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Gait training, strength training, and pain management of a 26 year old female recovering from a Multiple Sclerosis exacerbation: A Case Report

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The patient signed an informed consent allowing the use of medical information and video footage for this report and received information on the institution's policies regarding the Health Insurance Portability and Accountability Act.

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Abstract

Background and Purpose:

Multiple Sclerosis can be a debilitating disease that affects millions of people. Exacerbations range from mild to very severe. Due to the inconsistent nature of multiple sclerosis, the most effective treatments are still unclear. The purpose of this case report was to document the findings of an individual, who suffered a severe multiple sclerosis exacerbation after a series of stressful life events.

Case Description

This case report presents a 26 year old female with a known history of multiple sclerosis. This patient suffered an exacerbation and her level of function went from living independently to unable to care for herself or raise her limbs against gravity. This patient had history of social instability and lack of support, which caused stress. The patient underwent physical therapy with a focus on regaining strength and functional activity tolerance so that she could live independently again. Interventions focused on gait training, balance training, and functional training for daily activities.

Outcomes:

After 12 weeks of physical therapy intervention, the patient was able to safely ambulate unlimited distances continuously using a front wheeled walker. She had gained a gross strength of 5/5 in the Manual Muscle Testing grade, and was able to perform all functional tasks such as transfers and bed mobility.

Discussion

Although the patient made significant gains during her rehabilitation, she was unable to achieve her previous level of function, needing an assistive device for ambulation and was limited in functional activities. Her persistent pain and unstable support system likely contributed to a lack of full progression. This patient was able to gain enough function to be discharged to an apartment that caters towards disabled persons.

Word Count: 3,492

Background and Purpose

Multiple Sclerosis is a debilitating disease that affects more than 2.3 million people worldwide[1]. Multiple sclerosis is autoimmune disorder where the body attacks healthy tissue in the central nervous system, causing many symptoms ranging from loss of vision, poor balance and coordination, tremors, fatigue, problems with memory and concentration, and pain[1]. The disease has many different presentations and has been classified into four types, in order of severity: relapsing remitting multiple sclerosis in which a person suffers an exacerbation or attack and then has remission periods in which partial or all function is restored, secondary progressive multiple sclerosis which generally follows relapsing remitting multiple sclerosis until the disease begins to progress more steadily, primary progressive multiple sclerosis in which patients experience steady progression of the disease from onset with occasional plateaus and minor improvements, and finally progressive relapsing multiple sclerosis in which the disease steadily progresses from onset with occasional exacerbations from[1].

With relapsing-remitting multiple sclerosis being the most common form of multiple sclerosis, factors that cause relapses or exacerbations are of great interest to researchers. Smoking, infections, certain medications, low vitamin D levels, and stressful life events all have correlation to advancing the progression of multiple sclerosis and are associated with exacerbations[2]. Of particular interest to this case report was the correlation of stress and multiple sclerosis. A systematic review by Artemiadis et al showed results in favor of a positive correlation between stress and multiple sclerosis[3]. A study by Burns et al, looked at the correlation between stressful life events and the development of new lesions on the brain, as shown by magnetic resonance imaging. The study looked at 121 patients with multiple sclerosis over a period of 48 weeks and found that persons who reported "major negative events" (as defined by physical threat to the patient or someone close to them or threat to the structure of the person's immediate family), had an increased risk of developing new lesions 4-9 weeks after reporting the event[4]. Of particular risk to multiple sclerosis exacerbation due to stressful life events may be ambulatory women with relapsing-remitting multiple sclerosis. A prospective study by Mitsonis et al, demonstrated that ambulatory women with multiple sclerosis who experienced three or more stressful life events in a four week period had a 5-fold increase in a multiple sclerosis exacerbation[5]. However, this study showed no association of severity of stressor to likelihood for relapse. While there is still research to be done on correlation of stress to multiple sclerosis, empirical evidence is increasingly strengthening the link between stress and multiple sclerosis exacerbations.

Due to the unknown etiology of multiple sclerosis and the varied nature of presentation and progression of the disease, finding a blueprint for how to treat multiple sclerosis can be difficult. However, patients with a multiple sclerosis exacerbation causing severe disabling impairment are recommended to undergo inpatient rehabilitation[6]. Interventions may range from physical rehabilitation to medical management, psychological management, and social support. While research has been done

with specific treatment techniques and specific outcome measures, rarely have cases been documented that show a person's entire progression and treatment course after a severe flare-up from multiple sclerosis, especially in an inpatient setting. Therefore, the purpose of this case report is to document the findings of an individual, who suffered a severe multiple sclerosis exacerbation after a series of stressful life events. This case report documents this patient's progression through inpatient rehab in a multidisciplinary setting and their functional gains, especially with the stressors of poor family and social support.

