International Journal of Science and Research Archive
eISSN: 2582-8185
Cross Ref DOI: 10.30574/ijsra
Journal homepage: https://ijsra.net/

(RESEARCH ARTICLE)

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Comparative study on LSVT vs. PNF to Improve Balance, Gait and ADL in Parkinson's Disease

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International Journal of Science and Research Archive, 2025, 14(01), 1720-1724

Publication history: Received on 17 December 2024; revised on 25 January 2025; accepted on 28 January 2025

Article DOI: https://doi.org/10.30574/ijsra.2025.14.1.0281

Abstract

Objective: Parkinson's Disease (PD) is a neurodegenerative disorder causing bradykinesia, rigidity, tremors, and balance issues. It affects walking, balance, and daily tasks. Physical therapy helps improve gait, balance, and ADLs. The study's objective is to examine the effectiveness of Lee Silverman Voice Treatment (LSVT-BIG) and Proprioceptive Neuromuscular Facilitation (PNF) in improving balance, gait, and ADLs in Parkinson's patients.

Method: A comparative study was done, with information collected before and after the treatment, comparing the effectiveness of both Lee Silverman Voice Treatment (LSVT-BIG) and Proprioceptive Neuromuscular Facilitation (PNF) on patients with Parkinsonism.

Result: Comparative analysis revealed that PNF was more effective in improving gait and balance and LSVT-BIG demonstrated greater efficacy in enhancing ADLs.

Conclusion: Thus, this study concluded that LSVT-BIG is particularly beneficial for improving ADLs, whereas PNF is more effective for gait and balance, indicating that tailored therapeutic interventions can optimize outcomes for individuals with PD.

Keywords: Parkinson; Lee Silverman Voice Treatment; PNF; Balance; Gait; ADL

1. Introduction

Parkinson's disease (PD) is a progressive neurodegenerative disorder caused by dopaminergic neuron degeneration in the substantia nigra, affecting motor and non-motor basal ganglia circuitry. Key motor symptoms include bradykinesia, muscle rigidity, resting tremors, and impaired postural reflexes, leading to difficulties in walking, balance, and daily tasks. Physical therapy, employing various techniques, has proven effective in improving gait, balance, and ADL.[1] Parkinson's disease is the second most common neurodegenerative disorder after Alzheimer's, with a global incidence of 10–50 per 100,000 annually and a prevalence of 100–300 per 100,000. Its prevalence is expected to double by 2030 due to population aging.[2]

Fabian Schaible et al. (2021) studied the effects of LSVT BIG, intensive physiotherapy, and conventional physiotherapy on Parkinson's disease (PD). Forty-four PD patients showed improved non-motor symptoms (NMSs) and motor function, with intensive therapy outperforming conventional methods. LSVT BIG and intensive therapy also improved stride length, gait velocity, and mobility, proving their effectiveness in managing PD.[3]

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Iramaia Salomão Alexandre de Assis et al. (2020) conducted a systematic review and meta-analysis on the effects of proprioceptive neuromuscular facilitation (PNF) in Parkinson's disease. Out of 674 studies, six met the criteria. The meta-analysis showed PNF improved gait speed (M = 0.28, 95% CI = 0.21–0.34, p < .001) and was comparable or superior to other therapies. However, more robust randomized controlled trials are needed to confirm its efficacy.[4]

Very little literature is present for evidence of the effectiveness of Lee Silverman Voice Treatment (LSVT-BIG) and Proprioceptive Neuromuscular Facilitation (PNF) in Parkinson's patients. So, a structured research study was conducted to address a gap in understanding and evaluating the effectiveness of these interventions, providing evidence-based insights to improve outcomes and guide future therapeutic strategies.

2. Methods

A comparative study was done, with information collected before and after the treatment, comparing the effectiveness of both Lee Silverman Voice Treatment (LSVT-BIG) and Proprioceptive Neuromuscular Facilitation (PNF) on patients with Parkinsonism.

2.1. Participants

60 patients were randomly selected and divided into 2 groups 30 each. The inclusion criteria were (1) Age 40 to 70 years (2) Parkinson's disease (3) Patients of both genders (4) Patients who are medically stable (5) UPDRS - 2. Exclusion criteria include non-cooperative patients, who were diagnosed with congenital anomalies, any traumatic brain injury, or a history of seizures and alcohol abuse. Both groups received physiotherapy treatment for 28 days. The first group received the Lee Silverman Voice Treatment -BIG and the second group received Proprioceptive Neuromuscular Facilitation.

