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A Hip Strengthening Protocol For A Patient Following Achilles Repair: A Case Report

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

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Keywords: Achilles rupture, Achilles repair, hip strengthening, physical therapy, humerus fracture

Abstract

Background and Purpose: The Achilles tendon is the strongest, yet most frequently ruptured, tendon in the body. Hip strength has been associated with various lower extremity (LE) conditions. However, there is a lack of literature regarding hip strengthening and its impact on Achilles injuries. Therefore, the purpose of this case report was to describe the rehabilitation of a patient following a left Achilles tendon repair utilizing a comprehensive hip strengthening protocol.

Case Description: The patient was a 32-year-old female who ruptured her Achilles playing tennis. She underwent surgical repair three weeks later and was immobilized and non-weightbearing for a total of seven weeks. Manual muscle testing (MMT), range of motion (ROM), the Lower Extremity Functional Scale (LEFS), Foot and Ankle Disability Index (FADI), and the Achilles tendon Total Rupture Score (ATRS) were used to evaluate progress. Interventions included hip and ankle strengthening, ROM, stretching, manual therapy, balance training, and gait training.

Outcomes: The patient attended 18 visits over 11 weeks. Left ankle plantarflexion strength improved from +3/5 to -5/5. Left hip abduction improved from 4/5 to -5/5 and left hip extension improved from +4/5 to -5/5. Left ankle dorsiflexion AROM improved from -20° to 10°. LEFS scores improved from 28/80 to 57/80. FADI scores improved from 37% to 91.3% and ATRS scores improved from 52/100 to 32/100.

Discussion: The patient made improvements consistent with existing literature. Utilizing a hip strengthening protocol following Achilles repair may be beneficial, but the full magnitude of the effect of hip strengthening cannot be determined. Future research should focus on the effect of hip strengthening following Achilles repair, as well as the impact of hip weakness on Achilles injuries.

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Introduction/Background and Purpose

The Achilles tendon is the strongest tendon in the human body,[1,2] yet it is the most frequently ruptured tendon in the ankle.[3] Achilles rupture most commonly occurs in men between the age of 30 and 50 years,[1] with a reported male-to-female ratio of 3-to-1.[4] Incidence is estimated to be 11-37 per 100,000 people each year,[4] with an apparent increasing incidence rate.[1] Common mechanisms of injury include sudden forced plantarflexion (PF) or a sudden stretch of the tendon,[2] with a reported increased incidence in recreational athletes.[2,3] Achilles rupture is diagnosed by a positive Thompson's test and a palpable gap at the location of the tendon.[3]

Achilles tendon ruptures can be managed operatively or non-operatively, with operative management typically preferred for younger or athletic patients.[2] According to a meta-analysis, non-operative patients have a re-rupture rate that is three times higher than that of patients who have the tendon surgically repaired, although complications are more common in the surgical group.[2] There is no consensus for the best post-surgical protocol, although accelerated rehabilitation with early weightbearing appears to be beneficial.[5,6] A review of the literature by Brumann et. al found higher patient satisfaction and faster return to work and sport for patients who were fully weightbearing following Achilles repair than those who were non-weightbearing (NWB) following surgery.[5] Despite this, most rehabilitation protocols involve NWB for 4-8 weeks following surgery.[6] Typical rehab protocols following Achilles tendon rupture include progressive weightbearing, improving mobility, and exercises for strengthening, gait, and balance.[7]

Hip muscle weakness, particularly of the hip abductors, has been associated with many lower extremity (LE) conditions, including gait deviations, ankle sprains, and knee instability.[8] A study by Habets et. al on male runners with Achilles tendinopathy found weakness of the hip extensors, abductors, and external rotators compared to controls, indicating hip strength may have an impact on the Achilles tendon.[9] Additionally, a case report by Silbernagel et. al found altered running kinematics and kinetics in both LEs in a female soccer player following Achilles tendon rupture and repair.[10] There does not appear to be any studies to date assessing the effect of hip strength following Achilles tendon rupture and repair.

In addition to Achilles injuries altering gait, the use of a sling to immobilize a fracture of the upper extremity (UE) prevents reciprocal arm swing and can alter gait by interfering with the normal rhythm between the upper and lower extremities.[11] Arm swing is important for counteracting trunk rotation during normal gait[12] and lack of arm swing can cause a reduction in both speed and stability during gait.[11]

Additionally, while most Achilles repair protocols include LE strengthening exercises, there is a lack of literature regarding the utilization of a comprehensive hip strengthening protocol following Achilles repair. Therefore, the purpose of this case report was to describe the rehabilitation of a patient following a left Achilles tendon repair who also fractured her right proximal humerus and was immobilized utilizing a comprehensive hip strengthening protocol.

