2018

The Co-Treatment of Physical Therapy and Music Therapy and Its Effect on Parkinson's Disease: A Multidisciplinary Approach

Kayli Muckenhirn
University of North Dakota

Laura Whiteley
University of North Dakota

The Co-Treatment of Physical Therapy and Music Therapy and its Effect on Parkinson's Disease: A Multidisciplinary Approach

by

Kayli Muckenhirn, Student Physical Therapist
Bachelor of General Studies, University of North Dakota

Laura Whiteley, Student Physical Therapist
Bachelor of General Studies, University of North Dakota

A Scholarly Project Submitted to the Graduate Faculty of the

Department of Physical Therapy
School of Medicine

University of North Dakota

in partial fulfillment of the requirements for the degree of

Doctor of Physical Therapy

Grand Forks, North Dakota
May, 2018

This Scholarly Project, submitted by Kayli Muckenhirn and Laura Whiteley in partial fulfillment of the requirements for the Degree of Doctor of Physical Therapy from the University of North Dakota, has been read by the Advisor and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

Kristin L. Johnson
(Graduate School Advisor)

David Reese
(Chairperson, Physical Therapy)

PERMISSION

Title The Co-treatment of Physical Therapy and Music Therapy and its effect on Parkinson's Disease: A Multidisciplinary Approach

Department Physical Therapy

Degree Doctor of Physical Therapy

In presenting this Scholarly Project in partial fulfillment of the requirements for a graduate degree from the University of North Dakota, I agree that the Department of Physical Therapy shall make it freely available for inspection. I further agree that permission for extensive copying for scholarly purposes may be granted by the professor who supervised my work or, in her absence, by the Chairperson of the department. It is understood that any copying or publication or other use of this Scholarly Project or part thereof for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and the University of North Dakota in any scholarly use which may be made of any material in this Scholarly Project.

Signature Kayli Muckenhirn Signature Laura Whiteley

Date Sep. 15, 2017 Date Sep 15, 2017

TABLE OF CONTENTS

LIST OF TABLES

ACKNOWLEDGEMENTS

We wish to express a sincere thank you to our research participant and caregiver who so graciously agreed to participate in this study. We would like to show our gratitude to Dr. Cindy Flom-Meland, PT, PhD, NCS; Associate Professor/Director of Clinical Education (DCE) Dr. Kristin Johnson, PT, DPT, GCS, NCS; Assistant Professor, and Dr. Anita Gadberry, PhD, MT-BC for sharing their pearls of wisdom with us during the course of this research. We would like to acknowledge the contribution of Ilorium Pena, SMT, who volunteered her time and expertise in music therapy to make this research study possible. We are also immensely grateful to our fellow classmates Matthew Aymond, SPT, Michelle Sanders, SPT, Scott Syverson, SPT, and Nicholas Holkup, SPT for their comments on an earlier version of this manuscript. Any errors are the authors' and should not tarnish the reputation of these esteemed persons. Lastly, we would like to thank the University of North Dakota Physical Therapy Department for the opportunity and resourses to conduct this study.

Co-treatment of Physical Therapy and Music Therapy and its Effect on Parkinson's Disease: A Multidisciplinary Approach

Kayli Muckenhirn, BGS, SPT and Laura Whiteley, BGS, SPT

University of North Dakota School of Medicine and Health Sciences

Abstract

Background. A multidisciplinary approach combining physical therapy and music therapy can improve functional mobility in individuals with Parkinson's Disease. ***Objective.*** The authors studied whether a multidisciplinary approach of PT and MT would reduce the primary symptoms associated with PD. ***Methods.*** In a single subject design, one patient participated in the following interventions; seated activities, task-specific training, balance and posture, pre-gait activities, and gait activities. The patient was evaluated on the first, mid-term, and last days of treatment. Evaluations included the Parkinson's Disease Questionnaire-39 (PDQ-39), Freezing of Gait Questionnaire (FOGQ), Berg Balance Scale (BBS), Timed-Up-and-Go (TUG), Five Times Sit-to-Stand (5TSTS), GAITrite® assessment, and the Functional Reach. ***Results.*** The patient improved scores on the PDQ-39, FOGQ, BBS, and the 5TSTS at the end of 12 weeks of treatment. Improvements were shown on the TUG at mid-term but the patient could not maintain these improvements for the entire length of treatment due to comorbidities. ***Conclusion.*** Patients with PD can achieve improvements in functional assessments, outcome measures, functional mobility, and quality of life from a multidisciplinary approach of physical therapy and music therapy.

Keywords: Multidisciplinary, interdisciplinary care, physical therapy, music therapy, Parkinson's Disease, rhythmic auditory stimulation

CHAPTER I

BACKGROUND AND PURPOSE

Parkinson's disease (PD) is the second most common neurodegenerative disease following Alzheimer's Disease[1]. Approximately one-million Americans are living with PD, and over ten-million are affected worldwide[1].PD is classified into five stages of severity shown in Table 1, and is a progressive disorder associated with loss of pigmented (dopaminergic) neurons in the substantia nigra. This area is responsible for controlling voluntary movements. The amount of dopamine produced in the substantia nigra decreases as the diseases progresses, which reduces controlled movements. A diagnosis of PD is not considered fatal, however, the progressive nature of the disease occurs over an average of fifteen years with other systems failure causing death.

Table 1. Stages of Parkinson's Disease [2]

Stage I	Mild symptoms that do not interfere with daily activities Tremors only on one side of the body Changes in walking, posture, and facial expressions may not be noticeable.
Stage II	Symptoms progress Tremors and other movement symptoms affect both sides of the body Walking difficulties and poor posture become apparent. Patient is still able to live alone, however, activities of daily living become more difficult.
Stage III	Loss of balance and slowness of movements Falls are more common Patient is still independent, however, symptoms significantly impact activities of daily living
Stage IV	Symptoms are severe and very limiting Possible to stand without assistance, but movement may require an assistive device Requires assistance with activities of daily living, and is unable to live alone
Stages V	Most advanced and debilitating stage Stiffness is legs may make it impossible to stand or walk Requires a wheelchair, or is bedridden Around-the-clock nursing care is required

Presently, there is no cure for PD, but symptoms can be conservatively managed by medication if taken consistently, or managed more aggressively with surgery. Medications prescribed can vary from patient to patient depending on symptoms. The primary symptoms of PD are bradykinesia (slow movement), resting tremor, rigidity (stiffness and decreased flexibility), and postural instability (poor balance). Patients with PD are at a higher risk for falls due to decreased equilibrium and gait difficulties such as pivoting, shuffling (foot clearance), and backwards stepping. Robyn Galletly and Sandra G. Brauer et al[3]. found that patients with PD have decreased gait velocity when given a language task (0.85 m/s) and a motor task (0.15 m/s slower) when compared to patients without the disease. Secondary symptoms include freezing gait, micrographia (shrinkage of handwriting), mask-like facial expression, flexed posture, and unwanted accelerations with speech and movement (facilitation or uncontrolled gait). Mobility decreases with the progression of the disease which affects activities of daily living (ADLs), cognitive function, and social interaction.

Research supports multiple intervention strategies to treat PD including strengthen and balance training, dance exercise that involves rhythmic cueing, step training, and rhythmic auditory stimulation (RAS). RAS is a technique used to facilitate movements that are intrinsically rhythmical, such as gait. Auditory stimulation can come from a variety of sources including a metronome, guitar, autoharp, singing, tambourine, etc. Raglio stated, "Many studies report that musical rhythm in PD treatment can improve gait speed, frequency, and step length, limb coordination, postural control and balance[4]" Another study reported that music-based movement (MbM) therapy may be a promising intervention to improve gait and gait-related activities in patients with PD[5]. It naturally combines cognitive movement strategies, cueing

techniques, balance exercises and physical activity while focussing on the enjoyment of moving with music instead of the current mobility limitations of the patient[5]. A study by Zahra Kadivar, PhD, showed that physical therapy (PT) with RAS training increased the Timed Up and Go (TUG) scores to greater than 7.95 seconds above the cut off score, and the Freezing of Gait Questionnaire (FOGQ) score from 16-22 to 10-14[6]. Current research, however, is lacking in regards to the effects of cotreatment of PT and music therapy (MT) on patients with PD.

The purpose of this study is to examine the effects of multidisciplinary interventions involving PT and MT on a single patient with PD. The patient was selected from a group of community volunteers willing to participate for one hour a week for 12 weeks. No specific screening process was performed for the selection of the participant. All interventions were carried out by two PT students and one MT student under the supervision of a licensed Physical Therapist and Music Therapist.

CHAPTER II

CASE DESCRIPTION

[History] The patient is a retired, 81-year-old Caucasian female who first noted symptoms of PD in 2006, and was later diagnosed in 2008 by a neurologist. The patient has not received any PT, occupational therapy (OT), or speech and language therapy (SLP) services in the past 12 months. Currently, the patient is prescribed a variety of medications. Reference table 2 for a complete list of her medications, targeted treatment effects, and possible side effects. Chief complaints that the patient expressed at the date of examination included muscle aches, joint pain, decreased mobility, freezing during gait, and loss of voice. On the initial history intake form, the patient reported no falls in the last 6 months, however, her mobility was

primarily limited to the fear of falling. Upon initial examination and evaluation, the patient also presented with decreased upper extremity (UE) and lower extremity (LE) range of motion, shuffling gait, retropulsion (especially observable during sit-to-stand and turning), decreased balance, and decreased step length during ambulation. Other pertinent diagnoses and past medical history include cataracts, double vision, high blood pressure, right total knee arthroplasty performed in 2011, and arthritis. The patient's arthritis was especially painful in the left knee, right shoulder, and bilateral elbow joints. The patient lives in a one-level, private home, and receives 24-hour support from her daughter. The bathroom is equipped with hand rails and is wheelchair accessible. Based off a subjective report from her daughter, the patient is wheelchair bound or remains in a reclining lift chair for 90% of the day. All transfers, ADLs, and transportation were performed with maximum assistance of one. The patient owned a U-Step walker stabilizer, however, it was not utilized prior to treatment. Other assistive devices available to the patient included a standard front wheeled walker (4WW) and wheelchair.

