Fall 2019

The Application of Lee Silverman Voice Treatment (LSVT) – BIG with a Patient Diagnosed with Parkinson's Disease: A Case Study and Literature Review

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ABSTRACT

Background: Parkinson's disease is the most prevalent progressive neurological disease with motor deficits. The hallmark symptoms include bradykinesia, tremor, rigidity, and postural instability. The primary focus of physical therapy is to address these symptoms. The purpose of this case study is to present the use of the Lee Silverman Voice Treatment (LSVT)-BIG as a Parkinson's disorder intervention, along with a critical review of the literature. **Case Description:** The patient is a 71-year-old man diagnosed with Parkinson's disease during the summer of 2019. Before any noticeable symptoms, the patient reported being active and independent without any self-reported limitations. The patient became progressively limited with overall mobility over a period of a year. The patient's primary complaints included poor standing and walking balance with a history of falls as well as difficulty performing activities of daily living. **Intervention:** The patient participated in LSVT-BIG that included daily exercises, patient-identified functional activities, and gait training. The program was four weeks in duration and consisted of four consecutive one-hour sessions each week. LSVT-BIG is amplitude-based training with the cue for "big" as the sole focus. **Outcome Measures:** 10-Meter Walk Test, the Timed-Up and Go Test (with and without a cognitive task), the Functional Gait Assessment, and the Five Times Sit to Stand. **Discussion:** The patient made improvements in all outcome measures, demonstrating the potential benefits gained following the completion of LSVT-BIG. This case study provides additional research to the limited collection of evidence that currently exists for the support of LSVT-BIG. However, more high-quality randomized trials are needed to further assess the true efficacy of LSVT-BIG.

Keywords: Physical Therapy; rehabilitation; LSVT-BIG; Parkinson's Disease; parkinsonism; amplitude-based; exercise.

INTRODUCTION

Parkinson's disease (PD), a progressive neurological condition, is considered the most prevalent disease with motor symptoms, and was originally described by James Parkinson in his 1817 "Essay on the shaking palsy.” In this essay, the cardinal symptoms of PD are highlighted and included bradykinesia, tremor, and rigidity. Currently, postural instability is also considered a primary motor symptom of PD.[1] These motor deficits are the characteristics of a parkinsonism presentation. Many conditions that do not have the pathological features of PD can present with such symptoms, however, PD is the most common.[2]

The neuropathology of PD is the loss of dopaminergic neurons in the substantia nigra pars compacta located in the midbrain of the brain stem. Another characteristic finding in PD is the accumulation of Lewy bodies, which are deposits that contain the protein alpha-synuclein.[1] This pathological process is the underlying cause of motor dysfunction in patients with PD. However, non-motor deficits are also present in PD, supporting the idea that other areas of the brain are also affected by neuronal degeneration.[2]

In North America, the prevalence of PD is estimated that between 111 to 329 people per 100,000. Similar estimates have been reported in Europe and South America. Each year the incidence is roughly 10 to 18 per 100,000 people. Furthermore, both the incidence and the prevalence increase with age, peaking at approximately 80 years old, and by the year 2030 the prevalence of PD is estimated to increase by at least 50 percent.[3]

The diagnosis of Parkinson’s is based on the criteria set by the PD brain bank of the United Kingdom. This set of criteria says that the patient must present with the following: slow initiation of movement, bradykinesia, and one other symptom (tremor, rigidity, or postural instability). It is important to note that by the time any motor symptoms become clinically present, 80 percent of dopaminergic neurons in the substantia nigra pars compacta have degenerated. The magnitude of this degeneration shows how severe the progression of the disease becomes before any clinical diagnosis, or most importantly, any treatment is provided. Additional requirements to diagnosis PD include the following: unilateral symptoms during onset, asymmetrical deficits, and the patient must respond well to dopamine replacement therapy.[4] As mentioned previously, several other conditions can present with similar symptoms as PD but do not have the pathological features of PD.[2] This highlights the importance of an extensive evaluation that must be conducted to rule out any other potential etiologies.

