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Snezhana Rudakova
University of New England

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Use of Complete Decongestive Therapy and a task-oriented approach in treating secondary lymphedema and improving ambulation in a patient following a stroke: A Case Report

Snezhana Rudakova

S Rudakova, BA, is a DPT student at the University of New England, 716 Stevens Ave. Portland, ME 04103
Address all correspondence to Snezhana Rudakova at srudakova@une.edu

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.

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33 **Abstract:**

34 **Background and Purpose:** Ninety percent of stroke survivors have some functional disability
35 with mobility and paralysis of the extremities being a major impairment. A paralysis of the
36 extremities can result in an ineffective muscle pumping action, which can lead to the
37 development of lymphedema; further increasing difficulty with ambulation post stroke. The
38 purpose of this case is to report the use of complete decongestive therapy for the treatment of
39 lymphedema as part of a comprehensive treatment program consisting of a task-oriented
40 approach to improve walking ability in a stroke survivor.

41 **Case Description:** The patient was a 53 year old female six months s/p stroke who developed
42 right lower extremity lymphedema. She presented with deficits secondary to CVA with right
43 sided hemiparesis including decreased range of motion and decreased strength in the right lower
44 extremity, as well as increased tone and spasticity throughout the right upper extremity and
45 lower extremity. Her decreased strength, impaired balance, and increased limb heaviness
46 contributed to her difficulty with ambulation and ADL's.

47 **Outcomes:** She experienced a 1.0 cm-5.0 cm reduction in various areas of circumference
48 measurements of the right lower extremity with no signs or symptoms of infection. Her gait
49 mechanics and gait speed improved in conjunction with a decrease in disability of 39% (Tinetti).

50 **Discussion:** Despite her chronicity post-stroke, use of a task-oriented approach consisting of
51 both strength and intensive mobility training improved the patient's ambulation and increased
52 her independence with ADL's. Complete decongestive therapy was effective in reducing the
53 swelling of the right lower extremity, further contributing to improvement with ambulation.

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56 **Background and Purpose:**

57 Every year, there are approximately 795,000 people in the United States who experience
58 a new or recurrent stroke. While almost two-thirds of survivors have initial mobility deficits,
59 more than 30% of the survivors cannot walk independently six months following a stroke.¹ Of
60 those who are able to walk independently, only a small proportion can walk with sufficient speed
61 and endurance to be able to function within the community.² Ninety percent of stroke survivors
62 have some functional disability with mobility being a major impairment.³ Intensive mobility
63 training which incorporates functional strengthening, balance and aerobic exercises, and practice
64 on a variety of walking tasks improves gait ability both in sub-acute and chronic stroke.³

65 Following a CVA, it is common to have a paralysis of the extremities which can lead to a
66 decreased and ineffective muscle pumping action, thus resulting in lymph stasis.⁴ Lymphatic
67 fluid stasis is associated with the accumulation of interstitial fluid in the subcutaneous tissue and
68 skin.⁴ Lymphedema is the tissue fluid accumulation that arises due to impaired lymphatic
69 drainage.⁴ Lymphedema can result from an intrinsic fault in the lymphatic vessels (primary
70 lymphedema) or damage caused to the lymphatic vessels or nodes (secondary lymphedema).⁴
71 Secondary lymphedema is the most prevalent form of lymphedema and is typically caused by
72 obstruction or disruption of the lymphatics due to surgery, radiation, trauma, or infection
73 (typically filariasis).⁴ Lymphedema leads to swelling, decreased mobility, and increased risk of
74 infection.⁵ The management of lymphedema by physical therapists consists of complete
75 decongestive therapy (CDT) which includes a combination of skin care, compression,
76 lymphedema remedial exercises, and manual lymphatic drainage.⁵

77 Lymphedema often goes unnoticed and undiagnosed in patients following a CVA as it is
78 more commonly associated with removal of lymph nodes or radiation, and in cancer related

79 lymphedema.⁴ If left untreated, lymphedema can lead to further health issues and
80 hospitalizations.⁶

81 This case report describes a patient who developed lymphedema in the right lower
82 extremity following a CVA. The purpose of this case report is to explore the benefits of complete
83 decongestive therapy as part of lymphedema treatment and its role in lymphatic drainage, as well
84 as contribution to improving walking ability as part of a comprehensive treatment program
85 including task specific training and intensive mobility training.