Table 2. Subject's Medication List[7]

Medication:	**Targeted Treatment Effect:**	**Possible Side Effects:**
Carbidopa-Levadopa	Reduces stiffness and difficulty moving	Dizziness, lightheadedness, nausea, vomiting, loss of appetite, trouble sleeping, unusual dreams, or headache
Ropinirole	Improves ability to move and decrease shakiness (tremor), stiffness, slowed movement, and unsteadiness, and may decrease number of episodes of not being able to move	Nausea, drowsiness, dizziness, abdominal pain/discomfort, or headache
Carbidopa-Levadopa Extended Release	Reduces stiffness and difficulty moving	Dizziness, lightheadedness, nausea, vomiting, loss of appetite, trouble sleeping, unusual dreams, or headache
Simvastatin	Lowers "bad" cholesterol and fats (LDL, triglycerides) and raise "good" cholesterol (HDL) in the blood	Mild memory problems or confusion, however, very unlikely

Tramadol	Relieves moderate to severe pain	Nausea, vomiting, constipation, lightheadedness, dizziness, drowsiness, or headache
Metoprolol	Lowers high blood pressure	Drowsiness, dizziness, tiredness, diarrhea, and slow heartbeat
Losartan	Treats high blood pressure	Dizziness or lightheadedness
Furosemide	Treats high blood pressure, and also reduces extra fluid in the body (edema) and can lessen symptoms such as shortness of breath and swelling in arms, legs, and abdomen	Dizziness, lightheadedness, headache, or blurred vision
Baby Aspirin	Reduces fever and relieve mild to moderate pain and reduce swelling in arthritis	Upset stomach and heartburn, rarely causes serious bleeding from the stomach/intestines or other areas of the body

[Systems Review] A brief systems review was performed. **Vital Signs.** Due to the patient's medical history of high blood pressure, vital signs were taken at initial evaluation before, during, and after intervention. Values were within the expected range and there was no concerns for additional monitoring. **Musculoskeletal.** Muscular strength was assessed grossly through functional movements in which the patient was able to move against gravity. Range of motion was grossly assessed and measurements were based off of clinical judgement. The most significant findings included bilateral shoulder range of motion limited to 90 degrees due to arthritis increasing pain to 6/10 upon movement, and a lack of knee extension of approximately 5-10 degrees, bilaterally. **Neurological.** No formal neurological screening was taken at initial evaluation due to her current diagnosis. **Other findings.** The patient reports no gastrointestinal tract symptoms (nausea, vomiting, and bowel and bladder). There were no significant findings for the endocrinologic and integumentary systems.

[Clinical Impression] The patient demonstrated characteristics associated with PD . The patient's cognition was intact and she was able to understand instructions for all of the test and

measures. These tests included measures of balance, strength, gait speed, transfers, joint range of motion, and a quality of life (QoL) assessment. There were no significant concerns for cardiovascular or pulmonary issues. The patient presented with moderate to severe knee valgus due to arthritis, which limited her ability to complete all tests and measures in a standardized form. Adjustments were made for the examination procedure in order to obtain relevant data.

The clinical impression of the patient's current functional level was complete dependence on caregiver for all ADLs, assistance required for all transfers, freezing of gait, increased fall risk, and essentially wheelchair bound within the home and community. The patient also demonstrated a decrease in strength, functional mobility, and balance.

Overall, the patient was considered a good candidate for this study due to the PD diagnosis, arthritis, and functional limitations. The authors concluded that the patient would benefit from multidisciplinary intervention between PT and MT.

[Tests and Measures] At the initial evaluation, the patient was given the Parkinson's Disease Questionnaire-39 (PDQ-39), and Freezing of Gait Questionnaire (FOGQ). Reference table 4 for initial scores. Upon observation, the patient demonstrated decreased balance during the Berg Balance Scale (BBS) assessment and GAITrite® in which the patient required an assistive device and assist from a PT student to prevent falls.

The patient required UE support of a 4WW and contact guard assist (CGA) for the majority of the tests and measures. The patient performed the BBS which is designed to measure balance of the older adult in a clinical setting. A score of < 47/56 indicates individuals may be at greater risk of falling, and a score between 0-20 indicates that an individual is likely to be wheelchair bound. The minimal detectable change (MDC) needed for PD is 5[8]. Modifications for

the BBS for this patient included a 4WW, additional rest breaks, and minimal verbal cueing. She also required moderate assistance of one while performing specific tasks of the BBS due to her high fall risk. The BBS encompasses the functional reach test, which we used as a separate outcome measure. The patient's stability was assessed by measuring the maximum distance the patient was able to reach forward while standing in a fixed position.

The TUG was used to assess the patient's mobility, balance, walking ability, and fall risk by incorporating functional movements such as sit-to-stand, walking, and turning.

The patient performed the Five Times Sit-to-Stand (5TSTS) to assess functional lower limb muscular strength and functional mobility with regards to change in transitional movements. A score of >16 seconds on the 5TSTS, without the use of arms, is considered a fall risk for PD[9].

At initial intake and prior to the final session, the patient completed two separate questionnaire forms. The PDQ-39 was used to assess the patient's PD and its effect on her QoL. Dimensions of the PDQ-39 include mobility, ADLs, emotional well being, stigma, social support, cognitive impairment, communication, and bodily discomfort[10]. An overall score can be determined, as well as eight separate subsection scores, in order to compare and contrast specific aspects concerning QoL. Overall, a lower score indicates a better QoL.

The FOGQ was used to assess the severity of freezing of gait unrelated to falls, frequency of freezing, disturbances in gait, and relationship to clinical features conceptually associated with gait and motor speeds (e.g. turning)[11]. Overall, a lower score indicates less limitation due to freezing.

Lastly, the patient's gait pattern was assessed using the GAITrite® analysis system. This system is a portable device that provides reliable measurements of gait including cadence, step length, stride length, base of support, and distance ambulated[12]. The patient required an assistive device and support from the PT students. Reference table 3 for GAITrite® data.

Table 3. Initial GAITrite® Data

Level of assist	Cadence (steps/min)	Step Length (cm)	Distance (cm)	Velocity (m/sec)
Minimal assist of 1	73.5	11.20	251.3	0.39
Minimal assist of 2	65.3	0.82	293.1	0.35
Minimal assist of 2 with FWW	90.9	18.24	296.4	0.37
Minimal assist of 2 with 4WW	97.8	14.94	247.4	0.41

Table 4. Tests and Measures [8-20] * not assessed, + unable to complete

Test	Initial Score	Mid-term Score	Discharge Score	Validity	Reliability	MDC	Cut-off Score
PDQ-39	67	*	72	Not Est.	High 0.68-0.95	Mobility (12.24) ADLs (16.72)	N/A
FOGQ	20	*	17	0.74	0.84	Not Est.	Item 3: good indicator of FOG frequency
BBS	9/56	*	19/56	0.76 (in relation to stroke)	Excellent (ICC = 0.80)	5 points	< 47
TUG	1 min and 13 sec	58 sec	2 min and 12 sec	0.91	Excellent (ICC = 0.80)	4.85 sec	14.8 sec
1TSTS	1 min and 39 sec	*	12 sec	N/A	N/A	N/A	N/A
5TSTS	+	1 min and 20 sec	1 min and 18 sec	Excellent correlation w/ TUG (r = 0.91)	Excellent (ICC = 0.76)	0.11 sec (in relation to children w/ CP)	> 16 sec

Functional Reach	4 ½ in	*	*	0.59 (in relation to vestibular disorders)	Excellent (ICC = 0.84)	9 (forward functional reach)	25.4 cm

[Evaluation] The patient scored a 9/56 on the BBS indicating an extremely high fall risk and inability to live independently, causing her to use a wheelchair for mobility. Overall, the patient performed the BBS in a standardized manner, however, she did require moderate assistance of one with specific activities. Including single-leg stance, tandem stance, toe taps, narrowed base of support, 360-degree turns, chair-to-chair transfer, and sit-to-stand. It should be noted that the patient displayed significant uncontrolled descent during stand-to-sit. All other activities performed during the BBS were performed with CGA.

The patient was unable to perform the 5TSTS following multiple attempts and cueing from PT students. To obtain relevant data, modification to the assessment was made by having the patient perform a one time sit-to-stand (1TSTS) in which she was able to perform in 1 minute and 39 seconds. It should be noted that the patient required heavy use of arms to perform the 1TSTS, and also displayed decreased anterior weight shift, and uncontrolled descent during stand-to-sit. Due to the modifications needed, it was indicated that the patient had decreased LE muscular strength, decreased endurance, and requires moderate assistance of one for all transfers.

The patient performed the TUG in 1 minute and 13 seconds. Modifications were needed in regards to UE support for transfers and use of a U-Step walker during ambulation. Based off the time and modifications needed, the patient displays limitations in functional mobility, transfers, ADLs, and general independence.

The patient's problem list includes a decrease in the following: strength, functional mobility, balance, cardiovascular endurance, functional joint range of motion, and abnormal gait (decreased step length, freezing, retropulsion). The problem list also includes dependence with transfers (moderate assistance of one and/or CGA), flexed posture, unwanted accelerations with movements and speech, inability to complete ADLs independently, and increased fall risk.

[Diagnosis] The patient's current medical diagnosis is PD (as of 2008), and polyarthritis. The PT diagnosis revealed a decrease in the following: strength, functional mobility, balance, cardiovascular endurance, abnormal gait (decreased step length, freezing, retropulsion), functional joint range of motion, inability to complete ADLs independently, and increased fall risk. The focus of intervention was to improve the patient's limitations identified in the PT diagnosis.

[Prognosis] Based off clinical judgment and reasoning, the patient's current level of function is between stages IV and V on the PD Severity Scale referenced in table 1. While determining the patient's prognosis, multiple factors were taken into account. Demographic factors (age being the most impactful), and disease-specific factors, including stage and severity of her PD, negatively impacted her prognosis. The most limiting factor the patient presented with was severe osteoarthritis affecting mainly her left knee. This limited her ability to ambulate without pain and perform specific interventions discussed later in this report. Based off the examination findings, demographic and disease-specific factors, and comorbidities, the authors concluded that the patient's prognosis was fair, and she would benefit from the 12-week multidisciplinary intervention between PT and MT.

[Plan of Care] The clinical impression of the patient's current functional level was complete dependence on caregiver for all ADLs, assistance required for all transfers, freezing of gait, increased fall risk, and essentially wheelchair bound within the home and community. The patient also demonstrated a decreased in strength, functional mobility and balance. The authors believed the patient would benefit from the co-treatment of PT and MT. The main focus of treatment included RAS, balance activities, functional transfer training, cueing techniques for freezing of gait and unwanted accelerations, pre-gait activities, gait training, fall prevention strategies, caregiver education, and home exercise instructions. The patient agreed to attend therapy for one hour per week for 12 weeks. The patient's goals were aimed at reducing frequency of freezing, and improving her balance and vocalization. The student PT's short and long-term goals are listed in table 5. Re-assessment and examination were performed at the mid-term and final treatment sessions.

Table 5. PT Goals

Short-term Goals 1. Patient will improve confidence in voice by communicating 90% of the time to student PTs within 2 weeks 2. Patient will perform supine<>sit transfers with minimal assistance of one to get in and out of bed and promote independence within two weeks
Long-term Goals 1. Patient will perform STS transfers with minimal assistance of one to promote independence in the home within 12 weeks 2. Patient will demonstrate turning strategies and cueing techniques to decrease freezing by 50% and improve ambulation distance to 100 feet within 12 weeks 3. Patient will improve BBS score by 5 points to decrease falls and improve QoL within 12 weeks

CHAPTER III

INTERVENTION

Following examination and evaluation of the patient from both a PT and MT perspective, a detailed intervention plan was outlined each week based on the patient's response. A comprehensive program was designed for entrainment and improvement in functional mobility. Interventions were customized each week in response to the patient's tolerance of activity, and based off clinical judgement for appropriate exercise progression. This study incorporated musical cueing performed by a MT student with the majority of PT interventions. A comprehensive outline of weekly interventions can be referenced in table 6.

