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**The Use of Manual Therapy and Strengthening Exercises to Improve Plantarflexion  
Strength and Mobility Following Achilles Tendon Repair: A Case Report**

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

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**Background and Purpose:** The incidence of Achilles tendon ruptures is 1 in 10,000 per year, mostly affecting 30 to 50 year old males. These ruptures occur from either strong eccentric or concentric contractions of the gastrocnemius/soleus complex during acceleration or deceleration. Impact motions are common causes of this tendon ruptures. Neglected Achilles tendon ruptures occur when 4 weeks pass before treatment. This case report describes the clinical management of a patient with a neglected Achilles tendon rupture with global scar tissue formation due to a 3-month time period between injury and surgical repair, followed by a further 3-month time period between surgery and rehab. Literature is currently limited in suggesting the optimal treatment for this population, and this case report serves to add to the literature.

**Case Description:** A 43-year-old male presented to physical therapy following an Achilles tendon rupture and repair. He was seen for 24 visits and underwent a manual therapy program consisting of joint mobilization of the talocrural joint, distal tibiofibular joint, and metatarsophalangeal joint, soft tissue mobilization (STM) to the triceps surae, plantar fascia, and anterior tibialis, and passive ROM of the ankle. The patient also performed strengthening and stretching exercises for the ankle over a course of 8 weeks. Strengthening exercises were progressed as the patient's strength increased. Functional activity progress was tracked using the Lower Extremity Functional Scale (LEFS).

**Outcomes:** The patient demonstrated improved strength and ankle joint ROM. LEFS scores improved from 36/80 at initial evaluation to 54/80 at re-evaluation. Gait pattern showed qualitative improvements following increases in great toe and ankle strength and ROM.

**Discussion:** The findings of this case report indicate that a combination of manual therapy and strengthening and stretching exercises may yield positive results in improving a patient's functional mobility by improving ankle joint mechanics, strength, and ROM. Future studies examining the most effective ways to mobilize scar tissue following Achilles tendon repair would be beneficial in maximizing patient function, improving functional strength, and increasing ROM.

## **Background and Purpose**

Achilles tendon ruptures are common with an incidence of 1 in 10,000 per year.<sup>1</sup> Men are more commonly affected by this injury, usually in the 30 to 50 year old age group. The mechanism of injury is caused by a strong eccentric or concentric contraction of the triceps surae during acceleration or deceleration.<sup>2</sup> Activities such as jumping, landing, or pushing are examples that can lead to this injury. General risk factors, including advancing age, previous tears or ruptures, changes in training level, or new activities, as well as intrinsic and extrinsic factors, can further put someone at risk for injury.<sup>3</sup>

An Achilles tendon rupture becomes classified as chronic or neglected when the injury has been left untreated for 4 weeks or more. Following this period of time, the Achilles tendon becomes elongated and the gastrocnemius and soleus both present with weakness.<sup>4</sup>

Treatment of Achilles tendon ruptures may be conservative or surgical, although there is no consensus on the better treatment option. The overall goal of treatment is to gain strength with plantar flexion and restore functional strength and activity levels to the pre-injury status<sup>5</sup>. Operative treatment of the Achilles tendon rupture has been shown to have a lower re-rupture rate than conservative treatment, however surgical treatment has a higher rate of infection, adhesion formation, altered sensation, and thromboembolism<sup>6,7</sup>.

Willits et al., (2010) conducted a large randomized control trial with an operative group and a conservative treatment group. They found that the operative group performed slightly better than the conservative group, however each of the groups achieved >80% of their plantarflexion strength and 100% of dorsiflexion.<sup>8</sup> However, they recommended that patients should undergo accelerated rehabilitation and non-operative treatment, as the outcomes were not significant enough to risk surgical complications.

Global scar tissue formed due to a 3-month time period between injury and surgical repair and a further 3-month time period between surgery and rehab. Literature is currently limited in suggesting the optimal treatment for this population, and this case report serves to add to the literature.