86 **Patient History and Systems Review:**

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

90 The patient was 53 year old female who was referred for outpatient physical therapy six
91 months following a CVA resulting in hemiparesis on the right, as well as lymphedema in the
92 right lower extremity. The patient was referred to physical therapy for improving balance,
93 increasing strength in the right lower extremity, and improving ambulation in order to maximize
94 the patient's functional ability and independence with activities of daily living. Additionally, the
95 patient was referred for lymphedema treatment of the right lower extremity.

96 The patient presented with deficits secondary to CVA with flaccid hemiplegia of the right
97 upper extremity and hemiparesis of the right lower extremity. She presented with no active
98 movement of the right upper extremity but with some function of the right lower extremity.
99 Additionally, she presented with lymphedema of her right lower extremity. She utilized a solid
100 AFO as well as a quad cane when ambulating around her home, but used a motorized scooter in

101 public places. She was mostly independent with ADL's but was limited secondary to poor
102 balance and difficulty with ambulation. Her husband assisted with cooking, cleaning, and other
103 activities as needed.

104 She had no history of surgeries, but had a history of hypertension, controlled with
105 medication. Additionally, the patient had restless leg syndrome in the right lower extremity
106 controlled with medication. She also presented with type II diabetes, controlled by diet, and
107 denied any smoking and alcohol use.

108 She was not employed outside of the home and reported no regular hobbies. She lived
109 with her retired husband in a one story home which had three stairs leading up to the home with
110 a railing on both sides.

111 **Medications and Indications:** Refer to Table 1

112 **Systems Review:** For results of a full systems review, refer to Table 2

113 **Patient's Goals:**

114 The patient's goals for physical therapy were to improve balance, increase strength in her
115 right lower extremity, and improve ambulation in order to remain independent and decrease the
116 burden of care for her husband.

117 **Clinical Impression #1:**

118 The patient presented with deficits secondary to CVA which consisted of impaired
119 coordination, sensation, strength, and cardiovascular fitness. Secondary to lymphedema, the
120 patient presented with increased limb size and heaviness. These impairments affected the
121 patient's ability to perform functional tasks such as transfers, ambulation, and activities of daily
122 living. In order to confirm the diagnoses of CVA and lymphedema in the right lower extremity
123 and to rule out any differential diagnoses, the plan for examination consisted of performing

124 manual muscle testing on the patient's lower extremities bilaterally, as well as performing
125 bilateral goniometric measurements of the hip, knee, and ankle. Due to the patient's diagnosis of
126 a CVA, the patient's coordination, reflexes, and spasticity were planned. Circumference
127 measurements were planned for the right lower extremity to document the amount of swelling
128 due to lymphedema. As a functional outcome measure, the Tinetti Performance Oriented
129 Mobility Test was planned to be performed in order to assess gait mechanics, strength, and
130 balance.

131 **Examination:**

132 As part of the examination procedure, the patient's lower extremity gross strength and
133 range of motion was assessed bilaterally. Manual muscle testing was performed and graded as
134 described by Kendall and McCreary.⁷ Inter-examiner reliability is found to be in a range between
135 82% and 97% and between 96% and 98% for test-retest reliability.⁸ The patient's range of
136 motion was within functional limits in all hip, knee, and ankle motions on the left. On the right,
137 the patient lacked 20 degrees of active knee extension and 10 degrees of active ankle
138 dorsiflexion. All other hip, knee, and ankle motions were within functional limits on the right.
139 Active range of motion (AROM) and passive range of motion (PROM) of the lower extremities
140 were measured using a goniometer as described by Norkin and White.⁹ To assess the patient's
141 neuromuscular system, reflex and coordination tests were performed (Table 3). Coordination
142 tests consisting of finger to nose and heel to shin were performed as described by O'Sullivan.¹⁰

143 The patient's skin temperature and color was within normal limits in bilateral lower
144 extremities. There were no scars or wounds present, and toe nails were in good condition. In the
145 right lower extremity, the patient was positive for stemmer sign and presented with 2+ pitting
146 edema below the knee on the right lower extremity. No pitting edema was present in the left

147 lower extremity. Additionally, circumference measurements of the right lower extremity were
148 taken with a tape measure as described by Norkin and White⁹ (Table 4).

