Reactive walking with sudden verbal cues	 **Fig. 21:** Obstacle navigation with verbal cues
APAs	 **Fig. 10:** Sit to stand with cueing	 **Fig. 14:** Step and reach while solving math problems	 **Fig.18:** Throw/catch while alternating tasks	 **Fig. 22:** High stepping march with throw/catch
Motor Agility	 **Fig. 11:** Step-over obstacle course	 **Fig. 15:** Obstacle navigation while carrying objects	 **Fig. 19:** Step over hurdles	 **Fig. 23:** Speed walk and stop with command
Stability Limits	 **Fig. 12:** Controlled leaning forward	 **Fig. 16:** Extended reach while listening to music	 **Fig. 20:** Reach and rotate while alternating tasks	 **Fig. 24:** Controlled lunges with metronome

RESULTS

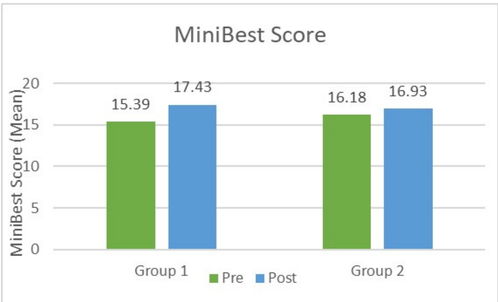
The data analysis was conducted using SPSS version 27. To assess the normality of the data, the Shapiro Wilk test was applied to the primary outcome measures. Since the p-values obtained were greater than 0.05, it was concluded that the data followed a normal distribution. As a result, parametric tests were appropriate for further analysis. For inter-group comparisons, paired t-tests were used to assess within-group differences, while independent t-tests were employed for between-group comparisons. In all analyses, results were considered statistically significant if the p-value was less than or equal to 0.05.

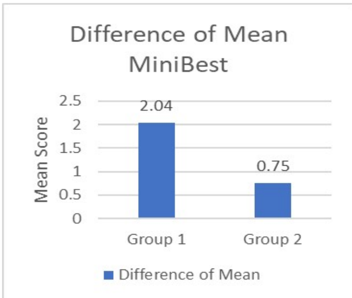
Participant Characteristics:

56 participants were recruited in total, 28 participants in each group. The mean age was 71.43±6.27 years for LSVT BIG group and 70.89±8.02 years in the HiBalance group. There were 17 males and 11 females in the LSVT BIG group, and 12 males and 16 females in the HiBalance group. The majority of participants were non-working (21 in the LSVT BIG group and 26 in the HiBalance group). The severity of the disease, according to the Modified Hoehn and Yahr Scale, ranged from stages 1 to 3 in both groups with the majority of patients being in stages 1.5 to 2.5. Mean time since diagnosis was 4.48±3.60 years in the LSVT BIG group and 4.86±4.22 years in the HiBalance group.

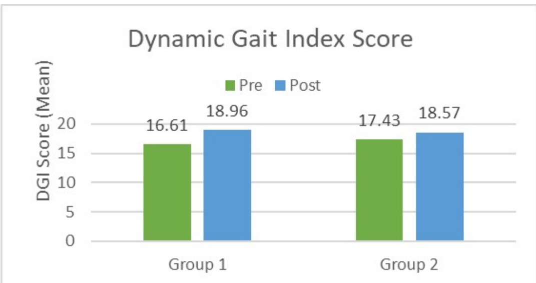
RESULT

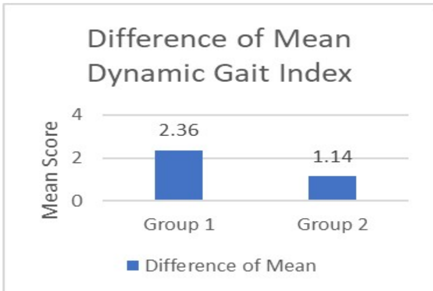
The MiniBest score improved significantly in both groups, increasing from 15.39±2.62 to 17.43±2.15 in the LSVT BIG group and from 16.18±3.06 to 16.93±3.04 in the HiBalance group ($p<0.05$).



