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Strength And Balance Training For A 29-Year-Old Female Who Sustained A Multifocal Stroke: A Case Report

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Strength and Balance Training for a 29-Year-Old Female Who Sustained a Multifocal Stroke: A Case Report.

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The patient signed a consent form allowing for use of medical information and her picture taken for use of this case report. She was informed on the school's policies regarding the Health Insurance Portability and Accountability Act.

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ABSTRACT

Background and Purpose: While balance and strengthening are standard interventions for older patients who have sustained a stroke, there is very limited research on the most effective physical therapy rehabilitation for a young female who recently suffered a stroke. Therefore, the purpose of this case report was to investigate a comprehensive physical therapy program that included balance and strength training for a young female who recently sustained a multifocal stroke.

Case description: The patient was a 29-year-old female who sustained a multifocal stroke in her left parietal, left frontal, and bilateral occipital lobes. She presented with right lower extremity weakness and numbness, and poor balance. Her plan of care included patient education, home exercise program, LE strengthening, and balance training. Outcome measures included Lower Extremity Functional Scale (LEFS), manual muscle testing (MMT), single limb stance, and dermatome sensitivity testing.

Outcomes: Improvements were noted in her progress note during her 5th week. Lower Extremity Functional Scale improved (31/80 to 50/80). General hip strength improved (3+/5 to 4/5). Knee extension improved (4-/5 to 4+/5). Single limb stance on right foot improved from unable to perform to 30 seconds. Dermatome sensation improved at L3 from complete numbness to normal sensation.

Discussion: A comprehensive physical therapy program that included balance and strength training was beneficial for a 29-year-old patient who had sustained a multifocal stroke. Future research should investigate a younger cohort of patients who have sustained a stroke and the best treatment option available.

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BACKGROUND and PURPOSE

In the United States, approximately 795,000 people suffer a stroke annually.[1] A stroke occurs when there is a decreased blood supply to the brain which deprives it from oxygen and nutrients. Typically, this is caused by a blood clot or from a burst blood vessel. Stroke is the leading cause of long term disability in the United States.[1]

Those who survive a stroke present with certain impairments depending on the location of the infarct. Common symptoms reported by patients who sustained a frontal lobe stroke may include weakness on one side of the body, behavioral changes, memory problems, and trouble with self-care. An infarct in the parietal lobe may cause symptoms of sensation loss on one side of the body, impairments in spatial perception, and problems with motor tasks. A stroke in the occipital lobes can cause partial or full vision loss. Impairments often affect balance and gait which can make it difficult to return to daily activities. Nearly three-quarters of all strokes occur in individuals older than the age of 65.[1] After each decade following the age of 55, the risk of experiencing a stroke nearly doubles.[1] Common risk factors for a stroke include high blood pressure, tobacco use, high cholesterol, diabetes, obesity, and physical inactivity. Common risk factors that are uncontrollable include increasing age, gender, heredity, and prior stroke. It is uncommon for a young adult with a normal body mass index (BMI) and no family history to have a stroke.

Physical therapy, especially balance and gait training, have been shown to be beneficial when treating patients who have sustained a stroke. A randomized controlled trial by Ordahan, Karahan, and Basaran demonstrated that balance training had a positive impact on balance and postural control of a person who had sustained a stroke.[2] The study discussed that improvements in motor function were the result of spontaneous recovery, visual feedback, and re-education of

the brain. The study demonstrated that visual biofeedback was effective during static balance by increasing activity of the neuromuscular effector system.[2]

Balance dysfunction in stroke survivors is common and have an impact on their functional independence. In addition to balance impairment, gait impairments also increase the risk of falling. A cross-sectional study done by Obembe, Olaogun, and Adedoyin has shown a correlation between balance performance and gait parameters for those at risk for falling after they suffered a stroke.[3] The study had seventy stroke survivors who participated with a mean age of 53.5 $\pm$10.4 years. It demonstrated that stroke survivors with higher cadence and higher gait speeds had better balance self-efficacy which in turn reduced their risk of falling.[3] Therefore, they concluded that a rehabilitation program for a stroke survivor should include balance training due to balance being an important factor of gait to reduce the risk of falls.