Case Description/ History

The patient (GB) was a 26 year old female with an initial diagnosis of multiple sclerosis given five years ago. The patient was currently in the relapsing remitting stage of multiple sclerosis. GB had two flare-ups since the initial diagnosis. The initial exacerbation was five years ago which resulted in a two-week coma and a tracheotomy. Two years later GB suffered another exacerbation and was also diagnosed with diabetes mellitus type II, which was caused by steroids she was taking to manage her symptoms. After she stopped taking the steroids GB exhibited normal glucose levels had no dietary restrictions and took no medications for diabetes.

GB had a seven year old daughter that she gave birth to at the age of 19, and was raising as a single mother. Prior to this episode of care, GB had been living with her daughter, mother and sister in a small apartment and sleeping on a couch for nine months. GB was involved in a domestic violence dispute which led to a quick decline in function and a trip to the emergency room where GB was treated for generalized weakness and then released. Afterwards, GB was forced to move into her daughter's baby-sitter's apartment due to the lack of support at her mother's apartment. GB continued to be under a significant amount of stress over her family and social situation, and she was undergoing final exams in school. GB further declined until she was unable to ambulate or move her limbs and was taken back to the emergency room approximately two weeks after her previous visit. It was then she was admitted to the hospital.

Previous to this episode of care, GB was independent with all activities of daily living, with occasional use of a rolling walker when ambulating long distances. GB was able to care for her daughter, run errands, drive, and attend school. At initial examination the patient stated she wanted to go home safely and be able to walk again. GB wanted to regain enough function to move into her own apartment with her daughter to distance herself from her unstable family and to focus on her health and recovery. GB gave a signed consent to be the subject of this case report.

GB took medications before and during her time at the facility to help with the symptoms and complications from multiple sclerosis. She regularly took Baclofen to assist with spasticity reduction and Gilenya to help with management of her multiple sclerosis, however after her exacerbation she was also

given medications to help with pain control. She was given several medications as preventive measures in the facility, such as a cranberry capsule, as she was unable to perform toileting tasks, initially. Please see Table 1 for a list of medications.

Clinical Impression 1

GB presented with impaired functional status and was unable to function in activities of daily living such as bathing, dressing, and feeding. She was also unable to participate in her usual activities such as attending school and caring for her daughter. Due to her presentation and past medical history, a diagnosis of a multiple sclerosis exacerbation was hypothesized. It was thought that a series of stressful life events led to her sharp and drastic decline in function. Further testing of function was warranted, including strength, balance, gait, transfers, and cognition. Potential differential diagnosis included undiagnosed neuromuscular disorders such as Guillain-Barre syndrome, amyotrophic lateral sclerosis, and complications from diabetes mellitus type II. This patient was a good candidate for a case report due to her high level of function before her current exacerbation. GB had a lot of potential to make large functional gains and was easy to follow for a full rehabilitation course, using a multidisciplinary approach.

Examination

Review of Systems

During the initial examination, a review of systems was performed. The musculoskeletal system was assessed using range of motion testing, visual assessment, and Manual Muscle Testing. The validity of manual muscle testing is studied in the literature review by Cuthbert et al, and is found to be reliable and valid as an examination tool, although more research is needed to confirm this[7]. The neuromuscular system was assessed using crude touch for sensation as well as a visual assessment for tremors. The cardiovascular system was assessed using notes from the patient's medical team. The integumentary system was assessed using a visual check as well as notes from the patient's medical team. Overall, GB showed no impairments with her cardiopulmonary and integumentary systems; however her musculoskeletal and neuromuscular systems were impaired. Please see table 2 for findings during the initial examination.

Additional Tests and Measures

GB was also assessed for ability to participate in functional activities such as sitting and standing balance, gait, transfers and bed mobility. This was in accordance with the facility where these measures were used and recorded using specific guidelines to track a patient's progression through rehabilitation.

Communication and cognition testing was conducted by speech language pathology, with the results communicated to the physical therapy team. Pain was assessed verbally with GB complaining of severe and constant pain in her left knee, left hip, and right knee. GB was found to have functional impairments, as well as impairments with her communication and cognition and increased pain levels. Please see table 2 for findings during the initial examination.

Clinical Impression 2

Per the initial evaluation, the impression of increased weakness, pain, and decreased functional activity tolerance due to a multiple sclerosis exacerbation was confirmed. The patient's practice pattern from the Guide to Physical Therapy Practice was 5E: Impaired Motor Function and Sensory Integrity Associated with Progressive Disorders of the Central Nervous System.