There is currently limited literature pertaining to chronic or neglected Achilles tendon ruptures. Therefore, the purpose of this case report is to examine the effects of physical therapy on a patient who developed severe compensatory gait patterns secondary to a neglected Achilles tendon rupture and operative repair.

### **Case Description**

The patient was a 43-year-old male who was referred by his surgeon to outpatient physical therapy following Achilles tendon rupture and subsequent repair. He was referred to physical therapy care due to functional strength and mobility deficits and the inability to work. Following the rupture of the Achilles tendon, he continued walking with the rupture for 3 months prior to seeing the doctor for repair, which classified his rupture as a neglected or chronic rupture<sup>9,10,11</sup>. This created a large amount of scar tissue around the tendon before and after the surgery. Following the repair, he was splinted for 2 weeks, casted for 6 weeks, and then used a walking boot for 4 weeks prior to physical therapy. He presented to physical therapy with extreme compensation strategies during ambulation, plantar fasciitis, and fat pad syndrome.

Prior to rupturing his Achilles tendon, this patient was fully independent with all ADLs and IADLs. He led an active lifestyle, enjoying hiking, fishing, and backpacking. He was working as an airline pilot with no restrictions. The patient was moderately to severely limited with ADLs and IADLs. These included housework, regular hobbies, bathing, walking, dressing, and squatting. He was unable to perform any ballistic movements, which were required for his

job. When performing these activities, he demonstrated extreme compensatory patterns and could only perform them for a limited amount of time. He was unable to work as a pilot because of the physical demands that the job required in emergency situations.

The patient’s goal for physical therapy was to return to his social activities and return to work. He stated that until he is 100%, he would be unable to work because he needed to be able to function optimally in the case of an emergency and his job would not allow him to return until he is cleared medically.

Results from the systems review, as described by the Guide to PT Practice, are summarized in Table 1.

**Table 1**

<b>Systems Review</b>	
<b>Cardiovascular/Pulmonary</b>	
<b>Impaired</b>	Edema was present in the right ankle and calcaneus.
<b>Integumentary</b>	
<b>Impaired</b>	Incision along the medial aspect of the right Achilles tendon, 3 inches long. Mild adhesion formation present along scar. Increased Achilles tendon thickness due to scar tissue formation.
<b>Neuromuscular</b>	
<b>Impaired</b>	Decreased balance with single leg stance with 4 second max on right.
<b>Musculoskeletal</b>	
<b>Impaired</b>	Gross strength impairments of the right hip and ankle. Gross range of motion impairments of the right ankle and right great toe. Gait impairments are present due to strength/range of motion impairments. Joint mobility of right ankle is decreased.
<b>Communication, Affect, Cognition, and Learning Style</b>	
<b>Not Impaired</b>	Patient prefers pictures and demonstrations.

## Clinical Impression #1

It was hypothesized based upon current patient information that impairments in strength, range of motion (ROM), balance, and gait were present. Following a chart review, a medical diagnosis of a ruptured Achilles tendon and surgical repair was given to the patient. Further tests and measures to confirm the hypothesis were gait and balance testing, joint integrity and mobility, anthropometric measurements, palpation, manual muscle testing (MMT), ROM measurements, and a Lower Extremity Functional Scale (LEFS). Furthermore, a full, bilateral examination of the entire lower extremity would be analyzed to assess impairments caused by compensation patterns.

## Examination: Tests and Measures

A standardized physical therapy examination was conducted as described by the Guide to PT Practice. See Table 2 for results.