Strength training has been shown to be beneficial for those who have experienced a stroke. The systematic review of 21 studies concluded that strength training after a stroke had a small, positive effect for improving muscle strength and activity.[4] The strength training interventions consisted of EMG-biofeedback, electrical stimulation, muscle re-education, and progressive resistance training. The studies in the review recommended performing strength training interventions within six months of the stroke to be most beneficial.[4] The review concluded that the interventions were effective, worthwhile, and not harmful.[4]

While multiple studies have investigated rehabilitation on adults over the age of 65 who recently sustained a stroke, there is only a small amount of research on the best treatment plan for a young adult under the age of 30 who has sustained a stroke. Some evidence has shown the benefits of strength and balance training for adults over the age of 30, however the evidence for young adults is lacking. Therefore, the purpose of this case report was to investigate a

comprehensive physical therapy program, that included balance and strength training, in a 29-year old patient who had recently sustained a stroke.

CASE DESCRIPTION

Patient History and Systems Review

The patient consented to participating in this case report. The patient was a 29-year-old female who presented to outpatient physical therapy four weeks following a stroke. Two weeks prior to her diagnosis, the patient reported having a constant migraine for which she went to the emergency room at the local hospital five times. Two weeks after her initial visit to the hospital, the patient returned to the emergency room with sudden onset of blurry vision, right anterior leg and foot hemiparesis and hemiplegia. A computed tomography (CT) scan was performed which showed multiple infarcts which involved the left parietal, frontal, and bilateral occipital lobes.

The patient was a young, white female with no family history of a stroke, no high blood pressure, normal BMI, and was a non-smoker. She worked as a medical assistant for an outpatient physician office. She lived in a two-story home with her supportive husband and two young children.

After the stroke, she remained at the hospital and received inpatient rehab for two weeks, and acute rehab for one week. She presented to her initial PT visit walking with a single point cane, had a lateral shift with increase weight bearing on her left leg, decreased toe-off through the right foot, unsteadiness in single leg stance, and climbed stairs with a step-to gait pattern. Her primary complaint was generalized weakness and sensation loss in her right leg and foot, moderate headaches, blurry vision, and dizziness with quick movements. She was unable to walk longer than 30 minutes without needing to rest. Additionally, she was unable to perform duties at work due to the fast-paced environment, and unable to climb stairs without assistance from the

158 railing and her cane. A list of her medications are listed below in Table 3. Her goals included
159 improving her strength and balance so she could return to work and help her husband take care
160 of their children and home. Refer to Table 2 for the systems review.
161
162 **Clinical Impression 1**
163 Due to the patient's CT scan and presentation, it was suspected that she had acute infarcts
164 involving the parietal, and bilateral occipital lobes. The CT scan performed on her cervical spine
165 showed moderate multilevel stenosis of the right distal vertebral artery which resulted in her
166 multiple infarcts. Her deficits included blurry vision, generalized motor weakness and sensation
167 loss in her lower extremities (LE), decreased proprioception, decreased activity tolerance, and
168 impaired balance. It was hypothesized she had a stroke which involved her parietal and occipital
169 lobes due to the patient's symptoms. Potential differential diagnosis discussed included multiple
170 sclerosis. The plan for exam based on existing data included Lower Extremity Functional Scale
171 (LEFS), manual muscle testing, range of motion, gait analysis, dermatome testing, testing of
172 deep tendon reflexes (DTR), Modified Ashworth Scale, upper quarter screening, and balance
173 testing. Her functional limitations resulted in her inability to walk long distances without an
174 assistive device, participate in household chores, drive, and return to work. Physical therapy
175 focused on lower extremity (LE) strengthening and balance, and addition of gait training and
176 postural cueing to achieve her goals of returning to work and household responsibilities.
177 The patient was a good candidate for a case report due to the rarity of her condition. It is
178 unlikely for someone of her age, gender, with no family history, low blood pressure, no history
179 of smoking, normal BMI, and activity level to have experienced multiple strokes. Also, she was
180 very motivated and willing to participate in physical therapy.
181

Examination – Tests and Measures

A LEFS was filled out by the patient to evaluate her LE impairment. While content and face validity has not been established, it has excellent test-retest and interrater reliability.[5] In the rehabilitation of patients with subacute stroke, the LEFS has been shown to be a clinically efficient outcome measure.[5]

