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Physical Therapy Management of a Patient with Stroke Utilizing Muscular Facilitation Techniques in a Skilled Nursing Facility: A Case Report

Erin Bayne

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

The author acknowledges Mike Fillyaw, PT, MS for assistance with case report conceptualization, Karen Gage, PT, MS, DPT for supervision and assistance as clinical instructor, and the rehabilitation staff at Maine Veterans’ Home, Bangor Maine for assistance with data collection.

28 **ABSTRACT**

29 **Background and Purpose** Stroke is the leading cause of long term disability in the United States.

30 Hemiparesis is an impairment following stroke, however trunk musculature asymmetry is also common
31 and is often overlooked when assessing a patient's muscular control. Trunk musculature is an essential
32 link between the upper and lower extremities during activities of daily living and impairments in trunk
33 musculature can result in decreased safety and balance. The purpose of this case report is to provide the
34 framework for treatment and an overview of the care plan for a patient following stroke, with special
35 attention to trunk musculature facilitation.

36 **Case Description** The patient was an elderly woman diagnosed with a right cerebrovascular accident and
37 left hemiparesis. She spent 18 days in acute care rehabilitation where she received daily physical,
38 occupational, and speech therapy. She was transferred to a skilled nursing facility for continued therapy
39 services, which she received 5-7 days per week for 8 weeks. She initially presented with deficits in
40 functional mobility, transfers and ambulation, inattention to her left side, decreased activity tolerance,
41 and increased fall risk. Therapeutic interventions were provided with special attention to tactile
42 facilitation of the left trunk musculature.

43 **Outcomes** The patient improved her activity tolerance, muscle activation, muscular endurance, bed
44 mobility, transfers and gait and was discharged to home. However, because of cognitive changes
45 following her cerebrovascular accident, it was highly recommended that the patient continue to receive
46 24-hour supervision and care.

47 **Discussion** Physical therapy has the potential to make significant improvements in a patient's overall
48 function and with proper muscular facilitation techniques patients may make even greater gains during
49 their time in rehabilitation.

50 **Manuscript word count** 3,257

51 **BACKGROUND and PURPOSE**

52 Each year more than 795,000 people in the United States have a stroke and 87% of those
53 strokes are ischemic strokes, in which the blood flow to an area of the brain is blocked.¹ Stroke is the
54 number 4 leading cause of death in the United States and functional mobility skills are often impaired
55 following stroke with wide variability between individuals.² During the acute stroke phase, less than 6
56 months following stroke, 70-80% of patients demonstrate mobility problems with ambulation and 67-
57 88% experience compromised basic activities of daily living including feeding, bathing, dressing, and
58 toileting.² For those affected by stroke, 10% will recover almost completely, 25% will recover with
59 minor impairments, and 40% will experience moderate to severe impairments requiring special care.^{3,4}
60 The greatest amount of recovery from stroke is generally seen within the first weeks to months
61 following onset, thus early rehabilitation is crucial for optimal recovery following stroke.⁴

62 Some degree of hemiplegia is often seen following stroke and just as common, but not as clear,
63 is the presence of asymmetric trunk musculature and posture. Weak trunk musculature following stroke
64 can affect functional ability and contribute to decreased safety and balance deficits.⁵ Trunk
65 musculature, or the core, functions as a kinetic link that facilitates the transfer of torques and angular
66 momenta between upper and lower extremities during the execution of whole-body movements during
67 activities of daily living.⁶ Often lower extremities (LE) are the primary target of interventions related to
68 transfers, mobility, balance and gait. However, decreased exterior trunk muscle activity can result in
69 even greater right to left asymmetry, leading to increased deficits in balance and gait abnormalities.⁵
70 Thus, enhanced core strength may allow older adults to more effectively use their upper and lower
71 limbs by optimizing trunk movements.⁶ Interventions specifically targeting trunk flexor and extensor
72 muscles can result in improved balance, functional abilities, and gait in patients following stroke.⁵

73 There are a number of muscular facilitation techniques available which therapists can use to
74 facilitate muscle activity in patients with both limited or abnormal muscle activation and sustainability.
75 Two techniques are quick stretch and manual contact. Quick stretch technique, which is applied through
76 a quick stretch or tapping on the muscle belly, excites the muscle being stretched and triggers a
77 temporary action in that muscle. ⁷ Manual contact, which is defined as firm, deep pressure, facilitates
78 the muscles under the contact to contract, resulting in muscle activity and sensory awareness. ⁷

79 The purpose of this case report is to provide the framework for treatment and an overview of a
80 care plan for a patient following stroke, with special attention to trunk musculature facilitation, in a
81 skilled nursing facility.