More recently, additional testing using nuclear medicine tomographic imaging has become more common. The specific technique, called dopamine transporter (DAT) single-photon emission computed tomography (SPECT), looks at the concentration of DAT, which is highly associated with dopamine levels. DAT-SPECT imaging has demonstrated to be a useful tool for clinicians when evaluating for PD, however, the diagnosis should be based on the previously mentioned clinical criteria. This is important because such imaging does not differentiate between PD and other atypical degenerative Parkinsonism syndromes.[5] In a systematic review by Suwijn et al. in 2015 that looked at the diagnostic accuracy of DAT-SPECT, it was concluded that this form of imaging could indeed be used to detect dopamine loss, however, additional research is needed due to the limited number of studies conducted.[6]

Currently, there is no available treatment to stop the progressive neurodegeneration of the disease. The standard initial first-line treatment to manage symptoms of Parkinson's is levodopa, a dopaminergic prodrug. However, the duration of the drug's effectiveness begins to fade with the progression of the disease. This means the “on-off” symptoms become more frequent. During the "on" phase symptoms of levodopa, a patient may exhibit dyskinesias. Whereas during the "off" phase, the patient may revert back to the cardinal symptoms (bradykinesia, hypokinesis, rigidity, postural instability) of PD. To help manage such responses of levodopa, the addition of supplemental medications have shown to be beneficial.[4]

Functional limitations for patients with PD not only come from the disease-causing motor impairments, but also from the secondary effects of deconditioning. This, combined with the natural progression of the disease as well as the adverse effects of levodopa, can have harsh effects on quality of life.[7] On a positive note, evidence has shown that using exercise as an adjunct intervention can

improve cognitive abilities and motor control for patients with PD, minimizing functional loss.[8] Specifically, studies show that just short-term exercise programs can provide noticeable benefits for patients with PD.[7] However, long-term exercise should be the goal so that functional mobility and health-related quality of life continue to improve.[9] To emphasize long-term exercise, it has been shown that exercise programs of six or more months in duration have more significant improvements in dynamic balance and overall mobility when compared to short-term programs of two and even ten weeks.[7] Additionally, patients with PD who exercise regularly, at least 2.5 hours per week for at least two years, have significantly better functional mobility and health-related quality of life versus patients who did not meet the 2.5-hour criteria for regular exercise.[9]

Insufficient movement amplitude is the primary deficit that limits mobility in patients with PD. Addressing this deficit with external cues, by targeting the auditory, visual, or somatosensory systems, has shown to be beneficial.[10] Refining motor performance in patients with PD is the goal when implementing such cues.[8] It has been reported that these external cues trigger pathways that bypass the pathological areas of the brain, thus using the intact and so-called "healthy" nervous tissue.[10]

These external cues are used during amplitude-based training, which is an intervention that focuses on improving movement amplitude to treat parkinsonism related motor symptoms. It was first introduced as a treatment option for patients with hypophonia secondary to PD and was called Lee Silverman Voice Treatment (LSVT)-LOUD. LSVT-LOUD is considered an evidence-based intervention to treat patients with PD related speech impairments, and research has shown that patients that participate in LSVT-LOUD retain improvements for at least two years.[11] Another form of amplitude base-training is LSVT-BIG, which is derived from the LSVT-LOUD and focuses on improving the movement amplitude of patients with a parkinsonism disorder. It is an intensive program with the aim to recalibrate the patient's kinesthetic sense to normalize movement. LSVT-BIG is four weeks in duration with each week consisting of four consecutive one-hour treatment sessions.[11]

In addition to LSVT-BIG, many other movement-based treatment options exist to address the functional deficits of individuals with PD. However, no treatment approach is considered the gold standard. The LSVT-BIG approach has gained popularity in recent years, yet only limited evidence supporting its effectiveness is available. Thus, the purpose of this case study is to present the use of the LSVT-BIG as a Parkinson's disorder intervention, along with a critical review of the literature.