Following the examination it was decided to proceed with physical therapy interventions to address the patient's impairments including strength, balance, transfers, gait, and functional activity tolerance. It was also decided the patient would be referred to other services: occupational therapy to address impairments in activities of daily living, speech pathology to address communication and cognition, dysphagia, and dysarthria, psychiatry to address depression, the medical team to address pain, and finally social work to address the patient's home-life and facilitation of discharge. In a systematic review by Khan et al, it was noted that persons recovering from multiple sclerosis exacerbations who receive multidisciplinary care made short-term gains in Internal Classification of Functioning, Disability, and Health (ICF) levels of activity and participation and had the potential for long-term gains[8].

The patient continued to be appropriate for the case report due to her willingness to work hard in therapy and her early functional improvements. Due to the inter-professional nature of the facility she was also appropriate because it was easy to communicate with other team members and get a full picture of GB's recovery process. It was thought that the patient had a good prognosis for improvement with physical therapy due to her previous high level of function and her high level of motivation to work hard. GB would be evaluated for discharge after she had met her rehab goals and met all the requirements determined by different disciplines of her health care team. Please see table 3 for a list of the patient's goals.

The plan for intervention included therapies that assisted the patient to safely return to her private residence and be able to participate in daily activities of her choice. This included therapeutic activities, therapeutic exercises, gait training, transfer training, neuromuscular re-education, and community reintegration training.

As GB made functional gains, it was also decided to include additional outcome measures to further assess the patient's progress. This included the Berg Balance Scale to address the patient's fall risk and ability to return to an independent lifestyle. The Berg Balance Scale was chosen because it was

highly recommended as an outcome measure for individuals currently residing in a skilled nursing facility who have multiple sclerosis[9].

Interventions

Coordination/Communication/Documentation

GB received a multidisciplinary treatment approach while in the facility. Aside from physical therapy, she also received services from speech language pathology, occupational therapy, psychiatry, medical management, nursing, and case management. All notes on GB were stored in her electronic medical records so that other disciplines could look at her overall progress. Communication was made between disciplines when appropriate.

Patient/Client Instruction

Pain control was addressed with therapy and medical management. Doctors prescribed increased dosages of medications such as Tylenol and Gabapentin. She spent several weeks taking Norco for neuromuscular pain; however this had to be administered carefully to prevent any addiction and bodily adaptations. Timing the therapy sessions with GB's medications also helped her achieve maximal effort during therapy. In therapy, treatment included ultrasound, and range of motion exercises/massage to alleviate pain and spasticity in GB's hips and lower extremities. GB was also encouraged to perform stretching activities in her room to help with spasticity management. GB was given information on safety, such as the use of assistive devices well as education on fatigue and how this affects her function.

Procedural Interventions

GB started her physical therapy interventions the day after her initial evaluation. It has been shown that it is important to start therapy early after multiple sclerosis exacerbations to reduce risk of losing abilities and independence and maintain as much function as possible[10]. Treatments were 5-6 days a week and lasted anywhere from 45 to 90 minutes. The interventions were tailored towards GB's impairments and goals as it has been shown that persons with multiple sclerosis made stronger gains in function with a personalized goal-directed rehab program versus a generic rehabilitation program[11]. It was also important that impairments in the GB's neuromuscular system were to be taken into account when designing her therapy program as her spasticity, tremors, and pain affected her participation in therapy. Focus was put on what GB was able to perform and to progress her as tolerated. GB started with therapeutic activities such as bed mobility training and therapeutic exercises in bed (for example straight leg raises and isometric exercises). As she progressed she began pre-gait activities such as weight-bearing in the parallel bars and then progressed to gait training with a front wheeled walker. Gait training followed a conventional walking therapy program, slowly reintegrating movement patterns back into GB's gait, and increasing her endurance. It is found that gait training with this method is equally effective versus robotic assisted gait training or use of specialized equipment[12]. Regaining core strength

was also a priority as it has been shown that this can help with balance and gait training in persons with multiple sclerosis[13]. Core training started slowly with GB encouraged to sit in a chair for all meals and progressed to exercises in quadruped then the physio ball. As GB improved she progressed to higher level activities such as stair climbing, and outdoor terrain negotiation. Please see table 4 under tables and figures for a list of interventions, by week.