Initially, seated activities were performed due to the patient's quick fatigue with ambulation and balance deficits while in standing[21]. Activities included weight shifting in multi-plane directions, hand and foot tapping to the beat of music, and reaching. Visual cues were given in the form of musical instruments, colorful targets on the floor, and therapists seated on both sides of the patient.

Task-specific training aimed at improving the patient's functional mobility and transferring ability. Initial focus was put on improving the patient's ability to self-transfer from a seated position to supine and vice versa. The patient displayed the ability to perform this transfer when asked, and minimal assistance was required at the LEs. Demonstration of proper mechanics was given to the caregiver in regards to minimally assisting the patient in order to maximize her independence. While performing transfers from the wheelchair (or chair) to another surface, verbal cues were given. This included cueing the patient to move to the edge of her seat in order to place the heels of her feet slightly behind her knees, shift anteriorly to place

her "nose over toes," and use of her hands to push off from the chair. Sit-to-stands (STS) were performed from an elevated plinth. Initially, STS were done from a height of 22 inches. As the patient progressed the plinth was lowered by half-inch increments, and five repetitions performed at each height. The patient was able to lower to a height of 19.5 inches, from the plinth. Manual cues were given at the scapulae as the patient initiated STS in order to facilitate anterior propulsion of the upper trunk and movement of the center of gravity over the base of support. Patient performed multiple repetitions of STS weekly, which were aimed at increasing the patient's LE strength, but did so in a functional manner. Functional activities, such as overhead and forward reaching, were performed at a counter with bilateral UE support. Forward reaching was initiated by asking the patient to turn the sink faucet on and off, and overhead reaching done so by grabbing objects out of a cupboard. Manual cues were given at the right and left anterior superior iliac spine (ASIS) to facilitate weight shift of the hips posteriorly as the upper trunk shifted anteriorly. The patient was able to carry over this motion and manual cues were reduced.

Interventions for balance and posture were chosen due to evaluation findings of flexed posture, decreased balance, and increased fall risk. Balance activities were chosen based off of research that identified nearly 50% of all patients with PD fell within a short period of 3 months[22]. Balance activities included ankle sways, hip strategies, and segmental movement. Exercises were performed in a controlled area to increase patient confidence and reduce possibility of falling. Si-nae Jeon et al. looked at the effects of ankle strategy exercises on balance and found significant improvements in shifting weight outside the base of support in the anterior, posterior, left, and right directions[22]. Postural training involved seated breathing

techniques and chest expansion with bilateral UE abduction, external rotation, and extension. Research has found that most postural deficits occur during the later stages of PD[23].

Pre-gait activities focused on movements similar to those encompassed within a "normal" gait pattern. This included standing anterior-posterior weight shifts in a staggered stance position, lateral weight shifts, rotational and diagonal stepping, and marching. The patient performed all exercises with support of a 4WW. Manual cues were often given during anterior-posterior weight shifting in a staggered stance. This entailed cues at the posterior superior iliac spine (PSIS) on the LE positioned in front to facilitate an anterior weight shift, and a cue at the ASIS on the extremity positioned in back to facilitate a posterior weight shift. Verbal cues, such as "heel-toe" or "one-two" were given. RAS, with use of various musical instruments, was provided by the MT student for all pre-gait activities. In conjunction with RAS, these pre-gait exercises aimed at neurologically "priming" the patient prior to gait training[24].

Gait activities were performed within a closed environment to reduce patient distraction. Assistance was provided by a 4WW and CGA from a PT student. The patient ambulated various distances (depending on patient tolerance and pain level for that day) with and without RAS provided by the MT student. During ambulation, visual cues were used to promote increased step length. Initially, tape was placed on the floor at 11-inch increments. As the patient progressed, increments increased to 13 inches. The patient was also prompted to identify a number ahead of her to facilitate looking forward during ambulation. Auditory cueing was given through use of an autoharp to facilitate an increase in cadence. A cadence of 60 beats per minute was used throughout treatment sessions. One research study revealed that one month of gait training with visual cues produced a lasting improvement in gait speed and step length while improving the

underlying motor control system responsible for gait[25]. Manual cues were given at the ASIS and PSIS to facilitate a more normalized "swing-through" phase while ambulating. Verbal cues were given to promote upright posturing. The patient was taught various strategies to reduce freezing while ambulating or turning, and was encouraged to demonstrate them independently when needed. Strategies included stopping movement, laterally weight shifting, and counting out loud to an external beat until initiation of movement was desired. Martin et al. found that using auditory cueing during ambulation had a positive effect in reducing self-reported FOG for patients with PD[26].

A formal home exercise program (HEP) was given to the patient on week 4 of intervention. Exercises prescribed were ones that had been performed in the weeks prior, and included STS, seated lateral weight shifting, forward and overhead reaching with bilateral UE support of a counter, and lateral side stepping with support. A handout was provided, and the caregiver documented the number of times the exercises were performed throughout the week. A video was created of the patient performing each exercise with explanation provided by the student PTs on proper technique. The caregiver was able to reference this video to ensure exercises were being performed properly with correct cueing.

Education was provided on the importance of consistently taking the medications prescribed to the patient, and the possible side effects that skipping doses can have on the symptoms of PD. The patient and caregiver verbalized understanding and were informed to contact their physician with any other concerns. Lastly, education regarding safe handling of the patient's 4WW during ambulation and transferring was frequently reinforced. This included the

proper use of brakes, distance the walker should be held from the body, and the importance of scanning the environment.

Table 6. Weekly Interventions

Week	Seated Activities	Task-Specific	Balance/Posture	Pre-gait Activities	Gait Activities
1	RAS: ^MAR, liftoffs, leg kicks	N/A	N/A	RAS +*^ w/ 4WW: WS, MAR, Amb	N/A
2	RAS~: LAT WS, MAR, diagonal stepping*+	STS	N/A	RAS: w/ 4WW; LAT and AP WS	RAS amb w/ 4WW
3	N/A	STS+^*~	Ankle sway, hip strategy	RAS +*^~ w/ 4WW: AP WS	RAS amb w/ 4WW
4	N/A	STS+^*~, bed mobility, reaching	Ankle sway, hip strategy	N/A	RAS +*^~ w/ 4WW: amb w/ and w/o RAS
5	N/A	STS +^*~ reaching	N/A	N/A	RAS w/ 4WW: amb +*^~
6	N/A	Overhead and forward reaching+	Hip strategy+	(L) rotational stepping	Amb w/ RAS*^~
7	N/A	360 turns w/ RAS^~, STS	N/A	AP stepping w/ RAS*^, MAR,	Amb w/ RAS*^~
8	RAS*~:LAT WS	Bed mobility	N/A	RAS^~: LAT/AP WS, diagonal stepping	Unable due to pain
9	RAS^~: Hand/foot tapst, LAT/AP WS	RAS^~ w/ 4WW: 360 turns	N/A	AP WS w/ RAS^~	Amb w/ and w/o RAS^~
10	RAS^~: Hand/foot taps, LAT/AP WS, heel-toe taps	STS w/ RAS+	N/A	AP WS w/ RAS^~	Amb w/ RAS*^~
11	RAS^~: Hand/foot taps, heel-toe taps	N/A	N/A	AP WS w/ RAS^~	Amb w/ RAS*^~

WS=weight shift/ MAR=marching/ +=manual cue/ *=visual cue/ ^=verbal cue/ ~=self cue/ Amb=ambulation/ LAT=lateral/ AP=anterior-posterior

CHAPTER IV

OUTCOMES

At discharge, following 12 weeks of intervention, the patient's functional mobility was as follows: minimal assistance of one with bed mobility, stand by assistance (SBA) and use of 4WW with all transfers, and ambulation up to 250 feet with 4WW and SBA. Compared to the initial evaluation, the patient's vocalization improved, as she was able to communicate effectively 90% of the time with family and health providers following treatment. Previously, upon standing the patient displayed significant retropulsion and inability to statically stand without human external support. At the time of discharge, the patient was able to statically stand with UE support of 4WW and close SBA. Her caregiver reported that transferring the patient at home required less assistance, and ambulation at home occurred daily. Previously, the patient was unable to ambulate due to significant freezing and uncertainty of the caregiver providing support.

Reassessment occurred during the last two treatment sessions. Significant improvements were noted with the 1TSTS, 5TSTS, the BBS, and FOGQ. Refer to tables 7 and 8 for a complete list of results. To standardize testing, the same examiner performed each outcome measure at initial evaluation, mid-term, and discharge.

Table 7. Outcome Measures

Test Performed	Initial Score	Mid-term Score	Discharge Score
PDQ-39	67	*	72
FOGQ	20	*	17
BBS	9/56	*	19/56
TUG	1 min and 13 sec	58 sec	2 min and 12 sec
1TSTS	1 min and 39 sec	*	12 sec

5TSTS	+	1 min and 20 sec	1 min and 18 sec
Functional Reach	4.5 inches	*	*

Table 8. Discharge GAITrite® scores

Level of assist	Cadence (steps/min)	Step length (cm)	Distance (cm) (m/sec)	Velocity
Minimal assist of 1	N/A	N/A	N/A	N/A
Minimal assist of 2 (Attempt #1)	68.8 (65.3)	2.08 (.82)	247.6 (293.1)	0.36 (0.35)
Minimal assist of 2 (Attempt #2)	73.9 (65.3)	7.38 (.82)	244.2 (293.1)	0.33 (0.35)
Minimal assist of 2 with FWW	82.7 (90.9)	18.33 (18.24)	279.0 (296.4)	0.35 (0.37)
Minimal assist of 2 with 4WW	-65.0 (97.8)	33.34 (14.94)	426.3 (247.4)	0.39 (0.41)

*Initial GAITrite® data is in parentheses

The patient's perception of interventions was positive with noticeable change in functional mobility, social interactions, and overall QoL. At the final treatment session, the caregiver stated, "I can see noticeable change in her ability to move at home and is able to help more with daily activities." The patient still required a full-time caregiver support, minimal assistance of one for the LEs with bed mobility, use of a 4WW with ambulation, and CGA during ambulation from the caregiver out of caution. Due to the patient's limited endurance and significant increase in pain while ambulating, she will use a manual wheelchair for community mobility.

At discharge, the therapy goals were reviewed and compared to initial patient status. At this time, all goals were met. Reference table 9 for a detailed explanation of discharge goal status. Although significant improvements were noted and goals were met, the patient would benefit from continued PT and MT treatment to address remaining limitations listed previously.

Table 9. Discharge Goal Status

1. Patient will improve confidence in voice by communicating 90% of the time to student PTs within 2 weeks	Goal met. Patient was able to express all needs and able to sing an entire song without assistance
2. Patient will perform supine<>sit transfers with minimal assistance of one to get in and out of bed and promote independence within two weeks	Goal met. Minimal assist needed for LEs
3. Patient will perform STS transfers with minimal assistance of one to promote independence in the home within 12 weeks	Goal met. CGA with 4WW needed for all transfers
4. Patient will demonstrate turning strategies and cueing techniques to decrease freezing by 50% and improve ambulation distance to 100 feet within 12 weeks	Goal met. FOG score decreased from 63 to 47
5. Patient will improve BBS score by 5 points to decrease falls and improve quality of life within 12 weeks	Goal met. Berg score improved from 9/56 to 19/56

Throughout the 12-weeks of intervention, no patient compliance issues were noted. At discharge, the student PTs held a discussion with the patient and caregiver about their expectations and satisfaction from this treatment plan. They voiced satisfaction with the interventions and stated that the significant improvements with functional mobility had carried over into the home environment.

