Acta Scientific Neurology (ASNE)

Volume 9 Issue 8 August 2026

Research Article

The Effectiveness of Lee Silverman Voice Treatment - Big Therapy for Improving Dexterity and Reducing Fall Frequency in Subjects with Mild to Moderate Case of Parkinson's Disease

Loganathan Thangavel[1]*, Sujitha G[2], Kavinkumar M[2], Mahendhiran L[2], Hariharan T[2], Naveen Prasath[2], Keerthiga S[2] and Aruna Sagar[3]

[1]Professor, Nandha College of Physiotherapy, The Tamilnadu Dr.M.G.R. Medical University, India

[2]Nandha College of Physiotherapy, The Tamilnadu Dr.M.G.R. Medical University, India

[3]RVS College of Physiotherapy, The Tamilnadu Dr.M.G.R. Medical University, India

***Corresponding Author:** Loganathan Thangavel, Professor, Nandha College of Physiotherapy, Erode, Tamilnadu, The Tamilnadu Dr.M.G.R. Medical University, India.

Received: July 21, 2026

Published: July 29, 2026

DOI: 10.31080/ASNE.2026.09.0929

Abstract

Background: Parkinson’s disease is the second most prevalent neuro degenerative disorder, primarily resulting dopamine deficiency. The condition progressively impairs dexterity, functional mobility, and facial expression, affecting both gross and fine motor skills required for daily activities such as dressing and feeding. Postural instability further contributes to unsteadiness and increased fall risk, particularly during turning, twisting, or gait initiation. Non-motor symptoms such as sensory deficits, anxiety, and excessive sweating are also common.

Method: Fifteen subjects meeting the inclusion and exclusion criteria were selected through randomized sampling. Each participant received Lee Silverman Voice Treatment (LSVT) BIG therapy on alternate days for 60 minutes per session, administered during their medication period. Gait performance was concurrently assessed.

Result: A repeated measures ANOVA was performed to evaluate the effect of time (pretest, midtest, and posttest) on dexterity and fall frequency using functional gait assessment scores. Significant main effects of time were observed for both dexterity and fall frequency, $F(2,28) = 194.00$ and $F(2,28) = 141.00$, $p<0.001$, indicating progressive improvement across assessments.

Conclusion: Post hoc paired t-tests revealed significant differences between all time points. Nine-Hole Peg Test (NHPT) times decreased, reflecting improved dexterity, while Functional Gait Assessment (FGA) scores increased, reflecting improved balance and reduced fall risk. Pretest scores were higher than midtest and posttest scores ($t = 10.9$, $t = 15.8$, $p < 0.001$), and midtest scores exceeded posttest scores ($t = 14.2$, $p < 0.001$). These findings demonstrate a statistically significant enhancement in dexterity and reduction in fall frequency among individuals with PD following the LSVT BIG therapy intervention.

Keywords: Parkinson’s Disease; Lee Silverman Voice Treatment; Motor Skill Disorders; Postural Balance; Rehabilitation Therapy

Introduction

Background

Neurological disorders are diseases that affect the central and peripheral nervous systems, including the brain, spinal cord, and associated nerves. They are among the leading causes of disability and mortality worldwide [1]. Lifestyle factors, aging, and genetic predispositions contribute significantly to their onset and progression [2]. Early diagnosis and timely intervention can reduce disease burden and improve quality of life. Neurodegenerative disorders, in particular, involve the progressive loss of neuronal structure and function, leading to impairments in movement, cognition, and autonomic control [3]. Examples include Parkinson's disease, Alzheimer's disease, Huntington's disease, and motor neuron disease. The blood–brain barrier presents a major therapeutic challenge, limiting effective drug delivery to neural tissues [4].

Parkinson's disease (PD), also known as idiopathic Parkinsonism or shaking palsy, was first described by James Parkinson in 1817 [5]. It is the second most common neurodegenerative disorder after Alzheimer's disease [6]. PD results primarily from dopamine deficiency due to degeneration of dopaminergic neurons in the substantia nigra and basal ganglia [7]. This leads to characteristic motor symptoms such as tremor, rigidity, bradykinesia, and postural instability, along with non-motor manifestations including sensory deficits, anxiety, and autonomic dysfunction [8]. The disease typically affects individuals between 30 and 60 years of age, with a higher prevalence among men and in Western populations [9]. The progressive loss of dopamine disrupts motor control and automatic responses, severely affecting daily functional activities [10].