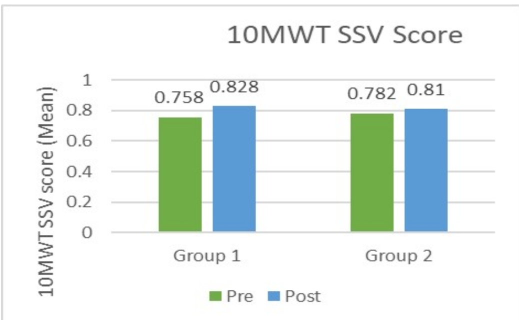


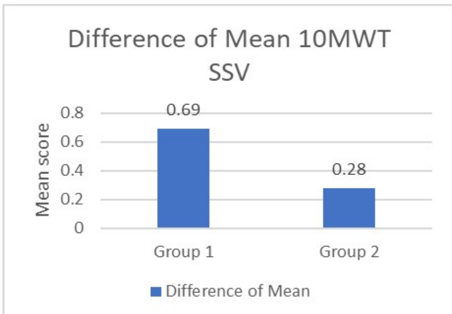
Dynamic Gait Index scores increased from 16.61±2.78 to 18.96±2.38 in the LSVT BIG group and from 17.43±2.74 to 18.57±2.54 in the HiBalance group ($p<0.05$).



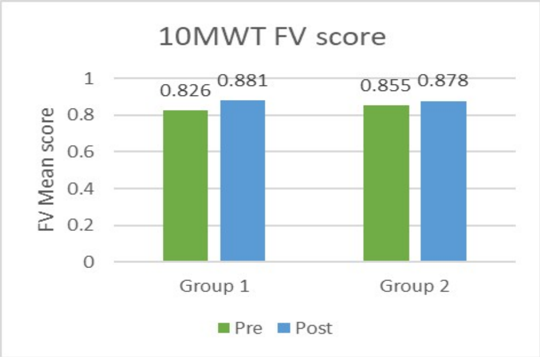


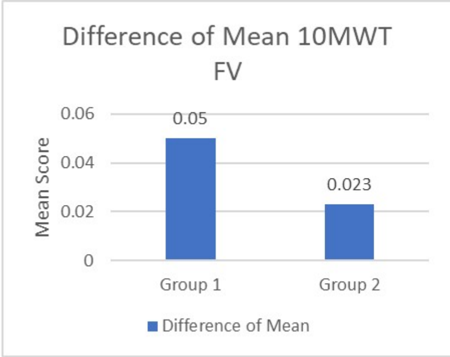
Self-selected gait velocity improved from 0.758±0.09 m/s to 0.828±0.08 m/s in the LSVT BIG group and from 0.782±0.12 m/s to 0.810±0.11 m/s in the HiBalance group ($p<0.05$).



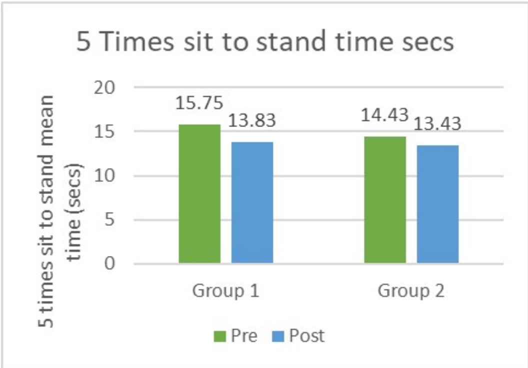


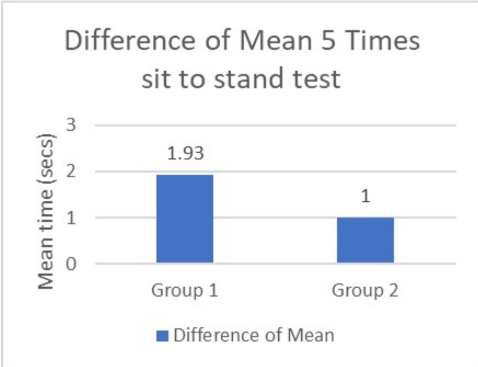
Fast-paced gait velocity increased from 0.826 ± 0.10 m/s to 0.881 ± 0.10 m/s in the LSVT BIG group and from 0.855±0.133 m/s to 0.878±0.127 m/s in the HiBalance group ($p<0.05$).