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93 **CASE DESCRIPTION**

94 The patient was an elderly Caucasian female, who was widowed to a United States veteran and
95 who considers herself to be a retired homemaker. She lived independently, in her own multi-level home
96 and reported community ambulation, driving, no use of assistive device (AD) and independence in all
97 mobility and age appropriate activities of daily living (ADLs). She denied a history of falls previous to her
98 stroke, as well as alcohol and tobacco use and reported that she has a large and supportive family in the
99 near vicinity.

100 She was admitted to her local hospital following a change in behavior and onset of left sided
101 weakness during a family get together. She underwent a number of tests upon admission to the hospital
102 including a CT scan of the head and a chest x-ray. The CT scan showed a very early infarction of the right
103 frontal lobe. She was subsequently diagnosed with a right-sided cerebrovascular accident (CVA) with
104 left-sided hemiparesis and severe dysphasia and admitted to acute care rehabilitation.

105 Her past medical history was significant for left breast cancer, hypertension (HTN) with
106 hypertensive urgency, colorectal polyps, diverticulosis and diverticulitis, hyperlipidemia, right hip
107 fracture with surgical fixation, left renal artery stenosis and kidney atrophy, chronic pulmonary fibrosis,
108 mild aortic insufficiency, mild mitral and tricuspid regurgitation, stenotic left vertebral artery,
109 cholelithiasis, and liver cysts. Her medications included daily Aspirin, Lisinopril, Metoprolol bid,
110 Simvastatin, Lovenox, Prevacid, nystatin, Zocor, and Nitroglycerin sublingually for chest pain.

111 She was referred to Maine Veterans' Home (MVH) 2.5 weeks following her CVA for continued
112 therapy including physical therapy (PT), occupational therapy (OT) and speech therapy (SLP). On the
113 date of admission, she fell in her room and was consequently provided with an alarm for the remainder
114 of her stay. The systems review revealed she had impairments to the musculoskeletal and
115 neuromuscular systems, as well as communication and cognition deficits. The patient and family stated

116 that their primary goals for PT were for her to return home safely and to return to her prior level of
117 function (PLOF).

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134 **CLINICAL IMPRESSIONS 1**

135 She presented with impairments including deficits in strength, range of motion (ROM), and
136 balance as well as impaired sensation, cognition, communication and gait. In accordance with her
137 systems review the plan was to continue with further examination of impaired systems, standardized
138 testing to establish baseline fall risk, discharge outcome planning, and intervention planning. Further
139 examination and test and measures were planned to quantify and qualify impairments noted during
140 systems review including manual muscle testing (MMT), observation of functional mobility and
141 transfers, gait analysis, postural analysis, activity tolerance, proprioception, and balance testing.

142 The patient is an excellent candidate for case report because she was highly motivated to return
143 to her PLOF, she remained in PT for 8 weeks with minimal refusals and she was ultimately discharged to
144 home with significant improvements in her impairments and activity limitations. Although her diagnosis
145 is a common one, we took a somewhat unique approach to her PT plan of care (POC) with special
146 attention to tactile facilitation of the trunk musculature during transfers, gait, and functional activities.

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154 **EXAMINATION**

155 Tests and measures were done at admission and again at discharge to get an objective picture of
156 the patient's progress (Table 1). Manual muscle testing is used to establish a patient's muscular
157 strength.⁸ Its quick and easy to perform, however, clinical experience and expertise play a role in
158 reliability.⁹ A literature review by Cuthbert and Goodheart⁹ showed MMT to have high interrater
159 reliability of 82-97%, test-retest reliability of 96-98%, and concluded that a true change in muscular
160 strength would be seen with a gain of greater than one full grade on the MMT scale. Observational
161 analysis is a visual inspection of a patient during functional tasks in which the physical therapist is
162 observing for information regarding defects, deficits, and abnormalities.¹⁰