The Lee Silverman Voice Treatment (LSVT) BIG program is an evidence-based, amplitude-oriented exercise therapy designed to improve motor function in individuals with PD [11]. Originating from the LSVT LOUD protocol developed in the 1990s to enhance vocal loudness, LSVT-BIG was introduced in 2005 to target large-amplitude, whole-body movements [12]. The therapy emphasizes recalibration of sensorimotor perception through repetitive, high-intensity exercises that promote greater movement amplitude, speed, and accuracy [13]. Sessions typically last 60 minutes, conducted four times per week for four weeks, with exercises rated at 8/10 on Borg's RPE scale [14]. The program integrates functional tasks, postural correction, and balance training to enhance both fine and gross motor skills. Studies have demonstrated that LSVT-BIG improves hand function, gait, and overall quality of life in mild to moderate PD patients [15-17].

Purpose of the Study

The primary motor impairments in PD—bradykinesia, rigidity, tremor, and postural instability—lead to reduced dexterity and increased fall frequency. This study aims to evaluate the effectiveness of LSVT-BIG therapy in improving dexterity and reducing fall frequency among individuals with mild to moderate Parkinson's disease.

Significance of the study

Understanding the therapeutic potential of LSVT-BIG provides valuable insight into non-pharmacological interventions that enhance functional independence and safety in PD patients. By quantifying improvements in dexterity and gait stability, this research contributes to evidence-based rehabilitation strategies that support motor recovery and reduce fall-related morbidity.

Materials and Methods

Study design and setting

The study was designed as a randomized experimental single group study. This experimental study was conducted in the Outpatient Department of Nandha College of Physiotherapy, Nandha Medical College and Hospital, Erode.

Subjects

Before initiating the procedure, subjects diagnosed with mild to moderate Parkinsonism both male and female subjects aged between 30 and 60 years who met the inclusion criteria were screened using the Functional Gait Assessment (FGA) and Nine-Hole Peg Test (NHPT). Subjects under regular anti-Parkinson medication, Modified Hoehn and Yahr Scale stages I–III and Impaired kinesthetic awareness were selected. Dementia (PANDA score <14), depression (Beck Depression Inventory >28), use of antidepressant or antipsychotic medication, bedridden patients, age above 60 years or Hoehn and Yahr stages IV–V and mini-mental state examination score <24 were excluded from the study. A total of 15 participants were selected through randomized sampling.

Methods

The research was approved by the Institutional Human Ethical committee (IHEC) of Nandha College of Physiotherapy (NCPT/

IHEC/026/2024), according to the Declaration of Helsinki. Written informed consent will be sought once participants have been able to ask questions. Pre and post intervention assessments were conducted using

- **Dexterity Assessment – Nine-Hole Peg Test (NHPT):** Dexterity was evaluated using the NHPT. Participants were instructed to pick up nine pegs from a container, place them into holes on the board, and then return them to the container as quickly as possible. The time taken to complete the task was recorded, with shorter times indicating better dexterity.
- **Fall Frequency Assessment – Functional Gait Assessment (FGA)**: Fall frequency and gait performance were assessed using the FGA, a modification of the Dynamic Gait Index. The FGA evaluates balance and postural stability during walking across ten tasks, including changes in gait speed, turning, and head movements. Each item is scored from 0 to 3, with a total possible score of 30.

Baseline (pretest) measurements were recorded prior to intervention, followed by midtest assessments at 2–3 weeks and posttest evaluations at the end of the 4th week. The study was carried out over a period of nine months. Each participant underwent four weeks of intervention, with sessions conducted four alternate days per week, lasting 60 minutes per session in which warm-up and cool down take place for 15 minutes, leaving 45 minutes for treatment done with exercise to be repeated 10 times. All treatments were administered during the "on-medication" period and supplemented with home-based exercises.

Intervention protocol

All participants received Lee Silverman Voice Treatment (LSVT) BIG therapy, focusing on large-amplitude movements and task-specific exercises. The program included individualized sessions and home-based practice to reinforce motor learning and functional carryover.