149 The patient scored a 10/28 on the Tinetti Balance Assessment which placed her at a high
150 fall risk and 64% disability. The Tinetti Performance Oriented Mobility Test exhibits sound
151 reliability with interrater reliability coefficients ranging from 0.80 to 0.95 and test-retest
152 reliability reported as 0.72 to 0.86. The MDC is estimated at 6 points, indicating that a patient
153 must have a greater than 6-point change to be reflective of a true change in balance ability.¹¹
154 During gait, the patient used a quad cane and minimal assistance during ambulation and
155 presented with a step to gait pattern, decreased foot clearance, no heel strike, decreased hip and
156 knee flexion during swing, and wide base of support on the right. Her gait speed was 1.2 ft. /sec
157 for a distance of 60 feet.

158 **Clinical Impression #2:**

159 During evaluation, she presented with significant weakness and increased tone
160 throughout the right lower extremity causing mobility concerns as well as increased fall risk and
161 difficulty with ambulation. The patient also presented with lymphedema in the right lower
162 extremity which exacerbated impairments with strength in the leg causing even further mobility
163 concerns due to heaviness.

164

165 Upon assessment of gait, foot drop was noted on the right as the patient was unable to
166 clear the ground with the right foot. Compensatory pattern included lateral trunk lean to the left
167 with decreased hip flexion and knee flexion during swing on the right. Additionally, she
168 demonstrated a wide BOS due to impaired balance and a step to gait pattern due to decreased
169 limb stance on the right.

170 Her score of 10/28 on the Tinetti Balance Assessment Tool placed the patient at a high
171 fall risk with a 64% disability. Therefore, it was determined that the patient would benefit from
172 skilled therapy services to work on gait, strength, functional transfers, and balance to reduce fall
173 risk and improve functional mobility.

174 The paralysis in her right lower extremity resulting from her CVA has led to an
175 ineffective muscle pumping action leading to a build-up of fluid. Due to right hemiparesis and
176 increased limb heaviness she is put at an increased fall risk and increased impairment with
177 ambulation. It was necessary to utilize a multifaceted approach as the impairments resulting from
178 her lymphedema were also impacting the patient's recovery process from stroke.

179 **Physical Therapy Diagnosis:**

180 The patient's presentation of right sided hemiplegia of the upper extremity and
181 hemiparesis of the right lower extremity, along with impaired mobility and balance were
182 consistent with ICD-9 code 434.91 for CVA; Practice Pattern 5D: Impaired Motor Function and
183 Sensory Integrity Associated with Nonprogressive Disorders of the Central Nervous System—
184 Acquired in Adolescence or Adulthood. Additionally, the patient's presentation of pitting edema,
185 increased fluid, and increased circumference measurements of the right lower extremity was
186 consistent with ICD-9 code 457.1 for secondary lymphedema; Practice Pattern 6H: Impaired
187 Circulation and Anthropometric Dimensions Associated With Lymphatic System Disorders.

188 **Prognosis:**

189 The patient presented with deficits secondary to a CVA resulting in right sided
190 hemiplegia of the upper extremity and hemiparesis of the right lower extremity. She was
191 considered to be a good candidate for CDT: Complete Decongestive Therapy consisting of skin
192 care, compression, lymphedema remedial exercise, and manual lymphatic drainage which assists

193 with reduction of swelling. This in combination with working on strengthening, balance, and gait
194 training will assist in maximizing patient's functional potential and improving her ability to
195 remain independent. She was expected to respond well to therapy as she was motivated to
196 improve and had an excellent support system with her husband. However, since it was greater
197 than six months following her CVA, which is after the significant recovery phase, it was
198 important that we were aware that her improvements may be slow in progression. Additionally,
199 we were limited to 23 visits as that was determined by her insurance. Given this situation, we
200 made it a priority to be efficient with each visit in order to properly address concerns with
201 lymphedema in conjunction with functional mobility, balance, weakness, and ambulation
202 concerns.

203 **Referral:**

204 The patient was referred to occupational therapy for treatment of impairments of her right
205 upper extremity. Additionally, the patient was referred to a certified orthotist to receive a custom
206 spiral AFO to assist with ambulation and a custom fitted compression sock for her right lower
207 extremity for long term management of lymphedema.

