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# **A Comprehensive PT Program Utilizing an AlterG® Treadmill for a Patient with Lower Extremity Fractures and Charcot-Marie-Tooth Disease: A Case Report**

## **Mark Whitsitt**

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The patient signed an informed consent acknowledging the participation in this case report and allowing the use of their personal health information and recorded images. The patient received information on the university’s policies regarding the Health Insurance Portability and Accountability Act.

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23 **Background and Purpose:** People with Charcot-Marie-Tooth (CMT) disease have a greater risk  
24 of falls and subsequent fractures. There is a scarcity of information regarding the most effective  
25 rehab protocol for a patient with lower extremity fractures and CMT disease. Utilization of the  
26 AlterG® has been shown to promote early mobility in patients with an orthopedic diagnosis,  
27 which is also vital for CMT patients, but has not been fully investigated. The purpose of this case  
28 report was to investigate a comprehensive physical therapy program, including use of the  
29 AlterG® treadmill, for a patient with lower extremity fractures and CMT disease.

30 **Case Description:** The patient was a 54-year-old female with CMT. A traumatic fall caused  
31 lower extremity fractures to her left talus, tibia, and fibula after which she received surgery.  
32 Upon initial evaluation, the patient demonstrated decreases in left ankle and knee passive range  
33 of motion (PROM) and strength. A comprehensive rehab program three times a week for 16  
34 weeks included manual techniques, therapeutic exercise, and stretching. Gait training, using the  
35 AlterG® concentrated on early weight bearing and proper biomechanics.

36 **Observations:** From initial evaluation to discharge, the patient improved in PROM, strength,  
37 girth measurements and ambulatory ability. Lower Extremity Functionality Scale scores  
38 demonstrated a 67% improvement in lower extremity function. The patient progressed from  
39 partial weight bearing to full weight bearing without an assistive device. Functionally, the patient  
40 reported being able to return to work unrestricted.

41 **Conclusion:** A comprehensive physical therapy program including the early implementation of  
42 the AlterG® for a patient with multiple lower extremity fractures and CMT disease resulted in  
43 increased function and decreased reported pain.

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46

## 47 **Background and Purpose**

48 Charcot-Marie-Tooth (CMT) disease is a prevalent neurological condition reported to  
49 occur in approximately 1 out of every 2,500 individuals.<sup>1</sup> CMT is the most common neurological  
50 disease that is genetically inherited.<sup>1</sup> It effects the myelin sheath surrounding nerves causing  
51 muscle insufficiencies, drop foot, lack of touch sensation, and cavus foot.<sup>1</sup> As a result of these  
52 impairments, patients often have a change in gait patterns. Research has found that CMT patients  
53 have a 1.5-fold increase in risk of obtaining a fracture in the foot, ankle, or hand.<sup>2</sup> This has been  
54 speculated to be a result of initial manifestation that begins in the feet, ultimately causing a fall.<sup>2</sup>

55 Lower extremity fractures are also a common event encompassing about 27% of the total  
56 caseload of orthopedic surgeons.<sup>3</sup> These fractures are a debilitating event and can have a large  
57 negative effect on the patient's physical health and daily activities for up to 6 months.<sup>4</sup> Despite  
58 their regular occurrence and negative effects, studies regarding protocols for recovery of tibia  
59 shaft fractures, without severe comorbidities, vary in opinion and results.<sup>5</sup> Further, there is a  
60 paucity of research regarding physical rehabilitation protocols of those who have sustained lower  
61 extremity fractures and also have the neurological condition of CMT.

62 Use of the AlterG® Anti-Gravity Treadmill (AlterG® Inc., Fremont CA) has increased in  
63 popularity for rehabilitation of many lower extremity conditions. Use of a positive pressure  
64 treadmill allows an individual to closely monitor and change their biomechanical environment.<sup>6</sup>  
65 The clinician alters the individual's total body weight that is loaded onto the treadmill. This  
66 dramatically decreases the ground reaction forces and joint forces produced within lower  
67 extremity joints.<sup>6</sup> A body weight supported physical activity program can be beneficial to  
68 patients with a lower extremity injury by allowing them graded exposure to the weight bearing  
69 activities as their injuries heal.<sup>7</sup>

70 While the implementation of positive pressure treadmills has been increasingly used in

71 the treatment of athletes and general orthopedic patients, it has not been extensively researched  
72 in those with multiple lower extremity fractures and underlying condition of CMT. There are  
73 also no known studies demonstrating a protocol for the rehabilitation of a patient who has  
74 sustained multiple lower extremity fractures and has CMT. The purpose of this case report was  
75 to observe the recovery of a patient with multiple lower extremity fractures and an underlying  
76 condition of CMT while using implementation of a positive pressure treadmill.