2.2. Instrument

2.2.1. Berg Balance Scale

The Berg Balance Scale (BBS), developed by Katherine Berg in 1989, is a qualitative tool designed to assess balance (static and dynamic) in older adults. It evaluates functional activities like reaching, bending, transferring, and standing, addressing key components of postural control. Tasks include sitting, transferring between chairs, standing in various positions (e.g., tandem Romberg, single-leg stance), and reaching or picking objects off the floor. Each of the 14 items is scored on a 5-point scale (0 to 4), with 0 representing the lowest function and 4 the highest. The total score ranges from 0 to 56.[5]

2.2.2. Functional Gait Assessment Scale (FGA'S)

The Functional Gait Assessment (FGA) is a modified version of the Dynamic Gait Index (DGI) designed to assess postural stability during walking tasks, particularly in individuals with vestibular disorders, Parkinson's disease, or stroke. It includes 10 items scored on a 0–3 scale (0 = severe impairment, 1 = moderate impairment, 2 = mild impairment, 3 = normal ambulation), with a maximum score of 30. The test takes 5–10 minutes to administer.[6]

2.2.3. Unified Parkinson's Disease Rating Scale (UPDRS)

The Unified Parkinson's Disease Rating Scale (UPDRS) is a widely used tool for assessing Parkinson's disease severity in clinical trials but is less common in practice due to its 17-minute administration time. The original UPDRS includes 42 items. Thirty-five of these are rated on a 5-point (0–4) scale, including 4 items in Section I (mentation, mood, and behavior), 13 items in Section II (activities of daily living [ADL]), 14 items in Section III (motor examination), and 4 items in Section IV (complications of therapy). Section IV also contains 7 binary yes/no items. By consensus, we selected 8 items from the original UPDRS to comprise the UPDRS-8. All are rated on a 5-point (0–4) scale.[7]

2.3. Intervention

2.3.1. Lee Silverman Voice Treatment (LSVT-BIG)

The LSVT BIG program, developed by Drs. Becky Farley and Gail Koshland adapt principles from LSVT LOUD® to address movement deficits in Parkinson's disease (PD). It focuses on increasing movement amplitude to counter bradykinesia, akinesia, poor postural control, and gait instability. Targeting damaged basal ganglia through repetitive motor activation helps recalibrate patients' perception of movement size. The program uses therapist modeling, visual/tactile cues, and an effort scale to improve self-awareness and movement patterns. It includes 16 sessions (4 per

week for 4 weeks, 30–45 minutes each) and can benefit patients at any stage, with earlier intervention being most effective.[8]

2.3.2. Proprioceptive Neuromuscular Facilitation (PNF)

Proprioceptive Neuromuscular Facilitation (PNF), developed in the 1940s by Kabat, Knott, and Voss, combines insights from motor development, control, learning, and neurophysiology to enhance functional movement and rehabilitation. PNF techniques aim to maximize voluntary effort and repetitions, using proprioceptive stimulation, manual resistance, stretching, and dynamic verbal commands to facilitate neuromuscular responses. Maximal resistance is key to stimulating proprioceptors and correcting muscle imbalances, making PNF effective for various conditions and accelerating rehabilitation. Proprioceptive Neuromuscular Facilitation (PNF) uses diagonal movement patterns to maximize neuromuscular facilitation by lengthening muscles and activating the stretch reflex. Patterns can be unilateral (one limb, with or without head/trunk movement) or bilateral (both upper or lower limbs). Facilitatory techniques include stretch, traction, approximation, and maximal resistance, while patient-active methods include rhythmic stabilization, contract-relax, hold-relax, slow reversal, and repeated contractions.[9]

2.3.3. Procedure

A total of 60 patients were randomly divided into two groups of 30 each: Group A and Group B. Both groups underwent physiotherapy treatment for 28 days, consisting of 16 sessions over four weeks, with sessions held four days per week. Group A received the Lee Silverman Voice Treatment (LSVT) - BIG program, while Group B was treated using Proprioceptive Neuromuscular Facilitation (PNF) techniques. Baseline data were collected from all participants on the first day before initiating treatment. After completing the treatment program on the 28th day, post-treatment data were gathered to evaluate the outcomes. The assessments included the Berg Balance Scale (BBS) for measuring balance, the Functional Gait Assessment Scale (FGA) for evaluating gait stability, and the Unified Parkinson's Disease Rating Scale (UPDRS) for determining Parkinson's disease severity. These measures helped analyze and compare the effectiveness of the two physiotherapy interventions.