208
209 **Additional Testing:**

210 Although no pitting edema was present in the left lower extremity, circumference
211 measurements should have been taken of the left lower extremity to compare the right lower
212 extremity (affected limb) to the left (unaffected limb). Since no measurements of the left lower
213 extremity were taken, the patient's improvements in girth measurements of the right lower
214 extremity will be compared to the measurements taken at initial evaluation.

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217 **Interventions:**

218 Complete decongestive therapy consisting of compression bandages, skin care,
219 lymphedema remedial exercises, and manual lymphatic drainage was performed in order to assist
220 with lymphatic drainage of the right lower extremity. Additionally, task specific training
221 consisting of intensive mobility training and treadmill training will be performed in order to
222 target the patient's deficits secondary to CVA in order to improve the patient's ambulation and
223 functional mobility.

224 **Functional Goals:**

225 The patient will experience a decrease in circumference measurements of the right lower
226 extremity in order to reduce limb heaviness and improve mobility of the right lower extremity.
227 Additionally, she will improve her strength in the right lower extremity in order to assist with
228 ADL's and functional mobility such as independently ascending and descending 3-4 stairs to
229 enter her home. By improving her gait mechanics and improving her score on the Tinetti Balance
230 Assessment, she will demonstrate a decreased fall risk, improvement in balance, and a decrease
231 in disability.

232 **Interventions:**

233 **Coordination, Communication, Documentation:**

234 Orthotic fit and train: In conjunction with a certified orthotist, the patient was fit for a custom
235 below the knee compression garment for the right lower extremity. It was a Juzo Dynamic
236 (Juzo® Compression Store, Inc 1595 E. Garrison Blvd. Suite C Gastonia, NC 28054) circular
237 knit stocking with a silicone border and closed toe, with a compression grade of 20-30 mmHg.
238 Additionally, the patient was fit for a graphite, spiral AFO to relieve the pressure on the sides of
239 patient's feet. The spiral design will allow room for potential swelling and to keep the AFO from

240 digging into the patient's right leg and foot. The graphite material will provide assistance for toe
241 off during the swing phase. Overall, this helped promote better body mechanics by decreasing
242 hip hike compensatory trunk lean, while promoting knee flexion.

243 **Patient/caregiver education:**

244 The patient and her husband were educated on lymphedema prevention strategies
245 including the use of custom fitted compression socks, and the importance of elevating the feet
246 when sitting. Additionally, the patient was educated on the role of complete decongestive
247 therapy (CDT) in reducing swelling, and how to identify signs of infection such as redness,
248 warmth, and swelling. Prior to beginning CDT, the patient and her husband were educated on
249 keeping the edematous limb clean, dry, and moisturized with a lotion of a neutral pH.

250 When first beginning outpatient physical therapy, the patient was given a home exercise
251 program consisting of strengthening hip adduction, hip abduction, hamstrings, and quadriceps.
252 These exercises were to be performed daily with ten repetitions per exercise. Towards the end of
253 the patient's allotted visits (23), the patient was given an updated home exercise program
254 consisting of standing hip abduction, standing hip extension, sit to stands, alternate stair
255 stepping, standing hip flexion, and mini squats. These exercises were to be performed daily, 2 x
256 10 per exercise.

257 **Procedural Interventions:**

258 At nearly every treatment session, the patient spent about 10 minutes warming up on the NuStep
259 (NuStep Recumbent Cross Trainer Model: T5XR NuStep, Inc. Ann Arbor, Michigan USA).
260 Following the NuStep, the patient would then participate in either therapeutic exercise, complete
261 decongestive therapy, or gait training. At the start of the patient's plan of care, therapeutic
262 exercise consisted of performing quad sets, glute sets, short arc quads, long arc quads, hip

263 abduction and adduction in sitting, ankle plantarflexion and dorsiflexion. The patient then
264 progressed to stair stepping exercises, standing hip abduction and adduction, standing hip
265 extension, repetitive sit to stands, and mini squats.

266 Transfer training: The patient practiced transferring from a chair with arm rests to a mat/bed with
267 a hard surface. The patient required minimal assistance x1 with verbal and manual cues to
268 encourage weight shift onto the right lower extremity.

269 Bed mobility: The patient practiced performing supine to sit and sit to supine with verbal and
270 manual cues from the physical therapist to encourage the patient to utilize her right lower
271 extremity instead of compensating with the left.