### 77 **Patient History and Systems Review**

78 The patient offered written consent to participate in this case report. The patient was a 54-  
79 year-old female who presented to an outpatient therapy clinic. She experienced a traumatic fall  
80 while at work approximately one month prior to initial evaluation. The fall caused the patient to  
81 fracture her left tibia, fibula, and talus. While hospitalized, she received an open reduction  
82 internal fixation (ORIF) surgery to repair her left leg. Surgery included one rod extending the full  
83 length of her tibia and fibula with no hardware needed to stabilize the talus. She was seen for a  
84 follow up appointment two weeks after surgery and was cleared to begin physical therapy two  
85 weeks later. A gross assessment was performed at initial evaluation. Limitations included  
86 impairments in left ankle range of motion, strength, and sensory function. A systems review  
87 revealed that she experienced limitations in balance and mobility. A complete summary of the  
88 performed systems review can be found in Table 1.

89 The patient's recovery was complicated by Charcot-Marie-Tooth disease (CMT). CMT  
90 affected motor and sensory function of both her feet causing bilateral foot drop and an impaired  
91 gait cycle. She received the CMT diagnosis approximately 30 years prior. The patient reported  
92 no further medical complications and was in relatively good health. She was unrestricted in her  
93 daily activities before the fall. The patient worked as a school teacher and had a very supportive  
94 family to aid in her recovery and attendance of physical therapy. The patient used the assistance

95 of crutches to walk and was not able to bear full weight on her left leg. She did not present with  
96 ankle foot orthotics for her bilateral foot drop. Her goals for therapy were to reduce her level of  
97 pain and return to work without restrictions.

### 98 **Clinical Impression 1**

99 The patient's primary problems included impaired range of motion, strength, sensation of  
100 her left knee, ankle, and toes. Other primary problems included impaired balance and gait,  
101 increased pain levels, and decreased ability to perform activities of daily living. Impairments  
102 related to Charcot-Marie-Tooth disease (CMT) were present for about 30 years. No differential  
103 diagnosis was required for this case. The following plan for examination included administration  
104 of a Lower Extremity Functionality Scale (LEFS), Numeric Pain Rating Scale (NPRS), and gait  
105 assessment. This patient was a good candidate for this case report due to her very high  
106 motivation to return to independence, rarely observed comorbidity of CMT, and likely benefit  
107 from utilization of the AlterG® treadmill. (AlterG® Inc., Fremont CA).

### 108 **Examination – Tests and Measures**

109 The patient was administered the Lower Extremity Functionality Scale (LEFS) while she  
110 was in the waiting room. The LEFS has been a widely chosen tool for the assessment of many  
111 different conditions of the lower extremities.<sup>8</sup> The LEFS involves many questions regarding  
112 daily tasks that involve lower extremities. The LEFS is a self reported questionnaire where  
113 scores are totaled to find a numerical disability percentage. This test is quick and easy to  
114 administer and score. Its use helps practitioners in determining independence and capability of  
115 the patient. It has been found to be reliable, valid, and responsive for the general patient  
116 population.<sup>8</sup>

117 The patient was also administered the Numeric Pain Rating Scale (NPRS) to assess  
118 severity of pain. This tool allows the administrator to question the patient on the severity of their

119 pain with the patient self-reporting a number from zero to ten. Ten is the worst amount of pain  
120 and zero is the least. This test was chosen based upon its high responsiveness in detecting  
121 changes in pain intensity and validity for numerous patient populations.<sup>9</sup> Current pain levels  
122 were further assessed upon every visit to determine pain.