163 Standardized functional testing (Table 2) using the 10 Meter Walk Test (MWT) was administered
164 at admission and discharge and intermittently throughout the episode of care in order to monitor
165 progress and make adjustments to the POC, as well as for justification for continued physical therapy
166 services. 10 MWT is a standardized test to assess walking speed in meters per second over a 10 meter
167 distance.¹¹ The patient is instructed to walk as quickly and safely as they can over a set distance of 10
168 meters for 3 timed trials. An AD may be used and must be documented along with level of assistance
169 required. The test is validated for patients with stroke and the minimally clinically important difference
170 is 0.14m/s change.¹¹ The 10 MWT was shown to have excellent test-retest reliability (ICC= 0.95-0.99) as
171 well as excellent intrarater reliability (ICC= .87-.88).¹¹ Gait speed is also a powerful predictor of fall risk
172 and correlates with function and balance, therefore it is recommended that patients with a gait speed
173 <1.0 m/s need interventions to reduce fall risk.¹²

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177 **CLINICAL IMPRESSIONS 2**

178 **Evaluation**

179 The patient presented with balance deficits, strength deficits, impaired safety awareness, ROM
180 deficits, impaired proprioception, gait abnormalities, decreased gait velocity, history of falls, impaired
181 ability to sustain muscle activation and decreased attention to her left side. These impairments
182 ultimately contributed to her difficulty with transfers, bed mobility, ambulation and stairs, and
183 decreased activity tolerance. As a result, the patient had an increased burden of care, increased fall risk,
184 decreased safety with access to her environment, decreased independence, decreased ability to
185 perform age appropriate activities of daily living and decreased quality of life (QOL). The patient was not
186 safe to drive due to her impairments and functional limitations. She is an appropriate candidate and
187 would benefit from skilled physical therapy to return to her prior, independent level of function.

188 Our primary concerns in PT were her abnormality of gait secondary to left hemiparesis, as well
189 as her decreased activity tolerance due to prolonged hospitalization. The patient and family's main
190 concerns were her change in behavior, decreased level of function, cognitive deficits, and mobility
191 deficits. Her gait abnormalities were found to be most influenced by her inability to activate and sustain
192 trunk musculature, specifically the left lateral lumbar flexors. Gait was also affected by her impaired
193 attention to the left side and cognitive impairments including inability to maintain focus on the task at
194 hand. While SLP focused their treatments more on her cognitive impairments, PT also addressed these
195 impairments as well, when applicable, in treatment sessions. Interventions to address her inattention to
196 the left included scanning activities and purposeful drawing of attention to the left. To address
197 maintenance of focus, redirection was often used and dual tasks were added as she progressed to
198 continue to enhance her cognitive abilities.

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200 **Physical Therapy Diagnosis**

201 Based on the Guide to Physical Therapy the patient's diagnosis is Practice Pattern 5D: Impaired
202 Motor Function and Sensory Integrity Associated with Non-Progressive Disorders of the Central Nervous
203 System- Acquired in Adolescence or Adulthood.

204 **Prognosis**

205 The patient demonstrated excellent potential to benefit from skilled PT as she was highly
206 motivated to return to her independent PLOF, she appeared to have intact mid-line orientation, she had
207 a local supportive family, and had limited cognitive impairments which would have minimal impact on
208 the PT POC. Skilled services were reasonable and necessary to address her noted impairments and
209 activity limitations and to decrease her fall risk and burden of care, as well as to increase safe and
210 independent access to her environment and QOL.

211 After initial assessment, there were some noted impairments which had the potential to
212 negatively impact the patient's prognosis and physical therapy progression. Her cognitive impairments
213 could become more apparent with further evaluation, her inattention to the left side, and her recent
214 history of falls all had the possibility to prolong the time it would take for her to reach her discharge
215 goals and had the potential to increase her length of stay at MVH. The patient's cardiac history and
216 other comorbidities also had the potential to restrict the use of some interventions in her POC.

217 **Plan of Care**

218 PT short term goals and long term goals were discussed with the patient and her family (Table
219 3). The patient and her family's primary goal of PT was for her safe return to home and to her prior level
220 of function. At initial assessment a POC was set for coordination, communication and documentation;

221 patient client related instructions; and procedural interventions, in addition to short and long term goals
222 and discharge plans.

223 Initial POC involved procedural interventions to address impairments and activity limitations
224 including: gait training, stair training, bed mobility, transfer training, patient education, strengthening,
225 stretching, activity tolerance, muscular facilitation techniques, neuromuscular reeducation, balance
226 training, modalities as indicated, aquatic therapy, wheelchair (WC) management/fitting/training,
227 physical performance testing, and manual therapy. Discharge plans were set with the hopes of patient
228 returning to home with modified independence and family support for all functional tasks and age
229 appropriate ADLs.

