Fall 2019

Utilization of AutoAmbulator as an Adjunct to Physical Therapy in an Individual with Parkinson's Disease: A Case Report

Megan Loux
University of Iowa

Utilization of AutoAmbulator as an Adjunct to Physical Therapy in an Individual with Parkinson's Disease: A Case Report

Megan Loux

DPT Class of 2019
Department of Physical Therapy & Rehabilitation Science
The University of Iowa

Abstract

Background: Parkinson's Disease is a neurogenerative disease of the basal ganglia resulting in decreased dopamine production. The imbalance of dopamine in individuals with Parkinson's Disease presents with symptoms including bradykinesia, rigidity, resting tremor, and postural instability. The purpose of this case report is to describe the use of an AutoAmbulator, bodyweight supported treadmill, in conjunction with traditional therapy and detail a patient with Parkinson's Disease response to therapy. **Case Description:** An 86-year-old male with Parkinson's disease was admitted to an inpatient rehabilitation facility after being hospitalized with generalized weakness and altered mental status. Prior to being hospitalized, he ambulated with a rolling walker household distances independently; however, at evaluation he required a two person assist to ambulate 10 ft in the parallel bars. **Intervention:** Three bouts of bodyweight supported treadmill training occurred in conjunction with overground training, postural education, lower extremity strengthening, transfer training, and dynamic standing balance over twelve sessions of inpatient rehabilitation. **Outcomes:** Outcome measures utilized consisted of FIM scores, Timed Up and Go test, 10 Meter Walk Test, and total distance ambulated. **Discussion:** Positive outcomes were observed in this patient with Parkinson's Disease with the incorporation of bodyweight supported treadmill training with traditional physical therapy treatment.

Keywords: Parkinson's Disease; bodyweight supported treadmill training; BWSTT; physical therapy; rehabilitation.

Background and purpose:

Parkinson's Disease is a neurodegenerative disease impacting more than 10 million people worldwide[1]. In 2010, an estimated 700,000 people in the United States were living with Parkinson's Disease. The prevalence of this disease in the United States is expected to grow and reach 1.25 million people by the year 2030[2]. The incidence of Parkinson's Disease is estimated to be 60,000 individuals newly diagnosed each year[1]. Men are more likely be diagnosed with Parkinson's disease with a ratio of 3:2 compared to women[1,3].

Parkinson's Disease is a disorder of the basal ganglia that results in decreased motor cortex activation secondary to a loss in production of dopamine in the substantia nigra[4]. The specific etiology behind Parkinson's Disease is unknown; however, it is thought to be a result of both genetic and environmental influences[3,5]. As a result of an imbalance of neurotransmitters, specifically a reduction in dopamine, four cardinal features present themselves including: bradykinesia, rigidity, resting tremor, and postural instability[1,3,4,6].

Bodyweight Supported Treadmill Training (BWSTT) is a task-specific locomotor training technique which utilizes harnesses for support and reduction of bodyweight[7]. BWSTT has been utilized in neurological disorders including Parkinson's disease, Multiple Sclerosis, spinal cord injury, and stroke. In Parkinson's Disease, task specific training is thought to elicit neuroplastic change by improving spatial temporal measures[8]. A systematic review demonstrated that BWSTT had a positive impact on stride length, step length, and gait speed in Parkinson's Disease; however, cadence and endurance were not impacted[8,9]. One study by Miyai and colleagues demonstrated improvements in step length lasting four months in individuals with Parkinson's disease receiving BWSTT[7]. Overall, treadmill training in individuals with Parkinson's Disease has shown reduction in gait variability and hypokinesia along with improvements in gait speed, distance, and stride length [6,8]. Additionally, studies reported increased quality of life for individuals with Parkinson's Disease as evident by the Unified Parkinson's Disease Rating Scale and increased functional independence measure (FIM) with treadmill training and traditional rehabilitation[10,11].The majority of studies involving individuals with Parkinson's Disease receiving BWSTT had sessions lasting 20-45 minutes with support of up to 20 percent of the individual's bodyweight. It is not known if shorter bouts of BWSTT elicit the same improvements in gait or quality of life.