123         The patient was initial observed using observational gait analysis. Although this tool does  
124 not have high validity or reliability, clinically it often used to observe large deviations in gait  
125 kinematics.<sup>10</sup> As she ambulated to the treatment area her gait involved excessive hip flexion and  
126 knee extension to accommodate for a foot drop bilaterally. The patient was grossly assessed for  
127 impairments in range of motion, sensation, strength, motor function, and balance through her  
128 reported history and observed findings. More objective measures of girth, goniometry, manual  
129 muscle testing, and reflex testing were performed with results listed in Table 2. Girth testing has  
130 been shown to be reliable in detecting circumferential differences in the lower extremity.<sup>11</sup>  
131 Goniometry is moderately reliable if assessed by the same therapist.<sup>12</sup> Manual muscle testing,  
132 however, is not a very reliable tool but can be useful in a clinical setting for determining  
133 strength.<sup>13</sup> Reflex testing was performed as a valid and reliable tool to confirm the presence of  
134 CMT and foot drop.<sup>14</sup> No active ankle range of motion was observed bilaterally due to the  
135 patient's CMT. No further tests were performed due to the sensitivity of the patient and lack of  
136 need for a differential diagnosis.

## 137 **Clinical Impression 2**

138         The patient's presentation was consistent with an open reduction internal fixation (ORIF)  
139 of the left tibia and fibula and a talus fracture. This was determined based upon surgical and  
140 physical therapy examination which consisted of objective goniometry measurements, strength  
141 findings, disability index obtained from the LEFS, NPRS current levels of pain, and girth  
142 measurements performed during examination. The patient continued to be an excellent candidate

143 for physical therapy and the case report according to her prior level of function, high motivation,  
144 likelihood of recovery, and general good health condition. An area that may have decreased her  
145 likelihood for a positive prognosis was her 30-year history of CMT. The patients overall progress  
146 remained satisfactory.

147         The main physical therapy diagnoses included impaired balance/ambulation, pain levels,  
148 and lower extremity strength. The selected ICD 10 codes for this case included S82.112F  
149 displaced fracture of left tibial spine, subsequent encounter for open fracture (type IIIA, IIIB or  
150 IIIC) with routine healing, R26.2 difficulties in walking, not elsewhere classified, and M79.605  
151 pain in left leg. Rehabilitation potential of the patient was excellent. She was highly motivated  
152 with a strong support system in her family. She had no reported comorbidities that would affect  
153 the rate of bone healing. Overall research for complete healing rates of CMT patients with ORIF  
154 injuries of the tibia was lacking. Estimated rates for fracture union in non CMT patients were  
155 between 19 and 25 weeks.<sup>15</sup> The patient's estimated length for skilled services was 2 to 3 weekly  
156 visits for 1 month. At 1 month, reassessment was planned with administration of the NPRS,  
157 observational gait analysis, and both goniometric and strength measurements. At initial  
158 evaluation, it was hypothesized that the patient may require a longer amount of time to return to  
159 unimpaired ambulation due to her abnormal gait cycle. The patient continued to follow up with  
160 her surgeon. No further health provider referrals or consultations were needed at the time. Follow  
161 up of the patient's progress was planned to be assessed before any subsequent appointments with  
162 her surgeon and at discharge. Planned interventions for this patient included stretching,<sup>16</sup> manual  
163 therapy,<sup>17</sup> gait re-education using the AlterG® anti-gravity treadmill (AlterG® Inc., Freemont  
164 CA),<sup>17</sup> and therapeutic exercises adhering to weight bearing restrictions.<sup>18,19</sup> A summary of the  
165 patient's short term and long-term goals can be found in Table 3.

166



167 **Intervention**

168 **Coordination, Communication, Documentation, Patient Instruction:**

169 Coordination regarding the patient's evaluation and plan of care was planned with clinic  
170 staff. Further communication was made between the clinic's administrative staff and the  
171 patient's referring physician. Communication included the initial written evaluation, progress  
172 notes, and discharge notes. All documentation from the initial evaluation and subsequent visits  
173 was recorded using an electronic medical records system. The patient was instructed on a home  
174 exercise program, with a printed copy of instructions that described home techniques for  
175 managing swelling and pain. This included a compression sleeve and intermittent icing.

