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Physical Therapy Interventions for Multiple Sclerosis and Diplegia

Kyle R. Nyquist
University of North Dakota

PHYSICAL THERAPY INTERVENTIONS FOR MULTIPLE SCLEROSIS AND DIPLEGIA

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Kyle R. Nyquist
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This Scholarly Project, submitted by Kyle Nyquist 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.

_____
(Graduate School Advisor)

_____
(Chairperson, Physical Therapy)

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Department Physical Therapy

Degree Doctor of Physical Therapy

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ABSTRACT

Background and Purpose – It is estimated that approximately 2.5 million people world-wide suffer from multiple sclerosis (MS). MS is a neurological disease that impacts messages from the brain to motor and sensory nerves. This disruption can cause loss of sensation and motion to a specific region of the body. The purpose of this case study is to identify interventions used for a person with multiple sclerosis. **Case Description –** The Patient is a 40-year-old male who has been suffering from MS for 27 years. He has lost the use of his lower extremities and had contractures at his knees and ankles. **Intervention –** Interventions for this patient include active assistive range of motion (AAROM) and active range of motion (AROM), stretching, transfer training, proprioceptive neuromuscular facilitation (PNF), gait and pre-gait training, and strengthening. **Outcomes –** The patient increased range of motion and strength in his lower extremities, improved sitting balance statically and dynamically, and was able to ambulate a functional distance with assistance. **Discussion –** The patient was very pleased overall with his gains in activities of daily living because of the time and effort he put forth in physical therapy. There is currently not a lot of research done on chronic MS accompanied by loss of function in the lower extremities.

CHAPTER I

BACKGROUND AND PURPOSE

In the ever changing world of medicine there are many diseases that have puzzled the medical world; one disease in particular is multiple sclerosis (MS). Since many of the cases around the world have symptoms that go unnoticed, it is estimated that 400 000 Americans and about 2.5 million people worldwide suffer from this debilitating disease.[1] MS is a neurological disease in which there is demyelinization of the axons of nerves in the central nervous system, which can impair sensation, motor control, and coordination in the individual. Demyelinated axons, because of the damage they have received, will have a reduction in velocity of the message sent to and from the brain. When the nerve does not relay the message from the brain to its destination, it is usually due to an increase in temperature, which is why the majority of the signs and symptoms are seen after exercising or following a hot shower or bath. This is why individuals may lose normal use of an extremity and with this loss a person can find many activities of daily living very difficult. People that suffer from MS also generally tire faster from physical and cognitive tasks. Patients may also take longer to recover from the fatigue that sets in from physical exertion compared to a nondisabled individual.[2] MS has 4 different variations with exacerbations of the signs and symptoms, these variations are called relapsing/remitting, secondary progressive, progressive relapsing multiple sclerosis, and primary progressive.[3] These exacerbations, also called relapses, may come slowly over time. There are times when the

symptoms may diminish or completely disappear but generally permanent neurological problems occur from the relapses.[4]

Although MS has been around for many years there is little direction given by researchers for physical therapy interventions. Current literature emphasizes the importance of fatigue levels for the individual, but the research literature for views on evidence-based interventions produces little information in progressive MS. There have been pilot studies done in regards to treadmill training, balance interventions and effects, and maximal eccentric and concentric effort in exercise. Some studies have provided beneficial direction for increasing fatigue levels, gait training, and muscle strengthening, of which interventions include aerobic training, neuromuscular re-education, and aquatic therapy.

With the pilot studies, little research has been completed, yet the quality of the information found was high. A treadmill training study showed that individuals with MS tolerated aerobic treadmill training as well as increased walking speed and endurance without reports of increased fatigue or other exacerbations from the intervention.[5] Another study examining balance incorporated into motor strategies supported the use of interventions that used both motor and sensory strategies.[6] In both cases the authors stated that more research and larger clinical randomized trials were necessary.