CHAPTER V

DISCUSSION

The authors' found that the patient's outcomes were achieved through multiple intervention techniques such as seated exercises, balance and proprioception, task-specific activities, pre-gait activities, and gait training. In this study, a majority of the interventions were accompanied by MT which proved to be very beneficial in reducing freezing of gait, unwanted accelerations, and improved step length. The evidence found in this study supports what Zahra

Kadivar et al. found relative to how RAS combined with traditional PT interventions will help patients with PD achieve or maintain improvements with gait and balance[6].

Unfortunately, the patient experienced unforeseen complications with arthritis of multiple joints, which limited her improvements in therapy. As the patient began to ambulate more frequently in therapy and in the home, her knee pain significantly increased from a 6/10 to 9/10 on the visual analog scale. This was evident through comparison of the assessment scores taken at mid-term and at the final treatment session. The patient did not achieve the full potential benefits from therapy due to her secondary pathology of arthritis producing an unbearable amount of knee pain.

The functional assessments and outcome measures used in this study are considered reliable measures for patients with PD shown in table 6. The patient showed improved scores on the majority of the functional assessments. The patient improved significantly in the 5TSTS. Initially, the patient was unable to complete the 5TSTS during evaluation. At discharge she was able to complete it in 1 minute and 18 seconds. Kadivar et al. expressed the idea that immobility may be partially to blame for gait and balance deficits associated with PD[6]. This case study supports the research found when looking at the patient's level of immobility at initial evaluation and comparing it to her status at discharge.

One limitation to this study would be the lack of screening criteria for participants. Although the writers believe that all individuals with PD would benefit from multidisciplinary based treatment, the number of comorbidities associated with this patient limited the potential outcomes anticipated. Another limitation would include the minimal number of treatment

sessions per week. Other research supports higher frequencies of treatment for patients with PD, however, this study only treated the patient once a week for one hour.

Overall, the patient outcomes were met through a highly specialized program including multiple different PT approaches accompanied with RAS and other MT. The patient was able to meet all the goals set by the PT students within the 12-week time frame. As previously mentioned, the student PTs believe the patient would benefit from continued PT services to further her independence and reduce caregiver burden. Based off of the results from this study, the writers concluded that the combination of PT and MT may have a positive effect on patients with PD. More research in this area would be beneficial to validate these findings.

Reflective practice. When evaluating this patient, an extensive history was taken and a thorough examination performed. Several changes could be made to maximize both qualitative and quantitative results for future studies. One suggestion would be increasing the treatment frequency. This study examined the effects of multidisciplinary treatment over the course of 12 weeks with a one hour session per week. A second suggestion would be to perform a pre-screen physical examination prior to the start of the study. The patient used in this study had significant arthritis and joint degeneration, which had a negative impact on the final results of the study. Future studies should consider utilizing patients in the earlier stages of PD. The effects of combined PT and MT may be more impactful to those in the earlier stages of progression because there is more room for improvement. Lastly, it may also be beneficial to provide a caregiver burden questionnaire. In doing so, a more comprehensive picture of how the co-treatment of PT and MT affects the QoL would be taken into account and more objective data would be collected.

REFERENCES

1. What is parkinson's disease? Parkinson Disease Foundation Web site. http://www.pdf.org/about_pd. Updated 2017. Accessed May 2017, 2017.
2. Stages of Parkinson's Disease Table: 1. The stages of parkinson's disease. National Parkinson Foundation Web site. http://www.parkinson.org/understanding-parkinsons/what-is-parkinsons. Published 2017. Updated 2017. Accessed May, 2017.
3. Galletly R, Brauer SG. Does the type of concurrent task affect preferred and cued gait in people with Parkinson's disease? *Aust J Physiother* 2005; 51: 175–180.
4. Raglio A (2015) Music therapy interventions in Parkinson's disease: the state-of-the-art. *Front. Neurol.* 6:185. doi: 10.3389/fneur.2015.00185
5. de Dreu M. J., van der Wilk A. S., Poppe E., Kwakkel G. & van Wegen E. E. Rehabilitation, exercise therapy and music in patients with Parkinson's disease: a meta-analysis of the effects of music-based movement therapy on walking ability, balance and quality of life. Parkinsonism Relat Disord 18Suppl 1, S114–119, doi: 10.1016/S1353-8020(11)70036-0 (2012).
6. Kadivar Z, Corcos DM, Foto J, Hondzinski JM. Effect of step training and rhythmic auditory stimulation on functional performance in parkinson patients. *Neurorehabil Neural Repair.* 2011;25(7):626-635.
7. FDA. https://www.fda.gov/Drugs/default.htm. Updated June 2017. Accessed June 6, 2017.
8. 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.
9. Duncan RP, Leddy AL, Earhart GM. Five Times Sit to Stand Test Performance in Parkinson Disease. *Archives of physical medicine and rehabilitation.* 2011;92(9):1431-1436. doi:10.1016/j.apmr.2011.04.008.
10. PDQ-39: Hagell P, Nygren C. The 39 item Parkinson's disease questionnaire (PDQ-39) revisited: implications for evidence based medicine. *Journal of Neurology, Neurosurgery, and Psychiatry.* 2007;78(11):1191-1198. doi:10.1136/jnnp.2006.111161.
11. Giladi, N., Tal, J., Azulay, T., Rascol, O., Brooks, D. J., Melamed, E., Oertel, W., Poewe, W. H., Stocchi, F. and Tolosa, E. (2009), Validation of the freezing of gait questionnaire in patients with Parkinson's disease. Mov. Disord., 24: 655–661. doi:10.1002/mds.21745
12. Chien SL, Lin SZ, Liang CC, et al. The efficacy of quantitative gait analysis by the GAITRite® system in evaluation of parkinsonian bradykinesia. *Parkinsonism Relat Disord.* 2006;12(7):438-442.

13. 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*. 2011;63(1):47-57. doi:10.3138/ptc.2009-08.
14. 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. *Phys Ther*. 2008;88: 733–746.
15. Brusse, K. J., Zimdars, S., et al. (2005). "Testing functional performance in people with Parkinson disease." Phys Ther 85(2): 134-141.
16. Clemens SL, Faulkner WC, Browning EB, et al. Primarytitle. *J Appl Theory* [IdentifyingPhrase]. PubYear;Volume(Issue):StartPg-OtherPg. Links. Accessed RetrievedDate. doi: DOI.[1,3-6]
17. Clemens SL, Faulkner WC, Browning EB, et al. Primarytitle. *J Appl Theory* [IdentifyingPhrase]. PubYear;Volume(Issue):StartPg-OtherPg. Links. Accessed RetrievedDate. doi: DOI.[1,3-6]
18. Menz HB, Latt MD, Tiedemann A, Mun San Kwan M, Lord SR. Reliability of the GAITRite® walkway system for the quantification of temporo-spatial parameters of gait in young and older people. *Gait Posture*. 2004;20(1):20-25.
19. Nelson AJ, Zwick D, Brody S, et al. The validity of the GaitRite® and the functional ambulation performance scoring system in the analysis of parkinson gait. *NeuroRehabilitation*. 2002;17(3):255-262.
20. Fahn S, Elton R, Members of the UPDRS development committee: Unified Parkinson's disease rating scale. In *Recent developments in Parkinson's disease*. Edited by: Fahn S, Marsden CD, Calne D, Goldstein M. Florham Park, NJ: Macmillan Health Care Information; 1987:153-163.
21. Robinson KR, Masud T, Hawley-Hague H. Instructors' Perceptions of Mostly Seated Exercise Classes: Exploring the Concept of Chair Based Exercise. *BioMed Research International*. 2016;2016:3241873. doi:10.1155/2016/3241873.
22. Pickering RM, Grimbergen YAM, Rigney U, Ashburn A, Mazibrada G, Wood B, et al. A meta-analysis of six prospective studies of falling in Parkinson's dis- ease. Mov Disord 2007;22(13):1892e900.
23. Jeon S-N, Choi J-H. The effects of ankle joint strategy exercises with and without visual feedback on the dynamic balance of stroke patients. *Journal of Physical Therapy Science*. 2015;27(8):2515-2518. doi:10.1589/jpts.27.2515.
24. Murgia M, Corona F, Pili R, et al. Rhythmic Auditory Stimulation (RAS) and Motor Rehabilitation in Parkinson's Disease: New Frontiers in Assessment and Intervention Protocols. *The Open Psychology Journal*. 2015;8(1):220-229. doi:10.2174/1874350101508010220.

25. Tangen GG, Bergland A, Engedal K, Mengshoel AM. The importance of parkinsonian signs for gait and balance in patients with alzheimer's disease of mild degree. *Gait Posture*. 2017;51:159-161.
26. Sidaway B, Anderson JF, Danielson GF, Martin LF, Smith G. Effects of long-term gait training using visual cues in an individual with parkinson disease. *Physical therapy JID - 0022623*. 0316.
27. T. Martin, M. Weatherall, T.J. Anderson, M.R. MacAskillA randomized controlled feasibility trial of a specific cueing program for falls management in persons with Parkinson disease and freezing of GaitJ. Neurol. Phys. Ther., 39 (2015), pp. 179-184

APPENDIX A

UNIVERSITY OF NORTH DAKOTA

UND.edu

DIVISION OF RESEARCH & ECONOMIC DEVELOPMENT

Institutional Review Board
Twamley Hall, Room 106
264 Centennial Dr Stop 7134
Grand Forks, ND 58202-7134
Phone: 701.777.4279
Fax: 701.777.6708
Email: UND.irb@research.UND.edu

June 21, 2017

Principal Investigator(s):	Cindy Flom-Meland, PT, PhD, NCS
Project Title:	The Effect of Collaboration of Physical Therapy and Music Therapy for Individuals with Neurologic Health Conditions
IRB Project Number:	IRB-201706-371
Project Review Level:	Exempt 4
Date of IRB Approval:	06/21/2017
Expiration Date of This Approval:	06/20/2020

The application form and all included documentation for the above-referenced project have been reviewed and approved via the procedures of the University of North Dakota Institutional Review Board.

If you need to make changes to your research, you must submit a Protocol Change Request Form to the IRB for approval. No changes to approved research may take place without prior IRB approval.

This project has been approved for 3 years, as permitted by UND IRB policies for exempt research. You have approval for this project through the above-listed expiration date. When this research is completed, please submit a Termination Form to the IRB.