272 Kinesiotape: The purpose of the kinesiotape (Kinesio[®] Tex Classic) was to assist with lymphatic
273 drainage.¹² The kinesiotape was applied using the spider technique on the patient's right knee as
274 well as below the knee on the right. Below the knee, the base of the kinesiotape was applied on
275 the lymphatic ducts with the tails extending across the anterior, lateral, and slightly posterior part
276 of lower leg on the right.

277 Gait training:

278 Stepping activities and gait training focused on improving weight shift, foot clearance,
279 step length, push off phase of gait, and ability for the patient to put weight on her right lower
280 extremity to improve swing with the left leg. This was performed both with and without the use
281 of a LiteGait (LGI 360E, PO Box 3141, Tempe AZ, 85280); minimal to moderate assistance x 1
282 was needed for proper weight shift and additional moderate assistance to steer the LiteGait.

283 Another variation of gait training was with the use of an agility ladder during which the patient
284 was given verbal cues to step into each square of the ladder to promote a proper step through gait

285 pattern on the right. With each step, the patient was given verbal cues to heel strike in order to
286 promote proper gait mechanics. Manual cues were provided to assist the patient with increasing
287 the weight shift to the right side to promote a better swing through of the left leg. The patient
288 used a quad cane with minimal assistance x 1 during weight shifting, and contact guard assist
289 with use of the ground ladder.

290 **Complete Decongestive Therapy:**

291 Skin Care: (See education section above)

292 Compression bandages: Application of compression bandages below the knee on the right lower
293 extremity consisting of tricofix (BrightLife Direct, Inc. 6925-D Willow St NW, Washington,
294 DC 20012), foam wrapping, and short stretch bandages (6, 8, and 10 cm wide), with eucerin
295 cream having been applied before the tricofix. The tricofix was applied like a sock to the right
296 lower extremity, extending from the base of the toes to the popliteal fossa. The foam wrapping
297 was applied next in a spiral manner, again from the base of the toes to the popliteal fossa. The
298 size 6 short stretch bandage was applied just to the foot and anchored around the ankle. The size
299 8 bandage was applied like a roman sandal to the foot and ankle, followed by the size 10
300 bandage which was applied slightly above the ankle all the way to the popliteal fossa in a spiral
301 manner. A short stretch bandage has minimal stretch and is used to maintain the volume
302 reduction from manual lymphatic drainage and exercise.¹²

303 Manual lymphatic drainage (MLD): MLD was performed to the following structures in a
304 sequential and rhythmic manner, deep cervical lymph nodes, axillary lymph nodes on the right,
305 inguinal axillary (IA) anastomosis, inguinal lymph node on the right, and pathways throughout
306 the right lower extremity. Stationary circles and soft effleurage was performed to gently direct
307 the fluid towards the unaffected lymph nodes.

308 Lymphedema remedial exercises consisting of toe flexion and extension, ankle pumps, ankle
309 circles, and heel slides (knee flexion).

310 **Outcomes:**

311 The patient experienced a decrease in fluid from the initial evaluation to the 10th visit,
312 which was during the process of complete decongestive therapy. However, she experienced an
313 increase in fluid between the 10th and 15th visit which is when she was transitioned into wearing
314 the tg soft compression garment (Lohmann & Rauscher, Doral, Florida) instead of the
315 compression bandages due to discoloration of the right lower extremity. The decrease in fluid
316 seen from the 15th visit to the 20th visit was when the therapist used kinesiotape (Kinesio[®] Tex
317 Classic) in conjunction with the tg soft compression garment, (Table 5).

318 The patient demonstrated a slight improvement in right hip abduction and right knee
319 extension, increased in both from a 4-/5 to 4/5, but otherwise remained the same between the
320 initial evaluation and the 10th visit. The therapist did not test the strength at the 20th visit.
321 Additionally, the patient demonstrated an improvement in balance and gait mechanics, as well as
322 a decrease in disability and fall risk, (Table 6).