Outcomes

During her rehabilitation process, GB improved in every functional measure from initial evaluation to discharge. She also performed grossly 5/5MMT for her upper extremity strength and performed grossly 4/5MMT for her lower extremity strength. Please see table 2 in tables and figures for a comparison between evaluation and discharge. Upon evaluation GB was unable to ambulate, stand, or transfer. By discharge GB was able to ambulate unlimited distances with a front wheeled walker, perform bed mobility with modified independence, and able to perform all transfers with modified independence. Stairs were a functional goal for GB and she was able to perform them with supervised assistance by discharge. Safety concerns for GB included her balance, and at evaluation she was unable to perform any standing balances. By discharge she was able to perform static standing activities with a G-/F+[1] rating and was able to perform dynamic standing activities with a fair rating. Her sitting balance improved with a static balance score of good and a dynamic sitting balance score of G-/F+. Please see table 5 in tables and figures for a week by week comparison of GB's functional status.

GB also improved in her speech and cognition, performing a 28/30 on the mini mental state exam and exhibiting no dysarthria when speaking by discharge. Although GB did improve in every functional category during her stay she was unable to fully return to her previous level of function as she still required a front wheeled walker for safe ambulation at all times and had concerns with her balance. This was shown with her Berg Balance Scores (BBS). Her initial BBS was administered approximately 6 weeks into her stay at the facility and she scored a 20/56, which put her in the high fall risk category. The BBS was re-administered 4 weeks later and GB improved her score to a 35/56 , however this still put her in the moderate fall risk category.

Spasticity was a concern throughout GB's treatment. This caused secondary musculoskeletal concerns which affected her hips, lower extremities, and ambulation patterns. During ambulation her movements were jerky and stiff and she frequently complained about pain in her left hip, which was asymmetrical from her right. She also ambulated with a toe-out gait pattern and had trouble clearing her left foot during gait activities. Muscular pain was thought to be secondary to spasticity and she also was thought to have neurogenic pain. While GB made significant functional gains, her pain never dissipated, and this impacted her ability to perform functional activities such as ambulation and stair climbing.

[1] Please see appendix 2 for functional measures

Please see figure six in tables and figures for a representation of GB' pain, using the visual analog scale which has been deemed reliable in a study by Boonstra et al[14]. Overall GB met all of her goals and was discharged from therapy with the intent to move into an adapted apartment for persons with disabilities, along with her daughter.

Discussion

GB's made significant functional gains during her recovery and we were able to track her progression and therapy interventions. However, it is important to remember the course and treatment of multiple sclerosis is extremely variable and can be affected by factors such as treatment received and social support systems. This was a challenge for GB as her social instability and the uncertainty of living arrangements after discharge led her to suffer bouts of depression and anxiety which affected her therapy. Days that GB had a stressful conversation with her family or felt homesick for her daughter, usually meant a difficult therapy session. Often her postural tremors would get worse when she was upset and her pain levels would be higher.

Difficulties with GB's treatment included the complexity of her case and her high level of impairment at baseline. Although she had a team of health care providers working with her, physical therapy sessions seemed short with all of the items that needed to be addressed. For example, for just physical therapy on any particular day the focus could be on pain management, gait training, strengthening activities (such as squats or theraband exercises), neuro-muscular re-education (such as balance or proprioceptive work), or functional activities (such as transfers). Fitting in all desired therapies into one session, or even one week, was a daunting task, especially with the frequent fatigue GB was experiencing.

Positive factors for GB included her willingness and desire to go through therapy. She never refused treatment and was willing to perform additional exercises in her room (such as passive stretching) outside of therapy time. GB demonstrated a healthy attitude in accepting her disease and hopefulness about her functional gains in the future. GB frequently expressed her desire to make healthy lifestyle modifications, after leaving the facility, to improve her health including stress reduction, healthy eating, and a regular exercise program. Positive attitude throughout treatment has been shown to help with adjustment to the disease related challenges of multiple sclerosis[15]. GB was also an advocate for multiple sclerosis awareness and had organized charity events in the past to raise attention towards the disease and she wanted to hold more events, once well. Another positive factor was the strong team approach GB received. Inpatient multidisciplinary rehabilitation has been shown to be beneficial in improving disability, participation, and quality of life, despite the progression of multiple scleroris[8]. GB was able to receive care in many aspects of her health, from speech, to strength, to function, to assistance with depression and anxiety. This multi-disciplined approach was instrumental in her recovery and eventual release back to an independent living lifestyle.

Overall, GB made many gains during her rehabilitation, but faced many challenges, particularly with pain control and social factors. GB was very proud of her hard-work; however she was frustrated by the impairments she still had at discharge, in particular needing an assistive device for safe ambulation, and her persistent pain. Future research should focus on rehabilitation from a multiple sclerosis exacerbation during stressful life events. GB was discharged from the facility and found an apartment that catered toward persons with disabilities. However, GB felt she was unable to return to school after discharge and wanted to make sure she kept health her top priority as she felt she had started to slip into unhealthy habits such as lack of exercise and unhealthy eating. GB will likely need additional help with daily activities and adaptations to an independent lifestyle. Since she comes from such an unsupportive family, this will likely have to come from an outside source. Being so young and having suffered severe relapses, the future for GB is uncertain.