CASE DESCRIPTION

A 71-year-old man was diagnosed with a Parkinsonism disorder during the summer of 2018. DAT-SPECT imaging (described above) was performed approximately one year later with the results consistent of PD pathology. These results, in addition to the clinical presentation, confirmed a diagnosis of PD. However, no specific stage of PD was determined. The patient's other medical history included type 2 diabetes, hyperlipidemia, hypertension, hypercholesterolemia, functional urinary incontinence, prostate cancer, renal cell adenocarcinoma, and gastroesophageal reflux disease.

Before any noticeable symptoms, the patient reported being active and independent without any self-reported limitations. However, over a period of a year, the patient became progressively limited with overall functional mobility. The patient's primary complaints included poor balance with standing and walking, and difficulty standing for periods greater than ten minutes because of feeling more off balance. Ultimately the patient's balance deficits contributed to a history of falls. The patient also reported trouble standing up from a chair or toilet, getting up off the floor, and walking on an unstable surface. At baseline, the patient used a cane while ambulating indoors but required a walker for community distances. Other complicating factors include difficulty with memory and attention.

The patient lived with his spouse in a multi-level house, thus requiring the patient to navigate stairs. Per the patient, stairs were a difficult task. The patient was retired and expressed that most of his physical activity occurred with the Silver Sneakers class at his local YMCA three times per week. The patient's goals for physical therapy were to improve his walking and overall mobility.

OBJECTIVE MEASURES

During the initial evaluation, the Five Times Sit-to-Stand Test (FTSTS), the Timed Up and Go Test (TUG), the TUG with a dual cognitive task (TUG COG), the 10-Meter Walk Test (10MWT), and the Functional Gait Assessment (FGA) were all utilized to assess level of impairment and to track progress. All initial scores at evaluation can be seen in table one.

The FTSTS was performed because the patient reported difficulty when standing up from a chair. This test has shown to have excellent reliability in PD.[12] The patient's initial score was 38.5 seconds, with scores greater than 16 seconds shown to be the cut-off score predictive of falls.

Additionally, the TUG was performed to evaluate changes in sit to gait transfer. The TUG has also been reported to have excellent reliability in PD.[13] The patient's first score at evaluation was 25.63 seconds without an assistive device. This score was notably higher than the reported norm of eight seconds for the patient's age group, indicating a worse performance. The TUG COG was also performed to show the change in the patient's ability to perform functionally while simultaneously attending to a cognitive task. This test was conducted by asking the patient to count backward from 100 by three. His evaluation score was 30.22, which was remarkably lower relative to the score of the TUG without a dual-task. Additionally, the patient performed this test without following full directions, counting backward by one instead of by three. This performance identified a potential cognitive deficit.

Another test conducted and shown to have excellent reliability for patients with PD was the 10MWT.[14] This test was used to track how well his gait velocity improved following the LSVT BIG protocol. His initial walking speed at the evaluation was 0.36 meters per second.

To test the patient's dynamic balance, the FGA was used. The patient's score at evaluation was 9/30, putting him in the "at risk for falls" category. For patients with PD, the definition of this category is a score that is less than 15/30.[15] This test also has excellent reliability for patients with PD.[16]

When the patient's gait was analyzed, the patient demonstrated stereotypical slow gait speed, which stemmed from decreased stride length and foot clearance bilaterally as well as a limited arm swing. The patient also showed a forward and rounded posture and was not able to attend to functional activities during a simultaneous cognitive task. The patient's functional limitations included standing up from a low chair, walking household and community distances, and navigating crowded community environments. With the deficits and functional limitations in which the patient presented, as well as the patient's ability to respond well with amplitude-based cueing, it was determined that the patient would benefit from the LSVT BIG program.

INTERVENTION

Daily Protocol

As previously mentioned, LSVT-BIG is a four-week long protocol with four consecutive days of one-hour sessions completed every week. Each visit consisted of three tasks and gait training. Task one consisted of the first two exercises of a daily exercise routine, and both exercises included sustained type movements in a seated position. Task two consisted of the remaining five exercises of the exercise routine. These five exercises were all in a standing position and performed with continuous movements instead of seated and sustained like the initial two exercises. The daily exercise routine is further detailed below.