230 The patient received PT services 5-7 days per week for 60- 90 minutes total, some of which were
231 split into two sessions per day with either the physical therapist or the physical therapist assistant
232 assigned to her treatment. Changes to POC and goals were made as necessary throughout episode of
233 care based on patient's tolerance to interventions and progress towards her current short and long term
234 goals.

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242 **INTERVENTIONS**

243 **Coordination, communication, documentation:**

244 Coordination among all therapists was maintained throughout the episode of care (EOC). The
245 patient's status and changes to the POC were discussed at weekly team meetings in order to provide
246 optimal care. Communication with the family, nursing, physicians, and social work regarding changes to
247 POC, progress and discharge (DC) planning occurred as needed throughout the EOC and documentation
248 of these encounters was recorded as they occurred. Documentation of daily interventions was done and
249 weekly progress notes were completed to evaluate the patient's progress and update the POC. In
250 addition, family meetings were held as requested by the patient and family with all team members
251 present.

252 **Patient Related Instruction**

253 The patient and her family were educated on safety with the four-wheeled walker (4WW) and
254 WC, ambulation with supervision, importance of therapy and rest to improve carryover, fall risk, and
255 allowing the patient to complete tasks on her own. The patient was educated about hand placement
256 during transfers and ambulation and proper brake use for safety with all activities. Further education
257 was provided to the family at DC for safe return to home and the importance of allowing the patient to
258 continue to participate in her ADLs and mobility tasks with supervision for safety.

259 **Procedural Interventions**

260 A number of PT interventions were provided during the EOC, including: therapeutic exercise,
261 therapeutic activities, mobility training, neuromuscular reeducation, aquatic therapy, physical
262 performance testing and manual therapy (Table 4). Therapeutic exercise included stretching activities to
263 address ROM deficits, strengthening to improve strength deficits, and activity tolerance to increase

264 endurance for ADLs, transfers and mobility tasks. Therapeutic activities consisted of bed mobility,
265 transfer training, and patient education. Mobility training, including gait and stairs, was used to improve
266 gait deviations, decrease fall risk, and to increase gait velocity. Neuromuscular reeducation was
267 especially important to address balance deficits in order to improve functional mobility, transfers and
268 ambulation, and to decrease fall risk. Aquatic Therapy was attempted during the first week of PT but
269 was discontinued because the patient did not tolerate the increased stimulation. During week 6 the
270 patient experienced pain at her sacroiliac (SI) joint and was treated with manual therapy techniques
271 including soft tissue massage (STM), muscle energy, and light joint mobilizations.

272 Interventions were progressed over time in an attempt to return to her PLOF. The patient did
273 endure some regression during her time in therapy due to Right SI pain in week 6 and increased
274 confusion during week 7; however, overall she made significant progress from start of care to discharge.
275 Early on therapy focused on simple neuromuscular reeducation, therapeutic activities and therapeutic
276 exercise. Emphasis was placed on activation and endurance of left lateral lumbar flexor contractions
277 during all tasks and therapists used a number of muscular facilitation techniques to achieve this.

278 Therapy progressed to including longer and more complex standing and neuromuscular
279 reeducation activities, increased ambulation distances, and decreased seated rest breaks. During week
280 3, the 4WW was introduced in order to increase safety with ambulation and after 3 treatment sessions
281 the patient was able to demonstrate sustained activation of the left lateral lumbar flexors. Her family
282 did voice concerns during week 5 that she would not be able to function at home with the 4WW, so
283 some ambulation was decreased to household distances and the 4WW was withheld in order to practice
284 household ambulation without the AD for her return to home.

285 The patient demonstrated high compliance with PT by her attendance at 88 of 92 scheduled
286 appointments and her willingness to participate in all PT treatment interventions. Her family adhered to

287 her therapy schedule and followed all recommendations from therapy during their visits, including
288 allowing her to perform all bed mobility, transfers, and ADLs on her own.

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305 **OUTCOMES**

306 At discharge, the patient had met all of her short term goals and two of four long term goals.
307 She also made significant progress towards her two unmet long term goals. She was able to complete
308 ADLs, as well as transfers and mobility with modified independence and increased time. However,
309 secondary to cognitive changes and increased confusion, there was concern for her safety with return to
310 independent living. After discussion with the patient and her family, she was discharged to home with
311 24 hours of assistance provided by a private nursing company and her family. Upon her return to home,
312 she was able to participate in all of her prior activities, although she was unable to return to her prior
313 level of independence in those activities.