Exercise Type	Position	Instructions	Repetitions/Hold
Floor to Ceiling	Sitting	Sit on edge of chair with open posture, Reach forward, down, up, back, Hold posture, Finish with hands on thighs	Hold 10 sec
Side to Side	Sitting	Sit on edge of chair, Arm out to side, Place one hand on chair, Reach across body with big movement, Hold posture, Finish with hand on thigh	Hold 10 sec
Forward Step and Reach	Sitting/Standing	Step forward firmly, Extend arms wide, Return foot, Strong thigh slap	10 reps
Sideways Step and Reach	Sitting/Standing	Step sideways firmly, Extend arms wide, Return foot, Strong thigh slap	10 reps
Backward Step and Reach	Sitting/Standing	Step backward firmly, Extend arms wide, Return foot, Strong thigh slap	10 reps
Forward Rock and Reach	Standing	One foot forward, other back, Hold support, Rock weight forward/back, Wide arm circles	10 reps
Sideways Rock and Reach	Standing	Wide base posture, Hold support, Twist body, Reach across, Return with thigh slap	10 reps
Hand Flick	Sitting/Standing	Spread fingers wide, Quick flicking motion	10 reps
Arm Flick	Sitting	Raise arms, elbows bent, Quick finger flicks	10 reps
Floor to Ceiling + Flicks	Sitting	Same as Floor to Ceiling, Add quick flicking motion	10 flicks + Hold 10 sec
Home-Based Exercises	Functional	Button/unbutton shirts, Writing, Arranging clothes, Cleaning, Sit-to-stand (10 reps), Sit-to-stand with one hand support	Daily practice

Table a

Warmup and cool down

Each session began with a 10-15 minutes warm consisting low intensity like normal Stretching include upper limb stretches and lower limb stretches and breathing exercise and in cool down phase consisting of walking, resting on chair and breathing exercise like meditation.

Data analysis

The collected data were analyzed using repeated measures analysis of variance (ANOVA) with the statistical software jamovi (Version 2.6). Descriptive statistics and subject assessments were also performed within the same software environment to obtain measured values and summary analyses.

	Number of Subjects	Mean	Median	SD	Minimum	Maximum
Age	15	47.9	48	7.14	35	60
Height	15	163.0	162.4	5.21	155.2	172.5
Weight	15	55.5	52	11.61	40	75
BMI	15	20.9	19.3	4.55	14.5	29.0

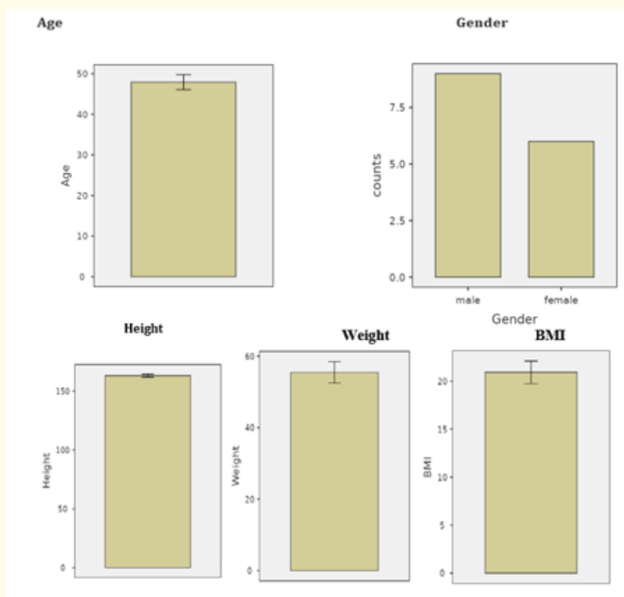
Table 1: Descriptives analyses.

Gender	Counts	% of Total	Cumulative %
Male	9	60.0%	60.0%
Female	6	40.0%	100.0%

Table 2: Frequencies of Gender.

Participant characteristics

Table 1 presents the descriptive statistics of the study participants. The mean age was 47.9 years (SD = 7.14), with a range of 35–60 years. The average height was 163.0 cm (SD = 5.21), mean weight was 55.5 kg (SD = 11.61), and mean BMI was 20.9 (SD = 4.55). Gender distribution is shown in Table 2, with 60% male and 40% female participants. Figure 1 illustrates the distribution of age and height across gender groups.



