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TITLE PAGE

A 6 Week Balance and Gait Training Program Using the AlterG for a Patient With Cervical Myelopathy After Spinal Decompression Surgery: A Case Report

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The patient signed a consent form, allowing the use of medical information, videos, and pictures for this case report. The patient received information regarding the institution's policies and the Health Insurance Portability and Accountability Act.

Key Words: Balance, Gait, AlterG, Cervical Stenosis with Myelopathy

ABSTRACT

Background and Purpose: Spinal stenosis is the narrowing of the spinal canal, which can cause radicular symptoms due to compression of the spinal cord. About 80% of patients over 70 years old have some level of stenosis. Patients with severe types of cervical stenosis may require operative management which includes spinal decompression and fusion. In this case report the AlterG was used to perform a balance and gait training program for a patient who had significant loss of strength and functional mobility after spinal decompression surgery.

Case Description: The patient was an 83-year-old male who was a retired farmer that lived with his wife. After multiple visits to the hospitals and complications; the patient was diagnosed with cervical stenosis with myelopathy affecting his bilateral upper and lower extremities equally. He underwent C4 corpectomy with C3-C5 anterior fusion and posterior cervical laminectomy in October 2017.

Outcomes: The Six-Minute Walk Test improved from 185.62 meters to 264.26 meters with the use of a rolling walker. The Berg Balance Test improved from 28/56 to 35/56. The 30 Second Chair Stand Test improved from 6 total stands to 8 total stands.

Discussion: The patient's functional mobility and functional outcome scores improved. This rehabilitation program focused primarily on gait and balance training with the use of the AlterG. Future research should look at a patient population with the use of the AlterG having the effects on gait and balance specifically to geriatric patients who have had cervical myelopathy.

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INTRODUCTION/BACKGROUND AND PURPOSE

Spinal stenosis is the narrowing of the spinal canal that can cause radicular symptoms due to compression of the spinal cord.[1] Spinal stenosis can involve the cervical, thoracic, or lumbar regions and can be multi-segmental or mono-segmental. With cervical and thoracic spinal stenosis, the spinal cord is compressed which can result in radiculopathy, myelopathy or myeloradiculopathy.[1] Cervical spondylotic myelopathy is the most common cause of spinal cord dysfunction for those patients older than 50 years old.[1] Eighty percent of patients over 70 years of age have some form of stenotic involvement.[1]

Surgery is performed in 3-11.5 cases per 100,000 each year. The most common indications for surgery are in patients older than 65 years, progressive myelopathy and severe pain. Many patients with milder forms of cervical stenosis non-operative management that-consists of physical therapy and exercise. Patients with severe types of cervical stenosis require operative management which includes spinal decompression and can be performed in three different ways. One is the anterior approach, which consists of discectomy or corpectomy and removal of osteophytes and then internally fixated by a cervical plate.[1] The second method is the posterior approach which is more commonly used because it provides more decompression compared to the anterior approach; the posterior approach consists of laminoplasty or laminectomy.[1] The third method is a combined approach where the anterior portion is completed first and then the posterior. Complications may include hematoma, iatrogenic instability, dural laceration, and deep venous thrombosis.[1]

One systematic reviewed the role of postoperative physical therapy (PT) treatment in degenerative cervical myelopathy. It consisted of 300 records that looked at physical therapy after patients received spinal decompression surgery.[2] This systematic review had insufficient evidence on postoperative PT but did suggest postoperative PT as a potential benefit for patients

to improve their functional status.

AlterG treadmill (AlterG Anti-Gravity Treadmill M320 / F320, Fremont, CA) is an antigravity treadmill that was used in this case report with other balance exercises. The AlterG is categorized as a body weight support system for the patient to ambulate. The purpose of this case report was to implement balance and gait training program on the AlterG in a geriatric patient with cervical stenosis and myelopathy who underwent spinal decompression surgery.

PATIENT HISTORY AND SYSTEMS REVIEW

The patient was an 83-year-old male who was a retired farmer and lived with his wife. The patient was referred to an outpatient rehabilitation clinic in August 2017 following a right hip replacement in 2016, complicated by multiple hospital visits secondary to numerous illnesses. The patient complained of numbness and tingling in his upper extremities (UE) and lower extremities (LE) and referred to physical therapy diagnosed with chronic neuropathy. His primary complaints were difficulty with walking, performing daily activities and loss of function of his UE and LE. The physical therapist noticed a decline with the patient's functional mobility, coordination, and gait pattern. The patient reported he had fallen, and the physical therapist referred the patient to a neurologist. The patient was diagnosed with cervical stenosis with myelopathy affecting his UE and LE equally; he underwent C4 corpectomy with C3-C5 anterior fusion and posterior cervical laminectomy and instrumented fusion in October 2017.