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Tables and Figures

Table 1

Medication	Purpose
Baclofen	Reduce spasticity
Cranberry capsule 250 mg	Urinary tract infection prevention
Cymbalta Capsule Delayed Release Particles 30 MG	Depression
Gabapentin Capsule 400 MG	Neuropathic pain
Gilenya Capsule 0.5 MG (Fingolimod HCI)	Multiple sclerosis management
Lactulose Solution 10GM/15ML	As needed for constipation
Oxybutynin Chloride Tablet	For neurogenic bladder
Sorbitol Solution 70%	As needed for constipation
Trazodone HCI Tablet 50 MG	Depression management
Tylenol Tablet (Acetaminophen)	Pain control
Zofran ODT Tablet Dispersible 4 MG (Ondansetron)	As needed for nausea and vomiting
Norco (hydrocodone tartrate and acetaminophen)*	Neuromuscular pain

*Norco was given to the patient for several weeks during her duration at the facility, after the patient complained she was not getting enough pain relief. This was only administered a short time to prevent dependency or other serious medical complications.

Table 2

Review of Systems/Functional Measures

	Initial Examination	**Discharge Status**
Cognition		
Mini Mental State Exam	Impaired.: 21/30	Not impaired.: 28/30
Communication		
	Impaired: Patient exhibited dysarthria	Not impaired
Integumentary System		
Skin check	Not impaired	Not impaired
Cardiopulmonary System		
Blood Pressure/Heart Rate/Respiratory Rate	Not Impaired	Not Impaired
Neuromuscular System		
Crude Touch	Not impaired	Not impaired
Tone	Impaired: GB presented with postural tremors and spasticity in all four limbs	Impaired: GB presented with spasticity in all four limbs and postural tremor when under stress
Musculoskeletal System		
Right UE Strength	Grossly 2+/5 MMT	5/5 MMT
Left UE Strength	Grossly 2+/5 MMT	5/5 MMT
Right UE Range of Motion	Impaired	Not impaired
Left UE Range of Motion	Impaired	Not impaired
Right LE Strength	Grossly 2+/5 MMT	Grossly 4/5 MMT
Left LE Strength	Grossly 2+/5 MMT	Grossly 4/5 MMT
Right LE ROM	Impaired	Not impaired
Left LE ROM	Impaired	Not impaired
Posture	Impaired: Kyphotic and lack of head control	Not Impaired
Functional Measures		
Static Sitting Balance	Fair -	Good
Dynamic Sitting Balance	Poor +	Good +/Fair -
Bed Mobility	Maximal Assistance	Modified Independence
Transfers	Did not test: Patient refused to stand due to pain in bilateral lower extremities	Modified Independence
Static Standing Balance	Did not test: Patient refused to stand due to pain in bilateral lower extremities	Good +/Fair -
Dynamic Standing Balance	Did not test: Patient refused to stand due to pain in bilateral lower extremities	Fair
Gait Assistance	Did not test	Supervised Assistance with Front Wheeled Walker
Gait Distance	Did not test	Unlimited
Stairs	Did not test	Supervised Assistance
Berg Balance Scale	Did not test	GB scored a 20/56 midway through therapy treatments indicating a high fall risk and improved to 35/56 by discharge, indicating a moderate fall risk

451 **Table 3**

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	Evaluation	Goal Met by Discharge
Short Term Goals	Patient will safely perform bed mobility tasks with contact guard assist in order to prepare for transfers and get in/out of bed by three weeks start of care.	**Yes**
	Patient will safely perform bed mobility tasks with contact guard assist in order to prepare for transfers and get in/out of bed by three weeks start of care.	**Yes**
Long Term Goals	Patient will safely perform bed mobility tasks with modified independence in order to prepare for transfers and get in/out of bed by eight weeks start of care.	**Yes**
	Patient will safely perform functional transfers with contact guard assist with increased safety awareness in order to safely return to private residence by eight weeks start of care.	**Yes**
	Patient will safely ambulate on level surfaces 150 feet using front wheeled walker with in order to ambulate household distances by eight weeks start of care.	**Yes**