**Table 2**

Tests & Measures	Initial Examination Results	Reliability
Gait, Locomotion, and Balance As described by O'Sullivan <sup>12</sup>	Antalgic gait, lateral rotation of the R hip and R foot, lack of heel-to-pattern, decreased push off on R, decreased MTP I extension and decreased step length. SLS on R: 4 seconds, L: 30 seconds. Semi-tandem: R leg forward: 30 seconds, L leg forward: 30 seconds with increased postural sway.	Within-raters=.60 <sup>13</sup>
Orthotics	Patient wears an OTC shoe insert with a heel cushion	
Anthropometric Measurements As described by O'Sullivan <sup>12</sup>	Superior malleolus – R: 26.5cm, L: 24 cm Calcaneus – R: 31cm, L: 28.2cm Heads of Metatarsals: R: 24cm, L: 23.8cm	
Joint Integrity and Mobility	Talocrural joint – PROM PF/DF –	

As described by Kaltenborn <sup>14</sup>	firm end-feel. Metatarsal joints – AP glides – WNL MTP I extension – PROM – firm end-feel MTP I: dorsal/ventral glides – severe hypomobility.	
Posture As described by O’Sullivan <sup>12</sup>	Patient stands with R hip/foot laterally rotated. Patient has a flat medial arch.	
Pain As described by O’Sullivan <sup>12</sup>	Numeric pain scale: current pain: 0/10, best pain: 0/10, worst pain: 8/10.	
Palpation As described by Hoppenfeld <sup>15</sup>	Patient TTP along the R Achilles tendon, R plantar fascia, R lateral sole of the foot,	
Muscle Performance – MMT As described by Kendall <sup>16</sup>	Ankle inversion: R: 4+/5, L: 5/5 Ankle eversion: R: 4-/5, L: 5/5 Functional single leg heel raise: R: no movement, L: 5 heel raises performed Hip flexors: R: 4/5, L: 5/5 Hip IR: R: 4/5, L: 4/5 Hip ER: R: 4/5, L: 5/5 Hip abductors: R: 4/5, L: 4/5	Interexaminer agreement: 82%-97% Test-retest: 96%-98% <sup>17</sup>
Range of motion – Goniometry As described by Norkin <sup>18</sup>	AROM: DF: R: 6 degrees, L: 19 degrees PF: R: 26 degrees, L: 53 degrees INV: R: 25 degrees, L: 31 degrees EV: R: 16 degrees, R: 20 degrees PROM: MTP I extension: R: 42 degrees, L: 73 degrees Other PROM values were not obtained.	Intrarater: r=.90 Interrater: r=.70 <sup>19</sup>
Work, Community and Leisure Integration - Lower Extremity Functional Scale	LEFS score: 36/80 = 55% disability (80/80 = no disability)	Test-retest: r=.86 Interrater/intrarater: r=.84 <sup>20</sup>

<b>Legend</b>	
<b>R = Right</b> <b>L = Left</b> <b>MTP = Metatarsophalangeal Joint</b> <b>OTC = Over the counter</b> <b>PROM = Passive Range of Motion</b>	<b>AP = Anterior/posterior</b> <b>WNL = Within Normal Limits</b> <b>IR = Internal Rotation</b> <b>ER = External Rotation</b> <b>AROM = Active Range of Motion</b>



<b>PF = Plantarflexion</b> <b>DF = Dorsiflexion</b>	<b>INV = Inversion</b> <b>EV = Eversion</b>
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He currently presents with deficits in strength, mobility, gait pattern, and pain, which are restricting his ability to perform his daily activities and job requirements as an airline pilot.

**Clinical Impression #2**

Based upon data from the examination, the diagnosis of his right Achilles tendon repair was confirmed. Findings from palpation and information from gait analysis further supported the hypothesis of mild plantar fasciitis and fat pad syndrome. Examination findings were consistent with the patient’s diagnosis and interventions were initiated at that time.

This patient continues to be appropriate for this case report due to the development of compensatory gait patterns, secondary impairments, and the uncommon amount of time that elapsed between the injury, surgery, and initiation of physical therapy. Furthermore, this case will add to the literature to further the discussion for future studies to determine what interventions are best to treat patients with neglected Achilles tendon repairs.