Once medically stable, the doctor referred the patient back to outpatient rehabilitation in February 2018. The patient regained strength in his UE and LE, but one major complaint the patient had was that he still had numbness and tingling in bilateral UE. The patient reported he was unable to walk with his cane and used the rolling walker (RW) to ambulate with minimal

assistance (MinA) only in his home. He primarily used a wheelchair as his primary way of mobility in the house and the community.

The patient had good family support from his children who live separately but are there to assist the parents. The patient does not drive, and his daughter assists with most of the outdoor activities and to appointments. The patient's list of medications is represented in Table 1. His past medical history includes arthritis, blood clots, bone fractures, Chronic Obstructive Pulmonary Disease (COPD), shortness of breath, elevated blood pressure, and implantable cardioverter defibrillator (ICD). The patients past surgical history consisted of left, right total hip replacement, spinal decompression surgery. His primary goals for physical therapy were to improve ambulation and improve overall functional mobility. Table 2 represents the results of the systems review performed on the re-evaluation day. Fracture, spondylolysis/ spondylolisthesis, or re-occurrence of stenosis with myelopathy at different segments of the spine were all considered for differential diagnoses. The plan for examination was to assess patient's functional mobility, LE strength, LE range of motion (ROM), gait, and balance. The patient received physical therapy and occupational therapy services. Upon re-examination, the patient gave written and verbal consent to participate in this case study. The patient was a good candidate for a case report due to very little evidence with interventions based on the AlterG and due to the patient's limited functional mobility and decreased balance.

EXAMINATION – TESTS AND MEASURES

The initial evaluation was performed by another physical therapist, and this examination was a re-evaluation that consisted of all parts performed in the initial evaluation. The examination started with bilateral passive ROM (PROM) of the patient's LE, manual muscle testing (MMT), light touch sensation, deep tendon reflexes of the patella and the Achilles. The

patient's LE strength of hip, knee, and ankle were bilaterally equally reduced to 3+/5. His LE PROM of hip, knee, and ankle were within functional limits (WFL). Deep tendon reflexes were 2+ normal. Light touch sensation from C2-T2 and L1-S2 were unimpaired, and he was able to verbalize location of light touch with eyes closed (Table 3).

The patient's functional mobility such as transfers from wheelchair to chair/ matt and sit to stands were assessed and the patient required MinA. A gait assessment was performed, and the patient presented with a toe out gait pattern and walked with knocked knees. The patient heavily used his UE on the rolling walker to help support himself upright. During the 6 Minute Walk Test (6MWT), and he walked with a rolling walker and required CtgA and later in the test required MinA. His right knee buckled three times during the 6MWT (Table 3). The 6 MWT assessed aerobic capacity and gait.[3] The 6MWT is a test that is standardized for patients with COPD and the geriatric population; it also has good sensitivity and specificity. [3]

A Berg Balance Scale was completed to assess the risk of falls. He scored a 28/56 which is indicative of a high risk of falling. A score under 45/56 is indicative of a patient to fall, and a score under 40/56 is indicative of 100% at fall risk.[4] This was used to assess the patient's functional mobility and non-vestibular balance.[4]

Lastly, the 30 Second Chair Stand Test was completed. This test evaluated functional LE strength in the geriatric population.[5] The patient was not able to perform this test without bilateral UE assist; therefore, this test was modified, and the patient did use both UE. The male geriatric population between the ages of 80-84 years old who are moderately active should score between 10-15 number of stands.[5] The patient had six stands within the 30 seconds, well below the range.

CLINICAL IMPRESSION 2: EVALUATION, DIAGNOSIS, PROGNOSIS

The findings from the re-examination were consistent with the patient's diagnosis of status post spinal decompression from the cervical stenosis with myelopathy. The patient's impairments included reduced strength, endurance, and balance that affected functional mobility and gait. Due to the decrease in the patient's functional mobility and after re-examination findings, the patient demonstrated the need for skilled physical therapy services. The patient was appropriate for this case report due to his motivation, great family support, and complicated medical history. Based on the International Classification of Diseases Ten (ICD-10 code) chosen for the patient's medical diagnosis was M99.41 which was described as connective tissue stenosis of neural canal of the cervical region.[6] The ICD-10 code for physical therapy diagnosis selected for this patient was R26.89 which was described as other abnormalities of gait and mobility.[7]

The patients who are diagnosed with cervical myelopathy and who received spinal decompression surgery have limited research on prognosis. One systematic review looked at different evidence to investigate if there was a significant role for postoperative physical therapy for patients with degenerative cervical myelopathy.[2] This review that suggested rehabilitation which included that physical therapy improved postoperative recovery.[2] Although this study favored physical therapy for postoperative rehabilitation, the study was a low-quality study due to low sample size, no comparative group, and the study was a retrospective study.[2] Although the patient had a complex medical history, he made strength gains quickly right after surgery and gained back function of his UE and LE after the surgery. Many patients may not be able to increase gains of functional mobility or strength post-surgery dependent upon nerve damage, and it was also said that the spinal decompression surgery prevents the progression of impairments.[1]