314 The patient increased her strength, activity tolerance, and ability to activate and sustain
315 contractions of left lateral trunk flexors; however, she continued to experience increased fatigue in the
316 left sided musculature compared to the right. Gait improvements were seen through decreased
317 deviations and an increased gait velocity, which afforded her increased safety with access to her
318 environment and placed her at a decreased fall risk. Although she demonstrated overall improvement,
319 she did experience setbacks on days when she was distracted or confused. The patient was discharged
320 with a 4WW for use in the community to increase her stability and safety with ambulation. The patient
321 stated that she felt “much safer with the walker”.

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327 **DISCUSSION**

328 This case demonstrated its intended purpose to provide the framework for the treatment of and
329 an overview of a care plan for a patient following stroke. This case was intended to show the use of
330 tactile cueing to initiate activation of the left lateral lumbar flexors in treatment of gait abnormalities
331 and improvements in fall risk. Because fall risk is associated with ambulation ability which has been
332 correlated with gait speed ¹¹ a great deal of treatment time was focused on gait with the use of tactile
333 cues. In light of the knowledge that the greatest improvements are seen in the first weeks to months
334 following stroke ⁴, there was a greater concentration of tactile cues provided early on in treatment as
335 compared to the weeks nearing DC. Although the patient continued to see recovery in the later weeks
336 we chose to provide less cuing in order to prepare her for return to home.

337 Aquatic therapy is indicated in patients following CVA in order to improve strength, balance and
338 coordination. Unfortunately the patient had a difficult time maintaining focus in the pool and required
339 increased assistance, verbal cues, and tactile cues as compared to land based treatments. She also
340 complained of stomach illness during her first aquatic treatment session. It was felt by the therapy staff
341 that the benefits of aquatic therapy did not outweigh the overstimulation and poor tolerance to
342 treatment experienced by the patient so aquatic therapy was discharged from her POC. Further research
343 into the timing of aquatic treatment sessions might be a topic worth looking into in the future.

344 The patient made limited progress in therapy when she was confused due to cognitive
345 impairments and fatigue. During the patient's last week at MVH, therapy was decreased to 3 sessions
346 per week for 45-60 minutes per day, because of her fatigue and limited progress. Episodes of confusion
347 were documented, monitored, and brought to the attention of her physician. Perhaps further gains may
348 have been witnessed had therapy sessions been decreased earlier in response to her cognitive decline,
349 confusion and fatigue.

350 Overall, this patient was an excellent candidate for physical therapy and through a combination
351 of treatments and therapies with a team approach the patient was able to be discharged to home, near
352 her prior level of function. The patient and her family were both pleased with the care she received at
353 MVH and felt that PT played a significant role in her recovery.

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Table 1: Tests and Measures at Admission and Discharge

	Initial Evaluation	Discharge	Comments
Bed Mobility			
Sit to Supine	S and increased time to complete task, less than optimal technique	I	
Supine to Sit	S and increased time to complete task, less than optimal technique	I with increased time to complete task, min v/c for technique	
Transfers			
Sit to Stand	CGA, using BUEs as part of BOS and v/c	I at best with 1 UE as part of BOS, occasionally increased attempts required to stand; consistently demonstrates DS level with v/c for SHP and technique	
Stand to Sit	CGA, using BUE as part of BOS and v/c to reach back to surface for controlled descent, 18" surface	DS- MI with increased time to complete task and occasional v/c for SHP	
Surface to Surface	CGA, using BUE as part of BOS, moving to L and R; moving L requires increased v/c to effectively sequence step pivot transfer	I with 1 UE as part of BOS	
Ambulation			
With 4 Wheel Walker	CI S 100'	800' with S-DS	
Without Assistive Device	CGA 200'	300' with S; occasional CGA secondary to increased confusion	
Stairs			
Ascending/ Descending	4 steps at 6.5" with B rails, CGA, and reciprocal pattern	12 steps at 6.5" with B rails, S, and reciprocal pattern	
Safety			
Behaviors	Fair	Good; occasionally Fair secondary to periods of confusion	Patient sustained 1 fall related to self-mobilization at evaluation.
Strength			
RLE	4/5 for all motions	4+/5	
LLE	3+/5 for all motions	4/5	
Trunk Extensors	Able to activate and sustain	Able to activate and sustain	
Trunk Flexors	Able to activate and sustain	Able to activate and sustain	
Lateral Trunk Flexors	R: able to activate and sustain L: able to activate, unable to sustain without t/c during mobility tasks	L: able to activate and sustain 75% of the time without t/c during mobility tasks	Patient does experience increased fatigue in L lateral lumbar flexors as compared to the R
Posture			
Sitting	Posterior pelvic tilt	Neutral pelvis	
Standing	L downward tilt to pelvis	Posterior Pelvic tilt and slightly forward head	
Activity Tolerance	Normal activities cause fatigue	Age appropriate activities do not cause increased fatigue	
Edema	None noted	None noted	
Proprioception	Diminished in LLE	Diminished in LLE	Increased awareness in LLE however still impaired from normal
Coordination (as reported by Occupational Therapy)			
Finger to Nose	L: decreased accuracy	L: increased accuracy with increased time	
Rapid Alternating Movements (RAMs)	L: Dysdiadochokinesia	L: minimal dysdiadochokinesia	
Serial Opposition	L: Impaired	L: increased accuracy with increased time	