The forms to assist you in filing your project termination, adverse event/unanticipated problem, protocol change, etc. may be accessed on the IRB website: http://und.edu/research/resources/human-subjects/

Sincerely,

Michelle L. Bowles, M.P.A., CIP
IRB Coordinator

MLB/sb

Cc: Chair, Physical Therapy

University of North Dakota Exempt Certification Form – SEPTEMBER 2015 VERSION
Research Involving Existing Records or Data

Complete this form if you are requesting permission to review existing records or conduct analysis of existing datasets.

All research with human participants conducted by faculty, staff, and students associated with the University of North Dakota, must be reviewed and approved as prescribed by the University's policies and procedures governing the use of human subjects. No activities are to be initiated without prior review and approval by the Institutional Review Board.

Please answer the following questions regarding your research. Handwritten forms are not accepted – responses must be typed.

1. **Are the data existing? Existing means the data are 'on the shelf' (i.e., they were collected prior to this research proposal).** ☒ **Yes** ☐ **No**

If you answered "No" to the above question, this research does not qualify as exempt. Please fill out and submit a "Human Subjects Review Form". If you answered "Yes", continue to question 2.

2. **Will there be any contact with the subjects?** ☐ **Yes** ☒ **No**

If you answered "Yes" to the above question, this research does not qualify as exempt. Please fill out and submit a "Human Subjects Review Form". If you answered "No", continue to question 3a.

3a. Are the data publicly available? ☐ **Yes** ☒ **No**

If you answered "No" to the above question, please continue to question 3b. If you answered "Yes", **skip** question 3b and provide the information requested below.

3b. Will the data be documented in a manner that subjects cannot be identified, either directly or through identifiers linked to the subjects (e.g., subject name, social security number, birth date, coding, etc.) ?
☒ **Yes** ☐ **No**

If you answered "No" to the above question, this research does not qualify as exempt. Please fill out and submit a "Human Subjects Review Form". If you answered "Yes", please provide the information requested below:

If the research involves the use of audio, video, digital or image recordings of subjects, this research does not qualify as exempt. Please fill out and submit a "Human Subjects Review Form".

Principal Investigator: Cindy Flom-Meland

Telephone: 701-777-4130 E-mail Address: cindy.flom.meland@med.und.edu

Complete Mailing Address: SMHS stop 9037, 1301 North Columbia Road, Depart of PT suite 321

School/College: SMHS Department: PT

Student Adviser (if applicable): _____

Telephone: _____ E-mail Address: _____

Address or Box #: _____

School/College: _____ Department: _____

*** ***All IRB applications must include a Key Personnel Listing***

Project Title: The Effect of Collaboration of Physical Therapy and Music Therapy for Individuals with Neurologic Health Conditions

Proposed Research Beginning Date: May 2017

Exempt research will be approved for 3 years from the original approval date.

Funding agencies supporting this research: None.

(A copy of the funding proposal for each agency identified above MUST be attached to this proposal when submitted.)

☐ YES or ☒ NO Does any researcher associated with this project have a financial interest in the results of this project? If yes, submit on a separate piece of paper an additional explanation of the financial interest. The Principal Investigator and any researcher associated with this project should have a Financial Interests Disclosure Document on file with their department.

☐ YES or ☒ NO Will any research participants be obtained from another organization outside the University of North Dakota (e.g., hospitals, schools, public agencies, American Indian tribes/reservations)?

☐ YES or ☒ NO Will any data be collected at or obtained from another organization outside the University of North Dakota?

If yes to either of the previous two questions, list all institutions: _____

Letters from each organization must accompany this proposal. Each letter must illustrate that the organization understands its involvement and agrees to participate in the study. Letters must include the name and title of the individual signing the letter and should be printed on organizational letterhead.

Does any external site where the research will be conducted have its own IRB? ☐ YES or ☐ NO

If yes, does the external site plan to rely on UND's IRB for approval of this study? ☐ YES or ☐ NO
(If yes, contact the UND IRB at 701 777-4279 for additional requirements)

If your project has been or will be submitted to other IRBs, list those Boards below, along with the status of each proposal.

_____ Date submitted: _____ Status: ☐ Approved ☐ Pending

_____ Date submitted: _____ Status: ☐ Approved ☐ Pending

(include the name and address of the IRB, a contact person at the IRB, and a phone number for that person)

Type of Project: Check "Yes" or "No" for <u>each</u> of the following.

☒ YES or ☐ NO New Project

☐ YES or ☒ NO Continuation/Renewal

☐ YES or ☒ NO Is this a Protocol Change for a previously approved project? If yes, submit a signed Protocol Change Form, along with a signed copy of this form with the changes bolded or highlighted.

☐ YES or ☒ NO Dissertation/Thesis/Independent Study

☒ YES or ☐ NO Student Research Project

Provide additional information regarding your research by responding to questions 4-11 <u>on a separate sheet of paper</u>.

4. **In non-technical language, briefly describe the purpose of the study and state the rationale for this research.**

5. **In non-technical language, describe the study procedures.**

6. **What is (are) the type(s) of records to be reviewed (medical records, data sets, etc.)?**

7. **Describe what data will be recorded, including the date range of the files/records you will be reviewing.**

8. **How will data be stored?**
   Note: Must state that data will be stored for a minimum of three years after data analysis is complete, or for a period of time sufficient to meet federal, state, and local regulations, sponsor requirements, and organizational policies and procedures.

9. **If data are not publicly available, please provide a letter of support from the agency, or IRB approval from the agency.**

10. **Describe procedures you will implement to protect confidentiality and privacy of participants.**

11. **If the project involves medical record information, complete the HIPAA Compliance Application and submit it with this form.**

Necessary attachments:

- ☐ Signed Student Consent to Release of Educational Record Form (students and medical residents only);
- ☐ Investigator Letter of Assurance of Compliance;
- ☐ Key Personnel Listing;
- ☐ Advertisements.

NOTE: The UND IRB requires that all key personnel involved in the research complete human subject education before IRB approval to conduct research can be granted.

****

By signing this form, I certify that the above information is accurate, and that this research will be conducted in accordance with the statements provided above. The investigators will not intervene or interact with identified research subjects in the conduct of this research project.

Cindy Flom-Meland [redacted] 6-1-17

(Principal Investigator) Date:

[redacted]

(Student Adviser) Date:

[redacted]

*****All students and medical residents must list a faculty member as a student adviser on the first page of the application and must have that person sign the application.*****

Submit the signed application form and any necessary attachments to the Institutional Review Board, 264 Centennial Drive Stop 7134, Grand Forks, ND 58202-7134; or bring it to Twamley Hall, Room 106.

4. In non-technical language, briefly describe the purpose of the study and state the rationale for this research.

The purpose of this study is to evaluate the outcomes of three clients that received collaborative physical therapy and music therapy as part of PT 590 Directed Studies course during the spring semester of 2017. The pre- and post-test results of the Readiness for Interprofessional Learning Scale (RIPLS) Questionnaire, completed by the physical therapy and music therapy students, will also be evaluated to examine any change in attitude of the students towards interprofessional learning.

5. In non-technical language, describe study procedures.

The outcome data will be reviewed, analyzed, and utilized in 2 ways. 1). To describe a model of inter-professional collaboration as a potential curriculum model 2). To analyze the outcomes of each client and to inform a potential larger study in the future.

6. What is (are) the type(s) of records to be reviewed (medical records, data sets, etc.)?

Outcome data collected at the beginning and at the end of the course for each of the clients will be reviewed and compared to observe for any improvement in function (i.e. walking parameters, balance, fall risk, quality of life)

7. Describe what data will be recorded, including the date range of the files/records you will be reviewing.

The data reviewed will be from January to April 2017. It will include outcome data from the following standard physical therapy tests: Berg Balance measure, 5 times sit to stand, timed backwards walking (including distance), Timed Up and Go, Timed Up and Go Cognitive, gait parameters (with use of GaitRite – sensor mat that measures speed, step length, stride length, etc., and quality of life).

8. How will data be stored?

The data will be stored in a locked storage area in the Department of Physical Therapy at the University of North Dakota. Records from the study will be destroyed using a paper shredder three years following the conclusion of this study.

9. If data are not publicly available, please provide a letter of support from the agency, or IRB approval from the agency.

Not applicable.

10. Describe procedures you will implement to protect confidentiality and privacy of participants

The outcome data will not be linked to any individual person; identifying information will not be utilized in any reporting procedures or written documents.

11. If the project involves medical record information, complete the HIPAA Compliance Application and submit it with this form.
    Not applicable.

APPENDIX B

[redacted] Initial

Parkinson's Disease Quality of Life Questionnaire (PDQ-39)

Due to having Parkinson's disease,
how often during the last month have you...

*Please **check one box** for each question*

		Never	Occasionally	Sometimes	Often	Always or cannot do at all
1.	had difficulty doing the leisure activities you would like to do?	☐	☐	☒	☐	☐
2.	had difficulty looking after your home, for example, housework, cooking or yardwork?	☐	☐	☐	☐	☒
3.	had difficulty carrying grocery bags?	☐	☐	☐	☐	☒
4.	had problems walking half a mile?	☐	☐	☐	☐	☒
5.	had problems walking 100 yards (approximately 1 block)?	☐	☐	☐	☐	☒
6.	had problems getting around the house as easily as you would like?	☐	☐	☐	☐	☒
7.	had difficulty getting around in public places?	☐	☐	☐	☐	☒
8.	needed someone else to accompany you when you went out?	☐	☐	☐	☐	☒

Please verify that you have ***checked one box for each question***
before going on to the next page.

Due to having Parkinson's disease,
how often during the last month have you...

*Please **check one box** for each question*

		Never	Occasionally	Sometimes	Often	Always or cannot do at all
9.	felt frightened or worried about falling in public?	☒	☐	☐	☐	☐
10.	been confined to the house more than you would like?	☐	☒	☐	☐	☐
11.	had difficulty showering and bathing?	☐	☐	☐	☒	☐
12.	had difficulty dressing?	☐	☐	☐	☐	☒
13.	had difficulty with buttons or shoelaces?	☐	☐	☐	☐	☒
14.	had problems writing clearly?	☐	☐	☐	☐	☒
15.	had difficulty cutting up your food?	☐	☐	☐	☐	☒
16.	had difficulty holding a drink without spilling it?	☒	☐	☐	☐	☐
17.	felt depressed?	☒	☐	☐	☐	☐
18.	felt isolated and lonely?	☒	☐	☐	☐	☐

Please verify that you have ***checked one box for each question***
before going on to the next page.

Due to having Parkinson's disease,
how often during the last month have you...

*Please **check one box** for each question*

		Never	Occasionally	Sometimes	Often	Always
19.	felt weepy or tearful?	☒	☐	☐	☐	☐
20.	felt angry or bitter?	☒	☐	☐	☐	☐
21.	felt anxious?	☒	☐	☐	☐	☐
22.	felt worried about your future?	☒	☐	☐	☐	☐
23.	felt you had to hide your Parkinson's from people?	☒	☐	☐	☐	☐
24.	avoided situations which involve eating or drinking in public?	☐	☐	☒	☐	☐
25.	felt embarrassed in public due to having Parkinson's disease?	☐	☐	☒	☐	☐
26.	felt worried about other people's reaction to you?	☐	☐	☒	☐	☐
27.	had problems with your close personal relationships?	☒	☐	☐	☐	☐

Please verify that you have ***checked one box for each question***
before going on to the next page.