Graph 1

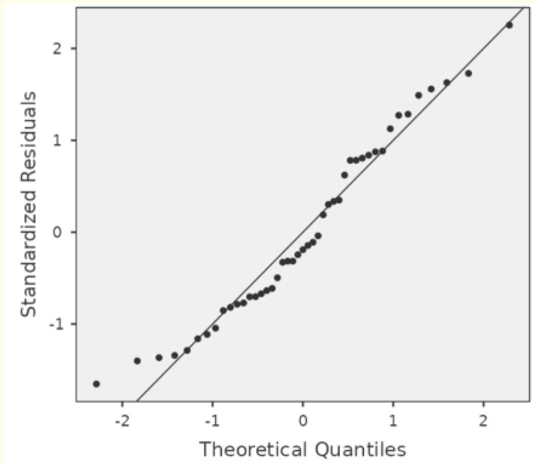
Within subject effects	Sum of squares	df	Mean square	F	p	η^2G	η^2	η^2p
NHPT Time	963.5	2	481.76	194	<0.01	0.534	0.534	0.933
Residual	69.4	28	2.48					

Between subject effects	Sum of squares	df	Mean square
Residual	773	14	55.2

Table 3: Repeated measure ANOVA for Dexterity.

	Mauchly's W	p	Greenhouse-Geisserε	Huynh-Feldtε
NHPT time	0.473	0.08	0.655	0.695

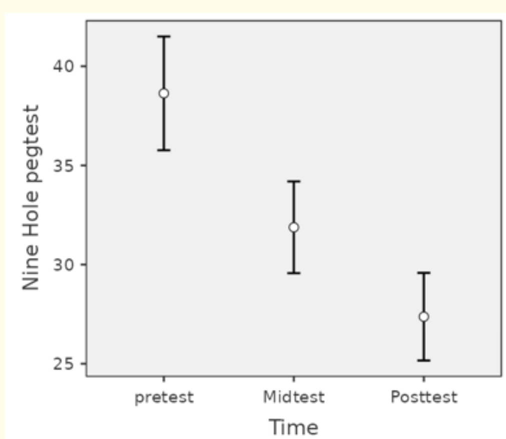
Table 4: Tests of sphericity.



Graph 2: Q-Q Plot.

NHPT Time	NHPT Time	Mean difference	SE	df	t	P value
Pretest	Midtest	6.75	0.621	14.0	10.9	<0.001
Pretest	Posttest	11.26	0.711	14.0	15.8	<0.001
Midtest	Posttest	4.51	0.317	14.0	14.2	<0.01

Table 5: Post hoc comparisons– NHPT Time.



Graph 3: Estimated Marginal Means NHPT Time.

NHPT Time	Mean	SE	Lower	Upper
Pretest	38.6	1.34	35.8	41.5
Midtest	31.9	1.08	29.6	34.2
Posttest	27.4	1.03	25.2	29.6

Table 6: Estimated Marginal Means- NHPT Time (95% confidence interval).

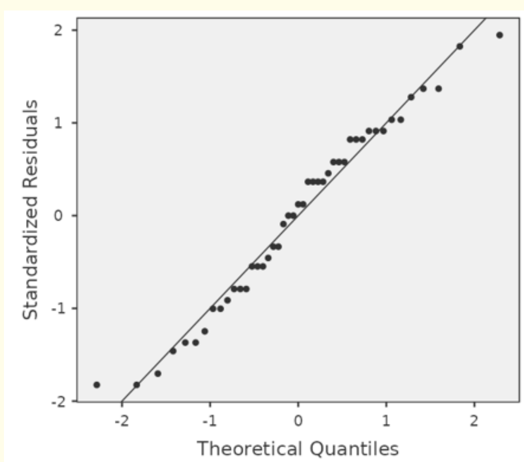
Within subject effects	Sum of squares	Df (adjusted)	Mean square	F	P	η^2G	η^2	η^2p
FGA scores	572.3	1.31, 18.27	436.41	141	<0.01	0.730	0.730	0.909
Residual	57.0	18.27	3.12					

Between subject effects	Sum of squares	df	Mean square
Residual	154	14	11.0

Table 7: Repeated measure ANOVA for reducing fall frequency.