Patient History and Systems Review

The patient was a 32-year-old female nurse who was referred to physical therapy (PT) after a left Achilles tendon repair. The patient ruptured her Achilles tendon playing recreational tennis as she was stepping to her right for a forehand strike and felt a pop. She underwent surgery to repair the tendon 24 days after onset. Her medical diagnosis was confirmed in the

operating room as a left Achilles tendon rupture. It was a full thickness tear with gapping of two-three centimeters and retraction of the proximal stump. She was placed in a cast with her foot in an equinus position and was to be NWB for four weeks.

The patient presented to PT four weeks after surgery with an antalgic gait pattern using bilateral axillary crutches, markedly decreased ankle range of motion (ROM), reduced strength, and a severe lack of flexibility in the gastrocnemius and soleus muscles. Including the three weeks prior to surgery, the patient was NWB for seven weeks total prior to initial evaluation (IE). The patient also had a moderate amount of edema in the left LE. The patient's primary complaints were the inability to work, difficulty performing activities of daily living (ADLs) and instrumental activities of daily living (IADLs), inability to participate in recreational activities, and inability to ascend or descend stairs without assistance. She was only able to ambulate very short distances with the crutches and a walking boot. Prior to her injury, the patient was independent with all ADLs and IADLs and did not use an assistive device. The patient's medical history included depression, anxiety, and high cholesterol. She reported a diagnosed leg length discrepancy that she stated was confirmed via imaging. Her past surgical history was unremarkable. Her medications included alprazolam, medical marijuana, and estarylla. The patient had no history of prior Achilles tendon injuries. She reported 0/10 pain at worst on the Numeric Pain Rating Scale (NPRS), indicating no pain. Refer to Table 1 for the results of the Systems Review. The patient signed an informed consent form for permission to use her medical information for this case report. Tests and measures planned to be performed based on her history and presentation included strength testing (including the ankle and hip musculature), ROM, gait, calf muscle flexibility, balance, and functional outcome measures.

Following visit nine (approximately eight weeks post-op), the patient sustained a right proximal humerus fracture after falling while descending the stairs. The patient opted for non-surgical management of the fracture and was placed in a sling for six weeks. The patient was a good candidate for this case report because of the increased length of immobilization following injury (including NWB for four weeks post-operatively), reported leg length discrepancy, and the effects of her immobilization on hip strength, in addition to ankle strength and ROM.

Examination – Tests and Measures

Refer to Table 2 to view the results of the physical examination performed at IE. Active range of motion (AROM) of the ankle was measured via goniometry using the methods described by Norkin & White.[13] Goniometry is a valid and reliable tool for measuring LE ROM.[14] The patient had severely limited ankle dorsiflexion (DF), PF, and inversion based on Norkin & White's values for normal ankle ROM.[13] Strength was measured using manual muscle testing (MMT) techniques described by Kendall et. al.[15] MMT is graded on a 0 to 5 scale, with 0 being no contraction and 5 being full, normal strength.[15] MMT is a reliable and valid tool for measuring muscle strength.[16] The patient had weakness throughout the ankle musculature, particularly at end range DF and PF. She also had mild weakness in the hip abductors and extensors on the affected side. The patient was unable to balance on the affected leg at initial evaluation. Observational Gait Analysis (OGA) was noted and re-evaluated every four weeks throughout the course of care. OGA has moderate interrater reliability for observing abnormal gait kinematics.[17]

The Lower Extremity Functional Scale (LEFS) is a patient-reported outcome measure that was administered at initial evaluation in order to measure the patient's subjective impact of her injury on her ability to perform ADLs. It was also used to assist with setting functional goals.

The LEFS has shown by Binkley et. al to be a valid and reliable measure of function for patients with various LE injuries.[18] The study by Binkley et. al did not include any Achilles tendon injuries, however, and there have been no studies thus far on reliability and validity specifically for patients with Achilles tendon repairs. Despite this, it was hypothesized that the LEFS would be an appropriate tool for measuring functional change over time and for setting functional goals for this patient.