Due to having Parkinson's disease,
how often during the last month have you...

*Please **check one box** for each question*

		Never	Occasionally	Sometimes	Often	Always
28.	lacked the support you needed from your spouse or partner? *If you do not have a spouse or Partner, please check here* ☒	☐	☐	☐	☐	☐
29.	lacked the support you needed from your family or close friends?	☒	☐	☐	☐	☐
30.	unexpectedly fallen asleep during the day?	☐	☒	☐	☐	☐
31.	had problems with your concentration, for example when reading or watching TV?	☒	☐	☐	☐	☐
32.	felt your memory was failing?	☒	☐	☐	☐	☐
33.	had distressing dreams or hallucinations?	☒	☐	☐	☐	☐
34.	had difficulty speaking?	☐	☐	☐	☒	☐
35.	felt unable to communicate effectively?	☐	☐	☒	☐	☐
36.	felt ignored by people?	☒	☐	☐	☐	☐

Please verify that you have ***checked one box for each question***
before going on to the next page.

Due to having Parkinson's disease,
how often during the last month have you...

*Please **check one box** for each question*

		Never	Occasionally	Sometimes	Often	Always
37.	had painful muscle cramps or spasms?	☐	☐	☒	☐	☐
38.	had aches and pains in your joints or body?	☐	☐	☐	☒	☐
39.	felt uncomfortably hot or cold?	☒	☐	☐	☐	☐

Please verify that you have ***checked one box for each question***.

Thank you for completing the questionnaire.

[redacted] discharge

Parkinson's Disease Quality of Life Questionnaire (PDQ-39)

Due to having Parkinson's disease,
how often during the last month have you...

*Please **check one box** for each question*

		Never	Occasionally	Sometimes	Often	Always or cannot do at all
1.	had difficulty doing the leisure activities you would like to do?	☐	☐	☐	☑	☐
2.	had difficulty looking after your home, for example, housework, cooking or yardwork?	☐	☐	☐	☐	☑
3.	had difficulty carrying grocery bags?	☐	☐	☐	☐	☑
4.	had problems walking half a mile?	☐	☐	☐	☐	☑
5.	had problems walking 100 yards (approximately 1 block)?	☐	☐	☐	☐	☑
6.	had problems getting around the house as easily as you would like?	☐	☐	☐	☐	☑
7.	had difficulty getting around in public places?	☐	☐	☐	☐	☑
8.	needed someone else to accompany you when you went out?	☐	☐	☐	☐	☑

Please verify that you have ***checked one box for each question***
before going on to the next page.

9q10h78ib [redacted]

Due to having Parkinson's disease,
how often during the last month have you...

*Please **check one box** for each question*

		Never	Occasionally	Sometimes	Often	Always or cannot do at all
9.	felt frightened or worried about falling in public?	☐	☐	☐	☑	☐
10.	been confined to the house more than you would like?	☐	☐	☐	☑	☐
11.	had difficulty showering and bathing?	☐	☐	☐	☑	☐
12.	had difficulty dressing?	☐	☐	☐	☐	☑
13.	had difficulty with buttons or shoelaces?	☐	☐	☐	☑	☐
14.	had problems writing clearly?	☐	☐	☐	☐	☑
15.	had difficulty cutting up your food?	☐	☐	☐	☐	☑
16.	had difficulty holding a drink without spilling it?	☑	☐	☐	☐	☐
17.	felt depressed?	☑	☐	☐	☐	☐
18.	felt isolated and lonely?	☑	☐	☐	☐	☐

Please verify that you have ***checked one box for each question***
before going on to the next page.

Due to having Parkinson's disease,
how often during the last month have you...

*Please **check one box** for each question*

		Never	Occasionally	Sometimes	Often	Always
19.	felt weepy or tearful?	☑	☐	☐	☐	☐
20.	felt angry or bitter?	☑	☐	☐	☐	☐
21.	felt anxious?	☑	☐	☐	☐	☐
22.	felt worried about your future?	☑	☐	☐	☐	☐
23.	felt you had to hide your Parkinson's from people?	☑	☐	☐	☐	☐
24.	avoided situations which involve eating or drinking in public?	☐	☑	☐	☐	☐
25.	felt embarrassed in public due to having Parkinson's disease?	☐	☑	☐	☐	☐
26.	felt worried about other people's reaction to you?	☐	☑	☐	☐	☐
27.	had problems with your close personal relationships?	☑	☐	☐	☐	☐

Please verify that you have ***checked one box for each question***
before going on to the next page.

Due to having Parkinson's disease,
how often during the last month have you...

*Please **check one box** for each question*

		Never	Occasionally	Sometimes	Often	Always
28.	lacked the support you needed from your spouse or partner? *If you do not have a spouse or Partner, please check here* ☑	☐	☐	☐	☐	☐
29.	lacked the support you needed from your family or close friends?	☑	☐	☐	☐	☐
30.	unexpectedly fallen asleep during the day?	☐	☐	☑	☐	☐
31.	had problems with your concentration, for example when reading or watching TV?	☐	☑	☐	☐	☐
32.	felt your memory was failing?	☑	☐	☐	☐	☐
33.	had distressing dreams or hallucinations?	☐	☐	☑	☐	☐
34.	had difficulty speaking?	☐	☐	☐	☑	☐
35.	felt unable to communicate effectively?	☐	☐	☑	☐	☐
36.	felt ignored by people?	☑	☐	☐	☐	☐

Please verify that you have ***checked one box for each question***
before going on to the next page.

Due to having Parkinson's disease,
how often during the last month have you...

*Please **check one box** for each question*

		Never	Occasionally	Sometimes	Often	Always
37.	had painful muscle cramps or spasms?	☑	☐	☐	☐	☐
38.	had aches and pains in your joints or body?	☐	☐	☐	☐	☑
39.	felt uncomfortably hot or cold?	☑	☐	☐	☐	☐

Please verify that you have ***checked one box for each question***.

Thank you for completing the questionnaire.

APPENDIX C

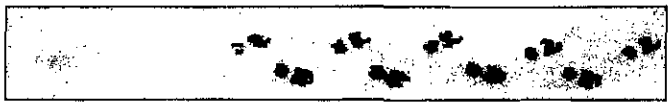
Tested on: **1/24/2017 3:09:09 PM**

UND-PT

[redacted]

[redacted] Initial

Age	Gender	Left LEG	Right	Height	Weight
81	F	0	0	162.56	0



Parameters

Distance (cm)	251.3
Ambulation Time (sec)	6.53
Velocity (cm/sec)	38.5
Mean Normalized Velocity	.00

Cadence (Steps/Min)	73.5
Step Time Differential (sec)	.21
Step Length Differential (cm)	11.20
Cycle Time Differential (sec)	.04

Walk # / Footfall #	L/R	Mean(%CV)	1	2	3	4	5	6	7	8	9
Step Time (sec)	L	.922(14.0)			864		.880		1 113		831
	R	.710(8.0)		.681		.681		.798		.681	
Cycle Time (sec)	L	1 632(11.0)			1 545		1 561		1.911		1 512
	R	1.672(11.0)				1.545		1.678		1.794	
Swing Time (sec)	L	561(18.0) /34.4			.515		515		.714		499
/ %GC	R	.443(9.0) /26.5				.449		.482		.399	
Stance (sec)	L	1 072(8.0) /65.7	1.030		1.046		1.197		1.013		
/ %GC	R	1.229(12.0) /73.5		1.096		1.196		1.395			
Single Support (sec)	L	.443(9.0) /27.1			.449		.482		.399		
/ %GC	R	.561(18.0) /33.6		.515		.515		.714		.499	
Double Support (sec)	L	642(10.0) /39 3			.597		.715		614		
/ %GC	R	.639(8.0) /38.2		.581		.681		.681		.614	
Step Length (cm)	L	37.006(4 0)			37 216		35 144		37 347		38.318
	R	25.808(7.0)		27.508		24.016		26.952		24.756	
Stride Length (cm)	L	62.847(4 0)			64.725		59 164		64.422		63.075
	R	61.846(1.0)				61.235		62.130		62.174	
Base of Support (cm)	L	14.51(14 0)			15 679		15.675		12 160		
	R	14.51(11.0)		15.223		16.338		12.666		13.817	
Toe In / Out (deg)	L	20(.0)			23		19		18		
	R	15(.0)		16		16		10		17	

Normal speed with MIA of 1 No Ad

Tested on: 1/24/2017 3:10:21 PM

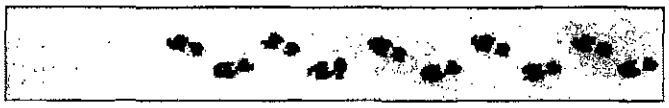
UND-PT

[redacted]

[redacted]

Age	Gender	Left LEG	Right	Height	Weight
81	F	0	0	162.56	0

[redacted]



Parameters

Distance (cm)	293.1
Ambulation Time (sec)	8.27
Velocity (cm/sec)	35.4
Mean Normalized Velocity	.00

Cadence (Steps/Min)	65.3
Step Time Differential (sec)	.01
Step Length Differential (cm)	.82
Cycle Time Differential (sec)	.00

Walk # / Footfall #	L/R	Mean(%CV)	1	2	3	4	5	6	7	8	9	10
Step Time (sec)	L	.926(4.0)			897		930		897		980	
	R	.914(3.0)		.897		.914		.964		.897		.897
Cycle Time (sec)	L	1.844(2.0)			1.794		1.844		1.861		1.877	
	R	1.844(2.0)				1.811		1.894		1.794		1.877
Swing Time (sec)	L	.552(6.0) /29.9			515		.598		.548		548	
/ %GC	R	.619(1.0) /33.6				.632		.615		.615		.614
Stance (sec)	L	1.292(3.0) /70.1	1.279		1.246		1.313		1.329			
/ %GC	R	1.225(4.0) /66.4		1.179		1.279		1.179		1.263		
Single Support (sec)	L	619(1.0) /33.6			632		615		.615		614	
/ %GC	R	.552(6.0) /29.9		.515		.598		.548		.548		
Double Support (sec)	L	.665(7.0) /36.1			614		.698		.714		632	
/ %GC	R	.673(5.0) /36.5		.664		.681		.631		.715		
Step Length (cm)	L	33.022(10.0)			31.975		31.724		37.791		30.599	
	R	32.206(7.0)		29.900		33.381		35.474		30.510		31.767
Stride Length (cm)	L	65.357(8.0)			61 942		65.105		73.265		61 114	
	R	65.638(4.0)				65.357		67.263		68.365		62.366
Base of Support (cm)	L	10.93(8.0)			12.076		10.416		10.261		10.967	
	R	10.68(13.0)		10.470		12.074		8.856		11.327		
Toe In / Out (deg)	L	12(.0)			13		12		12		11	
	R	21(.0)		19		18		24		21		

normal speed Mia x 2

Tested on: 1/24/2017 3:13:48 PM

UND-PT

[redacted]