The plan for intervention for this patient was two physical therapy sessions per week for

six weeks. Each treatment session lasted for 60 minutes. There were no plans for referral at that time, and the patient's primary care doctor and the orthopedic doctor were consulted when needed for any complications or setbacks. The intervention consisted of balance exercises and gait training on the AlterG. Overground gait training and therapeutic strength exercises were added towards the end of each session. The patient was re-evaluated at the end of the sixth week of this program. The short and long-term goals were made to monitor the patient's progress, listed in Table 4.

INTERVENTION AND PLAN OF CARE

Coordination, Communication, Documentation

Therapy included coordination with the patient's primary care physician (PCP) who referred the patient for physical therapy. The plan of care and progress notes were faxed to the PCP every 30 days. The patient concurrently received occupational therapy services and care was coordinated with PT. His re-examination and subsequent treatments were documented utilizing a paper chart system. The patient was compliant with all physical therapy appointments.

Patient/Client Related Instruction

The patient was educated about the results of the re-examination, the expectations for physical therapy, goals and the anticipated plan of care moving forward with PT. A home exercise program (HEP) was provided and demonstrated. Verbal cues were provided while the patient completed each exercise. A printed handout was given to the patient that contained instructions, pictures, duration, and repetition of each exercise as seen in Table 6.

Procedural Interventions

The patient was scheduled 60-minute appointments two times per week for six weeks. There were two appointments scheduled that were only 30-minute appointments, and the patient was unable to attend the third week due to personal reasons. Majority of the interventions each

week consisted of balance exercises, gait training in the AlterG, and overground gait training with his rolling walker. The goals of this program were to improve his balance, gait, decrease risk his risk for falls, and help minimize the level of assistance needed for ambulation.

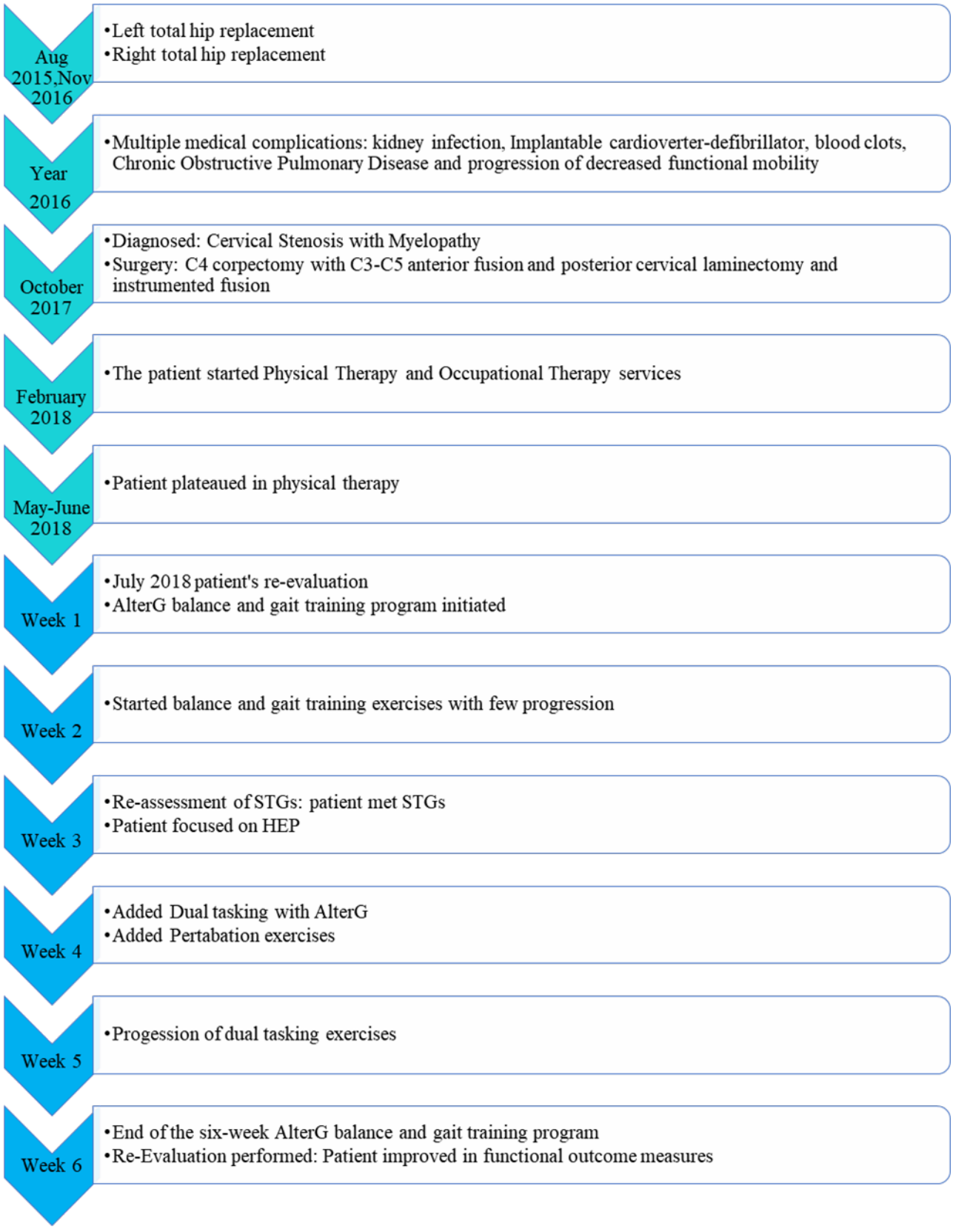
Weekly interventions consisted of gait training and balance exercises in the AlterG treadmill and on land. The activities performed in the AlterG were; single leg stance (SLS), tandem walking, walking with a cup of water in one hand, multitasking utilizing cognitive tasks, and dynamic reaching activities while the patient was walking. After the patient performed various exercises in the AlterG treadmill; overground gait training was performed to see the carryover effects. Following AlterG and overground gait training, balance exercises in the parallel bars were performed, and general LE therapeutic strengthening exercises to ensure the patient was making LE strength gains. The daily interventions are listed in Table 5 and the description with picture illustration are represented in Appendix A.