In much of the literature pertaining to MS, fatigue is a major factor due to the negative impact it has on the individual. A study that compares two different types of interventions for MS patients reports that aerobic training was more effective in improving exercise tolerance and walking capacity.[7] The study also states that there was no significant difference between neurological rehabilitation and aerobic training in fatigue and that aerobic training may have affected a person's quality of life in a positive matter. When examining increased strength and

power an investigation considering the effects an aquatic exercise program would have on a person with MS found that the program provoked positive changes in strength, fatigue, work, and power.[8] The purpose of this case study is to identify interventions used for a person with multiple sclerosis.

CHAPTER II

CASE DESCRIPTION

Patient was a 178 cm, 86.2 kg, 40-year-old male who was diagnosed with MS in July of 1982. The patient came for physical therapy services with a long history of MS, which has been causing a steady decline in his functional activities throughout the years. He has participated in physical therapy for at least 10 years, generally in the late fall and throughout the winter.

Examination, Evaluation and Diagnosis

The patient was referred by physician for an evaluation and treatment, a physical therapy prescription which was warranted due to weakness and deconditioning. He had a high risk of falls and a past medical history of multiple sclerosis, osteoporosis, and neurogenic bladder. He complains of numbness in the left foot up to the calf and has had these symptoms for 20 years, as well as weakness in the legs. Three months prior to the patient's first visit to physical therapy, he was ambulating across his deck three times in a day, approximately 60 feet, with a front-wheel walker (FWW), and assistance from his personal care assistant (PCA). He only ambulates outdoors because of the smooth deck surface and fewer obstacles compared too indoors. He now uses a wheelchair for household mobility and an electric scooter for primary outdoor mobility.

He resides with a PCA in a 1-story house that is accessible for people with disabilities and uses a ramp to enter his home. His bathroom had all the necessary modifications for him including a walk-in style shower with a large bench for sitting while showering and grab bars by the toilet to aid in transferring and balance. He was independent with wheelchair mobility for

the household and community. Currently the patient was not working because of his disability, but he is active in the community by going to events and activities held by the city and school. He needs assistance with bathing, transfers, and dressing, and is dependent on his PCA in performing the cooking, cleaning, and laundry. He has been doing stretching exercises with his PCA without difficulties but has not been ambulating due to the cold weather outdoors.

The patient's goal from physical therapy was to increase sitting balance to improve his posture. He wanted this goal because he could see other people sitting up straight in a chair and knew that sitting up straight was the correct way to sit. Throughout all the treatments the patient demonstrated good motivation while in therapy and would often say that he enjoyed fighting MS with us after the session was completed. He also stated that with previous physical therapy encounters he experienced good things in strength and ROM which increased his independence in transfers and activities of daily living. The patient is a good candidate for physical therapy services because of his eagerness to become more independent and for possible improvement in some of the existing disabilities. The examination plan included a falls risk analysis, spasticity measure, range of motion, strength, transfer ability, gait, and sensation.

The examination of the patient included aspects of orthopedic assessment[9] well as additional aspects of a neuromuscular examination. The patient entered physical therapy in an electric wheelchair with poor sitting posture, including increased kyphosis of the upper thoracic spine, forward head, and rounded shoulders. The patient needed a moderate assist of 1 (MOAx1) during standing pivot transfer from his wheelchair to the examination table. Range of motion of shoulders and cervical spine and strength of shoulders was within functional limits and he offered no complaints of pain in any direction of movement. Lower extremity range of motion

was limited and measured with a goniometer as seen in Table 1, as well as lower extremity strength found in Table 2.

Table 1. Initial Lower Extremity Passive Range of Motion (in Degrees)

	Right	**Left**
HIP		
Flexion	105	107
Extension	30	30
Abduction	15	15
Adduction	15	15
KNEE		
Flexion	135	135
Extension	5 of flexion	7 of flexion
ANKLE		
Plantarflexion	50	50
Dorsiflexion	0	5 of plantarflexion
Inversion	35	35
Eversion	15	15