The Foot and Ankle Disability Index (FADI) is a patient-reported outcome measure used to measure a patient's physical performance following a LE injury.[19] It is an older version of the Foot and Ankle Ability Measure (FAAM) and differs from the FAAM in that it includes additional questions regarding pain and sleep.[19] The FADI contains an ADLs form and a sport-specific form.[19] The FADI-ADL was administered at the first re-evaluation (eight weeks post-operatively). Many of the psychometric properties for the FADI are favorable for chronic ankle instability and have not been specifically applied to Achilles injuries.[19] The FADI-ADL was chosen to gather information about this patient's self-reported ability to perform physical tasks.

The Achilles tendon Total Rupture Score (ATRS) is an Achilles-specific scale developed by Nilsson-Helander et. al in 2007 due to a lack of Achilles-specific outcome measures. It uses an 11-point Likert scale (with 0 meaning major limitations and 10 meaning no limitations) to measure a patient's rating of function following Achilles rupture.[20] The authors found that the ATRS has high internal consistency and test-retest reliability for measuring a patient's physical activity following Achilles rupture.[20] Further studies are needed to confirm these findings. This scale had not been used by the clinic prior to this patient case and was chosen to provide an Achilles-specific measure of function for this patient. The ATRS was administered at visit eight.

Clinical Impression: Evaluation, Diagnosis, Prognosis

The patient's signs, symptoms, and examination data confirmed the patient's diagnosis of a left Achilles rupture and repair. The patient continued to be appropriate for this case report because of her functional impairments, willingness to participate, prolonged immobilization following surgery, and subsequent right humerus fracture sustained during post-op week eight. The decision was made to proceed with PT interventions in order to improve her strength, ROM, gait, and overall functional status. The patient's ICD-10 medical/PT diagnoses were S86.012D (strain of left Achilles tendon, subsequent encounter) and Z47.89 (encounter for other orthopedic aftercare). The patient had a good prognosis due to excellent family support, high prior level of function (PLOF), and motivation to participate in therapy. Potential barriers to recovery included the lengthy NWB period pre- and post-operatively, as research has suggested that early weightbearing and early mobilization following Achilles repair allows for better outcomes than prolonged immobilization.[5] Many patients recover full strength and prior level of function around four to six months post-operatively,[21] although strength, endurance, and functional deficits can linger for as long as one year or more post-operatively.[1] Based on her prognosis, it was determined that she would benefit from skilled PT services at a frequency of two visits per week for at least eight weeks.

There were no plans for referral to other providers. Consultation with the patient and the patient's surgeon about the plan of care (POC) was performed throughout the episode of care. Planned interventions included LE strengthening exercises, passive range of motion (PROM) & AROM exercises, joint mobilization techniques, soft tissue mobilization, gait training, balance training, and neuromuscular re-education. Short and long-term goals that were set at IE are listed in Table 3.

Intervention and Plan of Care

Coordination, Communication, Documentation

The results of the IE and the POC were communicated with the patient and the patient agreed with the POC. The student physical therapist consulted with the supervising physical therapist regarding all choices of intervention. All patient visits were documented via electronic medical records (EMR) and the referring physician had access to all evaluation and daily notes through this EMR. The surgeon's protocol for Achilles tendon repairs was followed and all precautions were communicated by the referring physician. Re-evaluations were performed and documented every four weeks. ROM was monitored and measured every session. A subjective report of the patient's improvement was also documented each session.

Patient/Client-Related Instruction

The patient was given a home exercise program (HEP) following the IE. This included handouts with descriptions and photos of all exercises given. Compliance with the HEP was confirmed during each visit through patient self-report. The patient was also educated on the importance of avoiding stretching DF past neutral until after eight weeks post-operatively and on the use of the boot and wedges. The patient was instructed to bear weight as tolerated on the left LE since the four week NWB period had concluded as of IE.

Procedural Interventions

Table 4 contains all therapeutic interventions provided, including duration and frequency. All interventions provided were within the allowances of the surgeon-provided protocol. Time frames in the protocol were considered relative and the patient was progressed based on her presentation and clinical judgement. Treatment sessions lasted between 30-60 minutes each. Interventions included calf stretching, LE strengthening exercises, manual therapy techniques

(including soft tissue mobilization and joint mobilizations), balance training, and gait training. Interventions were integrated and progressed as allowed per the rehab protocol.