	Mauchly's W	P	Greenhouse-Geisser ε	Huynh-Feldt ε
FGA Scores	0.492	0.010	0.653	0.706

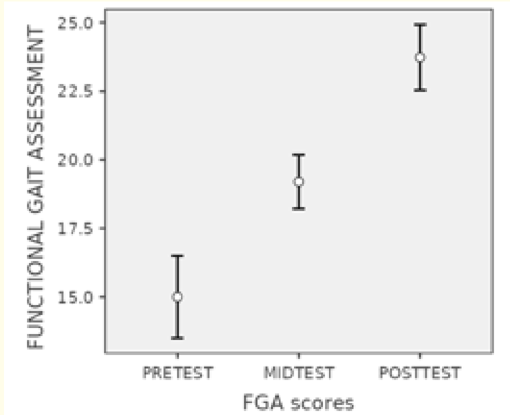
Table 8: Assumptions: Tests of sphericity.



Graph 4: Q-Q Plot.

FGA Scores	FGA Scores	Mean difference	SE	df	t	P value
Pretest	Midtest	-4.20	0.380	14.0	-11.04	<0.001
Pretest	Posttest	-8.73	0.679	14.0	-12.85	<0.001
Midtest	Posttest	-4.53	0.456	14.0	-9.93	<0.01

Table 9: Post hoc comparisons–FGA Scores.



Graph 5: Estimated Marginal Means, FGA scores.

FGA scores	Mean	SE	Lower	Upper
Pretest	15.0	0.697	13.5	16.5
Midtest	19.2	0.460	18.2	20.2
Posttest	23.7	0.556	22.5	24.9

Table 10: Estimated Marginal Means–FGA scores (95% Confidence interval).

Results

Dexterity outcomes (NHPT)

Repeated measures ANOVA demonstrated a significant within-subject effect of time on Nine-Hole Peg Test (NHPT) performance ($F(2,28) = 194$, $p < 0.01$, $\eta^2p = 0.933$), as shown in Table 3. The assumption of sphericity was met (Table 4). Post hoc comparisons (Table 5) revealed significant improvements from pre-test to mid-test (mean difference = 6.75, $p < 0.001$), pre-test to post-test (mean difference = 11.26, $p < 0.001$), and mid-test to post-test (mean difference = 4.51, $p < 0.01$). Figure 2 (Q-Q Plot) confirmed normality assumptions, while Figure 3 illustrates the estimated marginal means across time points. Table 6 provides the estimated marginal means with 95% confidence intervals, showing progressive improvement from pre-test (M = 38.6, CI [35.8, 41.5]) to post-test (M = 27.4, CI [25.2, 29.6]). Significant improvement across all time points with large effect size ($\eta^2p = 0.933$).

Fall risk outcomes (FGA Scores)

Analysis of Functional Gait Assessment (FGA) scores revealed a significant within-subject effect of time ($F(2,28) = 141$, $p < 0.01$, $\eta^2p = 0.909$), as shown in Table 7. The sphericity assumption was violated (Mauchly's W = 0.492, $p = 0.010$), and Greenhouse-Geisser corrections were applied (Table 8). Post hoc comparisons (Table 9) indicated significant improvements between pre-test and mid-test (mean difference = -4.20, $p < 0.001$), pre-test and post-test (mean difference = -8.73, $p < 0.001$), and mid-test and post-test (mean difference = -4.53, $p < 0.01$). Figure 4 (Q-Q Plot) confirmed distribution assumptions, while Figure 5 displays estimated marginal means across time points. Table 10 provides the estimated marginal means with 95% confidence intervals, showing progressive improvement from pre-test (M = 15.0, CI [13.5, 16.5]) to post-test (M = 23.7, CI [22.5, 24.9]). Significant reduction in fall frequency with large effect size ($\eta^2p = 0.909$).Figures 1–5 and Tables 1–10 collectively demonstrate consistent progression from baseline to post-intervention, supporting the effectiveness of the exercise protocol.