Table 2. Initial Lower Extremity Strength*

	Right	**Left**
HIP		
Flexion	+2/5	1/5
Extension	5/5	4/5
Abduction	2/5	1/5
Adduction	5/5	5/5
KNEE		
Flexion	4/5	-4/5
Extension	5/5	5/5
ANKLE		
Plantarflexion	5/5	5/5
Dorsiflexion	1/5	1/5
Inversion	4/5	4/5
Eversion	2/5	1/5

*Muscle strength grades as per Reese[10]

During the sensory aspect of the assessment and examination[10] the patient exhibited hypertonic extensor tone and as increased muscle spasticity in both of his lower extremities. Spasticity is a motor disorder characterized by a velocity-dependent increase in the tonic stretch reflexes of extremities with exaggerated stops in ROM of the extremity.[11] He also had decreased trunk control, displaying weakness in abdominals and erector spinae muscles. Proprioception

was unimpaired and light touch was diminished distally in the left lower extremity in the region of the L4-5 dermatome pattern.[12]

Throughout the objective portion of the examination the patient used his upper extremities to support himself in static sitting, while in dynamic sitting with his lower and upper extremities moving he needed a minimum assistance of 1(MIAx1) to prevent falling in a posterior direction. In the patient's transfers from supine to sit he needed a MOAx1 and from sit to stand he needed a maximum assistance of 2 (MAAx2) with facilitation at the gait belt as well as at posterior pelvis and sternum.

Patient ambulated four feet with a FWW and MAAx2, facilitation being at the gait belt, posterior pelvis, assistive device for proper placement, patient's left lower extremity, and for weight shifts. In the gait assessment the patient presents with extensor tone greater on his left side than the right in the swing phase of the gait cycle, decreased step length, foot clearance, and weight shifts as well as poor heel/toe mechanics. These findings are abnormal in people without MS, but are common in people that have MS.[13]

Physical therapy diagnosis is multiple sclerosis with lower extremity weakness, debility, abnormal gait, and decreased balance falls under 5E in the Guide To Physical Therapy Practice.[14] 5E is classed as Impaired Motor Function and Sensory Integrity Associated With Progressive Disorders of the Central Nervous System and also has the ICD-9 code of 340. Impairments include decreased range of motion, lower extremity weakness, impaired motor function, and impaired posture.

Prognosis and Plan of Care

The patient's prognosis is fair due to the fact that he has lived with MS for a number of years and is regressing from past years. The reason the patient did not receive a poor grade is

due to his good motivation and past years of physical therapy. Weinshenker et al[15] found that when the sensory or visual symptoms are the problem areas of the person, the prognosis is quite good. Alternatively, if the majority of signs and symptoms appear to be more motor involvement, particularly if balance and coordination are altered, the person has a more negative outlook. His research also found that when person affected is male and is older, the outlook is much less positive than if he were younger.

The physical therapy interventions this patient received included active assistive range of motion (AAROM) and active range of motion (AROM), stretching, transfer training, proprioceptive neuromuscular facilitation (PNF), gait and pregait training, and strengthening.

Short term goals for physical therapy intervention: in two weeks the patient would be able to increase sitting balance to independent during dynamic reaching beyond the patient's base of support (BOS), perform weight shifts independently laterally in standing with proper device four times to allow for progression in gait mechanics, and demonstrate ability to transfer sit to supine with MIAx1allowing decreased reliance on care provider for transfer. Long-term goals in following physical therapy intervention: in 6 weeks the patient would be able to ambulate 15 feet with the proper device and MOAx1 and transfer stand pivot treatment mat to chair with less than MIAx1 for decreased reliance of care provider. Another long-term goal was to increase dorsiflexion to WFL and knee extension to 0 degrees to increase gait mechanics for improved ambulation. All of these goals, if achieved would aid in the patient's return to previous level of function.