There was little evidence to support the use of the AlterG in patients with cervical myelopathy. There have been many studies performed on the body weight support system with treadmill walking but not the AlterG treadmill.[8,9,10,11] The concept of a body weight support system and the AlterG treadmill is very similar in that it unloads the patient's body weight and assists with ambulation. One study performed on patients who had hemiparesis resulted in improving gait and had a significant improvement with balance training due to the prolonged single stance period from partial body weight support system on the treadmill.[12] Improvement in balance was important for this patient because he had three falls in the past year and his Berg Balance score was low. Balance training along with therapeutic exercises was indicated for this patient to improve gait and reduce the risk of falls. Another review looked at six systematic reviews and one randomized control trial, and it supported a HEP program provided by physical therapists and Tai Chi, or other challenging balance exercises help reduce the risk of falls.[13] The

patient in this case study was provided with a HEP and performed challenging balance exercises during every PT session.

AlterG treadmill can be categorized with the body weight support system where patients can ambulate with partial body weight unloaded. This treadmill was patented with Differential Air Pressure (DAP) technology and was developed for NASA.[14] With the DAP technology the patient can walk in the chamber that surrounds the treadmill and has a cockpit that allows extra trunk support for those patients who need it.[14] This anti-gravity treadmill calibrates and configures patients body weight (BW) and starts the patient at their 100% body weight.[14] This is reduced depending on the level of assistance the patient requires. For example, if the patient were to ambulate with 60% as the set BW, this defines that the patient is capable of ambulating with 60% of his BW and 40% of his BW is unloaded.[14]

TIMELINE


Aug 2015,Nov 2016
•Left total hip replacement
•Right total hip replacement
Year 2016
•Multiple medical complications: kidney infection, Implantable cardioverter-defibrillator, blood clots, Chronic Obstructive Pulmonary Disease and progression of decreased functional mobility
October 2017
•Diagnosed: Cervical Stenosis with Myelopathy
•Surgery: C4 corpectomy with C3-C5 anterior fusion and posterior cervical laminectomy and instrumented fusion
February 2018
•The patient started Physical Therapy and Occupational Therapy services
May-June 2018
•Patient plateaued in physical therapy
Week 1
•July 2018 patient's re-evaluation
•AlterG balance and gait training program initiated
Week 2
•Started balance and gait training exercises with few progression
Week 3
•Re-assessment of STGs: patient met STGs
•Patient focused on HEP
Week 4
•Added Dual tasking with AlterG
•Added Pertabation exercises
Week 5
•Progession of dual tasking exercises
Week 6
•End of the six-week AlterG balance and gait training program
•Re-Evaluation performed: Patient improved in functional outcome measures

OUTCOMES

Six weeks of balance and gait training with the use of the AlterG resulted in improvements compared to the objectives on the initial evaluation. The patient was adherent to the six-week training program and tolerated the AlterG training without adverse reactions. Prior to this, the patient completed approximately five months of therapy and plateaued in progress. In six weeks, the patient's score on the Berg Balance Test improved seven points from 28/56 to 35/56. The patient's 6MWT improved 78.63 meters from 185.62 meters to 264.26 meters; requiring CtgA with RW and two standing breaks. The 30 Second Chair Stand Test was modified, and the patient required UE assistance; patient improved from six full stands to eight full stands but did not meet his LTG which was to preform 10 or more stands. Research suggests for the male geriatric population between the ages of 80-84 years old should complete between 10-15 number of stands.[5]