Individuals with Parkinson's Disease can benefit from various forms of exercise. One study by Shulman and colleagues demonstrated the benefits of exercise when comparing low-intensity treadmill exercise, high-intensity treadmill exercise, and stretching and resistance training[12]. They found that all three forms of exercise improved gait speed, with low-intensity treadmill exercise showing the largest improvements[12]. Additionally, cardiovascular fitness assessed by oxygen consumption (VO2 peak) improved with both types of treadmill exercise; however a measure of muscle strength was superior in individuals with Parkinson's Disease who completed resistance and stretching[12].

It is not well known if shorter bouts of low-intensity BWSTT in conjunction with traditional therapy will improve gait speed, quality of life, and functional strength. The purpose of this case report is to describe the use of an AutoAmbulator, bodyweight supported treadmill, in conjunction with traditional therapy and detail a patient's response to therapy in an individual with Parkinson's Disease in the inpatient rehabilitation setting.

Patient History:

An 86-year-old male presented to the local hospital with generalized weakness and altered mental status as a result of dehydration. Prior to his admittance, he became progressively weak over several days to the point where he was unable to get out of bed and was having difficulty communicating. A head CT revealed no acute processes. The patient had a significant past medical history including Parkinson's Disease, hypertension, hyperlipidemia, lung cancer, and deep vein thrombosis. He was formally diagnosed with Parkinson's Disease over twenty years ago. His Parkinson's Disease had been managed by his primary care physician with medication including Levodopa; however, he had plans to see his neurologist in the upcoming month. The patient self-reported that he was able to function better

during the mornings since mornings coincided with is on-time, a period of time in which his Parkinson's Disease symptoms were well controlled through medication, after taking levodopa.

He lived with his wife, who had early stage dementia, in a single level home with a ramp for entry. Additionally, he had daughters living nearby that could assist him as needed. Prior to his hospitalization, he ambulated within the home with no supervision and the use of a front wheeled walker. He required minimal assistance to steady himself during transfers and bed mobility. Within his home, he had equipment and home modifications including an elevated toilet seat, manual wheelchair, and tub transfer bench. He reported that when he was in his wheelchair his wife would push him around their house. The patient also reported having a fall within the last year in which he slid out of his chair. Due to the above subjective report and inability to reach his prior functional status within the hospital; he was admitted to an inpatient rehabilitation facility where he received three hours of therapy a day. His self-selected goals for physical therapy were to sit with good posture in his wheelchair and walk home distances or approximately 100 ft with his rolling walker.

Examination:

The patient was evaluated in the afternoon, and during his evaluation he demonstrated deficits in lower extremity strength, balance, bed mobility, transfers, range of motion, wheelchair mobility, in addition to impaired gait and activity tolerance. During his stay in inpatient rehabilitation, physical therapy treatments were focused on improving the above impairments. He was also evaluated and treated by both occupational therapy and speech therapy. Occupational therapy specifically focused on the patient's upper extremity deficits. In all, he received 75 minutes of physical therapy, 75 minutes of occupational therapy, and 30 minutes of speech therapy to achieve three hours of therapy five days of the week during his time in inpatient rehabilitation.

At evaluation, the patient demonstrated deficits in lower extremity strength and range of motion. As evident in Table 1, the patient had relatively comparable bilateral strength with scores ranging from 3/5 to 4+/5 (see Table 2 for definitions). Hip extension was not assessed due to safety with positioning. The patient's elbow flexion and extension were assessed to garner an understanding of upper extremity strength needed for transfers. He scored 4-/5 for both elbow flexion and extension.

Table 1: Lower Extremity Manual Muscle Testing at Evaluation

	Left	Right
Hip Flexion	3+	3+
Knee Flexion	3	3
Knee Extension	4	4-
Ankle Dorsiflexion	4+	4+
Elbow Flexion	4-	4-
Elbow Extension	4-	4-

The patient was limited to neutral motion of bilateral talocrural joints. Additionally, he had limited pelvic mobility and was unable to actively deviate from his posterior rotated pelvic position. His upper extremities were limited to 90 degrees of active abduction and 100 degrees of active shoulder flexion.

The patient's light touch, proprioception, and deep pressure localization were intact in bilateral lower extremities. The patient's lower extremity coordination was within functional limits bilaterally for toe taps and heel to shin assessment. The patient was within functional limits for right upper extremity coordination test; however, he did demonstrate decreased coordination with left upper extremity finger to nose coordination test at evaluation. At rest the patient demonstrated a pill roll tremor with his upper extremities.