CHAPTER III

INTERVENTION

Patient was seen for a 60-minute session, 2 times a week for 6 weeks. He had missed 2 treatments because of bad weather and illness. At the beginning of every session he transferred from his scooter to the treatment mat. This often was done incorrectly so giving verbal cues for scooter placement, lower extremity position, and upper extremity placement was needed as well as facilitation of a MIAx1occuring at the gait belt around his waist and shoulders for safety from falling. Many of his treatment sessions progressed into passive lower extremity stretching according to Kisner and Colby[16] with 30-second holds, 2 times in each of the following directions: hip flexion and abduction, knee extension, and dorsiflexion. Following the stretching the patient resisted light manual isometric holds against the student physical therapist (SPT). This strengthening activity was performed 2 times with the patient holding for 10 seconds in each direction; the activity targeted the patient's right and left quadriceps, hip flexors, abductors and adductors. Petajan and White[17] found that active resistive strengthening along with other strengthening activities increased a person's ability to accomplish a greater number of ADLs. They also found that exercise is also an important aspect of decreasing the progressive nature of MS in terms of muscle weakening. Throughout all of the patient's time in physical therapy he was encouraged to sit with good posture. This was commonly done with facilitation from the student at the patient's posterior pelvis and left shoulder along with verbal cueing, which was generally needed for him to pull his shoulders back and sit up straight. The facilitation aid for finding the proper posture while sitting may have impacted his static sitting balance. A home

exercise program (HEP) was given to the patient in paper form with directions for hamstring stretches for both legs and for stretching his heel cords with a towel along with increased overpressure assistance from his PCA. Sinkjrr et al[18] looked at stretching the ankle of spastic patients and found that a reflex-mediated stretch response decreased the flexor tone and increased the patient's extensor tone.

The second and third weeks' interventions were chosen out of books by O'Sullivan and Schmitz[19] and Davis.[20] After stretching, which was described earlier, the patient moved to a hooklying position, in which the patient is lying on his back with his knees bent. In this position the SPT began slow reversal, which is a passive movement of rotation of the patient's lower extremities on the trunk, and slow reversal holds, active assistive ROM with the patient holding the end position. There was also a quick stretch after the hold to facilitate the movement in the opposite direction. Staying in the same hooklying position the patient put a 6-inch ball between his knees and squeezed it together 20 times with 3-second holds. He also completed 20 pelvic tilts to help in strengthening his core to aid in core stabilization while sitting and standing. The patient also participated in PNF patterns in an upper extremity diagonal 2 flexion and extension for both upper extremities, 10 repetitions with MIAx1 required for completion of pattern with facilitation at hand and elbow. This activity was to aid in the teaching of proper bed mobility. Bed mobility instructions for rolling from his back to his side included verbal cues for lower extremity placement and a PNF lift with hand clasped in a prayer position along with sequencing movements, MIAx1 facilitation at his hip and knee. The patient rolled to the right five times and with each roll completed a static hold of 15 seconds in sidelying for strengthening and progression into supine-to-sit movement. To progress from static sitting to dynamic sitting the patient and SPT tossed a ball back and forth 20 times. The activity was increased in difficulty by

making the surface dynamic. The patient also used reaching outside of his base of support to increase awareness and strengthening of his core. The patient's PCA came to one of the therapy sessions during the 3rd week to participate in the patient's therapy and to be educated in the patient's HEP. The patient progressed in his HEP where added exercises were included: isometric hip adduction with the use of a pillow, trunk rotations with MIA x1, and rolling to the right for progression of supine to sit mobility.

The fourth and fifth week of intervention was geared toward pregait and gait activities. Patient began the treatment sessions by demonstrating a transfer to the mat and assisted with his stretching activities done in his HEP. Using a quadruped position, to add weight bearing in the hips, the patient progressed into weight shifting in posterior/anterior and lateral directions. The patient did not really tolerate this position, saying that the exercise mat was a little hard on his knees. This exercise and possible progression in crawling was discontinued because of the patient's intolerance to the position. The patient began his pregait activities by using an easy stand machine. His knees and feet were fixed to a stand with Velcro, and from there the patient could hold onto handles and pull himself up into a standing position. The patient tolerated the easy stand well, but still needed facilitation from the SPT at his posterior pelvis for erect standing posture and verbal cues for standing up straight. He was able to stand with standby assist (SBA) for 2 minutes without the easy stand belt, which would strap behind his hips while he was holding on to the easy stand bars. Sit to stand and standing and pivot transfers were practiced after the use of the easy stand. He needed a MIAx2, which was provided by the SPT and PT, with facilitation at the lower extremity for advancement and positioning and at the posterior pelvis and anterior trunk for erect posture. The patient was also introduced to a biofeedback machine. The patient used the biofeedback on the vastus medialis muscle belly of