The patient's gait was re-assessed and there was a reduction in toe-out gait. He relied less on his RW to maintain an upright posture, and there was no sign of knocked knees with ambulation. The patient improved on functional outcome measures, which are shown in Table 3. The patient continued physical therapy beyond the duration of this case report to further improve his balance, gait, and strength. Towards the end of the program the patient required CtgA or ClS with majority of the transfers and ambulation.

DISCUSSION

This case study described a six-week balance and gait training course of a patient with cervical stenosis with myelopathy status post spinal decompression surgery. The purpose of the case study was to implement balance training and gait training with the use of the AlterG in a patient who underwent spinal decompression surgery. Factors that may have contributed positively to his outcomes included his motivation, the interventions, his attendance to physical

therapy sessions, and compliance with HEP. Factors that may have negatively affected his outcomes included age[1] and continued numbness and tingling with B/L UE.

During the re-evaluation the patient's knee buckled multiple times primarily when he ambulated long distances. As he progressed through the six weeks, he reduced knee buckling during the therapy sessions. Towards the end of the six weeks, the patient had not once buckled during gait training when he walked further distances. The patient's primary goals were to be able to ambulate safely in his own home and improve his overall functional mobility to be able to feel safe and go to his barn. After completion of the six-week program, the patient was able to ambulate with CtgA with distances longer than 91.44 meters-121.92 meters and only required supervision when ambulating under 60.96 meters. The patient noticed a significant amount of improvement with his gait and felt safer in his own home. He has started to ambulate more in the community when he was with his family. The patient improved on transfers where he only required close supervision. The patient was able to increase independence in his own home. He continued physical therapy after the six-week program. To continue to address gait and balance training with the use of the AlterG.

The patient met his STGs during week three and met all LTGs except for the 30 Second Chair Stand Test. Majority of the interventions focused on gait and balance training for the six weeks. Currently there is little evidence to the support the use of the AlterG to show efficacy it has on gait and balance for a patient with cervical myelopathy. One study that used the anti-gravity treadmill on patients diagnosed with muscular dystrophy, showed an improvement in their dynamic balance that was tested by using a force platform.[15] The study also performed a 6MWT, and all the patients participating in the study showed improvement in their distance.[15]

Many patients with severe cervical stenosis and who have undergone a spinal decompression surgery do not regain function that was lost.[1] Considering patient's age,

comorbidities, and multiple stays in the hospital the patient was able to regain functional mobility and made substantial improvement during the six weeks of therapy compared to prior physical therapy sessions. Future research should look at the use of the AlterG and its effects on gait and balance specifically to geriatric patients who have had cervical myelopathy.

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TABLES AND FIGURES

Table 1: Patient's Medication List

Metoprolol 100 mg	High blood pressure
Baby Aspirin 81mg	For preventing blood clots
Lisinopril 2.5mg	High blood pressure
Vitamin B-12 100mg	For Vitamin B-12 deficiency
Warfarin 5mg	Blood thinner
Symbicort	COPD
Spireva- 2 puffs	COPD
Albuterol- as needed	For Wheezing and SOB

Mg: milligram, COPD: Chronic Obstructive Pulmonary Disease, SOB: shortness of breath

Table 2: Systems Review

Cardiovascular/Pulmonary	Shortness of breath with moderate leveled activities such as ambulation
Musculoskeletal	Impaired strength- all LE strength 3+/5 bilaterally
Neuromuscular	Unimpaired
Integumentary	Unimpaired: the incision from surgical site are healed
Communication	The patient used hearing aids, without hearing aids the patient had a difficult time hearing the therapist.
Affect, Cognition, Language, Learning Style	Unimpaired

LE: Lower Extremities

Table 3: Examination

Tests & Measures	Re-Evaluation Results (Week 1)	Re-Evaluation Results (Week 6)
LE PROM	All ranges were WFL	All ranges were WFL
LE MMT	The patient's strength was bilaterally equal +3/5	The patient's strength was bilaterally equal - 4/5
Deep Tendon Reflexes - Patella - Achilles	2+ (normal)	2+ (normal)
Light touch sensation C2- T2 and L1-S2	Sensation was normal, and patient was able to verbalize location of light touch	Sensation was normal, and patient was able to verbalize location of light touch