Task three consisted of functional movements that were identified by the patient. These movements were chosen at the beginning of the first session and were decided upon because he performed them routinely throughout day-to-day functions. It is important to note that sit-to-stand transfers was included as a functional movement to practice per the protocol. These functional movements were practiced every day with the patient performing five repetitions to start and progressing from there.

Gait training, termed "big walking," was also performed daily and was done at the end of each session following task three. The cue was to "think big" with each step, and due to the patient’s limited attention, he was cued to focus on each lower extremity separately. It was important to not provide too

many instructions at once because of the patient’s limited attention. Thus, the lower extremities were the initial focus and the arm swing was incorporated during later sessions.

Daily Exercises

Before the start of the daily exercise routine, the patient and therapist sat down facing each other. This enabled the therapist to "model" the quality of movement that the patient attempted to mirror. A more in-depth description of each exercise is provided below.

The initial position of the first two exercises was with the patient seated on the edge of the chair with full upright postural. The first exercise began with the patient pushing both of their hands out front of their body, followed with reaching down to the floor, then up overhead, and finally both upper extremities were brought down and back to approximately 90 degrees of shoulder abduction coupled with maximal horizontal adduction. This position was held for ten seconds. The exercise ended with a loud slap on the thigh with each hand. It is important to mention that each exercise was linked to pertinent functional movements specific to each patient. This helped demonstrate the saliency of each exercise.

The second exercise was performed with one upper extremity at a time, started out by reaching out to the ipsilateral side then proceeded to reach across the body to the contralateral side, simultaneously rotating the hips toward the direction of reach. Ultimately, the patient and therapist sustained what looks like a modified lunge position for ten seconds. Again, the exercise ended with a loud slap with the extremity (that performed the reach) on the ipsilateral thigh. The patient performed all the repetitions on each side before the next exercise.

Exercise three, the first of task two (standing exercises with continuous repetitions), began with the patient in a proper upright posture with his hands at his sides. The movement started with a "big" step forward with either his right or left lower extremity (mirroring the therapist) while he simultaneously reached both upper extremities out to the associated ipsilateral side. The patient proceeded by taking a step back so that all extremities were back to the starting position. After the assigned repetitions were completed, the same number of repetitions were then performed with the opposite lower extremity. Exercise four was similar to three, but rather than a forward step, a lateral step began the movement, followed with the patient having turned his head toward the direction of the step.

Exercise five was performed with a step back to start. At this same moment, both upper extremities were simultaneously extended as far back as possible. This movement was coupled with trunk flexion, which looked like a form of “bowing down." When the assigned repetitions were completed, this exercise was then repeated with the opposite lower extremity.

Exercise six was a form of simulated walking by utilizing arm swings and weight shifts. The starting position was with the patient's feet in a staggered placement, as if he had just taken a step and held that position. The exercise motion began with weight shifts back and forth between the front and back foot, which created a "rocking" type motion. Once the patient was able to get down this movement, full reciprocal arm swings were then incorporated so that both the lower and upper extremities were involved simultaneously.

The last exercise, number seven, had the patient begin in a similar starting position as the previous standing exercises. The movement started with the patient reaching out laterally with both upper extremities (similar to exercise three and four) while simultaneously rotating at the trunk and hips. This rotation was either to the left or right (mirroring the therapist) but with the initial foot position maintained bilaterally. The goal was that each rotation was far enough so that the patient could see what is behind them. The movement was then finished with the patient rotating back to the initial position and with his hands back to his sides.

Week 1

On the first day of LSVT-BIG, the focus was on introducing the daily exercises to the patient, emphasizing basic form and moving "big" with full effort but without being highly critical of form. This required cueing for the majority of the time. However, the need for frequent cues was suspected due to

the novelty of each exercise. For task three, the functional component movements, the patient came up with the following to practice in the clinic: two steps into his house, donning his disposable underwear, getting in and out of a car, handwriting**,** and sit to stand from the toilet. Because of limited time, only sit-to-stand transfers were practiced during this session. The patient was cued to perform a "big" reach prior to standing to shift his center of mass over his feet, easing the difficulty of the transfer. No "big" walking was performed on session one. Overall, the patient showed a good response to amplitude-based training during the first session.