Age	Gender	Left LEG	Right	Height	Weight
81	F	0	0	162.56	0

Parameters

Distance (cm)	296.4
Ambulation Time (sec)	7.26
Velocity (cm/sec)	40.8
Mean Normalized Velocity	.00

Cadence (Steps/Min)	90.9
Step Time Differential (sec)	.14
Step Length Differential (cm)	18.24
Cycle Time Differential (sec)	.01

Walk # / Footfall #	L/R	Mean(%CV)	1	2	3	4	5	6	7	8	9	10	11	12
Step Time (sec)	L	.738(4.0)			.731		.764		764		731		.698	
	R	.595(8.0)		.665		.581		.615		.532		.565		.614
Cycle Time (sec)	L	1.329(5.0)			1.396		1.345		1.379		1.263		1.263	
	R	1.319(5.0)				1.312		1.379		1.296		1.296		1.312
Swing Time (sec)	L	.462(11.0) /34.8			.466		.531		415		482		416	
/ %GC	R	.362(14.0) /27.4				.349		.432		.299		.349		.382
Stance (sec)	L	867(9.0) /65.2	930		814		964		.781		.847			
/ %GC	R	.957(3.0) /72.6		.963		.947		.997		.947		.930		
Single Support (sec)	L	362(14.0) /27.2			349		432		299		.349		382	
/ %GC	R	.462(11.0) /35.0		.466		.531		.415		.482		.416		
Double Support (sec)	L	505(7.0) /38.0			.465		.532		.482		.498		.548	
/ %GC	R	.495(12.0) /37.5		.497		.416		.582		.465		.514		
Step Length (cm)	L	36.894(6.0)			33.840		40.458		37.127		36.779		36.268	
	R	18.655(13.0)		15.736		19.362		22.541		16.881		19.404		18.003
Stride Length (cm)	L	55.746(8.0)			49.627		59.925		59.807		53.690		55.679	
	R	56.133(7.0)				53.202		62.998		54.008		56.184		54.272
Base of Support (cm)	L	11.43(14.0)			12.111		8.653		12.833		11.219		12.309	
	R	11.62(10.0)		13.191		10.369		10.764		11.953		11.804		
Toe In / Out (deg)	L	20(.0)			26		19		19		19		19	
	R	15(.0)		13		13		19		14		17		

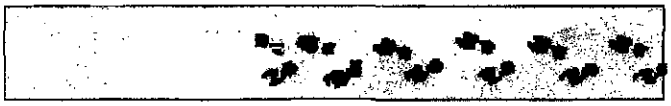
wheeled walker MIA x 2 normal speed

Tested on: **1/24/2017 3:15:04 PM**

UND-PT

[redacted]

Age	*Gender*	*Left LEG*	*Right*	*Height*	*Weight*
81	F	0	0	162.56	0



Parameters

Distance (cm)	247.4
Ambulation Time (sec)	6.75
Velocity (cm/sec)	36.7
Mean Normalized Velocity	.00

Cadence (Steps/Min)	97.8
Step Time Differential (sec)	.12
Step Length Differential (cm)	14.94
Cycle Time Differential (sec)	.01

Walk # / Footfall #	L/R	Mean(%CV)	1	2	3	4	5	6	7	8	9	10	11	12
Step Time (sec)	L	.678(7.0)			.648		.731		.631		.648		.731	
	R	.559(21.0)		.598		.598		.565		.698		.349		.548
Cycle Time (sec)	L	1.239(9.0)			1.246		1.329		1.196		1.346		1.080	
	R	1.229(9.0)				1.246		1.296		1.329		.997		1.279
Swing Time (sec)	L	.365(18.0) /29.5			.349		.448		.415		.332		.282	
/ %GC	R	.302(42.0) /24.6				.382		.316		.448		.116		.249
Stance (sec)	L	.874(11.0) /70.5	.897		.881		.781		1.014		.798			
/ %GC	R	.927(8.0) /75.4		.864		.980		.881		.881		1.030		
Single Support (sec)	L	.302(42.0) /24.4			.382		.316		.448		.116		.249	
/ %GC	R	.365(18.0) /29.7		.349		.448		.415		.332		.282		
Double Support (sec)	L	.542(16.0) /43.7			.499		.465		.566		.682		.499	
/ %GC	R	.562(19.0) /45.7		.515		.532		.466		.549		.748		
Step Length (cm)	L	30.641(13.0)			31.532		33.783		33.132		31.046		23.711	
	R	15.700(32.0)		14.059		20.489		12.907		20.548		18.560		7.635
Stride Length (cm)	L	47.969(10.0)			45.590		54.282		46.054		51.648		42.273	
	R	46.743(19.0)				52.027		46.818		53.845		49.675		31.352
Base of Support (cm)	L	12.08(7.0)			12.082		12.294		10.758		12.322		12.945	
	R	12.07(13.0)		12.519		11.111		13.443		9.837		13.427		
Toe In / Out (deg)	L	22(.0)			17		22		18		27		25	
	R	18(.0)		16		18		15		19		14		

wheeled walker MIA x 2

Tested on: **4/25/2017 3:14:03 AM**

UND-PT

[redacted]

[redacted]

Age	Gender	Left LEG	Right	Height	Weight
81	F	0	0	162.56	0

[redacted] Discharge

Parameters

Distance (cm)	247.6
Ambulation Time (sec)	6.98
Velocity (cm/sec)	35.5
Mean Normalized Velocity	.00

Cadence (Steps/Min)	68.8
Step Time Differential (sec)	.17
Step Length Differential (cm)	2.08
Cycle Time Differential (sec)	.01

Walk # / Footfall #	L/R	Mean(%CV)	1	2	3	4	5	6	7	8	9
Step Time (sec)	L	.959(5.0)		.980		947		1.013		.897	
	R	.765(2.0)			.761		.764		798		797
Cycle Time (sec)	L	1.733(2.0)				1.728		1.777		1.695	
	R	1.744(2.0)			1.761		1.711		1.811		1.694
Swing Time (sec)	L	.609(7.0) /35.1				.615		.648		.565	
/ %GC	R	.469(3.0) /26.9			.462		.449		.465		.481
Stance (sec)	L	1.124(1.0) /64.9		1.113		1.129		1.130			
/ %GC	R	1.275(4.0) /73.1	1.279		1.282		1.346		1.213		
Single Support (sec)	L	.469(3.0) /27.1		.482		.449		.465		.481	
/ %GC	R	.609(7.0) /34.9			.615		.648		.565		
Double Support (sec)	L	.665(4.0) /38.4		.631		.680		.665		.682	
/ %GC	R	.664(4.0) /38.1			.647		.898		.648		
Step Length (cm)	L	31.991(6.0)		32.803		33.218		32.976		28.967	
	R	29.908(7.0)			30.388		30.299		32.033		26.930
Stride Length (cm)	L	62.738(2.0)				63.594		63.406		61.214	
	R	61.911(7.0)			63.212		63.516		65.019		55.897
Base of Support (cm)	L	13.87(19.0)		15.801		13.669		10.175		15.843	
	R	13.04(10.0)			14.165		11.648		13.292		
Toe In / Out (deg)	L	15(.0)		14		16		14		14	
	R	17(.0)			14		17		21		

normal walk with hand held assist of 2

Tested on: **4/25/2017 3:15:43 AM**

#2

[redacted]

UND-PT

[redacted]

[redacted]

Age	*Gender*	*Left LEG*	*Right*	*Height*	*Weight*
81	F	0	0	162.56	0

Parameters

Distance (cm)	244.2
Ambulation Time (sec)	7.31
Velocity (cm/sec)	33.4
Mean Normalized Velocity	.00

Cadence (Steps/Min)	73.9
Step Time Differential (sec)	.24
Step Length Differential (cm)	7.38
Cycle Time Differential (sec)	.02

Walk # / Footfall #	L/R	Mean(%CV)	1	2	3	4	5	6	7	8	9	10
Step Time (sec)	L	.947(24.0)			1.262		748		.947		.830	
	R	705(7.0)		.648		781		.714		.665		.715
Cycle Time (sec)	L	1 649(11.0)			1.910		1 529		1.661		1 495	
	R	1.666(11.0)				2.043		1.462		1.612		1.545
Swing Time (sec)	L	632(28.0) /38 3			897		.499		.565		565	
/ %GC	R	.428(7.0) /25.7				.432		.448		.382		.449
Stance (sec)	L	1 017(7 0) /61 7	1 013		1.030		1 096		930			
/ %GC	R	1.238(21 0) /74.3		1,611		1 014		1.230		1.096		
Single Support (sec)	L	.428(7 0) /26.0			432		448		.382		449	
/ %GC	R	.632(28.0) /37.9		.897		499		.565		.565		
Double Support (sec)	L	.586(8.0) /35.5			.598		648		.548		.548	
/ %GC	R	.606(16 0) /38.4		.714		.515		.665		.531		
Step Length (cm)	L	31 227(9 0)			27.391		31.469		32.609		33 439	
	R	23.852(18.0)		17 324		23.318		26.942		25.033		26.641
Stride Length (cm)	L	54.449(12 0)			44.912		54.845		59.558		58 480	
	R	56 757(7 0)				50.796		58.487		57.646		60.095
Base of Support (cm)	L	12 78(14.0)			11.030		11.526		14 246		14.312	
	R	12.63(11.0)		11.642		11.275		13.481		14.101		
Toe In / Out (deg)	L	16(.0)			20		17		16		9	
	R	21(.0)		21		22		22		20		

normal speed hand held assist x 2

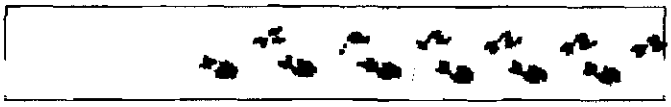
4/25/2017 3:20:23 AM

#3

UND-PT

[redacted]

Age	Gender	Left LEG	Right	Height	Weight
81	F	0	0	162.56	0



Parameters

Distance (cm)	[illegible]	Cadence (Steps/Min)	[illegible]
Ambulation Time (sec)	7.89	Step Time Differential (sec)	.31
Velocity (cm/sec)	35.4	Step Length Differential (cm)	18.33
Mean Normalized Velocity	[illegible]	Cycle Time Differential (sec)	[illegible]

