



Utilizing Telehealth to Deliver LSVT BIG Treatment for Young Onset Parkinson Disease: A Case Report

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Abstract

Background and Purpose: Young-onset Parkinson disease (YOPD) is characterized by an age of onset before 40 years and slower disease progression. Lee Silverman Voice Treatment (LSVT) BIG is an amplitude-based treatment performed to decrease symptoms of Parkinson disease (PD), administered in-person by certified physical and occupational therapists utilizing standardized exercises and patient goal-driven activities. Telehealth services allow for patient and clinician interaction when barriers exist for the delivery of traditional healthcare services. The goal of this case report was to investigate the effectiveness of LSVT BIG treatment delivered via telehealth.

Case Description: LSVT BIG treatment was delivered via telehealth to a 46-year-old male with Hoehn and Yahr Stage II YOPD who was unable to access an LSVT BIG certified clinician in a rural area. Doctor of physical therapy students who had completed LSVT BIG certification training were supervised by an LSVT certified physical therapist. Maximal daily exercises, functional tasks, a hierarchy task, and BIG walking were performed via telehealth over the course of four weeks with focus on high intensity and modeling big movements. Initial, discharge, and six month follow-up examinations were performed in-person.

Outcomes: Following completion of LSVT BIG via telehealth, the patient improved 9 Hole Peg for dominant hand, mini-BESTest, 10 Meter Walk Test, 30 second Sit to Stand, and UPDRS III scores. At the six-month re-evaluation, the patient improved or maintained mini-BESTest, 30 second Sit to Stand, and UPDRS III scores. Subjectively, the patient reported increased amplitude in daily movement patterns, improvements in gait, tremor, voice volume, typing, handwriting, energy level, and ability to think big.

Conclusion: Investigation into the effectiveness of providing physical therapy interventions via telehealth is imperative, now more than ever, as we navigate a global pandemic. This case report suggests that LSVT BIG delivery via telehealth may be effective for treatment of YOPD. Telehealth services could increase access to physical therapy treatment for patients with Parkinson disease. Further research on the delivery of LSVT BIG via telehealth is warranted.

Keywords: Young-onset Parkinson Disease, Parkinson Disease, Lee Silverman Voice Treatment, LSVT BIG, Telehealth, Case Report

Introduction

Parkinson Disease (PD) is a progressive neurologic condition which affects movement, resulting in tremor, bradykinesia, and rigidity, with eventual decline in function. Young-Onset Parkinson Disease (YOPD) is defined by an onset of symptoms before the age of 40 years [1]. Due to the young age of onset,

persons with YOPD may face additional challenges, including increased incidence of psychosocial issues, financial burdens, and difficulty balancing family life and employment [2].

Lee Silverman Voice Treatment (LSVT) BIG utilizes standardized high intensity, large amplitude exercises in order to reduce bradykinesia and hypokinesia symptoms associated with PD.

Patients are taught by certified physical and occupational therapists to increase motor output, use sensory feedback, and normalize functional movement through recalibration to think and move big. In addition to standardized exercises, the program is personalized with activities relating to personal goals. The treatment is delivered over sixteen sessions spanning four weeks, with prescription of a daily maintenance program following completion [3]. Research has shown that LSVT BIG produces positive functional outcomes at many stages of the disease [4].

According to the Centers for Disease Control and Prevention (CDC), approximately 15% of the US population lives in rural areas. Access to healthcare in rural communities is a well-documented inequality [5]. LSVT BIG is delivered by certified therapists; therefore, lack of proximity to a clinician may prevent access to valuable treatment. Telehealth, or the use of technology to deliver healthcare services, allows for patient and clinician interaction when barriers exist for traditional healthcare services. Recently, telehealth has shown potential to improve access to valuable healthcare services [6]. Compliance with the home exercise phase of LSVT BIG with telehealth has been previously researched [7]; however, there is currently no published research exploring LSVT BIG treatment delivered via telehealth. This case report will describe the successful provision of LSVT BIG treatment for a patient with YOPD living in a rural community.

Case Presentation

Patient History

The 46-year-old male patient was diagnosed with YOPD four years prior after noting a tremor in the right fourth and fifth fingers. A family history of Parkinson disease (paternal grandfather) caused the patient to seek out evaluation at the onset of symptoms. Following the diagnosis, the patient was prescribed dopamine promoters to address the tremors. He also sought out non-pharmacologic treatments and learned of the LSVT BIG program, but was unable to access treatment within a two hour radius of his home.