both lower extremities during short arch quad sets. The patient did 15 short arch quads with each leg while the biofeedback was at a setting where the patient could reach his goal with a moderate amount of effort. Gait training was also a part of the treatment sessions in the last part of the fourth week and fifth week. The first time that we did any gait instruction the patient used a front-wheeled walker and was MOAx3 to keep him in an upright position. One person was focusing on facilitation of right weight shift and tapping on left hip flexor. A second person facilitated lower extremity advancement and locking of the patient's knees. The last person facilitated at the gait belt for balance and the assistive device for proper use and alignment. Patient was able to ambulate a total of 20 feet with 5 rest breaks. At the rest breaks the patient was reminded of the progression of ambulation including weight shifting and when to step.

During the final week of treatment, assessment for the initial goals was done. The patient was completing scooter to exercise mat with independence and very little verbal cues for hand placement. His sit to stand was still a MIAx2, which was found mostly at the end of the transfer for upright standing. Stretching remained the same for the patient throughout the last week of therapy because positive results were still being seen. The patient brought in his ankle-foot orthosis (AFO) and had the weekly orthotist fit it to the patient, observing for any defects and to consider a possible new AFO. He had said that the AFO was still in good form and still fit the patient well. He encouraged the patient to use it for all transfer situations and educated him on the importance of using the device and awareness of skin break down.

CHAPTER IV

OUTCOMES

The patient was discharged from skilled physical therapy services after the sixth week. With the use of stretching, AAROM, PROM, strengthening, PNF, a HEP, and gait training the patient was able improve many of his deficits found in his initial examination. At discharge the patient showed improvement in ROM for his lower extremities seen in Table 3. I believe that the increases in ROM were partly because of the patient and his PCA's compliance in stretching in the patient's HEP.

Table 3. Final Lower Extremity Passive Range of Motion (in Degrees)

	Right	**Left**
HIP		
Flexion	117	114
Extension	30	30
Abduction	36	30
Adduction	15	15
KNEE		
Flexion	135	135
Extension	0	0
ANKLE		
Plantarflexion	50	50
Dorsiflexion	2	1
Inversion	35	35
Eversion	15	15

He also demonstrated physical independence with transfers from his scooter to a chair, though still needing a few verbal cues from this student physical therapist for hand placement while transferring. The patient was also able to improve his bed mobility to an independent level, decreasing his reliance on his PCA and achieving one of his short term goals. He was able

to transfer from sitting to standing with a MIAx2 but needed assistance to begin standing and to stand in an erect position. He improved his static sitting balance to an independent level for 5 minutes and his dynamic sitting increased to a MIAx1 when reaching for objects outside of his base of support. The fact that all of things were able to be accomplished may have been because his strength in his lower extremities increased while participating in physical therapy and completing his HEP on a daily basis, as seen in Table 4. He was also able to increase his ambulation to 20 feet using a FWW and with a MAAx2 without any rest breaks.

Table 4. Final Lower Extremity Strength*

	Right	**Left**
HIP		
Flexion	+3/5	-3/5
Extension	5/5	4/5
Abduction	3/5	3/5
Adduction	5/5	5/5
KNEE		
Flexion	+4/5	+4/5
Extension	5/5	5/5
ANKLE		
Plantarflexion	5/5	5/5
Dorsiflexion	3/5	3/5
Inversion	4/5	4/5
Eversion	3/5	3/5

*Muscle strength grades as per Reese[10]

At the time of discharge the patient had accomplished some of his long and short term goals, including transferring from sit to supine with MIAx1, transferring standing pivot from the treatment mat to chair with less than MIAx1, increased dorsiflexion in his right and left ankles to 2° and 1° respectively, and increased knee extension to 0°. The goals that were not met included increasing the patient's sitting balance to independent during dynamic reaching beyond his BOS, performing weight shifts independently laterally in standing with a FWW, and lastly ambulating 15 feet with a FWW and a MOAx1. I believe the goals that only showed little improvement but accomplished was that the patient exceeded the distance for ambulation at one time but was still

at MAAx2 in assistance. He also was able to laterally weight shift without assistance in the weight shifts, but needed the assistance for balance purposes.