Initial stretches included a gastrocnemius towel stretch performed in long sitting. The patient was instructed to avoid stretching DF past neutral until week eight post-op. Standing gastrocnemius and soleus stretches were incorporated following week six post-op. A systematic review found that calf stretching is effective for increasing DF ROM.[22]

LE strengthening exercises included strengthening of the ankle, hip, and foot. During the early phases of rehabilitation, open kinetic chain (OKC) exercises were utilized to address the patient's strength deficits from being immobilized for an extended period of time. OKC exercises are more effective than closed kinetic chain (CKC) activities for targeting weakness in isolated muscle groups.[23] Early ankle strengthening exercises included isotonics with light resistance bands to target the ankle plantarflexors, evertors, and invertors. Hip strengthening included exercises isolating the gluteus medius and gluteus maximus. CKC activities were initiated following week six post-operatively and included mini squats, step ups, and standing bilateral heel raises (after week eight post-op).

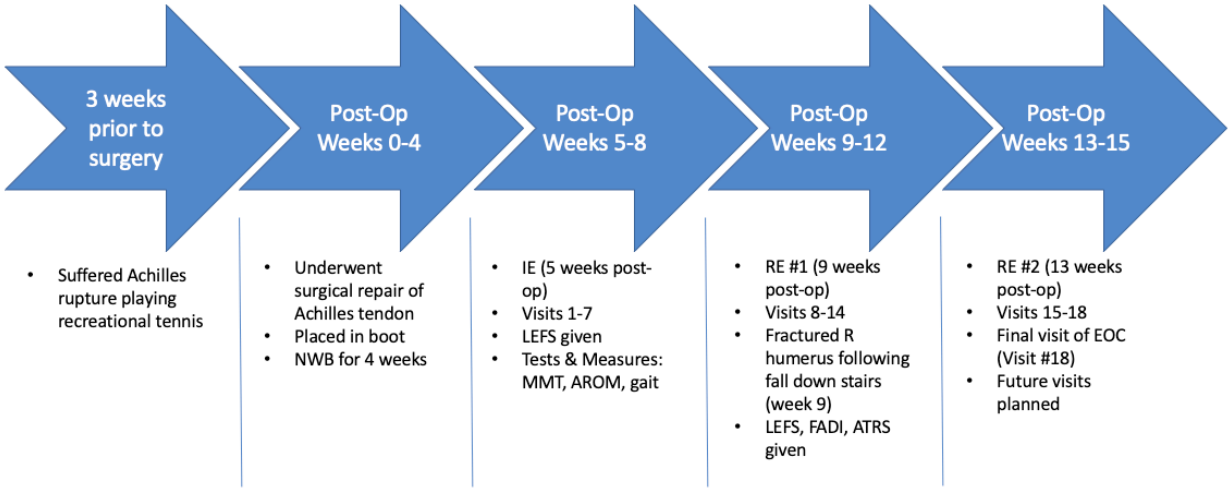
Manual therapy techniques performed included soft tissue mobilization (STM) and joint mobilizations. STM was performed in order to prevent fibrosis of the tissue surrounding the Achilles tendon. This intervention was selected based on clinical experience and per the protocol. There is a lack of randomized control trials on the effectiveness of STM for this purpose. Beginning at week nine post-op, gentle posterior talocrural glides were used to improve DF ROM. The patient was also instructed on a self-talar mobilization utilizing a resistance band to integrate as part of her HEP. Kang et. al found that sustained talocrural glides applied in combination with gastrocnemius stretching was more effective at improving DF ROM than

stretching alone.[24] DF ROM measurements were taken before and after joint mobilizations to assess effect.

Balance training was initiated starting at week six post-operatively and included single leg balance and balance board for dynamic standing balance. This was initiated due to the patient's deficits in single leg balance and to improve the patient's proprioception in the ankle. Balance can be diminished when ROM or strength of a joint is affected,[23] as was the case with this patient.

Gait training was performed frequently throughout the course of care, including training with crutches and normalizing gait once the patient was out of the boot. The focus of gait training was to restore time in stance phase bilaterally and to facilitate even weightbearing bilaterally. The patient had an early heel rise on the left during terminal stance until DF ROM was restored to normal limits. Approximately seven degrees of DF is required for normal heel rise.[23]

Timeline



NWB = non-weightbearing, IE = initial evaluation, LEFS = Lower Extremity Functional Scale, MMT = manual muscle testing, AROM = active range of motion, FADI = Foot and Ankle Disability Index, ATRS = Achilles tendon Total Rupture Score, RE = re-evaluation, EOC = episode of care