Table 2: Manual Muscle Test Grading[13]

Grade	Positioning	Description
0		No contractions felt in the muscle
1 (trace)		No visible movement, tendon becomes prominent or feeble contraction of muscle felt

2-	Gravity minimized	Moves through partial range of motion
2 (poor)		Moves through complete range of motion
2+	Against gravity	Against gravity, moves through partial range of motion
3-		Gradual release from test position
3 (fair)		Maintains test position with no added pressure
3+		Maintains test position against slight pressure
4-		Maintains test position against slight–moderate pressure
4 (good)		Maintains test position against moderate pressure
4+		Maintains test position against moderate-strong pressure
5 (normal)		Maintains test position against strong pressure

Table 3: FIM Scores at Evaluation

Task	Score
Transfer bed/chair/wheelchair	2
Locomotion	1
Stairs	0

The patient was assessed using the Functional Independence Measure (FIM) as seen in Table 3. He scored a 2 for transfers, 1 for locomotion and 0 for stairs (refer to Table 4 for definitions). The patient required maximal assistance of one person to roll in bed, transfer supine to and from sit, sit to stand, and complete a sit to sit transfer. The patient was able to complete stand to sit with moderate assistance.

Additionally, the patient required two-person assist to ambulate 10 feet in the parallel bars. One therapist provided moderate assistance to safely support himself while the other person followed with a wheelchair for safety. The patient ambulated with a forward flexed posture and slow festinating gait which required 30 steps to complete the 10 feet. The activity was stopped due to the patient's decreased activity tolerance. The stair portion of the FIM was not assessed due to patient and therapist safety.

The patient was unsuccessful at wheelchair management and required total assistance after propelling 1 foot in the wheelchair. Further assessment of mobility such as ambulating on uneven surfaces, ascending/descending a curb, picking up an object and completing a car transfer were not assessed due to decreased tolerance to physical activity and safety of the patient.

Table 4: FIM Grading for Transfers, Locomotion, and Stairs [14]

FIM Score	Classification	Transfer Description	Locomotion: Walk Description	Stairs Description
0	Does not occur	Does not occur	Does not occur	Does not occur
1	Total Assistance	The patient performs less than 25% of the task.	The patient performs less than 25% of walking effort, requires a 2-person assist, or walks less than 50 ft.	The patient performs less than 25% of effort. Requires assistance from 2 people. Completes fewer than 4 steps.
2	Maximal Assistance	The patient performs 25-49% of the task.	The patient performs 25-49% of walking effort to go a minimum of 50 ft. Requires only one-person assistance.	The patient performs 25-49% of the effort. Must complete 4-11 steps. Requires only one-person assistance.
3	Moderate Assistance	The patient performs 50-74% of the task.	The patient performs 50-74% of walking effort to go a minimum of 150 ft.	The patient performs 50-74% of the effort. Must complete one flight or 12 steps.
4	Minimal Assistance	The patient performs 75% or more of task.	The patient performs 75% or more walking effort with a minimum of 150 ft.	The patient performs 75% or more of the effort. Must complete one flight or 12 steps.
5	Supervision or Set Up	The patient requires supervision (standing by cuing, or coaxing) or setup	The patient requires standby supervision, cueing or coaxing to go a minimum of 150 ft* *Household Exception: the patient walks household distance (50-149 ft) independently with or without a device.	The patient requires standing by cueing or coaxing to go up one flight or 12 steps * *Household Exception: the patient completes 4-6 steps independently with or without a device.
6	Modified Independence	The patient requires an assistive device, or the task takes more than a reasonable amount of time to complete.	The patient walks a minimum of 150 feet and uses an assistive device or takes more than a reasonable amount of time to complete the task.	The patient completes one flight of stairs; however, they require a handrail, cane or other support or it takes more than a reasonable amount of time to complete the task.
7	Complete Independence	The patient performs 100% of the task.	The patient walks a minimum of 150 feet with no assistive device	The patient can complete a flight or 12 steps without a handrail or form of support.

Intervention:

The physical therapy sessions are described below. Each session took place on different days. The sessions consisted of 75 minutes of physical therapy. The patient also received occupational therapy and speech therapy to achieve 3 hours of therapy daily while in inpatient rehabilitation.