Discussion

The purpose of this study was to evaluate the effectiveness of Lee Silverman Voice Treatment BIG (LSVT-BIG) therapy in improving dexterity and reducing fall frequency among subjects with mild to moderate Parkinson's disease (PD). Fifteen participants who met the inclusion and exclusion criteria underwent individualized sessions lasting one hour, four consecutive days per week for four weeks, supplemented with home based exercises. Assessments were conducted at baseline, mid intervention, and post intervention.

The findings demonstrated significant improvements in dexterity, as measured by the Nine Hole Peg Test (NHPT), and in gait and balance, as measured by the Functional Gait Assessment (FGA). These results support the hypothesis that LSVT-BIG therapy enhances motor performance and reduces fall risk in PD patients. The repeated measures ANOVA confirmed statistically significant changes across time points, indicating that the intervention was effective in producing clinically meaningful improvements.

Our results are consistent with previous studies. Fabian Schaible., *et al*. reported that LSVT-BIG, when compared with intensified and traditional physical therapy, produced significant improvements in both motor and non motor symptoms of PD, as confirmed by ANCOVA analysis [18]. Similarly, Türkan Turgay., *et al*. demonstrated that four weeks of LSVT-BIG therapy led to statistically significant improvements in mobility, hand function, functional independence, and overall quality of life, as measured by PDQ-39 domains [19]. Sefa Eldemir., *et al*. compared standard LSVT-BIG with a modified protocol (m-LSVT) and found that both approaches improved gait speed, motor symptoms, and functional mobility, though the standard protocol yielded superior outcomes in balance and gait cycle symmetry [20]. Furthermore, YoungSeok Choi., *et al*. highlighted the benefits of task-based LSVT-BIG interventions, showing improvements in hand function, activities of daily living (ADL), psychological well-being, and quality of life [21].

The observed improvements in fine motor dexterity, as measured by the Nine Hole Peg Test (NHPT), can be explained by the underlying mechanisms of LSVT-BIG therapy. Although the program emphasizes amplitude based training of gross motor movements, its principles extend to fine motor control through sensorimotor recalibration. By practicing exaggerated, large amplitude movements, patients recalibrate their internal perception of movement size and effort, which generalizes to smaller, precise tasks. Specifically, hand flick exercises incorporated in LSVT-BIG sessions promote increased range of motion, speed, and coordination of the upper extremities. These exercises enhance neuromuscular activation patterns and improve proprioceptive feedback, thereby facilitating smoother execution of fine motor tasks such as peg placement in the NHPT. In addition, the repetitive practice of amplitude driven movements strengthens cortical and sub cortical circuits involved in motor planning, enabling patients to overcome bradykinesia and hypometria that typically impair dexterity in Parkinson's disease. Thus, the improvements in NHPT performance observed in this study likely reflect the transfer of amplitude training from gross-motor to fine-motor domains, mediated by recalibration of sensorimotor integration and reinforcement of motor learning principles.

Taken together, these findings reinforce the evidence base for LSVT-BIG therapy as an effective intervention for PD patients, particularly in addressing dexterity deficits and fall risk. The improvements observed in our study align with the broader literature, suggesting that both standard and modified LSVT-BIG protocols can be tailored to patient needs while maintaining therapeutic efficacy.

Limitations

Despite these promising results, several limitations must be acknowledged. The small sample size (N = 15) restricts the generalizability of findings, and the single arm design without a control group limits the ability to attribute improvements solely to LSVTBIG therapy. Additionally, the absence of long term follow up prevents conclusions about the durability of treatment effects. These factors highlight the need for larger, controlled trials with extended monitoring to validate and expand upon the present findings.

Future research should extend this work with larger cohorts and broader age ranges. Comparative studies involving other physiotherapy techniques could provide insight into relative efficacy. Modified LSVT-BIG protocols may also be explored in other neurological conditions such as stroke. Additionally, combining home based interventions with intensive or conservative physiotherapy management could enhance outcomes and improve adherence.

Conclusion

These findings indicate a progressive and statistically significant improvement in both dexterity and gait related balance, confirming the therapeutic efficacy of LSVT-BIG. The study concludes that LSVT-BIG therapy produces meaningful improvements in motor function, dexterity, and fall risk reduction in subjects with mild to moderate Parkinson's disease. The results align with previous evidence supporting LSVT-BIG as a targeted intervention for enhancing motor performance and functional mobility in Parkinson disease patients 1–4.