With session two, the patient was able to demonstrate good carryover, showing a spontaneous "big" reach during sit to stand transfers. Even throughout the entire treatment session, the patient was able to continue performing sit to stand transfers with "big" mechanics and without any cues. However, during the daily exercises, the patient still required cueing for the majority of the time using verbal, visual, and tactile cues to get "bigger." Gait training was performed for the first time at the end of this session. During this training, the patient was instructed to take "big steps” with the goal of increasing stride length and foot clearance.

Throughout sessions three and four, the patient continued to demonstrate recalibration by showing he could self-cue with sit to stand transfers using the "big reach" strategy that was taught in session one. His daily exercises still required cueing for the majority of the repetitions. "Big walking" also needed continuous cues to increase stride length and foot clearance. Additionally, verbal and visual cues for more significant arm swings were incorporated into gait training during this session. Specific to session four, the patient worked on dynamic balance by performing "monster walks" that allowed a slower type of gait to challenge balance. The patient's homework assigned following these two sessions was to "walk big" for the rest of the day.

Week 2

On the first day of week two (session five) of LSVT-BIG, the patient showed more noticeable improvements, demonstrated by the decrease in required cues during the daily tasks. During this session, the volume of the daily exercises was progressed, increasing the repetitions to the full ten. Despite this increase, the time it took to complete the daily exercises continued to be more and more efficient. Sit-to-stands were also progressed by decreasing the height of the sitting surface, challenging the patient to reach "bigger" to shift his weight more anteriorly over his feet, and to push harder with his lower extremities. The patient continued to demonstrate spontaneous "big" sit-to-stand transfers throughout the session, and the patient's wife also reported that he continued to perform "big" sit to-stands at home. Despite the good spontaneous "bigness," standing from the toilet continued to be difficult, as reported by the patient's wife. For the patient's homework following this session, the patient focused on using a "big" effort later that coming night when getting up from the toilet.

At the start of session six, the patient reported that he was feeling moderately fatigued, potentially due to just finishing a session of LSVT-LOUD, which will be discussed later. The patient also stated that he is compliant with his daily exercises at home but is frustrated by the amount of cueing he receives from his wife. Besides the patient report about feeling fatigued, nothing significant differed from session five. It is important to note that the patient complained of anterior knee pain after bouts of walking, requiring frequent rest breaks for relief. It is somewhat noticeable when the patient started to get this pain because the performance of his "big" walking began to fade due to his shift of focus from "big steps" to looking for a place to sit and rest. Overall, at this point in the protocol, the patient continued to progress, demonstrated by relatively less frequent cueing.

Despite the progress, the patient showed poor attention throughout session seven, requiring relatively more cueing but also with limited response. This limited attention span was apparent since the start of the protocol. During gait training, this inattention deficit was addressed, educating the patient to maintain focus on "big" steps and to drown out any distractions. Also, during walking on this date, the patient continued to complain of anterior knee pain, stating, "I'm sore from all this walking."

Reassessment was conducted during session eight, performing the same functional outcome measures that were completed during the initial evaluation. Before testing, the patient reported that he

thinks his "big" walking is becoming more automatic. Ultimately, this demonstrated the recalibration of the patient's kinesthetic sense. Reassessment scores can be seen in table one.

The reassessment scores, seen in table one, showed meaningful improvement following two weeks of LSVT-BIG. Reported minimal detectable change (MDC)[13,14,16] was achieved with the TUG, gait velocity, and the FGA. Although there is currently no MDC or minimally clinically important difference (MCID) reported for the FTSTS or TUG COG in the PD population, the patient showed distinguishable improvements with these two tests. At this point, the patient also made notable advancement with car transfers, donning undergarments, navigating stairs, and handwriting. With gait training, the patient progressed with performance but was limited by endurance. As mentioned previously, when the patient became fatigued, his focus on large amplitude diminished which led to a regression in walking performance.