The patient's past medical history included intermittent back pain for the past two years. He sought physical therapy treatment for this complaint and his symptoms were managed with a home exercise program. Prior to LSVT BIG treatment, the patient reported difficulty with dominant hand dexterity, reduced voice production, bradykinesia during functional activity, and continued tremors in his right hand. He described feelings of anxiety about the diagnosis and disease progression, and being able to continue working and providing for his family. The patient described slowed and smaller movement with his right arm and hand while playing table tennis and completing work tasks, such as writing and typing. Despite these symptoms, the patient was independent with all functional mobility and recreational activities, while successfully managing his own information technology (IT) company. As a business owner and busy father of five, his

goals for treatment were to improve rapid movement with his right side during leisure activities and right hand dexterity for handwriting and typing.

In addition to the diagnosis of Hoehn and Yahr stage II PD, the patient met the following inclusion criteria: ability to operate the teleconferencing system, no additional comorbidities that would impact the ability to perform high intensity exercise, and the inability to access in-person LSVT BIG treatment. The patient provided informed written consent to participate in an in-person initial examination, video-conferencing sessions to complete the LSVT BIG program in sixteen sessions over four weeks, an in-person discharge examination, and a six-month follow-up re-examination with LSVT BIG certified DPT students. A certified LSVT BIG clinician and faculty mentor directly supervised the students and complied with all telehealth regulatory requirements.

Examination

The supervising physical therapist and physical therapy students completed the in-person initial examination at the patient's home in order to determine an appropriate space for treatment via telehealth. The patient had previously utilized teleconferencing in his daily work environment, and therefore did not require training. The researchers provided the patient with necessary equipment including foam balance pads, resistance bands, cuff weights, and equipment to monitor vital signs. Training was completed to ensure that he was able to use a pulse oximeter to assess heart rate and oxygen saturation, and an electronic wrist blood pressure cuff to monitor blood pressure. The patient was instructed to maintain the wrist cuff at the level of the heart in order to improve reliability with this electronic device [8]. The patient was educated to rate exertion using the Borg Rating of Perceived Exertion (RPE) scale, as it is a valid tool for patients with PD [9]. The patient did not receive LSVT BIG exercise training during the initial examination.

Outcome measures were assessed pre- and post-LSVT BIG telehealth intervention and six months after completion of the program (results in **Table 2**). The Nine Hole Peg Test (9-HPT) was utilized to assess dexterity of the right and left hands. The 9-HPT is a timed standardized assessment of upper extremity function and dexterity which requires manipulation of nine pegs from a container into holes on a board, and then back to the container [10]. The tool is reliable and valid for individuals with PD, with an established minimal detectable change (MDC) of 2.6 seconds for the dominant hand and 1.3 seconds for the non-dominant hand [11].

Since balance deficits are common in individuals with PD, it was vital to assess the patient's dynamic balance before initiating LSVT BIG treatment via telehealth. The mini-BESTest is a 14 item dynamic balance assessment with four subcomponents that includes: anticipatory postural adjustments, postural responses, sensory orientation, and dynamic gait. The maximum score is 28 points [12]. The mini-BESTest has

been shown to be more effective than the Berg Balance Scale in discriminating postural response impairment in patients with PD [13]. The test is reliable for individuals with mild to moderate PD, [14] with an established MDC of 3.5 points, and minimal clinically important difference (MCID) of 4 points in patients with balance disorders [15].

The 10 Meter Walk Test (10MWT) and 30 second Sit to Stand (30sSTS) outcome measures were utilized to assess gait speed and functional mobility. The 10MWT has excellent reliability, with an established MDC of .18 m/sec for self-selected gait and .25 m/sec for fastest gait speed for patients with PD [16]. The 30sSTS test assesses the number of sit to stand repetitions in 30 seconds from a standardized seat height without use of upper extremities for assistance. The tool is reliable for patients with PD, with an established MDC of 3.3 reps for Hoehn and Yahr stages I-III PD [17].

The Unified Parkinson Disease Rating Scale (UPDRS) is a rating tool used to assess disability in PD. The tool is divided into the following categories: (I) mentation/behavior/mood, (II) ADL, (III) motor, and (IV) complications. UPDRS III, the motor subcategory, contains 14 items including speech, facial expression, tremor at rest, action tremor, rigidity, finger taps, hand movements, rapid alternating movements, leg agility, rising from a chair, posture, gait, postural stability, and body bradykinesia [18]. This subcategory has an established MDC of five points [19].

Therapeutic Intervention

All LSVT BIG interventions were completed via telehealth. Per the LSVT BIG protocol, sixteen teleconferences were scheduled over the course of four weeks, with four sessions scheduled per week. One student modeled the standardized exercises and provided instruction and cues, while a second student monitored the patient's performance, repetitions, and recorded progressions, RPE scores, and vital signs. The students were directly supervised by an LSVT BIG certified physical therapist during all sessions.