Walk # / Footfall #	L/R	Mean(%CV)	1	2	3	4	5	6	7	8	9	10	11	12
Step Time (sec)	L	.856(17.0)		780		964		1.097		.715		764		.814
	R	.551(22.0)			.665		.348		.546		598		599	
Cycle Time (sec)	L	1.422(9.0)				1.629		1.445		1.263		1.382		1.412
	R	1.415(9.0)			1.445		1.312		1.845		1.313		1.382	
Swing Time (sec)	L	.535(18.0) /37.6				.698		462		.482		.465		.548
/ %GC	R	.289(40.0) /20.4			.399		.099		.282		.366		.299	
Stance (sec)	L	.887(8.0) /62.4		931		.963		.781		.897		.864		
/ %GC	R	1.126(14.0) /79.6	1.046		1.213		1.363		.947		1.083			
Single Support (sec)	L	.289(40.0) /20.3		.399		.099		.262		.366		.299		
/ %GC	R	.535(18.0) /37.8			598		.482		482		.465		.548	
Double Support (sec)	L	.598(25.0) /42.1		532		.864		.499		.531		.565		
/ %GC	R	.598(28.0) /42.3			.515		.881		.486		598		.532	
Step Length (cm)	L	33.692(10.0)		33.176		37.847		37.419		31.178		32.251		30.281
	R	15.363(13.0)			17.472		13.384		13.164		16.974		15.822	
Stride Length (cm)	L	49.250(9.0)				55.573		50.951		44.364		49.239		46.123
	R	49.751(3.0)			50.650		51.236		50.631		48.153		48.083	
Base of Support (cm)	L	12.80(18.0)		13.930		8.697		14.027		13.926		13.433		
	R	12.64(12.0)			11.000		10.988		14.427		13.525		13.261	
Toe In / Out (deg)	L	22(0)		18		35		19		17		21		
	R	16(0)			15		17		17		16		15	

normal walk with FWW and SBA of 2

Tested on: **4/25/2017 3:22:32 AM**

UND-PT

[redacted]

[redacted]

Age	Gender	Left LEG	Right	Height	Weight
81	F	0	0	162.56	0

[redacted]

[redacted]

Parameters

Distance (cm)	426.3
Ambulation Time (sec)	-24.98
Velocity (cm/sec)	-17.2
Mean Normalized Velocity	.00

Cadence (Steps/Min)	-65.0
Step Time Differential (sec)	3.78
Step Length Differential (cm)	33.34
Cycle Time Differential (sec)	3.81

Walk # / Footfall #	L/R	Mean(%CV)	1	2	3	4	5	6	7	8	9	10	11	12	13
Step Time (sec)	L	1.015(999.0)			7.775		.017		315		050		.764		.066
	R	4.791(999.0)		6.795		930		1.230		1.479		.017		.549	
Cycle Time (sec)	L	1.279(38.0)			.980		.947		1.545		1.529		.747		615
	R	5.092(10.0)				8.705		1.247		1.794		.033		1.313	
Swing Time (sec)	L	279(92.0) /21.8			017		.017		.016		.034		432		017
/ %GC	R	3.673(999.0) /70.2				.199		183		.266				.167	
Stance (sec)	L	1.001(53.0) /78.3	.963		.930		1.529		1.495		315		598		249
/ %GC	R	1.674(999.0) /32.9		8.506		1.064		1.528		033		1.146		1.063	
Single Support (sec)	L	871(999.0) /302.7			.199		.183		.266				167		.016
/ %GC	R	.302(85.0) /5.9		.017		.017		.016		034		.432		.017	
Double Support (sec)	L	1.951(81.0) /152.5			.731		1.346		1.229		.349		.431		1.761
/ %GC	R	2.520(86.0) /49.5		8.489		1.047		1.512		033		.714		1.046	
Step Length (cm)	L	-1.497(999.0)			7.274		8.486		6.353		7.114		9.443		6.253
	R	31.839(999.0)		.409		4.761		4.470		5.371		2.626		4.299	
Stride Length (cm)	L	22.312(50.0)			8.330		13.248		11.610		14.822		15.038		11.223
	R	33.457(99.0)				13.005		12.999		13.570		11.599		15.701	
Base of Support (cm)	L	19.82(25.0)			22.840		25.977		18.887		10.631		18.954		19.878
	R	18.28(21.0)		18.768		25.376		24.405		11.476		18.266		17.087	
Toe In / Out (deg)	L	-16(999.0)			-51		-43		-44		47		-61		-30
	R	7(0)		72		-44		-28		-15		-16		55	

normal walk PDwalker (her own)

Tested on: 4/25/2017 3:34:07 AM

#5

[redacted]

UND-PT

[redacted]

[redacted]

Age	Gender	Left LEG	Right	Height	Weight
81	F	0	0	162.56	0

Parameters

Distance (cm)	284.3
Ambulation Time (sec)	7.36
Velocity (cm/sec)	38.6
Mean Normalized Velocity	.00

Cadence (Steps/Min)	81.5
Step Time Differential (sec)	.16
Step Length Differential (cm)	7.34
Cycle Time Differential (sec)	.00

Walk # / Footfall #	L/R	Mean(%CV)	1	2	3	4	5	6	7	8	9	10	11
Step Time (sec)	L	.817(5.0)			.814		.831		.780		.881		.781
	R	.655(11.0)		.681		698		.731		.585		.598	
Cycle Time (sec)	L	1.472(4.0)			1.495		1.529		1.511		1.446		1.379
	R	1.475(4.0)				1.512		1.562		1.345		1.478	
Swing Time (sec)	L	.498(10.0) /33.8			432		.532		465		.548		.515
/ %GC	R	.374(17.0) /25.4				.416		.432		.299		.348	
Stance (sec)	L	.974(9.0) /66.2	1.063		.997		1.046		.898		.864		
/ %GC	R	1.101(4.0) /74.6		1.096		1.130		1.046		1.130			
Single Support (sec)	L	374(17.0) /25.4			.416		.432		.299		.349		
/ %GC	R	.498(10.0) /33.8		.432		532		.465		.548		.515	
Double Support (sec)	L	.577(8.0) /39.2			.581		.614		.599		.515		
/ %GC	R	.591(8.0) /40.1		664		.598		.581		.582		.532	
Step Length (cm)	L	32.099(7.0)			34.383		30.390		30.458		34.445		30.818
	R	24.755(19.0)		23.609		26.692		31.881		21.130		20.462	
Stride Length (cm)	L	56.966(7.0)			58.171		57.129		62.563		55.676		51.289
	R	57.479(9.0)				61.104		62.275		51.588		54.948	
Base of Support (cm)	L	13.68(15.0)			13.171		11.445		16.237		13.793		
	R	14.00(5.0)		14.505		12.958		13.736		14.416		14.359	
Toe In / Out (deg)	L	20(.0)			19		19		21		19		
	R	20(.0)		20		22		25		9		24	

Music with normal walk with hand held assist of 2

APPENDIX D

[redacted] 2/22 - 2/28 [redacted]

Week 1 & 2

Home Exercise Program	2/27 Monday	2/28 Tuesday	2/22 Wednesday	2/23 Thursday	2/24 Friday	2/25 Saturday	2/26 Sunday
Sit to Stand week #1	1	1	7	3	3	3	3
Week #2	3/6 4		3/1 5	3/2 5	3/3 5	3/4 4	3/5 4
Week #3	3/8						
Seated weight shifts	1	1	2	2	2	2	2
	3/6 5		3/1 5	3/2 5	3/3 3	3/4 4	3/5 4
	3/8						
Seated reaching side-side	2	2	2	2	2	2	2
	3/6 5		3/1 4	3/2	3/3	3/4	3/5
	3/8 5		5	3	5	4	5
Seated side stepping	/	/	1	1	1	1	1
	3/6 2		3/1 3	3/2 3	3/3 2	3/4 1	3/5 1

Week 3+4

[redacted]

Home Exercise Program	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	3/6	3/7	3/8	3/9	3/10	3/11	3/12
Sit to Stand	IIII	III	~~IIII~~ II	III	~~IIII~~ II	II	III
	3/13	3/14	3/15	3/16	3/17	3/18	3/19
	~~IIII~~	IIII	IIII	II	III	~~IIII~~	III
Seated weight shifts	3/6 ~~IIII~~	3/7 III	3/8 II	3/9 IIII	3/10 ~~IIII~~	3/11 III	3/12 ~~IIII~~
	3/13 II	3/14 IIII	3/15 IIII	3/16 II	3/17 III	3/18 IIII	3/19 IIII
Seated reaching side-side	3/6 ~~IIII~~	3/7 III	3/8 ~~IIII~~	3/9 III	3/10 III	3/11 II	3/12 II
	3/13 III	3/14 III	3/15 IIII	3/16 IIII	3/17 ~~IIII~~	3/18 IIII	3/19 III
Seated side stepping	3/6 II	3/7 II	3/8 III	3/9 III	3/10 II	3/11 ~~IIII~~	3/12 II
	3/13 III	3/14 IIII	3/15 III	3/16 II	3/17 III	3/18 ~~IIII~~	3/19 ~~IIII~~

3/22/17
3/27/17

Home Exercise Program	3/27 Monday	Tuesday	3/22 Wednesday	3/23 Thursday	3/24 Friday	3/25 Saturday	3/26 Sunday
Marching	111		1111	111	1	111	11
(High Knees) 30sec at a time multiple times during day	1111		1111	1111	111	11	11
Sit to Stand	X		X	X	X	X	X
5 times in a row = goal							
-Reaching Forward at Counter - x 15	11		1111	1111	111	11	111
-* Push Bottom back*							
Listen to music	✓		✓	✓	✓	✓	✓
* Sing loud * 2 songs / day	✓		✓		✓	✓	✓

New York New York
You are my sunshine
God Bless America

3/29/17 - 4/3/17

Home Exercise Program	4/3 Monday	Tuesday	4/5 Wednesday	4/6 Thursday	4/7 Friday	4/8 Saturday	4/9 Sunday
Marching	𝍸		𝍸 I	IIII	IIII	𝍸	III
(High Knees) 30sec at a time multiple times during day	𝍸		𝍸	𝍸	IIII	IIII	𝍸
Sit to Stand 5 times in a row = goal	✓		✓	✓	✓	✓	✓
-Reaching Forward at Counter - X15	𝍸		𝍸	𝍸	𝍸	𝍸	IIII
* Push Bottom back *							
Listen to music	✓		✓	✓	✓	✓	✓
* Sing loud * 2 songs / day	✓		✓		✓	✓	✓

New York New York
You are my sunshine
God Bless America

[redacted]

4/11/17
4/17/17

Home Exercise Program	4/17 Monday	Tuesday	4/18 Wednesday	4/12 Thursday	4/13 Friday	4/15 Saturday	4/16 Sunday
Marching	111		1111	111	1	111	11
(High Knees) 30sec at a time multiple times during day	1111		1111	1111	1111	1111	111
Sit to Stand 5 times in a row = goal	✓		✓	✓	✓	✓	✓
-Reaching Forward at Counter - x15	11		1111	1111	111	11	111
~~* Push Bottom back *~~							
Listen to music	✓		✓	✓	✓	✓	✓
* Sing loud * 2 songs / day	✓		✓		✓	✓	✓

New York New York
You are my sunshine
God Bless America

Home Exercise Program	Monday 4/24	Tuesday	Wednesday 4/19	Thursday 4/20	Friday 4/21	Saturday 4/22	Sunday 4/23
Marching	5		8	6	3	5	4
(High Knees) 30 sec at a time multiple times during day	5		5	6	5	5	3
Sit to Stand 5 times in a row = goal	✓5		5 ✓	7 ✓	✓4	✓5	✓3
Reaching Forward at Counter - x15	4		7	6	5	3	5
Push Bottom back							
Listen to music	✓		✓	✓	✓	✓	✓
Sing loud 2 songs / day	✓		✓		✓	✓	✓

New York New York
You are my sunshine
God Bless America