Gait Analysis			
With 4 Wheel Walker	L downward pelvic tilt with L stance, corrected with t/c to L lateral lumbar flexors	Narrow BOS with occasional scissoring gait pattern	Scissoring gait exaggerated when patient is distracted by surroundings
Without Assistive Device	L downward pelvic tilt with L stance, corrected with t/c to L lateral lumbar flexors	Unsteady at times with narrow BOS and occasional scissoring gait pattern	Scissoring gait exaggerated when patient is distracted by surroundings
Balance			
Sitting Static	Leans posteriorly	Good	
Sitting Dynamic	Fair +	Good	
Standing Static	CGA with BUE support	Fair +/-Good; leans slightly L	
Standing Dynamic	Poor	Fair + with 4WW; Poor + without AD	
Pain			
VAS Scale	0/10	0/10	
Cognition			
Orientation	A & O x 3 to person, place, and year	A & O x 3 to person, place, and year	Patient does experience "sun-downing" in the afternoons at which time orientation is A & O x 1 to person

L: Left; **R:** Right; **B:** Bilateral; **UE:** Upper Extremity; **LE:** Lower Extremity; **AD:** Assistive Device; **4WW:** Four Wheel Walker
CGA: Contact Guard Assistance; **CI S:** Close Supervision; **S:** Supervision; **DS:** Distance Supervision; **MI:** Modified Independence; **I:** Independent
v/c: Verbal Cues; **t/c:** Tactile Cues; **min:** Minimum; **SHP:** Safe Hand Placement; **BOS:** Base of Support; **A&O:** Alert & Oriented

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Table 2: 10 Meter Walk Test

	Assistive Device	Level of Assistance	Score (seconds)	Gait Velocity (m/s)	Interpretation	Recommendations	Comments
Initial Evaluation	Without	CGA	16.69	.60	Limited Community Ambulator	Needs intervention to reduce fall risk	
4 Weeks	Without	CGA/Close Supervision	12.11	.83	Community Ambulator	Needs intervention to reduce fall risk	
	4WW	Close Supervision/ Supervision and tactile cues to lateral lumbar flexors	10.82	.92	Community Ambulator	Needs intervention to reduce fall risk	Patient stated "I feel less tired with the walker"
Discharge (8 weeks)	Without	Supervision	12.44	.80	Community Ambulator	Needs intervention to reduce fall risk	Patient shows increased steadiness with gait however gait abnormalities do persist
	4WW	Supervision/ Distance Supervision	11.59	.86	Community Ambulator	Needs intervention to reduce fall risk	Patient stated "I feel much more safe with the walker."
	4 WW	Tactile Cues to lateral lumbar flexors	10.70	.93	Community Ambulator	Needs intervention to reduce fall risk	Patient's gait abnormalities are improved with tactile cues.