176 **Procedural Interventions**

177 The patient's plan of care consisted of 3 therapy sessions per week for a duration of 4  
178 weeks. Interventions for the patient included stretching,<sup>16</sup> manual therapy,<sup>17</sup> gait re-education  
179 using the AlterG® anti-gravity treadmill (AlterG® Inc., Fremont CA),<sup>18</sup> and therapeutic  
180 exercises adhering to weight bearing restrictions.<sup>19,20</sup> A comprehensive description of all  
181 therapeutic exercises and their implementation can be found in Table 4 and Table 5. The  
182 patient's therapy began with the use of electric stimulation to reduce pain.<sup>21</sup> Stretching was  
183 added to help increase ankle range of motion and extensibility.<sup>16</sup> Manual therapy, in the form of  
184 an effleurage massage, was utilized to decrease swelling at the foot, ankle, and lower leg.  
185 Although research is inconclusive in the use of this intervention, a measurable difference in  
186 circumferential measurements was found post treatment. A deep tissue massage was used at the  
187 patient's calf to decrease stiffness and increase range of motion of the ankle as needed.<sup>17</sup> Both  
188 forms of massage proved to be particularly important due to the lack of voluntary motion that  
189 could be produced at the ankle. An initiation of weight bearing exercises began at one month  
190 post-surgery. Some studies have pointed to a beneficial pattern of healing with the addition of

191 weight bearing on lower extremity fractures.<sup>5</sup> Use of the AlterG® treadmill (AlterG® Inc.,  
192 Fremont CA) was added to allow the patient to begin the functional activity of walking while  
193 maintaining relatively low levels of weight bearing.<sup>18</sup> Studies regarding CMT and the use of  
194 positive pressure treadmills is scarce, however, there was support of the use of positive pressure  
195 treadmills to decrease joint force while ambulating.<sup>6,7</sup> This allowed the patient to engage in  
196 functional activities sooner for her work. Therapeutic exercises were also given to improve lower  
197 extremity strength while adhering to a limited weight bearing status.<sup>19,20</sup> As the patient's  
198 condition improved, alterations in duration and intensity of each intervention were made.  
199 Therapeutic exercises were also added or removed from the patient's regimen as improvements  
200 occurred. The patient was compliant with her home exercise program regarding techniques for  
201 decreasing swelling. The patient attended all scheduled therapy sessions and received no co-  
202 intervention treatments.

### 203 **Outcome**

204 The patient achieved all long-term and short-term goals as listed in Table 3. From initial  
205 evaluation to discharge, the patient improved in all areas of passive range of motion, strength,  
206 girth measurements, and ambulatory ability. LEFS scores improved from to 10/80 to 64/80 at  
207 discharge, which demonstrated a 67% improvement in lower extremity function. Left ankle  
208 dorsiflexion increased from 0° to 8° and left knee flexion increased from 90° to 110°. Muscle  
209 testing revealed an increase in left knee strength from -2/5 to 4/5 at discharge. Girth  
210 measurements at the malleoli improved from 22 cm to 20 cm. The patient progressed from  
211 partial weight bearing with crutches to full weight bearing without an assistive device, and was  
212 able to ambulate without a limp. The patient experienced pain during palpation along the medial  
213 and lateral ankle. NPRS scores improved from a 5/10 at initial evaluation to a 2/10 with activity  
214 at discharge. Comprehensive outcomes are listed in Table 2.

215           Functionally, the patient reported being able to return to work as a teacher without  
216 restriction. Small levels of discomfort persisted with increased standing or walking. Although the  
217 patient returned to a full functioning status, her return was delayed due to a stall in bone healing.

## 218 **Discussion**

219           Previous studies have observed the relationship between CMT and the risk of falls. These  
220 falls can often lead to adverse outcomes, such as fractures. While there is a positive correlation  
221 between patients with CMT disease sustaining a fracture through a fall, there is little research  
222 investigating the most effective rehabilitation protocol for these patients. Likewise, there are  
223 limited interventions that allow for early functional movement in the patient with multiple lower  
224 extremity fractures and CMT. The AlterG® has been shown to be effective in the orthopedic  
225 population, but its investigation in those with CMT is limited.<sup>6,7</sup> The utilization of the AlterG®  
226 was vital in allowing the patient in this case report to begin walking in a controlled environment  
227 with decreased pain. Within one month of treatment using the AlterG® began, the patient was  
228 comfortable returning to limited work that involved walking, standing, and cleaning. Her  
229 readiness to return to work may be attributed to the prescribed comprehensive physical therapy  
230 plan that included more traditional treatments such as stretching, strengthening, and massage as  
231 well as the implementation use of the AlterG® treadmill. The comprehensive program allowed  
232 the patient to tolerate full time work without restriction at discharge.