An observational gait analysis (OGA) at initial evaluation was performed. An OGA has moderate interrater reliability due to the variability of observable items in a gait analysis.[6] Lateral flexion of the trunk, arm swing, and knee extension in the late swing phase are considered easy to observe. Pelvis rotation and plantar flexion at the ankle in the late stance phase are considered more difficult to observe to the naked eye. According to the study by Brunnekreef, both experienced and inexperienced raters have good reliability.[6]

Gross active range of motion and gross manual muscle testing was assessed. Manual muscle testing is a standardized assessment to measure muscle strength. While content validity has not been established, it has been shown to have excellent test-retest reliability.[7] Active range of motion testing using a manual goniometer has shown high test-retest reliability in unskilled and skilled examiners.[8] A balance assessment consisting of sitting balance, narrow base of support (NBOS), tandem stance, and single leg stance was performed to assess any factors that affected her function and her risk of falling. A timed standing balance test, measured by a stopwatch, has been shown to have absolute and relative reliability, along with concurrent validity compared to other timed balance measures.[9]

Testing of deep tendon reflexes (DTRs) are part of a neurological exam and were assessed to determine if there were any impairments within her two-neuron reflex arc. Dermatome sensation was assessed as part of the neurological exam to determine any sensation loss at a specific spinal level. A Modified Ashworth Scale was used to measure spasticity at a

joint due to spasticity being a common symptom for someone who has experienced a stroke. It has been shown to have adequate intra-rater reliability in the lower extremities of 73% for patients who had sustained a stroke.[10] An image describing the instructions and scoring of the Modified Ashworth Scale can be found in the appendices. All results from the examination can be found in Table 7.

Clinical Impression 2

Based on the examination data, the original diagnosis of a cerebrovascular accident (CVA) was confirmed by MRI results. The MRI confirmed diagnosis of acute infarcts of left frontal, parietal, and bilateral occipital lobes.

At initial evaluation, she demonstrated poor posture compensation for right sided lower extremity weakness, which aligned with her physical therapy diagnosis of hemiplegia and hemiparesis following left cerebral infarction affecting right dominant side (ICD-10 code I69.351). The patient continued with skilled physical therapy because she remained motivated and demonstrated improvements quickly in the weeks following outpatient physical therapy.

The patient was young, active, motivated and had a strong support system. Her barriers to recovery consisted of unilateral lower extremity paresis, sensory impairments, and blurred vision which resulted in her inability to drive to the clinic. Despite these barriers, her support team and motivation provided for a good prognosis.

The treatment plan for this patient was to be seen twice a week for five weeks, for one hour treatment sessions. Her plan of care consisted of progressive exercises to improve lower extremity strength, balance and proprioception training, and cueing for postural control. The goal was to perform a re-evaluation at week four to measure improvements in manual muscle testing, LEFS, tandem stance, and single leg stance. She planned on consulting with an

optometrist about her blurry vision. The short and long term goals agreed upon by the therapist and the patient are listed in Table 1.

Intervention

Coordination, Communication, and Documentation

After her initial evaluation, a plan of care was established to focus on lower extremity strengthening and balance training. The initial evaluation was faxed to her neurologist to keep him informed of her treatment plan. Communication between other physical therapists and physical therapist assistants were maintained to provide the same care to achieve short and long term goals. A printed home exercise program was provided to the patient with pictures and written instructions. All documentation was completed on electronic medical records (EMR) system for easy access from other therapists, insurance companies, and physicians.

Patient/Client Related Instructions

During the initial evaluation, the patient was informed of the plan of care and expected outcomes by the time of discharge. She was instructed to perform her independent home exercise program twice a day for each day of the week. She was instructed to use her cane while walking on uneven surfaces or for long distances. She was educated on the importance of being aware of her posture with activity to reduce compensation and prevent additional injuries.

Interventions

Outpatient physical therapy included five 1-hour sessions over a 5-week period. During the first two weeks, the patient attended physical therapy twice a week. A progress report was done on her fifth visit during week five. The focus of the interventions were to improve strength, balance, and postural control.