Functional mobility - Supine to Sit and Sit to Supine - Wheelchair mobility - Transfers	 - MinA - Independent, propelled with feet - MinA	 - ClS - Independent, propelled with feet - ClS
Gait assessment	- Toe out gait pattern - Walked with knocked knees - Heavily used UE assistance on the rolling walker to keep upright position	- Improved gait with symmetrical gait pattern - No knocked knees or toe out gait pattern - Patient relied less on the RW and was able to maintain an upright posture independently with his trunk support.
6MWT	CtgA/MinA with rolling walker 1 seated rest break Total distance: 185.62 meters	CtgA with rolling walker 2 standing rest breaks Total distance: 264.26 meters
Berg Balance Scale	28/56 (High fall risk)	35/56 (High fall risk)
30 Second Chair Stand Test	6 total stands	8 total stands

LE: lower extremities, PROM: passive range of motion, WFL: within functional limits, MMT: manual muscle testing, MinA: minimal assistance, 6MWT: Six Minute Walk Test, ClS: close supervision, CtgA: contact guard assist

Table 4: Physical Therapy Goals

Short Term Goals (within third week of the program)	**Long Term Goals (6th week re-evaluation)**
Improve bilateral LE strength MMT to ≥ -4/5	Improve 30 Second Chair Stand score ≥ 10 stands
Decrease amount of assistance needed with transfers or other functional mobility to contact guard assist (CtgA)	Improve Berg Balance Score ≥ 35/56
Improve gait pattern: reduce toe out walking gait pattern and reduce knocked knee with gait.	Improve 6MWT: CtgA with rolling walker ≥213.36 meters

MMT: manual muscle testing, CtgA: contact guard assist, 6MWT: Six Minute Walk Test

Table 5: Daily Interventions

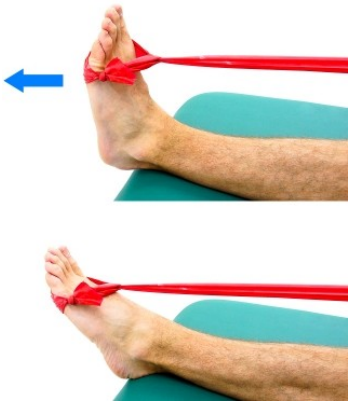
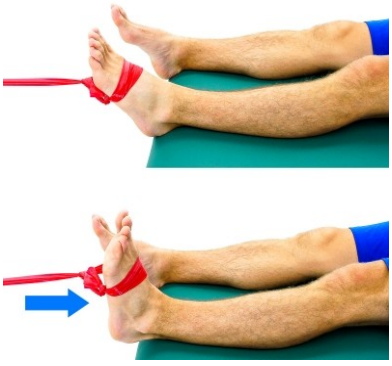
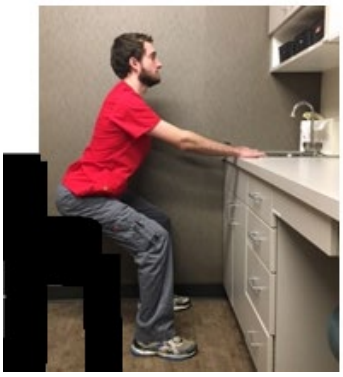
	Day 1	Day 2	Day 3	Day 4	Week 3 (days 5 & 6)	Day 7
Intervention 1	AlterG treadmill: AMB Cockpit level 10 Time: 10 minutes BW: 65% → 70% Speed: 1.0-1.2mph	AlterG treadmill AMB: Cockpit level 10 Time: 7 minutes BW: 65% → 70% Speed: 1.0-1.2mph	AlterG treadmill AMB: Cockpit level 10 Time 10 minutes BW: 65% → 70% Speed: 1.2mph	30 min apt: Exercises were demonstrated, and patient performed exercises with good technique. Handout was provided, please see Table 6 for more details. Assessed patient's STGs; patient met all STGs.	Due to Holiday week and patient had personal reasons and was not able to attend PT this week. HEP was emphasized the week prior.	30 minute apt: Over ground gait training: CtgA with RW Time: 10 minutes Patient required 2 seated rest breaks.
Intervention 2	SLS in AlterG: Right: 15sec, 40sec Left: 30 sec, 40 sec	Tandem Walking in AlterG: Speed: 0.3mph Time: 1 minute	SLS in AlterG: Right: 45 sec, 1 minute Left: 35 sec, 1 minute			Tandem walking in parallel bars without UE support: 3x6 reps
Intervention 3	Over ground gait training: CtgA/ MinA with RW for 111.55 meters	Walking with half cup of water in Right hand while in AlterG: Time: 2 minutes Speed: 1.0mph	Tandem walking in AlterG: Speed: 0.3 mph Time: 1 minute			Ball toss with beach ball at parallel bars: 60 reps
Intervention 4	Ball Taps with beach ball at parallel bars: 53 reps CtgA/ MinA	SLS in AlterG: Right: 1-minute x 2 Left: 20sec, 1 minute	Over ground walking: CtgA with RW for 108.20 meters			SLS in parallel bar attempted without UE support: Right: 3 sec, 5 sec, 10 sec Left: 4 sec, 7 sec, 11 sec
Intervention 5	SLS in parallel bars: had a difficulty lifting foot, was able to perform 3 sec bilaterally.	Heel raises in AlterG: 2x10 reps	Seated leg press: 40 pounds 3x10 reps			STS at mat: 3x10 reps without UE assist
Intervention 6		Overground walking: 94.79 meters ClS with RW	Step ups over 6-inch step: Bilateral 3x10			
Intervention 7		STS at parallel bars: 1x5 reps with no UE assist 2x7 reps with UE assist				