Based on the current data, the plan for intervention was to incorporate soft tissue mobilization and joint mobilization to restore the patient’s ROM. Strengthening exercises would be performed following ROM interventions to allow strengthening throughout the newfound ankle ROM. By increasing range of motion (DF, PF, MTP I extension), and increasing strength (primarily PF), it would be expected that factors would directly influence the patient’s gait pattern. At the end of each week, the patient will fill out a lower extremity functional scale (LEFS) to measure his progress in day-to-day function. Furthermore, he will be re-evaluated in four (4) weeks to track his progress in terms of range of motion, strength, pain, edema, and gait.

**Evaluation**

The findings of the examination were consistent with a patient who underwent surgery to repair a ruptured Achilles tendon. Due to the length of time prior to surgery and after surgery, there was a significant amount of scar tissue that formed as a result of the injury and repair. Scar tissue, in addition to long-term compensation and immobility, can reasonably be assumed to have influenced his decreased strength and range of motion. This data was collected during examination of the injury, including palpation, MMT, and goniometrical measurement. His secondary impairments of plantar fasciitis and fat pad syndrome likely resulted from his altered gait mechanics and strength and range of motion deficits. Secondary impairments should improve simultaneously during treatment of his primary impairments (strength/ROM at the ankle joint). Furthermore, 36/80 on the LEFS demonstrates 55% functional limitations, preventing the patient from participating in his normal daily activities, including work.

### **Diagnosis**

Based on the patient's presentation of musculoskeletal and neuromuscular impairments, 2 practice patterns were chosen from the *Guide to Physical Therapist Practice*. The primary diagnosis, "Impaired Joint Mobility, Motor Function, Muscle Performance, and Range of Motion Associated with Bony or Soft Tissue Surgery," was chosen due to the Achilles tendon being repaired. This pattern embodies decreased ROM, strength, joint mobility, pain, swelling, and functional limitations.

A secondary diagnosis, "Primary Prevention/Risk Reduction for Loss of Balance and Falling," was selected due to the patient's difficulty walking, decreased balance, and general deconditioning of the involved lower extremity.<sup>21</sup>

### **Prognosis**

The prognosis for this patient is good and is expected to recover well from surgery. However, his recovery time will likely be prolonged due to the amount of scar tissue that likely formed from the initial injury and then from the surgery. Most patients who undergo surgery for a neglected Achilles tendon rupture will be able to return to pre-injury level of activity on average in 5.8 months. The total ROM between the involved and uninvolved ankles was not statistically significant. Furthermore, with neglected Achilles tendon repairs, the loss of strength in ankle plantarflexion was equal to those that had acute, or immediate, tendon repairs. Finally, it was found that subjective and objective outcomes were similar between acute and neglected tendon repairs ( $p > 0.05$ ).<sup>11</sup>

### Plan of Care

**Table 3**

<b>Short Term Goals</b>	<b>Length</b>
Decrease pain at worst by 50%	4 weeks
Increase AROM DF/PF/GT extension 50%	4 weeks
Increase flexibility by 50%	4 weeks
Increase MMT grade by ½ grade	4 weeks
Independent performance of normalized gait pattern 50% of time	4 weeks
Girth measurements equal to opposite limb	4 weeks
Increased balance to >15 seconds SLS on right	4 weeks
LEFS score increased to >50	4 weeks
Independent with home exercise program	2 weeks

<b>Long Term Goals</b>	<b>Length</b>
Pain free performance of ADL/IADLs	8 weeks
Normal AROM ankle and toes to allow for normal movement patterns	8 weeks
Normal flexibility to allow normal movement patterns	8 weeks
Normalized functional strength to allow for return to work without fatigue or pain	8 weeks
SLS balance equal to uninvolved side	8 weeks
Ascend/descend stairs reciprocally	8 weeks
Normalized gait pattern with heel-to-toe pattern 100% of the time	8 weeks
<10% disability as indicated on LEFS	8 weeks
Independent with final home exercise program	8 weeks

## **Interventions**

### **Coordination, Communication, and Documentation**

- Coordination with the patient, insurance, physician and other clinical staff in the clinic to ensure high quality of care is given.
- Communication about patient's initial examination, plan of care, and progress will be sent to the referring physician to maintain open lines of communication for this patient following Achilles surgery. Also with patient and other clinical staff.