Table 3: Patient Goals

Short term goals: to be completed within 1 week	Long term goals: to be completed within 4 weeks
<ol style="list-style-type: none"> 1. The patient will transfer supine <> sit with verbal cues for technique and supervision in order to decrease burden of care. 2. The patient will transfer sit <> stand with supervision and verbal cues from an 18” surface with use of BUEs as part of BOS, in order to decrease burden of care. 3. The patient will ambulate without an AD x 400 feet, with tactile cues less than 100’ of the total distance in order to decrease her risk of falls. 4. The patient will ascend and descend 12 stairs at 6.5” with B handrails and supervision in order to increase safe access to her environment. 	<ol style="list-style-type: none"> 1. The patient will independently transfer supine <> sit in order to decrease burden of care. 2. The patient will independently transfer sit <> stand and surface <> surface from a height greater than or equal to 17” without the use of UEs as a part of BOS, in order to decrease burden of care and to increase access to her environment. 3. The patient will ambulate without an AD and with distance supervision greater than 1000 feet and a gait velocity of 1.0 m/s or greater in order to increase access to her environment and decrease fall risk. 4. Patient will ascend and descend 12 stairs at 6.5” with supervision and the use of one handrail in order to increase access to her environment.

B: bilateral; **UE:** upper extremities; **BOS:** base of support; **AD:** assistive device

Table 4: Interventions

		Weeks 1 & 2	Weeks 3 & 4	Weeks 5 & 6	Week 7 & 8
Therapeutic Exercise	ROM	PROM to B hamstrings and gastrocnemius			
	Strengthening	Optimal sitting, seated LE exercises with 1# and red theraband	<ul style="list-style-type: none"> Optimal sitting, seated LE exercises with 2# and red theraband Standing LE exercises with 2# and red theraband and BUE support 		Standing LE exercises with 2# and green theraband with 1UE support
	Activity Tolerance	<ul style="list-style-type: none"> Standing tolerance Sitting tolerance Continuous walking x 5 minutes with 10% BWS 	Outside ambulation x 25 minutes with 4WW and >5 standing rest breaks	60 minutes continuous standing activity <ul style="list-style-type: none"> Min t/c first 30 minutes Mod- max t/c following 15 minutes Unable to maintain trunk control even with max t/c after 45 minutes Ambulation with 4WW x 14 minutes <ul style="list-style-type: none"> Min t/c No rest breaks required 	10 minutes continuous ambulation; outside with 4WW <ul style="list-style-type: none"> 2 minute seated rest break Mod t/c at B lateral lumbar flexors Standing 12 minutes with dual UE task without UE support
Therapeutic Activities	Bed Mobility	<ul style="list-style-type: none"> Supine <> sit Rolling R and L Side-lying <> sit 	<ul style="list-style-type: none"> Supine <> sit Rolling R and L Scotting up and down (head <> foot of bed) 	<ul style="list-style-type: none"> Supine <> sit 	<ul style="list-style-type: none"> Supine <> sit Rolling R and L
	Transfers	<ul style="list-style-type: none"> Sit <> stand Bed <> WC 	<ul style="list-style-type: none"> Sit <> stand from a variety of surfaces Surface <> surface from a variety of heights, with and without armrests WC <> bed 	<ul style="list-style-type: none"> Sit <> Stand from 18" height with armrests Sit <> Stand from 18" height without armrests Sit <> Stand from 17" height with armrests Sit <> Stand from 17" height without armrests Surface <> surface with 1 UE BOS Bed <> WC Stand <> floor 	<ul style="list-style-type: none"> Sit <> stand with 5# weight Sit <> stand with 1 UE support t/c at lumbar extensors Bed <> WC
	Patient Education	Use of the call bell to alert the nursing staff that she needs assistance	<ul style="list-style-type: none"> Safe use of 4WW during transfers and ambulation SHP during transfers 	SHP during transfers and stair training	<ul style="list-style-type: none"> Safe use of 4WW brakes Importance of rest following therapy Family education regarding patient's DC to home <ul style="list-style-type: none"> - Need for 24 hours of S - Encouraging patient to remain active