323 **Discussion:**

324
325 The patient presented with deficits secondary to CVA consisting of right sided
326 hemiparesis, decreased range of motion and decreased strength in the right lower extremity as
327 well as increased tone and spasticity throughout the right upper extremity and lower extremity.
328 Her decreased strength, impaired balance, and increased limb heaviness contributed to her
329 difficulty with ambulation and ADL's. Secondary to lymphedema, the patient presented with
330 increased limb size and heaviness. These impairments affected the patient's ability to perform
331 functional tasks such as transfers, ambulation, and activities of daily living. Due to the patient

332 having two diagnoses, the sessions had to be strategically divided between performing complete
333 decongestive therapy to address the patient's lymphedema and use of a task oriented approach to
334 address the patient's deficits secondary to stroke. Depending on the patient's status from session
335 to session, some of the sessions were primarily focused on addressing her lymphedema, while
336 other sessions were primarily focused on utilizing a task oriented approach.

337 The impairments that result from stroke such as muscle weakness, impaired coordination,
338 impaired balance, spasticity, and impaired endurance can lead to persistent difficulties with
339 walking. Gait retraining through different types of exercise is currently the most common and
340 effective approach to improving walking ability.³ Intensive mobility training has been
341 particularly noted to improve walking ability in patients following stroke as it consists of
342 functional strengthening, balance exercises, and variation of walking tasks.³ We recognized that
343 the patient demonstrated an improvement in gait mechanics when there was variation in the
344 focus of the gait training. For example, the patient performed better when we switched up the
345 verbal and manual cues to focus on heel strike, or exaggerating hip flexion, or focusing on
346 weight shifting. Additionally, we recognized that the patient demonstrated an improvement in
347 gait mechanics when we combined strengthening activities with gait training. For example, the
348 patient benefitted from first attempting to perform a set or several sets of standing marches prior
349 to ambulating with a focus on exaggerating marching or hip flexion with each step.

350 Due to the chronicity of the patient's stroke, it was necessary to set realistic expectations
351 regarding the patient's progress. The primary goal was to improve the patient's ambulation and
352 increase her functional strength in order to assist with performance of ADL's and quality of life.
353 Despite her chronicity, use of a task-oriented approach consisting of graded strengthening,

354 aerobic exercise, and a variety of challenging walking tasks improved the patient's balance,
355 ambulation, gait mechanics, and endurance.

356 In order to improve the patient's lymphedema in the right lower extremity, complete
357 decongestive therapy was chosen as the intervention. Complete decongestive therapy is currently
358 the most effective treatment for lymphedema and consists of compression, manual lymphatic
359 drainage, skin care, and lymphedema remedial exercises.¹³ Manual lymphatic drainage (MLD)
360 serves to stimulate the lymphatic system to pump extra fluid out of the particular extremity and it
361 is most effective when combined with application of compression bandages to keep the fluid
362 from returning to the area. MLD can be used to redirect lymph across the plexus of initial
363 lymphatics towards healthy lymph nodes. The initial lymphatics respond to the rhythmic
364 movement of the skin under the therapist's hands, opening to allow fluid to enter the system.¹²
365 Skin care is important to avoid sunburns or cuts which can lead to infection and result in further
366 inflammation and build-up of fluid. The lymphedema remedial exercises are most effective when
367 performed with compression bandages and they assist with lymphatic drainage by contracting the
368 muscles against the bandages and pumping the extra fluid out of the extremity.¹⁴ Combining the
369 four parts of complete decongestive therapy serves to provide the most beneficial results.¹²

370 Although lymphedema treatment for the right lower extremity began with complete
371 decongestive therapy, due to the patient's impaired sensation in the right lower extremity and the
372 patient's husband applying the compression bandages too tightly, she ended up with some
373 discoloration in her right foot. This was noted after 15 visits. In order to improve the coloration
374 of the right foot, and to still continue addressing the patient's lymphedema, the physical therapist
375 made the decision to switch to using a tg soft compression garment. The patient and her husband
376 were educated on the fact that the compression grade of the tg soft compression garment was not

377 as effective as the compression bandages, but it would still assist with lymphatic drainage. To
378 accommodate the decreased compression grade of the tg soft compression garment, the patient
379 and her husband were instructed to elevate the right lower extremity when in sitting in order to
380 prevent an increase in swelling. After several days of using the tg soft compression garment, the
381 patient demonstrated an increase in fluid in the right knee but was still unable to use compression
382 bandages due to discoloration in the right foot. To assist with lymphatic drainage, application of
383 kinesiotape was used in conjunction with the tg soft compression garment. The kinesiotape was
384 applied to the right knee using the spider technique with the heads placed at the lymphatic ducts
385 and the tails extending across the anterior and lateral parts of the right knee where the fluid was
386 most prominent.¹²