Following self-assessment of resting vital signs, maximal daily exercises, functional tasks, a hierarchy task, and BIG walking per the LSVT BIG protocol were performed at each telehealth session (see Table 1). High intensity was maintained with progression of repetitions, addition of resistance, use of compliant surfaces, dual task cognitive challenges, flicks, and use of RPE scale. The patient completed homework practice and carryover exercises once daily on telehealth intervention days, and twice daily on non-intervention days. The patient did not complete two of the sixteen sessions because there was insufficient bandwidth on those days to support videoconferencing.

Upon completion of the telehealth portion of the program, an in-person discharge examination was performed in the patient's home. At that time, the patient was encouraged to continue with daily homework practice on his own for six months, when a follow up re-examination was to be completed.

Though the patient was able to adhere to the rigorous protocol during the telehealth portion, he was unable to consistently maintain the home program in the six months following.

Outcomes

After four weeks of LSVT BIG via telehealth, the patient demonstrated improved MiniBESTest, 10 MWT, and 30sSTS, 9-HPT, and UPDRS III scores. The patient met the MDC of 2.6 seconds for his right dominant hand, but did not maintain this gain at the six month follow-up. The patient did not meet the MDC of 3.5 points or MCID of 4 points for the Mini-BESTest at the four week assessment, but met both at the six month follow up examination. His self-selected walking gait speed met the MDC of .18 m/sec at the four week assessment, and was maintained at the six month follow up. The patient exceeded the 3.3 reps MDC for the 30sSTS assessment at four weeks, and demonstrated continued improvement at the six month follow up. The patient did not meet the MDC of 5 points for the UPDRS III at the four week or six month follow up assessments.

Patient Perspective

Following LSVT BIG via telehealth intervention, the patient reported improvements in his daily life, describing increased ease and amplitude in movement patterns, with most significant change in gait, posture, and energy level. The patient and his family noted better voice volume during conversation. At work, he noted improved typing and handwriting ability. Most importantly, he described the ability to think big. The patient was grateful to be able to access treatment in his own home, without the barrier of a two hour commute he would have faced with in-person treatment.

Discussion

Following telehealth treatment, the patient demonstrated clinically significant improvement in several outcome measures and reported positive changes in functional mobility, endurance, work related tasks, communication, and the ability to think big in his daily life. Telehealth has the potential to create new opportunities in healthcare by reducing barriers such as access to care and proximity to a clinician or specialist. Delivery of LSVT BIG via telehealth may improve access to the program and its benefits to those living in rural communities.

Important components of LSVT BIG treatment include large amplitude movement with high effort in order to recalibrate small and slow movement patterns associated with PD. Clinicians use modeling and shaping techniques to drive muscle activation for BIG effort. Telehealth delivery did not allow for shaping with tactile cues. To compensate for the lack of shaping, additional focus was placed on modeling large amplitude movements. Shaping was achieved with increased visual and verbal cueing and reinforced with positive feedback for BIG movement. The two-to-one student therapist-to-patient ratio assisted with effective delivery; however, assistance from a therapy aide may be more feasible in a clinic setting.

Table 1. Daily LSVT BIG Protocol, Homework, and Telehealth Intervention with Progression.