	Day 8	**Day 9**	**Day 10**	**Day 11**	**Day 12**
Intervention 1	AlterG treadmill: AMB Cockpit level 10 Time: 10 minutes BW: 70% Speed: 1.0 mph	AlterG treadmill AMB: Cockpit level 9 Time: 7 minutes BW: 70% Speed: 1.0-1.2mph	AlterG treadmill AMB: Cockpit level 9 Time: 5 minutes BW: 72% Speed: 1.0-1.2mph	AlterG treadmill AMB: Cockpit level 9 Time: 5 minutes BW: 75%-77% Speed: 1.5 mph	Re- Evaluation-performed: Berg Balance Test, 30 Second Chair Stand score, 6MWT, Strength, and assessed functional mobility.
Intervention 2	Dual tasking: walking in AlterG while holding a cup of water. Speed: 0.8 mph R: 2.5 minutes L: 2.5 minutes	Dual tasking: walking in AlterG while holding a cup of water. Speed: 1.0 mph R: 2.5 minutes L: 2.5 minutes	Dual tasking: fast pace walking in AlterG while counting backwards from 70, stating months and days backwards Time: 5 minutes	Dual tasking: counting backwards from 100, stating months and days backwards while ambulating in AlterG Time; 4 minutes Speed: 1.0 mph	Patient attempted to walk without RW and held onto a hand on each side for balance. Patient ambulated 204.52 meters in 10 minutes with 3 standing rests.
Intervention 3	Tandem walking in AlterG: Speed: 0.6mph Time: 3 minutes	Dual tasking: counting backwards from 50, stating months and days backwards while ambulating in AlterG Time; 3 minutes Speed: 1.0 mph	Dynamic reaching across midline for rings and ambulating in AlterG 2x 12rings Time: 5 minutes Speed: 1.2mph	Dynamic reaching across midline for rings and ambulating in AlterG 2x 12 rings Time: 5 minutes Speed: 1.2mph	
Intervention 4	SLS in AlterG: Right: 30 sec x 2 Left: 30 sec x 2	SLS in AlterG: Right: 30 sec x 2 Left: 30 sec x 2	Tandem walking in AlterG 1.0mph Time: 3 minutes	Dual tasking: walking in AlterG while holding 2 cups of water in each hand. Speed: 1.0 mph Time: 3 minutes	
Intervention 5	Fast Paced walking in AlterG Speed: 1.3-1.5mph Time: 5 minutes	Fast Paced walking in AlterG Speed: 1.5mph Time: 5 minutes	Over ground gait training: CtgA with RW for 139.29 meters Time: 4 minutes	Tandem walking in AlterG Speed: 1.1mph Time: 3 minutes	
Intervention 6	Over ground gait training: CtgA with RW for 6 minutes, Patient ambulated 190.19 meters and required 2 standing rests breaks.	Over ground gait training: CtgA with RW for 222.80 meters Time: 7 minutes 2 standing rests	SLS at parallel bar: R: 10 sec x 1 L: 11 sec x 1	Over ground gait training: CtgA with RW for 4 minutes. Time: 6 minutes 2 standing rests	
Intervention 7	RTB Perturbations at parallel bar, patients' feet together and therapist tug TB while patient keeps balance Time: 2 minutes	Perturbations at parallel bar when walking without UE support. 3X3	Ball toss with beach ball at parallel bars: 60 reps	RTB Perturbations at parallel bar, patients' feet together and PT tug TB while patient keeps balance Time: 3 minutes	

Apt: appointment, AMB: ambulation, SLS: single leg stance, STS: sit to stands, CtgA: contact guard assist, MinA: minimal assistance, ClS: close supervision, RW: rolling walker, UE: upper extremities, RTB: red TheraBand (TheraBand, Akron, OH), YTB: yellow TheraBand, BW: body weight, TB: TheraBand, sec: seconds

Table 6: Home Exercise Program[16]