Table 1. Functional outcome scores at initial evaluation and 2-week reassessment.

Test	***Initial Evaluation***	***Reassessment***	***Percent Change***
FTSTS	38.50s	21.78s	43
TUG	25.63s	*20.75s	19
TUG COG	30.22s	28.25s	7
10MWT	0.36m/s	*0.74m/s	106
FGA	9	*13	44

FTSTS: Five-Times-Sit-To-Stand Test, TUG: Time Up and Go Test; MDC = 3.5,[13] TUG COG: TUG with cognitive task, 10MWT: 10-Meter Walk Test; MDC = 0.18,[14] FGA: Functional Gait Assessment; expressed as absolute score out of 30; MDC = 4.[16] * = Improvement by at least the reported Minimal Detectable Change (MDC)
m/s = meters per second, s = second

Week 3

During session nine, the patient continued to require moderate to maximum cueing to maintain attention and large amplitude during daily exercises. The most significant progression to the patient's treatment was the increased walking distance to challenge the patient's endurance and focus. Fatigue and anterior knee pain were the two primary factors that continued to limit the patient's ability to perform continuous walking at relatively long distances. The patient's homework following the session was to walk "big" in small spaces due to the evident decrease in walking speed in such areas. This reduction was most noticeable when walking through doorways.

Session ten's progression involved gait training in a more open environment with surroundings full of distractions, simulating community walking. During these distracting moments, the patient required maximum cueing to maintain a large amplitude. Additionally, the patient stated that he felt like he was moving "too big," which is a common complaint by patients. The therapist explained that when he moves with an amplitude that is "too big," other people see it as a normal movement. The therapist educated the patient that with a consistent large-amplitude, movements will start to feel normal. Another significant progression of this session was having the patient perform sit-to-stands from a low soft cushioned chair, simulating the patient's couch in his home. The patient was cued to "reach big" to shift his center of mass over his forefeet. Because the patient demonstrated proper mechanics, the increase in difficulty was only minimal.

With gait training during session eleven, the goal was to challenge the patient with an unsteady ground (walking on large airex), small spaces (walking through parallel bars), curb steps (box step), and obstacles (walking around cones). The patient was able to perform relatively well but still required max cueing to maintain a large amplitude due to the tendency of losing focus. No other progressions were made during this session. Session twelve was canceled.

Week 4

During task three of session thirteen, the patient and his wife expressed that practicing getting up off the floor would be beneficial due to concerns that he might fall and be unable to get up. The patient was able to perform with standby assist but required cues throughout for technique and to perform "big" movements. To make it a more step-by-step task, the therapist broke it down into several small tasks, simplifying the original complex movement for the patient. Additionally, the patient began to show spontaneous "big" gait throughout this session, demonstrating improved foot clearance and arm swing. With gait training, longer distances were continued in a more open environment and progressed to working on quick stops. With this progression, the patient required minimal assist to maintain balance.

At the start of session fourteen, the patient reported having positive benefits from LSVT-BIG when asked about his thoughts on this program. During the treatment, the patient continued to demonstrate spontaneous "big" walking and sit-to-stand transfers. Gait training was again progressed, having the patient walk while performing a dual-task (balancing a ball on the open end of a cone) that simulated carrying a glass of water. The patient was then instructed to carry a glass of water at home for his homework. Getting up from the floor was again performed on this date with the patient showing carryover from the previous session, demonstrating the ability to complete the task without any cues.

The primary focus of session fifteen was to continue working on quick stops and dual tasking with gait. The patient showed good performance, with continuous repetition being a contributing factor to the improvements of each task. There were no other significant progressions or highlights from this session.

Session sixteen was the patient's last day of LSVT-BIG, with the plan to discharge following reassessment testing. Overall, these discharge reassessment scores (seen in table two) demonstrated meaningful improvement with sit to stand transfer and gait (velocity and balance). Additionally, the patient continued to make progress with all his patient-identified functional movements, requiring fewer cues. This progression suggested a recalibration occurred. Furthermore, as part of the discharge planning, the patient was educated on the commitment of LSVT-BIG beyond the four-week protocol because of the expectation to adapt to a new way of moving. To help maintain this adaptation, the patient continued with the daily exercise routine by performing each exercise one time each day. The plan was also to have the patient get periodic "checkups" to assess whether he was regressing, progressing, or maintaining the improvements he gained during the protocol. This would determine if he would benefit from a physical therapy "tune-up" or not.