233           Based on the outcomes measures previously described, the patient appeared to improve  
234 from the provided plan of care. These findings suggest that those patients with CMT who have  
235 sustained multiple lower extremity fractures may benefit from a comprehensive physical therapy  
236 treatment that includes the implementation of the AlterG® treadmill. This finding is consistent  
237 with existing theories in current research. A 2015 study highlighted the effectiveness of body  
238 weight supported systems to help patients with knee osteoarthritis ambulate on a treadmill with

239 significant decreases in acute pain by decreasing joint forces that in turn decrease compressive  
240 joint pain.<sup>6,7</sup> The decreases in acute pain were consistent with the findings of the patient  
241 highlighted in this case report.

242 According to the patient's physician, she experienced a delay in bone healing 8 weeks  
243 after treatment as a result of her CMT. The implementation of the AlterG® treadmill and physical  
244 therapy was not viewed as an impedance in the healing process. Precautions and correct  
245 screening may be important in deciding whether a patient may experience adverse healing times  
246 while using this treatment.

247 In conclusion, a comprehensive physical therapy program including the early  
248 implementation of the AlterG® for a patient with multiple lower extremity fractures and CMT  
249 disease resulted in increased function and decreased reported pain. Future research should  
250 investigate the use of positive pressure treadmills as part of a comprehensive physical therapy  
251 program for those patients with fractures and neurologic comorbidities. Additional research may  
252 also investigate any relationship between the use of the AlterG® in decreasing future fall risk for  
253 at risk populations.

254

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313

314 **Tables and Figures**

315 Table 1. Systems Review

<b>Systems Review</b>	
<b>Cardiovascular/Pulmonary</b>	<b>Unimpaired</b>
<b>Musculoskeletal</b>	<b>Impaired:</b> Range of motion of right and left ankle and toes Strength of left knee, bilateral ankles, bilateral toes Gait due to CMT and use of crutches
<b>Neuromuscular</b>	<b>Impaired:</b> Tone diminished in bilateral lower extremities below the knee Sensation diminished in bilateral lower extremities below the knee Balance due to touch down weight bearing status
<b>Integumentary</b>	<b>Impaired:</b> Multiple healing incisions of the left lower extremity Swelling of left ankle and foot
<b>Communication</b>	<b>Unimpaired</b>
<b>Affect, Cognition, Language, Learning Style</b>	Bright affect, unimpaired cognition, English language, preferred demonstrations

316

317 Table 2. Tests and Measures

<b>Tests &amp; Measures</b>	<b>Initial Evaluation Results</b>	<b>Re-Eval Results (One Month)</b>	<b>Discharge Results</b>																																																																																																																								
<b>Gait Assessment</b>	Increased hip flexion bilaterally Drop foot bilaterally <b>Non weight bearing</b>	Relative decrease in hip flexion Drop foot bilaterally <b>100% weight bearing</b>	Pre-injury level of gait  <b>100% weight bearing</b>																																																																																																																								
<b>LEFS</b>	12.5% (10/80)	<b>Not Tested</b>	80% (64/80)																																																																																																																								
<b>NPRS (0-10)</b>	3/10 pain at its best 5/10 current pain 10/10 pain at its worst	3/10 current pain 5/10 pain at its worst	2/10 pain at its worst																																																																																																																								
<b>Girth Testing (cm)</b>	<u><b>Ankle Circumference</b></u> Left 22 cm Right 17 cm	<u><b>Ankle Circumference</b></u> Left 22 cm Right 17 cm	<u><b>Ankle Circumference</b></u> Left 20 cm Right 17 cm																																																																																																																								
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Whitsitt, A Comprehensive PT Program Utilizing an AlterG® Treadmill for a Patient with Lower Extremity Fractures and Charcot-Marie-Tooth Disease: A Case Report