At discharge the patient still was wheelchair bound for mobility but was able to use chairs and a firm sofa to sit in at home. He was also able to statically sit independently at the edge of his chair or bed. This was a great encouragement for the patient because that was his goal for physical therapy. He often told us of new things that he was able to accomplish at home and things he had not been able to do before physical therapy but was now doing them on a daily basis. The patient had mentioned that he was very pleased with the outcomes of Physical Therapy and that he will continue his HEP.

I did not use a clinimetric to describe the functional status of the patient. One that could have been used was the Multiple Sclerosis Quality of Life (MSQOL)-54 Instrument. This 54 question clinimetric resource has 2 summary scores, physical and mental health of the patient, and 12 subsections which help provide information on the patient's quality of life. A study done by Solari et al[21] on the validation of Italian multiple sclerosis quality of life 54 questionnaire, found it to be easy to administer, well accepted by patients, that neurological impairment had a limited influence on perceived quality of life, and that the patient's age and depressive symptoms had a major influence on the final scoring.

CHAPTER V

DISCUSSION

The results from when the patient came into physical therapy to when he was discharged looked very good, showing an increase in ROM, strength, transfer dependency, and ambulation distance. I believe that the increases in ROM were partly because of the patient and his PCA's compliance in stretching in the patient's HEP. Another aspect of the increase of ROM was the fact that we used overpressure while stretching. Three studies[22, 23, 24] all done by the same group of researchers have found affirmative findings in stretching decreasing the amount of stiffness in the lower extremity and increasing the PROM. A study done by Selles and fellow researchers[24] found that the individuals' walking speed increased and also found that individuals' voluntary maximum contraction increased, also paralleling a study done by Chung et al.[22] Stretching has been a controversial subject in its clinical application in its effectiveness. Bovend'Eerdt and colleagues[25] found that with all the available evidence the clinical benefits are inconclusive in terms of evidence going either way. More research in this topic may be needed for further evaluation of stretching for clinical relevance in terms of increasing ROM in spastic patients.

I believe the reason the patient's sitting balance increased was partially because of the time he spent in the clinic working on core strengthening to enable him to sit independently in a chair without a back or arms to rest against. This is very functional in aiding transferring from his bed to his chairs in the house. A study done to assess the effects of balance training in a person with multiple sclerosis found that a combination of motor and sensory interventions

increased both final scores in the Berg Balance Scale and the Dynamic Gait Index when compared to the scores taken before the interventions began.[6] The study also found that the group that had both interventions reported less falls than the groups with only 1 of the 2 interventions. This coincided with the treatment that the patient did using both motor and sensory aspects while sitting. The study was done with people that were walking but the results were comparatively similar in regards to balance while sitting.

I also think that doing a transfer training session before each session helped the patient break his bad habit of pulling himself to transfer from his chair to another surface. Practicing and reiterating how to safely transfer from one object to another and for getting from supine to sitting off of the edge of his bed was another way to make sure that the patient was able to start being more independent from his PCA. At the end of his treatments he was depending on her less for simple transfers and was able to do more in his home while she was away.

With more resources in the clinic the patient could have had more opportunities to do other forms of interventions. Aqua therapy is one type of intervention that could have been useful in the treatment plan for this patient. One study found that an aquatic exercise program benefited patients who suffer from MS.[8] This program was not found harmful to the patients' muscular strength and endurance. Overall the program was beneficial in changes to fatigue, work endurance, power, and muscular strength measured in force and torque.

There are many excellent studies completed in the interventions aspect for patients with early stages of MS. These studies are great for physical therapists with patients that can ambulate; but when researching for information on interventions for those patients that no longer walk, there is a limited amount of resources and information. When the field expands the

research into the chronic debilitating form of MS, it will help the physical therapists working with those individuals immensely.