Table 4

	Week 1	Week 2	Week3	Week 4	Week 5	Week 6
Therapeutic Activities	Bed mobility training, transfer training, gross motor coordination	Bed mobility, transfers (supine to sitting edge of bed and chair to chair transfers), active assisted range of motion	Bed mobility, transfers (sit to stand in parallel bars, ROM, facilitation of postural control in sitting	Transfer training, bed mobility, postural control, ROM, reaching for objects outside base of support	Transfer training, ROM, throwing/catching in sitting, bending/lifting activities	ROM, dynamic balance activities in sitting and standing, crossing midline
Therapeutic Exercises	Omnicycle, heel pumps, ankle pumps, straight leg raises, knee extension,	Omnicycle, LE/UE strengthening exercises	Theraband for UE and LE strengthening activities,	Strengthening exercises for LE, UE	Strengthening exercises for LE, UE	Strengthening exercises for LE, UE, activities in quadruped and bridging to increase core stability
Pre-Gait Training		Standing in parallel bars, weight shifting in lateral and anterior/posterior directions; standing frame 2x4 min	Standing in parallel bars, weight shifting in lateral and anterior/posterior directions	Weight shifts in standing		
Gait Training				Training in correct hand/foot placement during gait, facilitation of swing through during gait, adjustment of center of mass over base of support	Emphasis on normalized gait pattern including sequencing, knee flexion, and hip extension	Emphasis on normalized gait pattern, safe maneuvering around obstacles and toe clearance
Neuromuscular Re-education					Facilitation of anticipatory postural adjustments, facilitation of proprioception, postural control in sitting/standing	Facilitation of patterned movement, motor control and postural control
Comments			Nursing instructed to put patient in in chair for meals to improve sitting tolerance	Patient spoke to doctor regarding her pain levels/upping her medications	Safety training regarding ambulation to/from bathroom	Patient complained of pain/tightness so manual stretching was performed in hips and LE

Table 4 Continued

	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Therapeutic Activity	Postural Control, Dynamic Balance Activities in Sitting	Dynamic balance activities on physioball	Bending activities while standing, transfer training, placement of objects out of reach, range of motion activities, dynamic balance activities on physioball	Bending activities while standing, balance activities while in physioball, fall recovery techniques	Transfer training, bending activities, overhead activities	Car transfers, dynamic standing activities to simulate ADLs, throwing/catching activities , bending/lifting activities, wheelchair management on ramps
Therapeutic Exercises		Side-stepping to increase hip abduction strength, straight leg raises, knee extension in supine, hip abduction in supine, Nustep	Nustep, omnicycle, hip abduction in standing	Side-steps, activities in quadruped, lower extremity theraband exercises, straight leg raises, knee extension in supine, stretching of hips/adductors to alleviate pain	Lower extremity theraband resistance activities,	Lower extremity exercises in supine with 2 pound ankle weights, quad sets, ankle pumps, heel raises in standing, squats
Gait Training	Normalized gait pattern: toe clearance during ambulation, emphasis on stride lengths and lateral trunk stability, training on stairs	Alteration of surfaces/terrain during ambulation, directional changes, stair climbing, emphasis on R hip flexion to prevent circumducted gait	Gait training outdoors, challenging patient outside base of support, emphasis on stride length and quick stops/starts/safety in the community	Gait training outdoors, curb negotiation, toe clearance, facilitation of hip extension	Stair climbing, obstacle negotiation, outdoor ambulation, focus on patient self-awareness for fatigue levels, ambulating while carrying objects	Gait training outdoors, gait training while multi-tasking, emphasis on safety and performance in all environments
Neuromuscular Re-Education	Balance reactions, training in limits of stability and adjustment of center of mass over base of support, gross motor coordination training	Postural control, use of biodex to facilitate hip and ankle balance strategies, proprioceptive techniques,	Biodex, PNF patterns, single leg stance activities, tandem walking, vibration techniques and challenges to balance control	Techniques to facilitate motor control and postural control	Techniques to facilitate functional balance control	Proprioceptive techniques, facilitation of crossing midline
Comments	Patient began stair training		Use of ultrasound to left hip for pain control, wheelchair education	Patient given clearance to ambulate around facility with walker, unsupervised	Patient complained of increased pain in left thigh	Patient given home exercise program after discharge