Interventions performed at initial evaluation included exercises to strengthen glute musculature. According to Hamstra-Wright and Bliven, the gluteus medius muscle plays an important role in stabilizing the pelvis and controlling femoral adduction and internal rotation during functional activity.[11] Also, gluteus medius strengthening has been shown to improve lower extremity kinematics for the prevention of dysfunction and injury.[11] All exercises were performed on the table due to the patient feeling unsteady while ambulating without a cane. These exercises included sidelying (s/l) clams with resistance and s/l hip abduction. She presented with a left lateral trunk lean due to weight bearing more on the unaffected leg. Manual therapy was provided to correct the lateral trunk lean. According to McKenzie, 90% of people respond rapidly to manual correction, and it has been shown to result in superior outcomes compared to a control treatment of nonspecific massage and general back care advice.[12] She was educated on an exercise how to independently self-correct her lateral lean at home. A picture of the self-correction exercise can be found in Figure 3.

During the second visit, the patient presented with improved posture with decreased lateral trunk lean, and could ambulate without an assistive device. The second visit had additional interventions with an emphasis on balance training. According to Ordahan, balance training exercises have shown an improvement in postural control and functional activities.[2] The balance training exercises included step ups onto a 4-inch Original Step (Step Fitness & Recreation, Inc., Marietta, GA) and bilateral heel raises. A study by Rozzi and Lephart looked at the effects of a 4-week single-leg balance training program. They concluded a single-leg balance program improved joint proprioception and single-leg standing ability.[13] These exercises included agility cone taps (Power Systems, Knoxville, TN) with single leg stance (SLS) on right leg, SLS with trunk leans, tandem stance, and SLS on the Airex foam (Magister Corp, Chattanooga, TN). The third session the patient demonstrated no lateral trunk lean and the self-

correction exercise was discontinued. She continued with the procedural interventions including s/l clams, s/l hip abduction, heel raises, single leg cone taps and trunk leans, SLS on foam, and tandem stance on foam. The repetitions were progressed when the patient demonstrated improved muscle endurance. Some of the procedural interventions can be found in Figures 1-3. The procedural interventions were implemented to improve strength and endurance that would allow her to return to work without any limitations, and to prevent falls while ambulating on uneven ground or long distances in the community. The patient did not require stretching exercises due to her normal range of motion at the hip, knee, and ankle. Parameters for each intervention can be found in Table 4. The patient was compliant with her independent home exercise program 4-5 days a week which can be found in Table 5.

OUTCOME

PT interventions primarily focused on improving the patient's functional mobility through balance training, postural control, and lower extremity strengthening. After five sessions over five weeks, the therapist observed improvements in ambulation and postural symmetry. Initially, an OGA revealed slow cadence, a lateral shift to the right, decreased toe-off through her right foot, and use of a single-point cane in her left hand. The patient reported a step-to gait pattern and holding onto the railing with one hand while ascending and descending stairs. During her re-evaluation, the patient showed no lateral shift, increased cadence, and did not use an assistive device. She improved her single leg stance time by reaching max time of thirty seconds compared to 0 seconds in the beginning. Tandem stance improved from three seconds to reaching max of 30 seconds with no loss of balance. She reported she could walk a mile without needing to rest, compared to half a mile at initial evaluation.

Manual muscle testing of upper extremity and left lower extremity were within normal limits. Her general right lower extremity strength improved one full manual muscle test grade. Her improved strength enabled her to ascend and descend stairs reciprocally with one hand on the railing for safety instead of using a step-to gait pattern. Her gross range of motion were within normal limits for all upper and lower extremities. She did not present with any spasticity in her upper or lower extremities. She demonstrated improvement of dermatome L2 sensation from complete sensation loss to normal sensation. Additionally, dermatome L3 improved from mild sensation loss to normal sensation. She continued to show mild sensation loss at L4-S2 with no improvements. While testing her deep tendon reflexes, hyperreflexia was noted as 3+ for her right patellar tendon and achilles tendon. At re-evaluation, her LE reflexes returned to a normal grade of 2+. She continued to have blurry vision which resulted in her inability to drive. She intended to return to work as a medical assistant in one month. Her LEFS score improved from 31/80 to 50/80. Although LEFS does not have a MCID specific to a stroke, it has demonstrated a MCID of 9 or better to be statistically significant in other diagnosis.[5] Results of her test and measures taken at week five can be seen in Table 6, and status of short and long-term goals can be seen in Table 1.