Reflective Practice

Overall I thought that I learned a lot from this patient. Looking back there are things that I would not change and others that I would have liked to do differently, especially if I would have had all the resources to successfully complete the interventions. One advantage of seeing the patient in the morning hours compared to the evening hours is that patients with MS typically follow a cycle, in which they wake in morning reasonably rested but gradually fatigue throughout the day and begin to recover as they wind down in the evening.[6]

During the examination I would have taken more information in the subjective aspect to get to know the patient even better. I would have gone more in depth in his past medical history such as current and past pharmaceutical drugs, what other interventions that other physical therapists had used, and what he had thought worked and what did not work. I also would have given him the Multiple Sclerosis Quality of Life (MSQOL)-54 Instrument. This instrument would have given me more information about him to see if he needed a referral for any mental health problems that I was not able to perceive.[26] Another thing that I should have looked for during the examination was to check his deep tendon reflexes in both the upper and lower extremities, which would have allowed for the examination of involuntary muscle contractions and innervation problems.[12]

I think that the plan of care was good in terms of progression for the patient; however, I would have changed the ambulation aspect of the plan. Looking back at this case I am not sure if ambulation was really functional, at least for the distance that my clinical instructor and I had set for him in one of the goals. In the examination the patient had said that he only walked on his

deck because it was clear of clutter, whereas his house had little space to be able to walk. I do believe that standing was functional for this patient to aid in transferring from one object to another. I think that I should have spent more time on stability in sitting, endurance in standing, and increased training in a standing pivot. These changes may have increased his independence from his PCA to an even greater extent compared to his status at discharge from physical therapy.

I would also seek more information on the use of biofeedback for MS. I used it as a guide to help activate the correct muscle for short arch quadriceps lifts. One problem with this was that he was able to get to the correct level for a limited amount of times, and then I would have to turn it down so he could meet the correct level. This demonstrated his easily achieved fatigue level.

When looking at pay for performance, I would say that I did a good job in terms of cost based on outcomes. On average the cost of his treatment was about $280 for one hour and he came to physical therapy 10 times, so overall the total cost for his time in physical therapy was about $2800. He said he was happy with his treatments and thought that he was getting stronger. He achieved his goal of being able to sit more upright in a chair without a backrest or arm rests, with only a minimal degree of rounded shoulders and a forward head. He was also able to ambulate at the end of his overall session of physical therapy which was a great improvement compared to his initial examination during which he took very few steps.

This patient also helped me in my learning process as a student. Because of him I am better prepared for neurological cases and how to develop treatment plans for patients with neurological problems. He also helped me learn to progress my patients in ways that make the

patient work a little harder to achieve success and yet not make the activity too difficult to discourage the patient when the activity cannot be accomplished.

REFERENCES

1. National Multiple Sclerosis Society. Who gets MS. Available at: http://www.nationalmssociety.org/about-multiple-sclerosis/who-gets-ms/index.aspx. Date accessed April 14, 2009.

2. Compston A, Coles A. Multiple sclerosis. Lancet. 2008 Oct 25;372(9648):1502-17.

3. What is Multiple Sclerosis? Available at: http://www.mult-sclerosis.org/whatisms.html. Date accessed September 4, 2009.

4. Lublin FD, Reingold SC. Defining the clinical course of multiple sclerosis: results of an international survey. National Multiple Sclerosis Society (USA) Advisory Committee on Clinical Trials of New Agents in Multiple Sclerosis. *Neurology*. 1996;46(4):907–911.

5. van den Berg M, Dawes H, Wade DT, et al. Treadmill training for individuals with multiple sclerosis: a pilot randomised trial. *J Neurol Neurosurg Psychiatry*. 2006; 77(4):531-533.

6. Cattaneo D, Jonsdottir J, Zocchi M, Regola A. Effects of balance exercises on people with multiple sclerosis: a pilot study. *Clin Rehabil.* 2007;21(9):771–781.