Exercise Protocol			
Maximum Daily Exercises	Functional Component Tasks	Hierarchy	BIG Walking
1. Floor to ceiling	1. Sit to stand	Timed bilateral alphabet hand writing and shape drawing	Timed BIG walking
2. Side to side	2. Mock table tennis		
3. Forward step and reach	3. Chair pull and side step (left)		
4. Sideways step and reach	4. Chair pull and side step (right)		
5. Backward step and reach	5. Bilateral fine motor grasp and place		
6. Forward rock and reach			
7. Sideways rock and reach			
Daily Homework			
Repeat half repetitions of daily exercise protocol on treatment days; half reps twice on non-treatment days			
Telehealth Intervention			
Week 1	Week 2	Week 3	Week 4
Day 1 Max daily exercises x 10 reps * Loud counting	Day 5 Max daily exercises x10 *added foam balance beam to #3 and #4	Day 9 Max daily exercises x10	Day 13 <i>Missed session</i>
Functional tasks x 10 reps	Functional tasks x 10	Functional tasks x 10 *added stepping obstacle to #3 and #4	Patient repeated day 12
Hierarchy task	Hierarchy task	Hierarchy task	
BIG walking 3 minutes	BIG forward and backward walking 3 minutes total	BIG walking 2 minutes *forward and backward walking with yellow band	
Day 2 Max daily exercises x10	Day 6 Max daily exercises x10	Day 10 Max daily exercises x12 *added foam balance beam to #6	Day 14 <i>Missed session</i>
Functional tasks x 10 *added flicks to #5	Functional tasks x 10 *added foam at feet to sit to stand	Functional tasks x 12 *added jumping obstacle to #3 and #4	Patient repeated day 12
Hierarchy task	Hierarchy task	Hierarchy task	
BIG walking 3 minutes *90 seconds forward walking, 90 seconds backward walking	BIG forward walking 3 minutes *added yellow band loop resistance above knees	BIG forward and backward walking 2 minutes with yellow band	
Day 3 Max daily exercises x10 *added flicks to #1 and #2	Day 7 Max daily exercises x10 *added foam balance beam to #7	Day 11 Max daily exercises x12	Day 15 Max daily exercises x12 *added 1.5 pound cuff weights to #1
Functional tasks x 10	Functional tasks x 10	Functional tasks x 12	Functional tasks x 12
Hierarchy task	Hierarchy task	Hierarchy task	Hierarchy task
BIG forward and backward walking 3 minutes total	BIG forward walking 3 minutes with yellow band	BIG forward and backward walking 2 minutes with yellow band	BIG forward and backward walking 2 minutes with yellow band
Day 4 Max daily exercises x10	Day 8 Max daily exercises x10 *added dual task cognitive challenges	Day 12 Max daily exercises x12	Day 16 Max daily exercises x12 *added 1.5 pound cuff weights to #2
Functional tasks x 10 *lowered seat height	Functional tasks x 10	Functional tasks x 12	Functional tasks x 12 *added supination/pronation to flicks
Hierarchy task	Hierarchy task	Hierarchy task	Hierarchy task
BIG forward and backward walking 3 minutes total	BIG forward walking 3 minutes with yellow band	BIG forward and backward walking 2 minutes with yellow band	BIG forward and backward walking 2 minutes with yellow band

Max = Maximum

Table 2. Outcome Measurements^a.

Outcome Measure	Pre-Treatment	Post-Treatment	6 Month Follow-up
9-HPT (sec) <i>Dominant hand = right</i>	Right 25.6	Right 21.2 ^b	Right 26.5
	Left 20.1	Left 20.8	Left 23.2
Mini-BESTest (0-28)	24/28	27/28	28/28 ^b
Self-Selected 10MWT (m/sec)	1.18	1.78 ^b	1.41 ^b
30sSTS (reps)	15 reps	24 reps ^b	26 reps ^b
UPDRS III	8	5	5

^a9-HPT = 9 Hole Peg Test, MiniBESTest = Mini Balance Evaluation Systems Test, 10MWT = 10 Meter Walk Test, 30sSTS = 30 Second Sit to Stand, UPDRS III = Unified Parkinson Disease Rating Scale, motor subcategory

^bMet or exceeded minimal detectable change

The risk for falls is a significant concern for individuals with PD; therefore, assessing and managing fall risk is necessary before proceeding with treatment. Seated and supine versions of the exercises are available, which allows the program to be tailored to the ability of the patient. The patient's risk for falls was low, therefore he was able to perform standing versions of all applicable maximum daily exercises without the need of supervision or assistance. However, an elevated risk for falls could have been mitigated with modification of the exercises into seated or supine versions, or with the addition of a caregiver for guarding or assistance.

A limitation of telehealth services includes insufficient bandwidth for videoconferencing, as evidenced by two missed sessions. The COVID-19 crisis has increased demand for internet services, necessitating providers to improve connectivity for vital services such as telehealth and online schooling. Continued investment in internet infrastructure is vital to advance telehealth services.

In conclusion, this case report describes the effectiveness of telehealth delivery of LSVT BIG treatment to a 46 year-old male with YOPD, and suggests that provision of LSVT BIG via telehealth may be beneficial to patients who may not be able to access in-person treatment. Investigation of physical therapy services provided via telehealth is imperative, now more than ever, as we navigate a global pandemic. In addition to enhancing access to rehab services, telehealth delivery of LSVT BIG may reduce the risk of exposure to COVID-19 to a vulnerable population with chronic disease. Further research regarding delivery of LSVT BIG via telehealth is warranted.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Authors' contributions	WH	SC	ACA	NA	MG	CM	RT
Research concept and design	√	√	√	√	√	√	√
Collection and/or assembly of data	√	√	√	√	√	√	√
Data analysis and interpretation	√	√	√	√	√	√	√
Writing the article	√	√	√	√	√	√	√
Critical revision of the article	√	√	--	--	--	√	--
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