Session 1:

The first therapy session focused on the patient's posture, transfers, lower extremity strengthening, and gait training. The patient completed six sit-to-stand transfers within the parallel bars. He required minimal assistance to stand; however, he relied heavily on parallel bars to pull himself up into a standing position and to lower himself down slowly. Between transfer repetitions, when the patient was standing within the parallel bars, standing posture, endurance and balance were emphasized. When standing in the parallel bars the patient demonstrated a forward flexed posture that would worsen with time. The patient's standing endurance only lasted approximately 30 seconds. Additionally, the patient worked on lower extremity strengthening and completed an exercise program consisting of 2 sets of 10 repetitions of bilateral hamstring curls, seated marches, long arc quads, ankle pumps, and hip abduction and adduction

The session continued with the use of the AutoAmbulator, bodyweight supported treadmill. The patient was fitted with a pelvic harness which required the assistance of two people to safely don and attach to the treadmill. With verbal and external cueing on the treadmill, the patient was able to increase step length. External cues consisted of a target mark to try to step to and improve step length on the treadmill. The results are as follows in Table 5. The patient's walking speed originally began at 1.1 mph, however the speed had to be decreased until he was comfortable ambulating at 0.6 mph. The percentage of weight bearing for the initial session was not documented.

Table 5: BWSTT Over 3 Sessions

	Session 1	Session 3	Session 6
Total Time	5 minutes 39 seconds	5 minutes 35 seconds	5 minutes 11 seconds
Feet	310 feet	297 feet	279 feet
Speed	0.6 mph	0.65 mph	0.7 mph
Bodyweight	NA*	75%	85%

Note: Bodyweight support was not documented during the initial session

After the bodyweight supported treadmill training, the patient completed overground ambulation within the parallel bars. The patient was able to ambulate 10 feet three separate times in the parallel bars with contact guard assistance and a wheelchair follow. The patient took about 25 steps to ambulate a distance of 10 feet within the parallel bars.

Session 2:

During the second session, the patient completed transfer training outside of the parallel bars. He completed a sit to stand transfer with his rolling walker requiring moderate assistance. The sit to stand transfer progressed to minimum assistance this session with verbal cues for technique and safety. The patient continued the above lower extremity exercise program; however, during this session he completed an additional set and all exercises were completed with minimal theraband resistance. Additionally, he demonstrated standing lateral side steps this session. Cardiovascular endurance was promoted this session with the seated *SciFit* exercise machine, utilizing both upper and lower extremities, for 10 minutes.

The AutoAmbulator was not utilized during this session as overground training was the focus. With moderate assistance the patient ambulated 2x30 feet, 2x20 feet, and 3x15 feet with his rolling walker

this session. He required frequent rest breaks between ambulation trials and had a wheelchair follow for safety.

Session 3:

By the third session, he was able to complete sit to stand transfers to his walker with minimal assistance. He completed another AutoAmbulator session (refer to Table 5). The patient continued to require significant tactile and verbal cueing for step length and erect posture. During this session the patient did not adequately alert the physical therapist about fatigue, and the treadmill would automatically pause, or the therapist would manually pause the treadmill at their discretion based upon patient body language. Time during rest breaks included actively focusing on standing posture with anterior thoracic stretching.

After utilizing the AutoAmbulator, the patient continued with his lower extremity exercise program and overground ambulation. The patient was able to ambulate 30 feet with contact guard assist, his rolling walker, and a wheelchair follow. Additionally, this session also addressed dynamic standing balance utilizing bilateral upper extremities.

Session 4:

During the fourth session, the patient was able to progress to sit to stand transfers with supervision. Additionally, with overground gait training he progressed to supervision and ambulated 2x30 ft and 1x20 ft with his rolling walker. He did not require a wheelchair follow this session with strategically placed chairs throughout the room. The Timed Up and Go (TUG) was assessed for the first time along with 10-Meter Walk Test (10MWT). The patient completed the TUG within 3 minutes and 32 seconds and the 10 MWT with a gait speed of 0.38 m/s. Lower extremity strength training was also incorporated into the session.

Session 5:

The fifth session consisted of turning strategy, gait training, and lower extremity strengthening in a standing positioning with upper extremity support. The patient progressed to modified independence with sit to stand transfers this session. Additionally, he ambulated 68 feet two times with his rolling walker. The patient had fair gait speed at a straight distance; however, he experienced the greatest difficulty with freezing of gait during turns. The patient's bed mobility improved to minimal assistance.