7. Rampello A, Franceschini M, Piepoli M, et al. Effect of aerobic training on walking capacity and maximal exercise tolerance in patients with multiple sclerosis: a randomized crossover controlled study. *Phys Ther*. 2007;87(5):545-555.

8. Gehlsen GM, Grigsby SA, Winant DM. Effects of an aquatic fitness program on the muscular strength and endurance of patients with multiple sclerosis. *Phys Ther.* 1984; 64(5):653-657.

9. Magee DJ. Orthopedic Physical Assessment. 5th ed. St. Louis, MO: Saunders. 2008. Chapters 11-13.

10. Reese NB. Muscle and Sensory Testing. 2nd ed. St. Louis, MO: Saunders. 2005.

11. Zorowitz R, Leffler J, Murray C. Spasticity: A Clinical Review. *MedscapeCME*. 2008.

12. Moore K, Dalley A. Clinically Oriented Anatomy. 5th ed. Philadelphia, PA: Lippincott Williams & Wilkins. 2006:585.

13. Rodgers M, Mulcare J, King D, et al. Gait characteristics of individuals with multiple sclerosis before and after a 6-month aerobic training program. *J Rehabil Res Dev.* 1999;36(3):183-188.

14. American Physical Therapy Association. Guide to Physical Therapy Practice : Chapter 3 Preferred Practice Patterns: Neuromuscular. Alexandria, VA, American Physical Therapy Association. 2001;383-392.

15. Weinshenker B, Bass B, Rice G, et al. The natural history of multiple sclerosis: a geographically based study: predictive value of the early clinical course. *Brain* 1989;112(Pt 6):1419-1428.

16. Kisner C, Colby LA. Therapeutic Exercise-Foundations and Techniques. 5th ed. Philadelphia, PA: FA Davis Co. 2007:65-104.

17. Petajan J, White A. Recommendations for physical activity in patients with multiple sclerosis. *Sports Med*. 1999;27(3):179-91.

18. Sinkjaer T, Toft E, Larsen K, Andreassen S, Hansen HJ. Non-Reflex and Reflex Mediated Ankle Joint Stiffness in Multiple Sclerosis Patients with Spasticity. *Muscle Nerve*. 1993;16(1):69-76.

19. O'Sullivan SB, Schmitz TJ. Physical Rehabilitation Laboratory Manual. Philadelphia, PA: FA Davis Co. 1999.

20. Davis PM. Steps to Follow: The Comprehensive Treatment of Patients with Hemiplegia. 2nd ed. Berlin, Germany: Springer-Verlag Berlin Heidelberg. 2000.

21. Solari A, Filippini G, Mendozzi L, et al. Validation of Italian multiple sclerosis quality of life 54 questionnaire. *J Neurol Neurosurg Psychiatry.* 1999;67(2):158-162.

22. Chung S, Bai Z, Rymer WZ, Zhang LQ. Changes of reflex, non-reflex and torque generation properties of spastic ankle plantar flexors induced by intelligent stretching. *Conf Proc IEEE Eng Med Biol Soc.* 2005;4:3672-3675.

23. Zhang LQ, Chung SG, Bai Z, et al. Intelligent stretching of ankle joints with contracture/spasticity. *IEEE Trans Neural Syst Rehabil Eng.* 2002;10:149-157.

24. Selles RW, Li X, Lin F, Chung SG, Roth EJ, Zhang LQ. Feedback-controlled and programmed stretching of the ankle plantarflexors and dorsiflexors in stroke: effects of a 4-week intervention program. *Arch Phys Med Rehabil.* 2005;86(12):2330-2336.

25. Bovend'Eerdt TJ, Newman M, Barker K, Dawes H, Minelli C, Wade DT. The effects of stretching in spasticity: a systematic review. *Arch Phys Med Rehabil.* 2008;89(7):1395-1406.

26. O'Sullivan SB, Cullen KE, Schmitz TJ. Physical Rehabilitation: Evaluation and Treatment Procedures. Philadelphia, PA, FA Davis Co. 1981;249-257.