Intervention	Sets, Repetitions, Timing	Picture
Seated Clamshells with TheraBand: Have a seat in a chair with no armrests and wrap a TheraBand around your knees. Move both knees to the sides to separate your legs and make sure your feet are on the floor when performing this exercise.	Repeat 10 Times Complete 3 Sets	
Seated Marching: Have a seat in a chair and lift your foot and knee, then set it down. Alternate and perform with the other leg.	Repeat 10 Times Complete 3 Sets	
Bridging: Lie down on your back, tighten your abs and squeeze your buttocks and lift your buttocks off the bed just as if your creating a "bridge" with your body. Hold for 1 second and then lower your buttocks slowly. Make sure to put a folded pillow in between your knees.	Repeat 5 Times Complete 3 Sets Hold 1 second	 
Straight Leg Raise: Point the toes towards your face. Lie down on your back and raise your leg with your knee straight. Make sure you keep your opposite knee bent, and when raising your leg, it should not go past the opposite knee.	Repeat 10 Times Complete 3 Sets	

<u>Supine Ankle Plantarflexion with TheraBand:</u> Perform this exercise lying down on your back. Tie a TheraBand above the middle of your foot but below the toes. Next, hold onto the band making sure there is resistance in the band and point your foot down just as if you were pressing down on a gas pedal of a car. Return to starting position and repeat.	Repeat 10 Times Complete 3 Sets	
<u>Supine Ankle Dorsiflexion with TheraBand:</u> Perform this exercise lying down on your back. Tie a TheraBand above the middle of your foot but below the toes. Have a family member hold the end of the band and make sure there is some tension on it. Once there is some tension, move your ankle so that your foot is pointing towards the ceiling. Return to starting position and repeat.	Repeat 10 Times Complete 3 Sets	
<u>Sit to stands at countertop:</u> Stand towards your kitchen countertop sink and have your feet shoulder-width apart. Hold onto the countertop for support and slowly lower your hips into the chair. Make sure you bend your knees and do not allow knees to travel forward over toes. Your body weight should be through your heels. Return to a standing position.	Repeat 10 Times Complete 3 Sets	

APPENDICES

Appendix A: Intervention Description with Picture Illustrations

Intervention Description:	Picture Illustration:
AlterG: This is a picture of the anti-gravity treadmill. The next picture demonstrates the patient ambulating in the AlterG.	 

Static Perturbation Exercise: Patient stands with feet touching together. The patient holds onto a TheraBand and patient requires to maintain his balance while the TheraBand is being pulled on from the other end in multiple directions. Another therapist is guarding in case the patient loses his balance.	 
Dynamic Perturbation Exercise: Patient is walking in the parallel bars while a therapist is guarding the patient. Another therapist has a yellow TheraBand around patients' trunk and is applying multidirectional perturbations.	 

Dual tasking with 2 cups of water: While the patient is ambulating in the AlterG, he was also able to hold two cups of water; one in each hand.	
Dual tasking with rings: These pictures demonstrate the patient reaching across midline for the ring and placing it on the other side while he is still ambulating in the AlterG.	 

CARE CHECKLIST

CARE Content Area	Page
1. **Title** – The area of focus and "case report" should appear in the title	2
2. **Key Words** – Two to five key words that identify topics in this case report	2
3. **Abstract** – (structure or unstructured) a. Introduction – What is unique and why is it important? b. The patient's main concerns and important clinical findings. c. The main diagnoses, interventions, and outcomes. d. Conclusion—What are one or more "take-away" lessons?	3
4. **Introduction** – Briefly summarize why this case is unique with medical literature references.	4
5. **Patient Information** a. De-identified demographic and other patient information. b. Main concerns and symptoms of the patient. c. Medical, family, and psychosocial history including genetic information. d. Relevant past interventions and their outcomes.	5
6. **Clinical Findings** – Relevant physical examination (PE) and other clinical findings	6
7. **Timeline** – Relevant data from this episode of care organized as a timeline (figure or table).	12
8. **Diagnostic Assessment** a. Diagnostic methods (PE, laboratory testing, imaging, surveys). b. Diagnostic challenges. c. Diagnostic reasoning including differential diagnosis. d. Prognostic characteristics when applicable.	8
9. **Therapeutic Intervention** a. Types of intervention (pharmacologic, surgical, preventive). b. Administration of intervention (dosage, strength, duration). c. Changes in the interventions with explanations.	9
10. **Follow-up and Outcomes** a. Clinician and patient-assessed outcomes when appropriate. b. Important follow-up diagnostic and other test results. c. Intervention adherence and tolerability (how was this assessed)? d. Adverse and unanticipated events.	13
11. **Discussion** a. Strengths and limitations in your approach to this case. b. Discussion of the relevant medical literature. c. The rationale for your conclusions. d. The primary "take-away" lessons from this case report.	13
12. **Patient Perspective** – The patient can share their perspective on their case.	14
13. **Informed Consent** – The patient should give informed consent.	2