Outcomes

The patient attended 18 visits over an 11-week period. Over the course of therapy, the patient demonstrated improvements in LE strength, ankle ROM, balance, gait, and functional outcome scores. Refer to Table 2 for the results from tests and measures found at the final visit of the episode of care (EOC). Ankle strength improved from -5/5 to 5/5 grossly. Specifically, left ankle PF strength improved from +3/5 to -5/5 (compared to 5/5 for her right LE). Left hip abduction strength improved from 4/5 to -5/5 and left hip extension strength improved from +4/5 to -5/5, which was the same as her right side. The patient's left ankle DF AROM improved from -20° to 10°. Ankle PF AROM improved from 10° to 51° and ankle inversion improved from 10° to 34°. At the final visit, the patient was able to stand on a foam surface with eyes open on the left LE for four seconds (compared to 30 seconds on the right LE), while she was unable to balance on that leg at all at IE. The patient's quality of gait improved as well and the patient was able to ambulate reciprocally without an AD and had little to no limp, although the patient had a lack of right arm swing and reduced right trunk rotation related to her UE sling. Her LEFS score improved from 28/80 at IE to 57/80 at visit #18. Her FADI score improved from 37% at visit #8 to 91.3% at visit #18 and her ATRS score improved from 52/100 at visit #8 to 32/100 at visit #18.

The patient also reported functional improvements. She returned to working as a nurse, albeit in a limited capacity related to her right UE NWB status and use of a sling secondary to the humerus fracture. She reported she was able to perform most ADLs with little to no difficulty, although she was unable to return to any of her usual recreational activities related to weakness in the calf.

HEP compliance was assessed by asking the patient how often she was performing the HEP each visit. However, it cannot be guaranteed that the patient was fully compliant with the

exercises prescribed, as the patient occasionally reported being unable to perform the HEP prior to some visits. The patient had six cancellations or no-shows over the course of therapy, including one full week when the patient did not attend PT.

Discussion

This case report described the use of hip strengthening exercises as part of the PT management of a patient following Achilles tendon repair and, therefore, demonstrated its intended purpose. The patient demonstrated improvements in ankle ROM, ankle and hip strength, gait, balance, and functional outcomes. Binkley et. al reported a minimal clinically important difference (MCID) for the LEFS to be nine points, so her change in LEFS scores was significant.[18] Eechaute et. al found a minimal detectable change (MDC) value of 4.48 points on the FADI for patients with chronic ankle instability.[25] To the author's knowledge, there is no current MCID data available for the FADI or the ATRS. However, the patient showed improvements in both measures. These improvements were consistent with the literature regarding post-operative rehabilitation of Achilles ruptures.[1,6,21] However, this literature did not specifically include a hip strengthening protocol. Therefore, the magnitude of the influence of the hip strengthening protocol in this case report cannot be determined. The patient did not return to her full prior level of function by the end of the episode of care, however, this is consistent with the literature that states most patients have functional deficits up to 12 months after surgery.[6] This is especially relevant when considering her prolonged immobilization of approximately seven weeks since the current literature suggest early mobilization allows for better outcomes.[5,6]

Strengths of this case report included the use of interventions based on research evidence, rehab protocols, and clinical expertise. Limitations of this case report included the inability to

perform exercises in sidelying or exercises that involved weight-bearing through the right UE related to the patient's use of a sling for the right UE through the majority of the course of treatment.

Based on the improvements the patient made, utilizing a hip strengthening protocol in addition to established post-operative rehab protocols for Achilles tendon ruptures may be beneficial, although further research is needed to confirm this. Future research could focus on hip strengthening exercises in addition to ankle ROM and strengthening exercises, as well as research on the effects of hip weakness on Achilles injuries, including Achilles rupture. With the increasing incidence of Achilles ruptures,[1] research on the possible use of hip strengthening in a preventative role for Achilles ruptures could be beneficial.