UE= upper extremity, LE= lower extremity, ROM= range of motion

Table 5

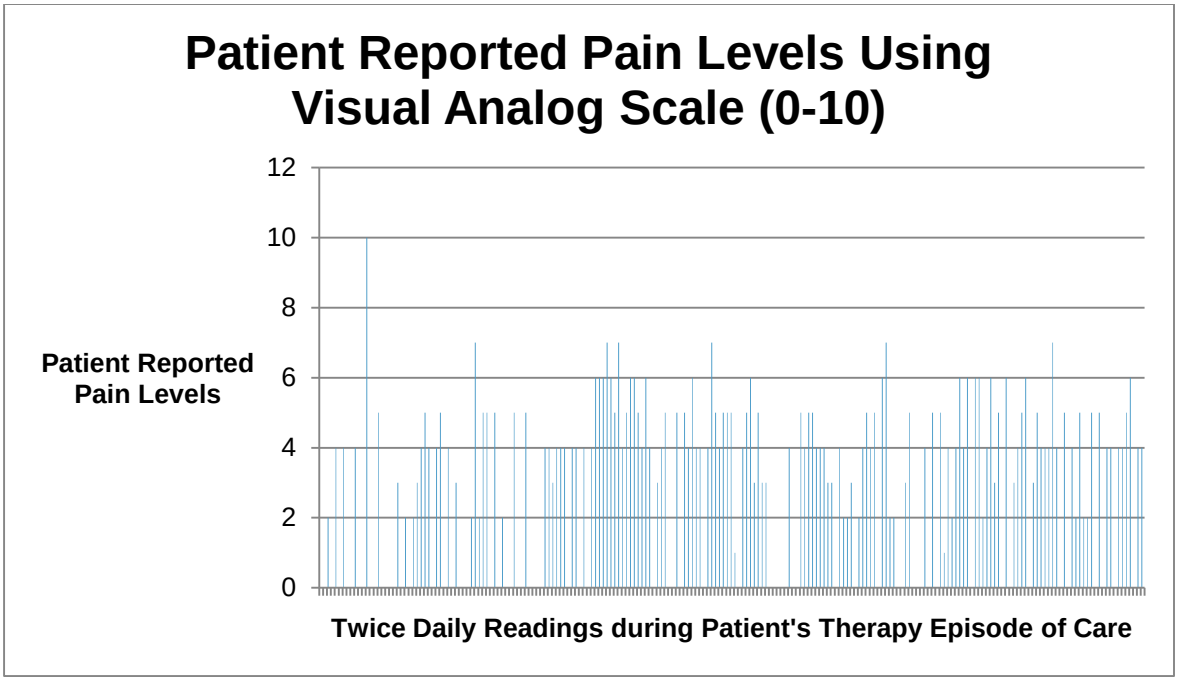
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Static Sitting Balance[1]	Fair -	Fair -	Fair	Fair	Fair	Fair	Good -/ Fair +	Good -/ Fair +	Good	Good	Good	Good
Dynamic Sitting Balance[1]	Poor +	Poor +	Fair -	Fair	Fair -	Fair -	Fair	Fair	Good-/ Fair +	Good-/Fair +	Good –/Fair +	Good-/Fair +
Bed Mobility[2]	Moderate Assistance	Moderate Assistance	Moderate Assistance	Minimal Assistance	Minimal Assistance	Contact Guard Assist	Stand by Assist	Supervised Assistance	Modified Independence	Modified Independence	Modified Independence	Modified Independence
Transfers[2]	Maximal Assistance	Maximal Assistance	Maximal Assistance	Minimal Assistance	Minimal Assistance	Contact Guard Assist	Stand by Assist	Supervised Assistance	Supervised Assistance	Set-up Assistance	Modified Independence	Modified Independence
Static Standing Balance[3]	DNT	DNT	Poor +	Poor +	Fair	Fair	Fair	Fair	Fair	Fair	Good -/Fair +	Good -/Fair +
Dynamic Standing Balance[3]	DNT	DNT	Poor +	Poor +	Fair -	Fair -	Fair -	Fair	Fair	Fair	Fair	Fair
Gait Assistance /Assistive Device[2]	DNT	DNT	DNT	Moderate Assistance/Front Wheeled Walker	Contact Guard Assist/ Front Wheeled Walker	Contact Guard Assist/ Front Wheeled Walker	Contact Guard Assist/ Front Wheeled Walker	Contact Guard Assist /Front Wheeled Walker	Stand by Assist/Front Wheeled Walker	Stand by Assist /Front Wheeled Walker	Supervised Assist/Front Wheeled Walker	Supervised Assist/Front Wheeled Walker
Gait Distance, Without Rests	DNT	DNT	DNT	5 feet	90 feet	50 feet	150 feet	200 feet	225 Feet	250 Feet	325 Feet	Unlimited
Stairs[2]	DNT	DNT	DNT	DNT	DNT	DNT	Contact Guard Assist	Contact Guard Assist	Stand by Assist	Stand by Assist	Supervised Assist	Supervised Assist