Session 6:

This was the final session in which the AutoAmbulator was utilized with the patient (see Table 5). In addition to the AutoAmbulator, the session consisted of overground training, transfer training, and lower extremity stretching. The patient ambulated 88 feet, 110 feet and 130 feet with rest breaks between repetitions. He completed overground training with supervision and verbal cues.

Session 7-12:

The subsequent six sessions continued to focus on overground gait training, dynamic balance, transfer training, lower extremity and core strengthening, bed mobility, and posture.

Outcome:

After twelve sessions, the patient was discharged home to family care. With supervision, the patient was able to ambulate 150 feet with his rolling walker. He was able to complete sit to stand transfers with modified independence; however, all other transfers and bed mobility required supervision for safety. At evaluation, the patient was unable to complete steps, pick up an object, walk over uneven ground, or even complete a car transfer safely due to decreased activity tolerance; conversely, the patient was able to complete all of the above tasks with supervision at discharge.

Table 6: FIM Scores at Discharge

Task	Score
Transfer bed/chair/wheelchair	5
Locomotion	5
Stairs	2

Furthermore, the patient improved their FIM score (Table 6), TUG time and 10 MWT. The patient ascended and descended 4 stairs with standby supervision and the use of bilateral railings. The patient completed the TUG in an average time of 1 minute and 15 seconds, half the time of his initial TUG time. One study reported the minimal detectable change for an individual with Parkinson's Disease completing the TUG is 4.85 seconds[15]. According to findings by Brusse and colleagues, the mean TUG score for an individual with Parkinson's disease is 14.8 seconds with a standard deviation of 5.8 seconds[16]. One study reports that individuals with TUG times greater than 11.5 seconds are at higher risk of falls; therefore, the patient in this case study is categorized as a fall risk with his TUG time of 1 minute and 15 seconds[17]. After completing the 10 MWT, the patient's gait speed improved to 0.56 m/s, a near improvement of 0.2 m/s. The Minimal Detectable Change for an individual with Parkinson's Disease is reported to be at 0.18 m/s for their comfortable gait speed[18]. The patient was able to safely discharge home to family care, after reaching his prior level of function before his recent hospital admittance.

Discussion:

The majority of research conducted on Bodyweight Supported Treadmill Training in Parkinson's Disease reported increased step length, gait speed, decreased hypokinesia, and improved gait distance[6-9]. Many of these studies had sessions lasting 20-45 minutes long with maximum reduction of 20% bodyweight. This is in contrast to the five-minute sessions of BWSTT and the 15-25% reduction of bodyweight used with the patient in this case study. This dosage was chosen per patient tolerance. The patient showed improvements in gait speed as evident by his 10 MWT and increased ambulation distance; however, those improvements cannot be attributed to a specific intervention implemented.

The patient was able to develop trust with the therapy staff early on with the use of the bodyweight supported treadmill. With the harness, the patient felt supported and knew he was in a safe environment in which he could not fall. As a result, he was able to get more repetitions and increased distance of ambulation early in his care in inpatient rehabilitation. Once he demonstrated improved strength and stability when standing with his rolling walker, the therapy team thought it was important to transition to overground walking. This transition was pertinent to his care as this would be his ambulation status around his home at discharge.

To note, the patient completed his sessions in both the morning and afternoon. This is significant since the patient self-reported that his "on time," period in which his Parkinson's Disease symptoms were well controlled through medication, was in the morning, and his "off time," period when medication wore off and had limited effect leading to increased symptoms, were in the afternoon[1]. As a result, the patient had days in which his Parkinson's Disease symptoms were elevated during sessions and days in which they appeared minimal depending on his treatment time. His therapy sessions were not scheduled during his "on time"; however, it is to note that when this individual discharged home he would need to be able to demonstrate mobility even during his "off time" to be able to complete activities of daily living at home.

Conclusion:

In conclusion, the purpose of this case report is to describe the use of an AutoAmbulator, bodyweight supported treadmill, in conjunction with traditional therapy and detail a patient with Parkinson's Disease response to therapy. The bodyweight supported treadmill was utilized during three sessions, in addition to overground training, balance training, transfer training, postural facilitation, lower extremity strengthening, and dynamic standing tasks. Throughout his stay in inpatient rehabilitation, the patient improved his transfers and bed mobility to only require supervision. Additionally, he was able to ambulate 150 feet overground compared to 10 feet at his initial evaluation. His TUG time was reduced in half; however, with a time of 1 minute and 15 seconds he was still

categorized as a fall risk. Thus, this case demonstrates positive outcomes and improvements in an individual with Parkinson’s Disease when utilizing bodyweight supported treadmill training as an adjunct to traditional physical therapy.