Performance on the Five Times Sit-to-Stand Test improved significantly, with completion time decreasing from 15.75±2.33 s to 13.82±1.96 s in the LSVT BIG group and from 14.43±2.21 s to 13.43±2.23 s in the HiBalance group ($p<0.05$).





Although post-intervention intergroup comparisons were not statistically significant for any outcome measure ($p>0.05$), the mean change scores were significantly greater in the LSVT BIG group across all measures ($p< 0.05$), indicating comparatively superior improvements in balance, gait, walking speed, and functional mobility.

DISCUSSION

LSVT BIG is an amplitude-based training approach designed to address hypokinesia, one of the primary motor impairments in Parkinson's disease. The intervention emphasizes the performance of large-amplitude movements through an intensive protocol involving four sessions per week for four weeks, along with daily home practice [10].

LSVT-BIG works on principles of motor learning and neuroplasticity, including repetition, specificity, intensity, and saliency. Repeated practice of functional, task-specific movements promotes automaticity and strengthens motor pathways, while the high-intensity nature of the training enhances motor output and learning. By tailoring activities to meaningful daily tasks, LSVT BIG increases patient engagement and facilitates the transfer of gains into everyday function [11].

The key mechanism underlying LSVT BIG is sensory recalibration. Repeated practice of large-amplitude movements increases afferent input from muscle spindles, Golgi tendon organs, and joint receptors, enhancing proprioceptive awareness and the accuracy of sensory feedback. This improved perception of movement and body position supports better anticipatory and reactive postural control, ultimately contributing to improved balance and functional mobility [11].

The Hibalance program is built on four main components of balance control: Anticipatory Postural Adjustments, Reactive Postural Control, Sensory Integration and Motor Agility. The program includes balance tasks of increasing difficulty that challenge the participants to the limits of their stability, stimulating the use of corrective postural responses and improving reactive balance control [12].

The Hibalance program is based on the principles of specificity, individuality and progression. Specificity is attained by targeting balance components known to be affected in Parkinson's disease such as anticipatory postural adjustments, reactive balance control, and sensory integration. Individuality guarantees that exercises are adapted to the individual's balance skills and functional limitations. There is built-in progression with tasks gradually becoming more complex and challenging to promote motor learning and incremental gains in balance and mobility [12].

The Hibalance program may improve balance through repeated activation of neural pathways involved in movement control, enhanced processing of sensory information, and the development of appropriate postural responses. Furthermore, continuous exposure to challenging balance tasks promotes neuroplastic changes within the nervous system, contributing to sustained improvements in balance and functional mobility [13].

The advantage of LSVT-BIG over the Hibalance program is its focused approach toward hypokinesia, which is considered the hallmark motor impairment in Parkinson's disease. Through the practice of large-amplitude, whole-body movements, LSVT BIG directly targets reduced movement size while simultaneously addressing impaired kinesthetic awareness through sensory recalibration. The intensive daily home practice component reinforces motor learning and promotes the carry-over of gains into everyday activities. By concentrating specifically on movement amplitude and internal cueing rather than multiple balance subsystems, LSVT BIG may be particularly effective for individuals in whom hypokinesia is the predominant contributor to functional limitations and balance deficits.

CONCLUSION

The study found that both LSVT BIG and Hibalance programs were effective in improving balance and functional mobility in people with Parkinson's disease. LSVT BIG with its focus on high-amplitude, intensive, task-specific movements to target bradykinesia, movement scaling and gait speed had comparatively greater gains. In addition, the Hibalance program, which includes dynamic balance, dual-tasking, sensory integration, and gait adaptability, resulted in meaningful functional gains. The relatively larger mean improvements with LSVT BIG suggest that amplitude-based, high-intensity training may provide a stronger stimulus to improve motor output and translate gains into functional performance in this population.

ABBREVIATIONS

PD: Parkinson's Disease
LSVT-BIG: Lee-Silverman Voice Treatment-BIG
SNOSE: Sequentially numbered, opaque sealed envelopes
CONSORT: Consolidated Standards of Reporting Trials

Authors contribution

Ketaki Kathe and Sabah Thaver: equally contributed to the Selection of the research topic, research process and design, data collection, manuscript drafting, editing, and writing.

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Conflicts of interest: None

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