387 Following complete decongestive therapy, the patient demonstrated a reduction in
388 circumference measurements of the right lower extremity. As mentioned above, the patient did
389 experience a slight setback when switching over to the tg soft compression garment, but once
390 again demonstrated improvement following the application of the kinesiotape. Although the
391 patient did demonstrate a reduction of fluid in the right lower extremity following complete
392 decongestive therapy, it would have been beneficial to compare the right lower extremity
393 (affected) to the left lower extremity (unaffected) in order to see the true difference. However,
394 the left lower extremity was never measured by the therapist, which is a significant limitation. It
395 would have also been beneficial to have more visits as the patient experienced a setback when
396 having to switch over to the tg soft compression. Further research is needed to explore the impact
397 of lymphedema in patients following a stroke.

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487 **Tables:**

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489 **Table 1**

490 **Medications**

Indication

Aspirin	Pain in her right knee
HCTZ	HTN and lymphedema in right lower extremity
Ropinirole	Restless leg syndrome in right lower extremity
Coumadin	Anticoagulant: preventing blood clots
Baclofen	Spasticity in right lower extremity
Magnesium Oxide	Source of magnesium
Trazodone	Antidepressant
Acetaminophen	Pain in her right knee
Citalopram	Antidepressant
Potassium chloride powder	Electrolyte replenisher

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492 **Table 2**

493 **Systems Review**

Cardiovascular/Pulmonary	Normal heart rate, normal pulse and rhythm. Lymphedema in the right lower extremity
Musculoskeletal	Impaired strength and range of motion on right side. Refer to tests and measures for specific results.
Neuromuscular	Increased tone and spasticity throughout right upper extremity and lower extremity. The following were impaired: Gait, balance, reflexes, coordination. Refer to tests and measures for specific results.
Integumentary	Skin temperature and color is within normal limits. No scars or wounds present. Toe nails are in good condition. Positive for stemmer sign. Patient presents with 2+ pitting edema below the knee on the right lower extremity.
Communication	Patient is verbal.
Affect, Cognition, Language, Learning Style	Patient is alert and oriented x3. Patient presents with pseudobulbar affect.

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495 **Tests and Measures: Table 3**

		Right	Left
Gross Strength Testing	Hip Flexion	2-/5	5/5
	Hip Abduction	3+/5	5/5
	Hip Adduction	3+/5	5/5
	Knee Flexion	3+/5	5/5
	Knee Extension	3+/5	5/5

	Ankle Plantar flexion	1/5	5/5
	Ankle Dorsiflexion	1/5	5/5
Reflexes	Patella (Nerve Root L2, L3, L4)	3+	2+
	Achilles Tendon (Nerve Root S1, S2)	3+	2+
	Babinski	Positive	Negative
	Ankle Clonus	Positive with 2 beats	Negative
Coordination	Finger to Nose	Unable to complete finger to nose on right due to lack of active movement	WNL
	Heel to Shin	Unable to complete heel to shin on right due to lack of active movement	WNL

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497 **Circumference Measurements of the right lower extremity: Table 4**

	Initial Evaluation
Metatarsals	24.0 cm
Figure 8	61.0 cm
Malleoli	31.0 cm
20 cm up from the ankle	39.5 cm
30 cm up from the ankle	46.5
Popliteal Fossa	46.5 cm

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499 **Circumference Measurements of the right lower extremity: Table 5**

	Initial Evaluation	10 th visit	15 th visit	20 th visit
Metatarsals	24.0 cm	23.0 cm	22.4 cm	23.0 cm
Figure 8	61.0 cm	55.0 cm	58.5 cm	58.3 cm
Malleoli	31.0 cm	28.0 cm	31.6 cm	29.0 cm
20 cm up from the ankle	39.5 cm	32.6 cm	34.1 cm	(Not measured)
30 cm up from the ankle	46.5	43.2 cm	38.5 cm	41.7 cm
Popliteal Fossa	46.5 cm	44.6 cm	42.5 cm	(Not measured)

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503 **Tinetti Balance Assessment: Table 6**

	Initial Evaluation	10 th Visit	20 th Visit
Balance Score	7	11	13
Gait Score	3	5	8
Total	10	16	21
% Disability	64%	43%	25%
Fall Risk	High	High	Moderate

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