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Tables and Figures

Table 1: Systems Review

Cardiovascular/Pulmonary	Not impaired
Musculoskeletal	Impaired gross symmetry – left calf atrophy compared to right Impaired gross range of motion (ROM) – Reduced left end range ankle dorsiflexion, plantarflexion, and inversion Impaired gross strength – Reduced left ankle dorsiflexion, plantarflexion, eversion, inversion strength. Reduced hip abduction and extension strength. Impaired height/weight – Body mass index (BMI) greater than 25
Neuromuscular	Impaired balance Impaired gait
Integumentary	Not impaired Incision scar on left posteromedial heel. No signs of infection.
Communication	Not impaired
Affect, Cognition, Language, Learning Style	Not impaired Preferred Language: English Learning Style: Verbal and visual

438 **Table 2: Tests and Measures**

Tests & Measures	**Initial Evaluation Results**		**End of Episode of Care (Visit #18)**	
AROM (°)	**Left**	**Right**	**Left**	**Right**
Ankle DF	-20°	10°	10°	10°
Ankle PF	10°	50°	51°	50°
Ankle Eversion	10°	10°	10°	10°
Ankle Inversion	10°	40°	34°	40°
MMT (0-5/5)	**Left**	**Right**	**Left**	**Right**
Ankle DF	+3/5	5/5	5/5	5/5
Ankle PF	+3/5	5/5	-5/5	5/5
Ankle Eversion	-4/5	5/5	-5/5	5/5
Ankle Inversion	-4/5	5/5	5/5	5/5
Hip ABD	4/5	-5/5	-5/5	-5/5
Hip EXT	+4/5	-5/5	-5/5	-5/5
Balance (seconds)	**Initial Evaluation**	**Re-Evaluation (Visit #8)**	**End of Episode of Care (Visit #18)**	
Standing, Firm Surface, Eyes Open	L: unable to perform R: 30 seconds	L: 30 seconds R: 30 seconds	L: 30 seconds R: 30 seconds	
Standing, Firm Surface, Eyes Closed	Not tested	L: 3 seconds R: 8 seconds	L: 5 seconds R: Not tested	
Standing, Foam Surface, Eyes Open	Not tested	L: 4 seconds R: 20 seconds	L: 4 seconds R: 30 seconds	
Gait	Antalgic gait with walking boot and bilateral crutches		Reciprocal gait with lack of arm swing on R and mildly reduced trunk rotation due to R UE sling. Minimal to no limp present on L LE.	
Palpation	L Achilles tendon tender to palpation. No tenderness noted on right Achilles tendon.		No tenderness to palpation of the L Achilles tendon.	
Functional Outcome Measures	**Initial Evaluation**	**Re-Evaluation (Visit #8)**	**Re-Evaluation #2 (Visit #15)**	**Final Visit of Episode of Care (Visit #18)**
Lower Extremity Functional Scale (LEFS) (0-80/80)	28/80 (35% of maximal function)	52/80 (65% of maximal function)	60/80 (75% of maximal function)	57/80 (71% of maximal function)
Foot and Ankle Disability Index (FADI) (%)	Not measured at IE	37%	91.3%	91.3%
The Achilles tendon Total Rupture Score (ATRS) (0-100/100)	Not measured at IE	52/100	36/100	32/100

AROM = active range of motion, DF = dorsiflexion, PF = plantarflexion, MMT = manual muscle testing, ABD = abduction, EXT = extension, IE = initial evaluation, L = left, R = right, UE = upper extremity, LE = lower extremity

Table 3: Short & Long Term Goals

Short Term Goals	**Long Term Goals**
1. Patient will increase LEFS score by >25% in order to ambulate without an AD (4 weeks). 2. Patient will increase DF AROM to 0 degrees and PF AROM to 40 degrees in order to ascend stairs with a handrail and reciprocal pattern (6 weeks). 3. Patient will increase LE strength to 4+/5 via MMT throughout in order to work 4 hours without pain (6 weeks).	1. Patient will increase DF AROM to 10 degrees and PF AROM to 50 degrees in order to reciprocally descend stairs with a rail (8 weeks).

LEFS = Lower Extremity Functional Scale, AD = assistive device, DF = dorsiflexion, AROM = active range of motion, PF = plantar flexion, LE = lower extremity, MMT = manual muscle testing

Table 4: Physical Therapy Interventions

Intervention	IE (Visit #1)	Visits #2 & 3	Visits #4 & 5	Visits #6 & 7	Visits **#8** & 9 ***Re-Eval**
ROM & Stretching					
Ankle AROM (DF, PF, IV, EV)	2 sets x 20 reps	2 sets of 20 reps (DF/PF)			
Gastrocnemius Towel Stretch (long sit)	5 x 30”	5 x 30”	5 x 30”	5 x 30”	
Seated BAPS board			IV, EV, PF – 1 minute each		
Standing Gastroc & Soleus Stretch				2 x 30” (Visit 7)	2 x 30”