Acknowledgement

The authors would like to thank all the participants for their invaluable contribution and cooperation in this study.

Conflict of Interest

The authors declare no conflict of interest.

Funding

This research received no external funding.

Bibliography

1. World Health Organization. "Neurological Disorders: Public Health Challenges". WHO Press (2006).
2. Feigin Valery L., *et al*. "Global Burden of Neurological Disorders". *The Lancet Neurology* 19.5 (2020): 439-458.
3. Przedborski Serge., *et al*. "Neurodegeneration: What Is It and Where Are We?" *The Journal of Clinical Investigation* 111.1 (2003): 3-10.
4. Abbott N Joan., *et al*. "Structure and Function of the Blood-Brain Barrier". *Neurobiology of Disease* 37.1 (2010): 13-25.
5. "Parkinson James. An Essay on the Shaking Palsy". Sherwood, Neely, and Jones, London, (1817).
6. Poewe Werner., *et al*. "Parkinson Disease". *Nature Reviews Disease Primers* 3 (2017): article 17013.
7. Dauer William and Serge Przedborski. "Parkinson's Disease: Mechanisms and Models". *Neuron* 39.6 (2003): 889-909.
8. Chaudhuri K Ray., *et al*. "Non Motor Symptoms of Parkinson's Disease". *The Lancet Neurology* 5.3 (2006): 235-245.
9. De Lau LML and MMB Breteler. "Epidemiology of Parkinson's Disease". *The Lancet Neurology* 5.6 (2006): 525-535.
10. Jankovic Joseph. "Parkinson's Disease: Clinical Features and Diagnosis". *Journal of Neurology, Neurosurgery and Psychiatry* 79.4 (2008): 368-376.
11. Farley Barbara G and G F Koshland. "Training BIG to Move Faster: The Application of the Speed-Amplitude Relation as a Rehabilitation Strategy for People with Parkinson's Disease". *Experimental Brain Research* 167.3 (2005): 462-467.
12. Ramig Lorraine O., *et al*. "Intensive Voice Treatment (LSVT) for Patients with Parkinson's Disease: A Two Year Follow Up". *Neurology* 56.4 (2001): 498-506.
13. Ebersbach Georg., *et al*. "Amplitude Oriented Exercise in Parkinson's Disease: LSVT BIG Therapy". *Movement Disorders* 25.14 (2010): 1902-1908.
14. Borg Gunnar A V. "Psychophysical Bases of Perceived Exertion". *Medicine and Science in Sports and Exercise* 14.5 (1982): 377-381.
15. Velmurugan G. "Effectiveness of LSVT BIG Therapy on Balance in Mild to Moderate Parkinson's Disease". *International Journal of Physiotherapy Research* 5.3 (2017): 2100-2105.
16. Kim Dong Jin., *et al*. "Task Based LSVT BIG Program Improves Hand Function and Quality of Life in Parkinson's Disease". *Healthcare (Basel)* 10.3 (2022): article 456.
17. Flood Michael W., *et al*. "LSVT BIG Partially Restores Speed-Amplitude Relationship in Parkinson's Disease". *Frontiers in Neurology* 11 (2020): article 598.
18. Schaible Fabian., *et al*. "Comparative Effectiveness of LSVT BIG, Intensive Customized Therapy, and Traditional Physiotherapy in Parkinson's Disease". *Frontiers in Human Neuroscience* (2021).
19. Turgay, Türkan, *et al*. "Effects of LSVT BIG Therapy on Motor and Non Motor Symptoms in Parkinson's Disease Patients". *Journal of Clinical and Diagnostic Research*.
20. Eldemir Sefa., *et al*. "Modified LSVT BIG Protocol versus Standard Training in Parkinson's Disease: A Comparative Study". *Frontiers in Rehabilitation Sciences* (2024).
21. Choi Young Seok., *et al*. "Task Based LSVT BIG Intervention and Its Impact on Hand Function, ADL, Psychological Function, and Quality of Life in Parkinson's Disease". *Healthcare (Basel)* (2022).