DISCUSSION

The goal of this case report was to investigate a strength and balance training program for a young adult who recently sustained a multifocal stroke. The rehabilitation program was created based on research that has found strength and balance programs to be beneficial for older adults who have sustained a stroke. The study performed by Ordahan, et al demonstrated a significant improvement in balance for elderly patients who have sustained a stroke after performing balance training for 30 sessions in 6 weeks.[2] The patients who participated in the randomized

control trial had a mean age of 57-years-old. The patient displayed improvements during her re-evaluation on her fifth visit during week five. She demonstrated improvements in her strength, endurance, gait speed and quality, postural control, and balance. These results suggested that lower extremity strength and balance training may be beneficial to improve functional limitations in a young stroke survivor with fewer treatment sessions. Positive factors that may have contributed to her positive outcome include her age, positive support at home, general good health, and the patient's motivation. Although transportation issues initially were thought as a barrier, her improvements at re-evaluation suggested that the minimal number of treatment sessions did not hinder her recovery. It is unclear if the patient improved from the physical therapy interventions, or if she improved on her own with time.

The reported outcome measures were consistent with the provided evidence which stated the inclusion of a strength and balance training program for patients who experienced a multifocal stroke to be beneficial to return to their functional activities. Although this program has been shown to be beneficial for both older and younger populations, it may suggest that younger populations may yield similar functional outcomes with fewer visits compared to older adults. Further research is warranted to maximize on the effects of strength and balance training for young adults. Additional research may investigate if young adults who sustained a multifocal stroke would benefit from a strength and balance training program with limited physical therapy visits.

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TABLES and FIGURES

Table 1. Goals

Time frame	Goal	At discharge
Short Term: 3 weeks	Patient will receive a score of hip abduction strength of 4-/5 to walk longer than 40 minutes without needing to take a rest while shopping at the grocery store	Achieved
	Patient will improve single leg stance on the right leg to 20 seconds to ambulate without an assistive device	Achieved
	Patient will be able to perform tandem stance for 20 seconds without loss of balance to ambulation with no unsteadiness	Achieved
Long Term: 6 weeks	Patient will receive a score of 70/80 on her LEFS to be able to work with no limitations	Not achieved
	Patient will improve knee extension strength to 4+/5 to ascend and descend stairs reciprocally to get to her bedroom	Achieved
	Patient will improve R SLS to 30 seconds on stable ground to reduce risk of falling	Achieved

410

411 Table 2. Systems Review at initial evaluation
412

Systems Review	
Cardiovascular/Pulmonary	Impaired: decreased endurance
Musculoskeletal	Impaired: impaired gross strength in R LE; impaired gait with lateral shift with increase WB on L leg and decreased R toe-off
Neuromuscular	Impaired: decreased balance in R SLS; sensation loss at L2, impaired sensation L3-S2; impaired proprioception, abnormal reflexes 3+ (L3-4, S1-2)
Integumentary	Not impaired
Communication	Not impaired
Affect, Cognition, Language, Learning Style	Not impaired

413

414 Table 3. Medications at initial evaluation

Medication	Usage
Ranitidine	Prevent stomach ulcers when they are a side effect of some medicines
Aspirin	For preventing blood clots
Plavix	Prevents blood clots after a recent stroke
Amitriptyline	Used to treat symptoms of depression

415

416

417 Table 4. Procedural Interventions

Intervention	Rx Day 1	Rx Day 2	Rx Day 3	Rx Day 4
s/l clams	Lv 2 TB 2 x10 reps	Lv 2 TB 2x10 reps	Lv 2 TB 2x10 reps	Lv 2 TB 3x10 reps
s/l hip abduction	2 x10 reps	2x10 reps	2x10 reps	2x10 reps
Bridges	2 x 10 reps	2x10 reps	2x10 reps	3x10 reps
Lateral shift correction	1 x 10 reps	1x10 reps		
NBOS		Foam EC 2 x 30 sec	Foam EC 2 x 30 sec	Foam EC 2 x 30 sec
SLS		Foam EO 2 x 30 sec	Foam with ball toss	BOSU with ball toss

			2 x 10 tosses	2 x 10 tosses
Tandem Stance		Foam EO 2 x 30 sec	Foam EO 2 x 30 sec	Foam EO 2 x 30 sec
SLS 4-way cone taps		1 x 10 each direction	1 x 10 each direction	1 x 10 each direction
SLS 4-way trunk leans		1 x 5 each direction	1 x 5 each direction	1 x 5 each direction
Standing marches in mirror		1 x 2 minutes	1 x 2 minutes	
Step ups		6-inch step 2 x 10	6-inch step 2 x 10	6-inch step 2 x 10
Squats		2 x 10	2 x 10	On BOSU 2 x 10
Heel Raises		2 x 10	2 x 10	2 x 10
Recumbent bike			5 minutes	5 minutes

s/l (sideline). Clams (clamshells). Lv (level). X (times). reps (repetitions). TB (theraband). NBOS (narrow base of support). EC (eyes closed). EO (eyes open). Sec (seconds).