Strengthening					
SLR – Flexion (supine)	3 sets x 10 reps	3 sets of 10 (2 lb)	3 sets of 10 (2 lb)	3 sets of 10 (2 lb)	
Sidelying hip abduction	3 sets x 10 reps	3 sets of 10 (2 lb)	3 sets of 10 (2 lb)	3 sets of 10 (2 lb)	
Ankle PF, EV, IV w/ TB		3 sets x 10 reps– (PF w/ peach TB, EV/IV w/ orange TB)	3 sets x 10 reps (green TB)	3 sets x 10 reps (green TB)	
Seated Intrinsic Tubing Pickups		2 cups of 15 tubes	2 cups of 15 tubes	2 cups of 15 tubes	
Heel Raises		Seated - 2 sets x 10 reps (no weight)	Seated - 2 sets x 10 reps (no weight)	Seated - 2 sets x 10 reps (no weight) Bilateral Standing (Visit 7)	Standing – 2 sets x 10 reps
Corrective Squats - Bilateral				Mini-squats to mat table (2 sets of 10 reps)	Mini-squats to mat table (2 sets of 10 reps)
Step Ups				4-inch box (2 sets of 10 reps)	6-inch box (3 sets of 10 reps)
Side Steps (TB around ankles)					3 sets of 10 reps (yellow TB)
Manual Interventions					
STM – AT into soleus		12 minutes	12 minutes	10 minutes	10 minutes
Manual DF stretch w/ Posterior Talocrural Glides					1 set of 15 (starting w/ Visit #9)
Aerobic Activity/Gait Training					

Gait Training	5 minutes with boot & bilateral crutches	2 minutes with boot & single crutch	2 minutes with boot & with/without single crutch – cueing for knee flexion and reducing circumduction on L LE	5 minutes with no AD, no boot. Cues for increasing knee flexion in swing and heel strike on IC, cue to increase stance time on L LE.	5 minutes with no AD, no boot. Cues for increasing knee flexion in swing and heel strike on IC, cue to increase stance time on L LE.
Bicycle Ergometer (SCIFIT Systems ISO7000 – SCIFIT, Tulsa, OK)			8 minutes (heel push only on L LE) – Initiated on Visit #5	8 minutes (heel push only on L LE)	10 minutes
Balance					
Single Leg Balance				3 x 30", shoes on. Able to hold 15 seconds on L LE.	3 x 30", shoes on. Able to hold 15 seconds on L LE.
Balance Board (Side to Side)					3 x 30"
Intervention	Visits #10 & 11	Visits #12 & 13	Visits #14 & **15*** ***Re-Eval**	Visits #16 & 17	Visit **#18** **Last visit of EOC**
ROM & Stretching					
Standing Gastroc & Soleus Stretch	2 x 30"	2 x 30"	2 x 30"	2 x 30"	2 x 30"

Standing Self-Talar Posterior Glide with resistance band and foot on box	2 sets of 10 reps	2 sets of 10 reps			
Strengthening					
Heel Raises	Standing – 2 sets x 10 reps	Standing – 3 sets of 10 (moderate lean to R)	Standing – 3 sets of 10 (mild lean to R) Seated – 2 sets of 10 reps with 15 lbs weight	Standing – 3 sets of 10 (mild lean to R) Seated – 2 sets of 10 reps with 15 lbs weight	Standing – 3 sets of 10 (single leg eccentric, unable to perform single leg concentric) Seated – 2 sets of 10 reps with 20 lbs weight
Corrective Squats - Bilateral	3 sets of 10 (to chair + 6 inch box)	3 sets of 10 reps (to chair with yellow TB around knees)	3 sets of 10 reps (to chair with green TB around knees)	3 sets of 10 reps (to chair with green TB around knees)	3 sets of 10 reps (to chair with green TB around knees)
Step Ups	3 sets of 10 reps (6 inch box)	3 sets of 10 reps (6 inch box)	3 sets of 10 reps (8 inch box)	3 sets of 10 reps (8 inch box) – eccentric step downs	
Side Steps (TB around ankles)	3 sets of 10 (yellow TB)	3 sets of 10 (green TB)	3 sets of 10 (green TB)	3 sets of 10 (green TB)	3 sets of 10 (blue TB)
Steamboats (Contra-Kicks) – Forward, Side, Back	25 reps each direction (green TB)	25 reps each direction (green TB)	25 reps each direction (green TB)	25 reps each direction (green TB)	25 reps each direction (green TB) – on airex pad
Leg Press (Quantum Fitness QARM-08036 – Horizontal Leg Press – Quantum Fitness Corporation, Sugar Land, TX)		3 sets of 10 reps (120 lbs)	3 sets of 10 reps (120 lbs)	3 sets of 10 reps (120 lbs)	3 sets of 10 reps (120 lbs)
Calf Raises on Leg Press (Quantum Fitness QARM-08036 – Horizontal Leg Press – Quantum Fitness Corporation, Sugar		3 sets of 10 reps (60 lbs) – double LE concentric, single LE eccentric	3 sets of 10 reps (80 lbs) – double LE concentric, single LE eccentric	3 sets of 10 reps (80 lbs) – double LE concentric, single LE eccentric	3 sets of 10 reps (80 lbs) – double LE concentric, single LE eccentric