[1] Please see appendix 2 for functional measure

[2] Please see appendix 4 for functional measure

[3] Please see appendix 3 for functional measure

Figure six

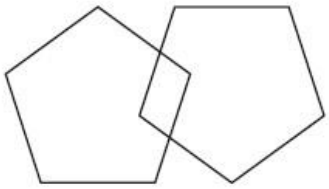

Patient Reported Pain Levels Using Visual Analog Scale (0-10)
Patient Reported Pain Levels
12
10
8
6
4
2
0
Twice Daily Readings during Patient's Therapy Episode of Care

Appendix 1

The Mini-Mental State Exam

Patient_____ Examiner _____ Date_____

Maximum	Score	
		Orientation
5	( )	What is the (year) (season) (date) (day) (month)?
5	( )	Where are we (state) (country) (town) (hospital) (floor)?
		Registration
3	( )	Name 3 objects: 1 second to say each. Then ask the patient all 3 after you have said them. Give 1 point for each correct answer. Then repeat them until he/she learns all 3. Count trials and record. Trials _____
		Attention and Calculation
5	( )	Serial 7's. 1 point for each correct answer. Stop after 5 answers. Alternatively spell "world" backward.
		Recall
3	( )	Ask for the 3 objects repeated above. Give 1 point for each correct answer.
		Language
2	( )	Name a pencil and watch.
1	( )	Repeat the following "No ifs, ands, or buts"
3	( )	Follow a 3-stage command: "Take a paper in your hand, fold it in half, and put it on the floor."
1	( )	Read and obey the following: CLOSE YOUR EYES
1	( )	Write a sentence.
1	( )	Copy the design shown.



_____ Total Score

ASSESS level of consciousness along a continuum _____

Alert Drowsy Stupor Coma

Appendix 2

Functional measurements for dynamic and static sitting balance

FUNCTIONAL LEVEL	DESCRIPTION
Normal	Maintains without support, weight shifts, and crosses midline against maximal resistance
Good	Maintains without support, weight shifts, and crosses midline against moderate resistance
Good-/Fair+	Maintains without support, weight shifts, and crosses midline against minimal resistance
Fair	Maintains while unsupported without loss of balance or upper extremity support
Fair -	Maintains with minimal assistances or upper extremity support
Poor +	Maintains with moderate assistance and upper extremity support
Poor	Maintains with maximal assistance and upper extremity support
Unable	Unable to achieve- total dependence

Appendix 3

Functional measurement levels for bed mobility, transfers, gait, and stairs

FUNCTIONAL LEVEL	DESCRIPTION
Independent	Patient is independent with all components of tasks. Requires no assistance and no equipment.
Modified Independent	Patient performs the task independently, however, requires additional time to complete the task or assistive equipment or devices to facilitate functional task performance.
Set-Up Assistance	Patient performs the task independently, however, after set-up assistance from caregiver
Supervision	Patient performs the task independently, however, given distant supervision and/or verbal and/or visual cueing from a caregiver to initiate or complete the task, with or without adaptive equipment or devices.
Stand-By Assistance	Patient performs the task independently, however, given close supervision and/or verbal and/or visual cueing from a caregiver to initiate or complete the task, with or without adaptive equipment or devices.
Contact Guard Assist	Patient requires close supervision and tactile cues, and/or verbal and/or visual cueing, from a caregiver to initiate or complete the task, with or without adaptive equipment or devices.
Minimal Assistance	Patient is able to perform at least 75% or the task, however, requires 25% assistance from a caregiver.
Moderate Assistance	Patient is able to perform at least 50% of the task, however, requires 50% assistance from a caregiver.
Maximal Assistance	Patient is able to perform at least 25% of the task, however, requires 75% assistance from a caregiver. This level may also be used when a patient requires a second person for assistance with at task.
Total Dependence +	Patient is totally dependent upon the caregiver for task performance, however, attempts to participate in the task.
Total Dependence	Patient is totally dependent upon the caregiver for task performance and does not attempt to participate in the task. No contributions from the patient; task is done by others.

Appendix 4

Functional Measurement for static and dynamic standing balance

Functional Level	Description
Normal	Stands unsupported, weight shifts & crosses midline against maximal resistance
Good	Stand unsupported, weight shifts, and crosses midline against moderate resistance
Good -/Fair +	Stands unsupported, weight shifts, and crosses midline against minimal resistance
Fair	Unsupported without loss of balance 1-2 minutes without upper extremity support. Minimal weight shifting ipsilateral, difficulty crossing midline.
Fair -	Minimal assistance or upper extremity support to stand without loss of balance to reach ipsilateral; unable to weight shift.
Poor +	Moderate assistance and upper extremity support to stand without loss of balance and to reach ipsilateral; unable to weight shift
Poor	Maximal assistance and upper extremity support to maintain standing supported and reach ipsilateral; unable to weight shift
Unable	Total dependence
Did not test	Did not test