Table 5. Independent Home Exercise Program.

Intervention	**Rx**
s/l clams	Lv 2 2 x 10
s/l hip abduction	2 x 10
Bridges	2 x 10
Heel raises	2 x 10
Squats	2 x 10
Postural correction in front of mirror	1 x 10
Standing marches in front of mirror	1 x 2 minutes

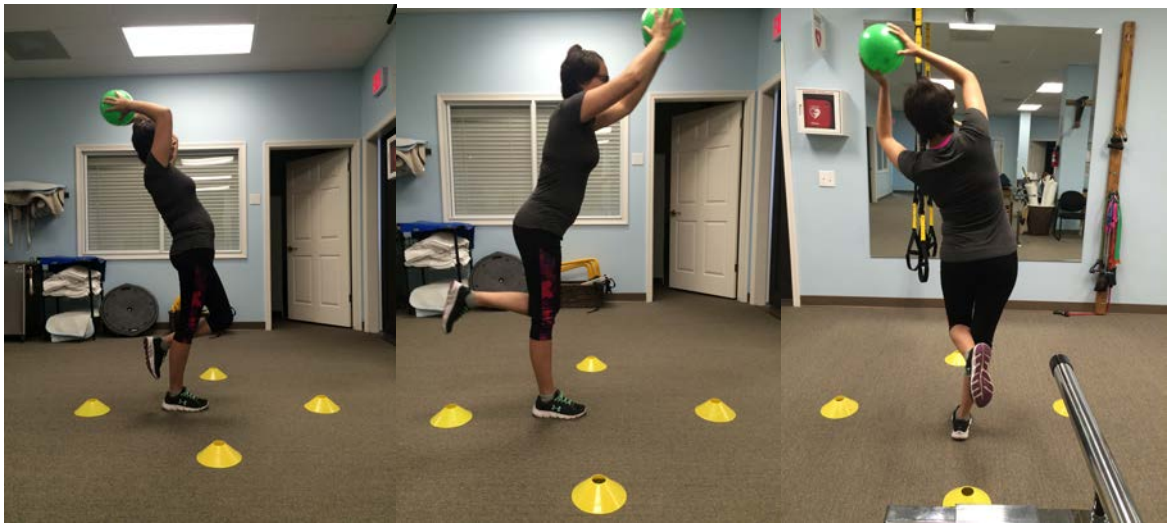
Table 6. Examination – Test and Measures.

Tests & Measures	**Initial Evaluation Results**	**Re-evaluation Results**
Lower Extremity Functional Scale	31/80 – lower scores indicate greater disability	50/80
Gait	Lateral shift with increase weight bearing on L leg, decreased toe-off of R foot, use of single-point cane in L hand	Normal gait pattern with no use of assistive device
Stair Climbing	Step-to gait pattern with use of railing for assistance	Reciprocal gait pattern with one hand on railing
Dermatomes	R LE: complete sensation loss at L2, mild sensation loss at L3, L4, L5, S1and S2 L LE: normal	R LE: normal sensation at L2-L3; mild sensation loss at L4-S2 L LE: normal
Endurance	Walking without rest: 0.5 miles	Walking without rest: 1 mile
Deep Tendon Reflexes	R LE: hyper reflexive at patellar tendon and Achilles tendon L LE: normal	Normal
Modified Ashworth Scale	Grade: 0 - Normal	Grade: 0 - Normal
Upper quarter screening	Normal	Normal
Balance Screening	Sitting balance: normal Standing balance: normal NBOS EO: normal NBOS EC: normal Tandem: 3 seconds SLS on L: normal SLS on R: unable	Sitting balance: normal Standing balance: normal NBOS EO: normal NBOS EC: normal Tandem: 30 seconds SLS on L: normal SLS on R: 30 seconds
Foot and Ankle Strength Testing	R Dorsiflexion: 4/5 L Dorsiflexion: 5/5 R Plantarflexion: 4/5 L Plantarflexion: 5/5	R Dorsiflexion: 5/5 L Dorsiflexion: 5/5 R Plantarflexion: 5/5 L Plantarflexion: 5/5
Hip Strength Testing	R Hip Abduction: 3+/5 L Hip Abduction: 4/5 R Gluteus Maximus: 3+/5 L Gluteus Maximus: 4/5 R Hip Flexion: 4-/5 L Hip Flexion: 4+/5	R Hip Abduction: 4/5 L Hip Abduction: 4/5 R Gluteus Maximus: 4/5 L Gluteus Maximus: 4/5 R Hip Flexion: 4/5 L Hip Flexion: 4+/5
Knee Strength Testing	R Knee Extension: 4-/5 L Knee Extension: 5/5 R Knee Flexion: 4-/5 L Knee Flexion: 4+/5	R Knee Extension: 5/5 L Knee Extension: 5/5 R Knee Flexion: 4+/5 L Knee Flexion: 4+/5