	Dorsiflexion 1/5 1/5 Plantarflexion +1/5 +1/5 Eversion 1/5 1/5 Inversion 1/5 1/5	Dorsiflexion 1/5 1/5 Plantarflexion +1/5 +1/5 Eversion 1/5 1/5 Inversion 1/5 1/5	Dorsiflexion 1/5 1/5 Plantarflexion +1/5 +1/5 Eversion 1/5 1/5 Inversion 1/5 1/5
	<b>Toe Left Right</b> Extension 1/5 1/5 Extension, great 1/5 1/5 Toe Flexion -2/5 -2/5	<b>Toe Left Right</b> Extension 1/5 1/5 Extension, great 1/5 1/5 Toe Flexion -2/5 -2/5	<b>Toe Left Right</b> Extension 1/5 1/5 Extension, great 1/5 1/5 Toe Flexion -2/5 -2/5
<b>Deep Tendon Reflex Testing</b>	<b>Left L3 Patellar Tendon: 3+</b> <b>Left S1 Achilles Tendon: 1+</b>	<b>Not Tested</b>	<b>Not Tested</b>

AROM: Active Range of Motion, PROM: Passive Range of Motion, WNL: within normal limits

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320 Table 3. Patient Goals

<b>Short Term Goals</b>	<b>Long Term Goals</b>
The patient will experience a pain decrease to 4/10 according to the NPRS within two weeks from the start of care.	The patient will experience a pain decrease to 3/10 according to the NPRS within four weeks from the start of care.
The patient will increase knee extensor and flexor strength to 3+/5 within two weeks from the start of care in order to prepare to return to work.	The patient will increase knee extensor and flexor strength to 4+/5 within four weeks from the start of care in order to prepare to return to work.
The patient will be able to weight bear to 50% of her body weight within two weeks from the start of care in order to prepare for gait.	The patient will be able to improve her gait to a normal and unassisted level within four weeks from the start of care in order to return to work.
	The patient will be able to return to work with minimal restrictions within four weeks from the start of care.

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322 Table 4. Intervention Plan

<b>Intervention</b>	<b>Stage 1 Example</b>	<b>Stage 2 Example</b>	<b>Stage 3 Example</b>
Electric Stimulation with Ice	15 min	15 min	
Stationary Bike	10 min	10 min	10 min
Calf Stretching	3x30 sec (Slant Board)	3x30 sec (Slant Board)	3x30 sec (Slant Board)
Knee and Ankle Stretching	5x30 sec		
Total Gym Squats	3x10 Level 10	3x15 Level 10	
4-Way Hip	2x10 Orange	2x10 Orange	2x10 Orange
Seated Hamstring Curls	2x10 Yellow	3x10 Green	3x10 Green
AlterG® Treadmill Walking	5 min 70-75% BW	15 min 85-90% BW	15 min 100% BW
Trampoline Weight Shifts	2 min		
Effleurage Massage	10 min	5 min	

Whitsitt, A Comprehensive PT Program Utilizing an AlterG® Treadmill for a Patient with Lower Extremity Fractures and Charcot-Marie-Tooth Disease: A Case Report

Soft Tissue Massage	10 min	5 min	
Push Away			3x10 Teal
Leg Press			3x10 60 lbs.

min: Minutes, sec: Seconds, sets x reps, BW: Body Weight

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325 Table 5. Intervention Descriptions