2.4. Data Analysis

Data were analyzed using Microsoft Excel, with paired t-tests for within-group comparisons and independent t-tests for between-group comparisons, setting significance at $p \leq 0.05$. In Group A (LSVT), BBS, FGA, and UPDRS scores improved from 23.13 to 35.26, 7.2 to 16, and 34.66 to 18.53, respectively, with significant P-values and reduced variances. In Group B (PNF), BBS increased from 19 to 32.33, FGA from 8.86 to 19.4, and UPDRS decreased from 33.06 to 23.86, also with significant improvements. Post-test comparisons showed BBS scores of 35.26 (Group A) and 32.33 (Group B), with a P-value of 0.0969. For FGA, Group A scored 16 and Group B 19.4 ($P = 0.003$), while UPDRS scores were 18.53 (Group A) and 23.86 (Group B) ($P = 0.0001$). Both interventions demonstrated significant patient improvements across all measures, with notable differences between groups.

3. Result

In Group A (LSVT), the mean pre- and post-test BBS scores were 23.13 and 35.26, with variances of 29.98 and 13.21, showing significant improvement ($p < 0.05$). Similarly, the mean FGA scores increased from 7.2 to 16, with variances of 7.46 and 11.57, confirming a significant difference ($p < 0.05$). UPDRS scores also improved, decreasing from 34.66 to 18.53, with variances of 16.66 and 4.98, and a p-value below 0.05, indicating a positive effect.

In Group B, the BBS scores increased from 19 to 32.33, with variances of 28.57 and 30.52, and a significant p-value ($p < 0.05$). The FGA scores improved from 8.86 to 19.4, with variances of 9.55 and 5.26, also showing a significant change ($p < 0.05$). UPDRS scores in Group B decreased from 33.06 to 23.86, with variances of 24.49 and 15.98, with statistical significance ($p < 0.05$).

Comparing post-test results between Group A and Group B, the mean BBS scores were 35.26 and 32.33, with variances of 13.20 and 30.52, and a p-value below 0.05. The FGA scores were 16 in Group A and 19.4 in Group B, with variances of 11.57 and 5.26, again showing a significant difference ($p < 0.05$). The UPDRS scores were 18.53 in Group A and 23.86 in Group B, with variances of 4.98 and 15.98, and a p-value less than 0.05. In all cases, the null hypothesis was rejected, confirming significant improvements in both groups.

4. Discussion

Physiotherapy plays a vital role in improving the quality of life for individuals with PD by maximizing physical abilities and minimizing complications throughout the disease's progression.[10] This study aimed to compare the effectiveness of two therapeutic techniques—Lee Silverman Voice Treatment-BIG (LSVT-BIG) and Proprioceptive Neuromuscular Facilitation (PNF)—in enhancing gait, balance, and activities of daily living (ADLs) among patients with PD.

The study was conducted on 30 patients at Mahatma Gandhi Medical College and Hospital, Jaipur, and other hospitals, divided into two groups using a randomized sampling method. Both groups underwent 16 therapy sessions (4 days per week for 4 weeks), with outcomes measured on the first and 28th days. The metrics used were the Functional Gait Assessment (FGA) for gait, the Berg Balance Scale (BBS) for balance, and the Unified Parkinson's Disease Rating Scale (UPDRS) for ADLs. In Group A, which received LSVT-BIG therapy, significant improvements were observed in all metrics: BBS (from 23.13 to 35.26), FGA (from 7.2 to 16), and UPDRS (from 34.66 to 18.53). Group B, treated with PNF, also showed significant improvements: BBS (from 19 to 32.33), FGA (from 8.86 to 19.4), and UPDRS (from 33.06 to 23.86). Statistical analysis confirmed these improvements ($P < 0.005$).

Comparative analysis revealed that PNF was more effective in improving gait and balance, as evidenced by higher FGA and BBS scores in Group B compared to Group A. Conversely, LSVT-BIG demonstrated greater efficacy in enhancing ADLs, with superior UPDRS outcomes in Group A. These findings align with previous research highlighting the benefits of both techniques. For example, a study on LSVT-BIG showed improvements in gait, balance, and mobility, while research on PNF demonstrated its effectiveness in enhancing balance and gait. This study concluded that LSVT-BIG is particularly beneficial for improving ADLs, whereas PNF is more effective for gait and balance, indicating that tailored therapeutic interventions can optimize outcomes for individuals with PD.

5. Conclusion

This study revealed significant differences between the two groups. Proprioceptive Neuromuscular Facilitation (PNF) was more effective in improving gait and balance, while Lee Silverman Voice Treatment-BIG (LSVT-BIG) showed greater efficacy in enhancing ADLs. Group A (LSVT-BIG) demonstrated significant improvement in the Unified Parkinson's Disease Rating Scale (UPDRS), whereas Group B (PNF) showed notable improvements in the Berg Balance Scale (BBS) and Functional Gait Assessment (FGA).

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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