Figure 1. Single leg stance with cone taps.

Stand in the center of four cones placed in front, back, and each side of the patient. Balance on the right leg with slight bend in the knee. With the unaffected leg reach and touch each cone without loss of balance. Repeat 10 times to each cone.

Figure 2. Single leg stance with trunk leans.



Balance on right leg with slight bend in the knee while holding a ball or light weight overhead. Slowly lean forward, backward, and to each side without loss of balance. Repeat five times.

Figure 3. Lateral shift correction.

Lean right side up against a wall, and with the left hand push against left pelvis towards the wall. Hold stretch for a count of five seconds and repeat ten times.

485

486 **APPENDICES**

Modified Ashworth Scale Instructions

General Information (derived Bohannon and Smith, 1987):

- Place the patient in a supine position
- If testing a muscle that primarily flexes a joint, place the joint in a maximally flexed position and move to a position of maximal extension over one second (count "one thousand one")
- If testing a muscle that primarily extends a joint, place the joint in a maximally extended position and move to a position of maximal flexion over one second (count "one thousand one")
- Score based on the classification below

Scoring (taken from Bohannon and Smith, 1987):

0	No increase in muscle tone
1	Slight increase in muscle tone, manifested by a catch and release or by minimal resistance at the end of the range of motion when the affected part(s) is moved in flexion or extension
1+	Slight increase in muscle tone, manifested by a catch, followed by minimal resistance throughout the remainder (less than half) of the ROM
2	More marked increase in muscle tone through most of the ROM, but affected part(s) easily moved
3	Considerable increase in muscle tone, passive movement difficult
4	Affected part(s) rigid in flexion or extension

487

"THE LOWER EXTREMITY FUNCTIONAL SCALE"

Name:_____ Date:_____

We are interested in knowing whether you are having any difficulty at all with the activities listed below because of your lower limb problem for which you are currently seeking attention. Please provide an answer for each activity.

Today, do you, or would you have any difficulty at all with:

	Activities	Extreme Difficulty or Unable to Perform Activity	Quite a Bit of Difficulty	Moderate Difficulty	A Little Bit of Difficulty	No Difficulty
1	Any of your usual work, housework or school activities	0	1	2	3	4
2	Your usual hobbies, recreational or sporting activities	0	1	2	3	4
3	Getting into or out of the bath	0	1	2	3	4
4	Walking between rooms	0	1	2	3	4
5	Putting on your shoes or socks	0	1	2	3	4
6	Squatting	0	1	2	3	4
7	Lifting an object, like a bag of groceries, from the floor	0	1	2	3	4
8	Performing light activities around your home	0	1	2	3	4
9	Performing heavy activities around your home	0	1	2	3	4
10	Getting into or out of a car	0	1	2	3	4
11	Walking 2 blocks	0	1	2	3	4
12	Walking a mile	0	1	2	3	4
13	Going up or down 10 stairs (about 1 flight of stairs)	0	1	2	3	4
14	Standing for 1 hour	0	1	2	3	4
15	Sitting for 1 hour	0	1	2	3	4
16	Running on even ground	0	1	2	3	4
17	Running on uneven ground	0	1	2	3	4
18	Making sharp turns while running fast	0	1	2	3	4
19	Hopping	0	1	2	3	4
20	Rolling over in bed	0	1	2	3	4
	Column Totals:					

Minimum Level of Detectable Change (90% Confidence): 9 points **SCORE: _____/80**

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