Mobility Training	Gait Training	150' x 2 at best without AD <ul style="list-style-type: none"> t/c at L lateral lumbar flexors and L hip abductors during L stance 	700' with 4WW, inside over level surfaces <ul style="list-style-type: none"> surfaces including hardwood, linoleum, and carpet min to mod t/c at L lateral lumbar flexors 375' with 4WW, outside over uneven terrain <ul style="list-style-type: none"> surfaces including asphalt pavement, grass, pebbles, and dirt hill negotiation (up and down) min to mod t/c to L lateral lumbar flexors 	800' with 4WW, inside over level surfaces <ul style="list-style-type: none"> up and down ramps min t/c 25' x 4 without AD <ul style="list-style-type: none"> mod t/c to L lateral lumbar flexors 	125' x 2 without AD <ul style="list-style-type: none"> min- mod t/c B lateral lumbar flexors
	Stair Training		Ascend and descend 12 steps at 6.5" with B rails and reciprocal gait pattern	Ascend and descend 18 steps at 6.5" with R handrail and step to negotiation	Ascend and descend 12 steps at 6.5" with R handrail and reciprocal gait pattern
Neuromuscular Reeducation	Balance Training	Static Standing <ul style="list-style-type: none"> Without UE support Weight shifting R to L and forward to back Optimal Sitting <ul style="list-style-type: none"> Weight shifting R to L and forward to back Reaching to the R with t/c at L lateral lumbar flexors 	<ul style="list-style-type: none"> Figure 8s with 4WW Straight line ambulation with 4WW Obstacle course with 4WW Standing reaching up to R with t/c at L lateral lumbar flexors 	Dynamic standing <ul style="list-style-type: none"> Figure 8s with 4WW Balloon toss with forward stepping Alternate step ups at 5" step, R and L with 4WW BOS Static Standing <ul style="list-style-type: none"> reaching alternate heights and across midline with dual UE task Balloon toss Reaching down to L with R UE and up to R with R UE and t/c at L lateral lumbar flexors Optimal sitting <ul style="list-style-type: none"> Reaching down to L with R UE and up to R with R UE and t/c at L lateral lumbar flexors 	Static Standing (on blue foam board) <ul style="list-style-type: none"> Closed stance with dual UE task Tandem stance with B UE support Semi-Tandem stance with dual UE task Closed stance with head turns, R&L and Up & Down Reaching task with BUE up & down to R&L Biodex LOS <ul style="list-style-type: none"> Skill level 12 R&L and fwd & back Mod-max t/c L lateral lumbar flexors Dynamic Standing <ul style="list-style-type: none"> Standing toe taps R&L Lateral side stepping to R&L Later side steps up and over 6" height with BUE support Obstacle course Ambulation with dual UE task with weighted objects (4-9#)

	Body Weight Support System	6.7-10% BWS <ul style="list-style-type: none"> • Single leg stance • Righting reactions • Obstacle course • Lateral side stepping R&L • Backwards ambulation • Toe taps on 4" cone • Weight shifting R to L and forward to back 		0%- BWS used for increased safety with new tasks <ul style="list-style-type: none"> • Alternating ball kicks R and L • Obstacle course without AD 	
	Kinesiotaping	"I" strip to the L lateral lumbar flexors and L hip abductors			
Manual Therapy	STM			R posterior SI joint	
	Muscle Energy			Light, to promote R anterior rotation 3 sets of 10 second holds	
	Joint Mobilizations			Light mobilizations to R posterior SI to promote forward shift	
PPT	10 Meter Walk Test	Week 1: 16.69 seconds without AD and CGA Week 2: 16.91 seconds without AD and CGA	Week 3: 13.13 seconds with 4WW and cl S Week 4: <ul style="list-style-type: none"> • 12.11 seconds without AD with CGA • 10.82 seconds with 4WW and CI S/S 		Week 7: <ul style="list-style-type: none"> • 11.82 seconds without AD and noticeable gait deviations • 11.88 seconds with 4WW and minimal gait deviations Week 8: <ul style="list-style-type: none"> • 12.44 seconds without AD and S • 11.59 seconds with 4WW and S • 10.70 seconds without AD and t/c to L lateral lumbar flexors
Aquatic Therapy	Aquatic Therapy	<ul style="list-style-type: none"> • Stairs in and out of the pool with CGA • Backwards ambulation with handheld assist and v/c • Lateral side stepping with handheld assist and v/c • Backwards and lateral step ups with v/c • Static standing 			

PROM: Passive Range of Motion; **R:** right; **L:** left; **UE:** upper extremity; **PF:** Plantarflex; **DF:** Dorsiflex; **LAQ:** long arch quad; **#:** pound; **BWS:** body weight support; **ADD:** Adduction; **ABD:** Abduction; **t/c:** tactile cues; **SHP:** save hand placement; **4WW:** 4 wheel walker; **min:** minimal; **mod:** moderate; **max:** maximal; **BOS:** base of support; **SI:** sacroiliac; **STM:** Soft tissue massage; **PPT:** physical performance testing; **fwd:** forward; **LOS:** limits of stability; **S:** supervision; **DC:** discharge