Land, TX)					
Lunges			In place – 3 sets of 10 reps	In place – 3 sets of 10 reps	Walking – 3 sets of 10 reps
Double Leg Glute Bridge with feet on bench			3 sets of 10 reps	3 sets of 10 reps	3 sets of 10 reps
Manual Interventions					
STM – AT into soleus	10 minutes	10 minutes	10 minutes	10 minutes	
Manual DF stretch w/ Posterior Talocrural Glides	1 set of 15	1 set of 15	1 set of 15		
Aerobic Activity/Gait Training					
Bicycle Ergometer (SCIFIT Systems ISO7000 – SCIFIT, Tulsa, OK)	10 minutes	10 minutes	10 minutes	10 minutes	
Elliptical Trainer (Precor EFX 427 – Precor Incorporated, Woodinville, WA)					10 minutes
Balance					
Single Leg Balance	3 x 30" (with shoes off, attempted eyes closed – held 2-3 seconds with eyes closed)	3 x 30" (with shoes off, on airex pad)	3 x 30" (with shoes off, on airex pad)	3 x 30" (with shoes off, on airex pad)	

Ground Clock – single leg balance with 6 point taps		3 sets of 5 reps each direction	3 sets of 5 reps each direction	3 sets of 5 reps each direction	3 sets of 5 reps each direction

AROM = active range of motion, SLR = straight leg raise, IE = initial evaluation, TB = theraband, STM = soft tissue mobilization, AT = achilles tendon, L = left, LE = lower extremity, AD = assistive device, R = right, EOC = episode of care, IC = initial contact, DF = dorsiflexion, PF = plantarflexion, IV = inversion, EV = eversion, BAPS = biomechanical ankle platform system

CARE Checklist

CARE Content Area	Page
1. **Title** – The area of focus and "case report" should appear in the title	2
2. **Key Words** – Two to five key words that identify topics in this case report	2
3. **Abstract** – (structure or unstructured) a. Introduction – What is unique and why is it important? b. The patient's main concerns and important clinical findings. c. The main diagnoses, interventions, and outcomes. d. Conclusion—What are one or more "take-away" lessons?	3
4. **Introduction** – Briefly summarize why this case is unique with medical literature references.	4
5. **Patient Information** a. De-identified demographic and other patient information. b. Main concerns and symptoms of the patient. c. Medical, family, and psychosocial history including genetic information. d. Relevant past interventions and their outcomes.	5
6. **Clinical Findings** – Relevant physical examination (PE) and other clinical findings	7
7. **Timeline** – Relevant data from this episode of care organized as a timeline (figure or table).	12
8. **Diagnostic Assessment** a. Diagnostic methods (PE, laboratory testing, imaging, surveys). b. Diagnostic challenges. c. Diagnostic reasoning including differential diagnosis. d. Prognostic characteristics when applicable.	9
9. **Therapeutic Intervention** a. Types of intervention (pharmacologic, surgical, preventive).	10

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b. Administration of intervention (dosage, strength, duration). c. Changes in the interventions with explanations.	
10. **Follow-up and Outcomes** a. Clinician and patient-assessed outcomes when appropriate. b. Important follow-up diagnostic and other test results. c. Intervention adherence and tolerability (how was this assessed)? d. Adverse and unanticipated events.	13
11. **Discussion** a. Strengths and limitations in your approach to this case. b. Discussion of the relevant medical literature. c. The rationale for your conclusions. d. The primary "take-away" lessons from this case report.	14
12. **Patient Perspective** – The patient can share their perspective on their case.	6
13. **Informed Consent** – The patient should give informed consent.	6