Table 2. Functional outcome scores of 4-week reassessment and initial evaluation.

Test	*Initial Evaluation*	*Discharge*	*Percent Change*
5TSTS	38.50s	17.72s	54
TUG	25.63s	*18.31s	29
TUG COG	30.22s	24.75s	18
10MWT	0.36m/s	*0.96m/s	167
FGA	9	*18	100

FTSTS: Five-Times-Sit-To-Stand Test, TUG: Time Up and Go Test; MDC = 3.5,[13] TUG COG: TUG with cognitive task, 10MWT: 10-Meter Walk Test; MDC = 0.18,[14] FGA: Functional Gait Assessment; expressed as absolute score out of 30; MDC = 4.[16] * = Improvement by at least the reported Minimal Detectable Change (MDC)
m/s = meters per second, s = seconds

LITERATURE REVIEW

The focus of this literature review is to provide a summary of the most up to date evidence behind the efficacy of LSVT-BIG. The research described is of the highest quality available and most relevant to this case study. Other studies exist but only a limited amount compare LSVT-BIG to alternative forms of movement-based interventions.

In a systematic review and meta-analysis conducted by McDonnell et al. in 2018,[17] three randomized trials were analyzed to compare LSVT-BIG to alternate forms of exercise. General unsupervised exercise, Nordic Walking, and a similar shorter protocol to LSVT-BIG were all studied, using the motor function of the Unified Parkinson's Disease Rating Scale (UPDRS-III) as the primary outcome of the meta-analysis performed. The results showed that patients had significantly more sustained benefit at three-months following completion of LSVT-BIG program versus Nordic walking, general unsupervised home exercise plan, or a shortened protocol. This provided some evidence behind the benefit of LSVT-BIG versus alternative interventions, however, the authors of this study determined that the included trials were only of moderate quality.[17]

In a small study (n=9) conducted in 2017, gait speed, the Berg Balance Scale (BBS), FGA, quality of life (PDQ-39), and UPDRS-III were all analyzed in individuals diagnosed with stage one PD that participated in LSVT-BIG. In this study, all the subjects demonstrated improvements in at least one of the mentioned functional outcome measures following completion of LSVT-BIG. Furthermore, the majority of patients sustained the improvements (improvements defined as the associated MCID of each measure) at a three-month follow-up. Additionally, at least half (5) of the participants reported an increase in quality of life which is defined as the MDC of the PDQ-39.[18]

Additionally from 2017, a study with a similar set of outcomes also showed significant improvements in the FGA and BBS as well as the Six-Minute Walk Test, TUG, and TUG COG for individuals that participated in LSVT-BIG. This test also looked at the geriatric depression scale (GDC), which also showed improvement. It has been reported that this is a modified way to assess quality of life because the GDC includes a component of community participation.[19]

Previous studies have reported that impaired functional mobility is exacerbated when performing a dual-task, thus compounding the limitations in community participation. However, in one of the largest LSVT-BIG efficacy studies conducted, dual-tasking ability in patients with PD was shown to improve. Specifically, this study showed significant improvements with mobility, with and without a dual-task, following LSVT-BIG. This was demonstrated using the TUG for general mobility (without a dual-task), and TUG COG (cognitive dual-task) and TUG MOTOR (motor dual-task) for mobility with a dual-task. As previously stated, this study is one of the largest being addressed in this case study, reporting a sample size of 96. Additionally, no specific PD stage was indicated as part of the inclusion criteria making this study a relatively unique characteristic that aligns well with the patient of this case study.[20]