References:

1. Parkinson's Foundation. Understanding Parkinson’s. https://www.parkinson.org/understanding-parkinsons. Published 2019. Accessed October 12, 2019.
2. Marras C, Beck JC, Bower JH, et al. Prevalence of Parkinson's Disease Across North America. *NPJ Parkinson's Disease.* 2018;4:21.
3. Capriotti T, Terzakis K. Parkinson Disease. *Home Healthcare Now.* 2016;34(6):300-307.
4. Evans S. Disorders of the Basal Ganglia. 2019.
5. US Department of Health and Human Services. Parkinson’s Disease. https://www.nia.nih.gov/health/parkinsons-disease. Published 2017. Updated May 16. Accessed.
6. Miller Koop M, Rosenfeldt AB, Alberts JL. Mobility Improves After High Intensity Aerobic Exercise in Individuals with Parkinson's Disease. *Journal of the Neurological Sciences.* 2019;399:187-193.
7. Miyai I, Fujimoto Y, Yamamoto H, et al. Long-Term Effect of Body Weight-Supported Treadmill Training in Parkinson's Disease: a randomized controlled trial. *Archives of Physical Medicine and Rehabilitation.* 2002;83(10):1370-1373.
8. Robinson AG, Dennett AM, Snowdon DA. Treadmill Training May be an Effective Form of Task-Specific Training for Improving Mobility in People with Parkinson's Disease and Multiple Sclerosis: A Systematic Review and Meta-Analysis. *Physiotherapy.* 2019;105(2):174-186.
9. Mehrholz J, Kugler J, Storch A, Pohl M, Hirsch K, Elsner B. Treadmill Training for Patients with Parkinson's Disease. *The Cochrane Database of Systematic Reviews.* 2015(9):Cd007830.
10. Capecci M, Pournajaf S, Galafate D, et al. Clinical Effects of Robot-Assisted Gait Training and Treadmill Training for Parkinson's Disease. A Randomized Controlled Trial. *Annals of Physical and Rehabilitation Medicine.* 2019.
11. Berra E, De Icco R, Avenali M, et al. Body Weight Support Combined With Treadmill in the Rehabilitation of Parkinsonian Gait: A Review of Literature and New Data From a Controlled Study. *Frontiers in neurology.* 2018;9:1066.
12. Shulman LM, Katzel LI, Ivey FM, et al. Randomized Clinical Trial of 3 Types of Physical Exercise for Patients with Parkinson Disease. *JAMA Neurology.* 2013;70(2):183-190.
13. Research. National Institute of Environmental Health Sciences. https://www.niehs.nigh.gov/research/. Accessed October 19, 2019.
14. The Center of Medicare and Medicaid Services. The Inpatient Rehabilitation Facility Patient Assesment Instrument. https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/InpatientRehabFacPPS/downloads/irfpai-manualint.pdf. Published 2001. Accessed October 19, 2019.
15. Dal Bello-Haas V, Klassen L, Sheppard MS, Metcalfe A. Psychometric Properties of Activity, Self-Efficacy, and Quality-of-Life Measures in Individuals with Parkinson Disease. *Physiotherapy Canada Physiotherapie Canada.* 2011;63(1):47-57.
16. Brusse KJ, Zimdars S, Zalewski KR, Steffen TM. Testing Functional Performance in People with Parkinson Disease. *Physical Therapy.* 2005;85(2):134-141.
17. Nocera JR, Stegemoller EL, Malaty IA, Okun MS, Marsiske M, Hass CJ. Using the Timed Up & Go Test in a Clinical Setting to Predict Falling in Parkinson's Disease. *Archives of physical medicine and rehabilitation.* 2013;94(7):1300-1305.
18. Steffen T, Seney M. Test-Retest Reliability and Minimal Detectable Change on Balance and Ambulation Tests, the 36-Item Short-Form Health Survey, and the Unified Parkinson Disease Rating Scale in People with Parkinsonism. *Physical Therapy.* 2008;88(6):733-746.