<b>Intervention</b>	<b>Description</b>
Electric Stimulation with Ice	2 electric stimulation pads were placed at either sides of the knee. Gel ice packs (Sammons Preston, Bolingbrook IL) were placed on top of the knee and around the ankle. The Dynatron 850 (Dynatronics, Salt Lake City UT) was set to interferential current with a patient selected intensity.
Stationary Bike	The patient cycled on a stationary bike (Cybex, Medway MA) at a self-selected pace and resistance. Both feet strapped into bike pedals.
Calf Stretching	This was performed one of two ways. 1) Long sitting with a Stretch Out Strap (OPTP, Minneapolis MN) wrapped around the foot as the patient pulls to a self-selected tension, or 2) standing on a slant board (CanDo, White Plains NY) leaning forward to a self-selected tension.
Knee and Ankle Stretching	While sitting on a stability ball (Resist-A-Ball, Venice CA) with both feet on the ground, the patient gently rocked her hips forward until the knee/ankle bends to a desired threshold.
Total Gym Squats	With both feet on the total gym foot pad and lying supine on the shuttle, the patient slowly lowered the shuttle until the knees were at about 70°. The patient then pushed back into a knee extended position.
4-Way Hip	The patient stood at a self-selected distance that provided tension from a resistance band (Lifeline by Innovation, Chicago IL) which was looped around her ankle and attached to a stable anchor. The patient was allowed 2 poles (Fitter, Calgary Alberta Canada) to aide in stabilization. While facing multiple directions, the patient then slowly kicked her leg away from the anchor. Directions used were standing toward, away, left sided, and

	right sided from the anchor. (A white board surface was added onto the floor in week 3 to allow for the foot to slide.)
Seated Hamstring Curls	The patient sat at a self-selected distance that provided tension from a resistance band (Lifeline by Innovation, Chicago IL) which was looped around their ankle and attached to a stable anchor. The patient sat facing toward the anchor and then slowly flexed the knee thus pulling the band.
AlterG® Treadmill Walking	The patient donned the appropriate provided AlterG® pants (AlterG® Inc., Fremont CA). The patient was placed into the AlterG® Treadmill (AlterG® Inc., Fremont CA) opening. The housing was brought up to, and locked, at hip height. The pants were zipped into place. The treadmill was then calibrated by pressing start. The patient selected the appropriate speed and body weight percentage to allow for relatively pain free walking.
Trampoline Weight Shifts	The patient stood on top of the small trampoline (unspecified brand) with a hand rail in front of her. While grasping the hand rail the patient slowly weighted one leg and then shifted weight onto the other.
Effleurage Massage	The patient laid down in a supine position with the feet and head supported by a pillow. The practitioner provided gentle upward strokes to the patient's foot and ankle.
Soft Tissue Massage	The patient laid down in a prone position with the feet supported by a pillow. The practitioner provided self-selected pressure and massage techniques to provide muscle relief along the length of the calf.
Push Away	The patient stood perpendicular to a resistance band (Lifeline by Innovation, Chicago IL) anchored to the wall. The patient held the band with both hands to the sternum. The patient extended the elbows while not allowing for trunk rotation and immediately returned to the starting position.
Leg Press	The patient sat on the leg press machine (Cybex International Inc., Medway MA) with her feet positioned neutrally on the bar. The patient slowly extended her knees until about 5 degrees of knee flexion. The patient slowly returned back to the starting position.

326 APPENDICES

327 Appendices 1. Lower Extremity Functionality Scale

Patient Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Lower Extremity Functional Scale (LEFS)**

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

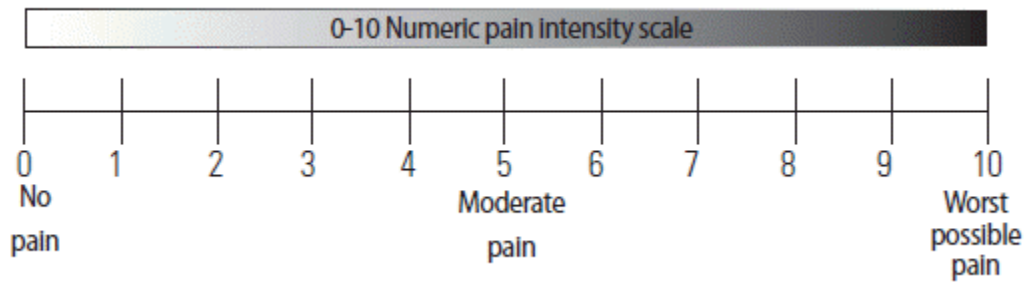
Column Totals:

Total Score: ____/80 = ____% physical function	<b>MEDICARE PATIENTS ONLY</b> 100% - ____% Function = ____% Impairment
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Patient Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Therapist Signature: \_\_\_\_\_ Date: \_\_\_\_\_

329 Appendices 2. Numeric Pain Rating Scale



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