For people with advanced progression of PD, medication will begin to have a wearing-off effect. This is when the window of effectiveness for dopamine replacement therapy starts to slowly lessen. The smaller window is evident when the patient begins to have more frequent dyskinesia fluctuations. Even with these types of patients, a small study (n=8) reported that patients with either stage two or three PD (and with at least two hours of "off-time" each day) were also able to benefit from the completion of LSVT-BIG, shown with improvements in the UPDRS-III. Although the study showed good outcomes following completion of LSVT-BIG, these improvements did not continue beyond the protocol, thus suggesting and reiterating that unsupervised home exercise is not the most effective method for long-term outcomes. It should also be mentioned that this same study also looked at pre and post gait speeds and TUG scores with no significant improvement in either outcome.[21]

Overall, the currently available research is highly limited. As previously outlined, most studies conducted have small sample sizes, no control group, and primarily only include patients with early stages of PD. These limitations make it challenging to get a true grasp of the efficacy of LSVT-BIG as a treatment for PD, especially for individuals with advanced stages. However, with what has been reported, it appears that patients will have some form of benefit following LSVT-BIG participation. It also seems that LSVT-BIG is a better intervention when compared to unsupervised home exercises alone. Although LSVT-BIG showed better improvements versus a shorter protocol and Nordic walking, it is difficult to determine whether LSVT-BIG is superior to other forms of supervised interventions due to the limited availability of literature that currently exists.

DISCUSSION

The purpose of this case report was to present the application of LSVT-BIG in a physical therapy plan of care for a patient with PD. This type of treatment addressed the patient's identified impairments that were initially outlined in the initial evaluation. These impairments included standing up from a low chair, walking household and community distances, and navigating crowded community environments.

Following the initial evaluation, it was determined that the patient was an appropriate candidate for the LSVT-BIG program. This was concluded because it was evident that the patient could tolerate an intensive program and that the impairments and functional limitations that he presented with were able to be addressed using amplitude-based training.

After the first two weeks of the program, the patient was able to show a meaningful improvement with the TUG, TUG COG, 10MWT, and the FGA, all demonstrating improved overall functional mobility. Most importantly, the patient continued to make substantial progress until the end of the four weeks. The increase in gait speed was the highlight of this case study, with the patient improving by 167 percent. This was the percent change between the 10MWT at the initial evaluation and the last day of the four-week protocol. Overall, the improvements the patient made were consistent with the outcomes of the research that was previously discussed.

One of the unique characteristics of this case report is that this patient was going through LSVT-LOUD during the same period as LSVT-BIG. This potentially may have contributed to the outcomes of this case study due to the additional reiteration of amplitude-based treatment. Another unique feature of this case study, and potentially a limitation, is that the patient was never diagnosed with a specific stage of PD. The severity of PD motor symptoms is typically categorized into several stages, which are based on the Modified Hoehn and Yahr Scale. Knowing this would have provided readers with a better sense of outcomes and prognosis with patients of the same Hoehn and Yahr stage. However, some readers may appreciate the uncertainty of this patient's stage due to similar patient circumstances.

Another potential limitation of this case report is that the UPDRS was not utilized as an outcome measure. It has been reported by the Neurological Section of the American Physical Therapy Association that this is the only outcome measure that is both highly recommended for all stages of PD and represents three ICF categories (body structure, activity, and participation). Additionally, being able to compare the outcomes of this case study has been somewhat limited due to the absence of the UPDRS as an outcome measure since this measure is commonly used in current literature.[22]

CONCLUSION

To conclude, this case report and literature review support the use of LSVT-BIG, a program that emphasizes exercise and amplitude-based training, as a treatment strategy to address the motor symptoms of PD. Ultimately, this study outlines the potential benefits gained with improvements in overall functional mobility in patients with PD following the completion of LSVT-BIG. However, it must be noted that the results of this case study come from the patient described above and should not be extrapolated to all patients with PD. Not every patient will be appropriate for such an intense program, nor will all patients respond equally. This case study does, however, provide some additional evidence to the limited collection of research that currently exists for the support of LSVT-BIG. To further assess the true efficacy of LSVT-BIG, more randomized trials of higher quality are needed.

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