- Documentation of initial examination, daily progress notes, outcome measures (Lower Extremity Functional Scale), exercise program, and plan of care to allow consistency and progression of therapeutic interventions.
- The patient will be educated on condition, frequency and duration of visits, plan of care/procedural interventions, and home exercise program.

Procedural interventions will include:

- Manual therapy: Soft tissue mobilization, passive range of motion (PROM), joint mobilizations, scar tissue mobilization
- Modalities: Ultrasound to improve tissue mobility, ice to reduce swelling
- Neuromuscular Reeducation: To retrain lower extremity postural awareness, recruitment patterns, and balance.
- Gait training: To decrease compensation and restore normal gait pattern.
- Therapeutic exercise: To restore strength, range of motion and to reinforce proper movement patterns.

### **Procedural Interventions**

Interventions were chosen based on the patient's body structure and function impairments, activity limitations, and participation restrictions. The primary focus was to mobilize both scar and soft tissue, including the gastrocnemius/soleus complex, plantar fascia, and the Achilles tendon to improve ROM. Increased ROM is needed to allow the patient to strengthen his ankle plantarflexors through their full ROM and thus improve his gait pattern. Joint mobilizations to the talocrural joint (TCJ), subtalar joint (STJ), and the first metatarsophalangeal joint (MTP I) were utilized to address joint mobility restrictions. Eccentric loading therapeutic exercises were a focus to build strength. A plan of care to see the patient for

3 visits per week for the first 2 weeks, followed by 2 visits per week for 6 weeks. This was chosen in order to begin aggressively gaining ROM and strength in his ankle. A home exercise program (HEP) was given to supplement therapy on days.

**Table 4**

Initial Examination	
Calf stretches	3x30 seconds
Supine ankle pumps	30x
Towel Scrunches	30x

Week 1	
Joint mobilization	Performed
Scar tissue mobilization	Performed
Soft tissue mobilization	R gastrocnemius/soleus, Achilles tendon
PROM	Performed
Ultrasound	Performed
Ankle 4-way with resistance (DF, PF, Inversion, Eversion)	Red t-band, 2x10
Manual great toe extension stretch	2x30 seconds
Ankle Alphabet	1 set
Cybox – Leg press	3x10, 210 lbs
Cybox plantarflexion	3x10, 70 lbs - L foot assist
Cybox Single Leg press	3x10, 17.5 lbs
Upright Bike	8 minutes
Kinesiotape	Performed
Gastrocnemius stretch	Against wall, 2x30seconds, flat surface
BAPS board	20x circular motion, each direction, level 2, sitting
Ice	10 minutes, R ankle

Week 2	
Joint mobilization	Performed
Scar tissue mobilization	Performed
Soft tissue mobilization	R gastrocnemius/soleus, Achilles tendon
PROM	Performed
Elliptical	8 minutes
Kinesiotape	Performed
Gastrocnemius/soleus stretch	Against wall, 2x30 seconds, flat surface
Squats	3x10, wood board under heels

Monster walks	Green t-band, 3 x 20 feet
BAPS board	20x circular motion, each direction, level 2, sitting
Eccentric calf raises	3x10
Step up and over	4 inch steps, 2x10
Sidestepping	Green t-band, 3x20 feet
Gait training	8 min, with ski poles
Cybox plantarflexion	80 lbs, single leg, eccentric focus, 3x10
Ice	10 minutes, R ankle

Week 3	
Joint mobilizations to TCJ, STJ, MTP I	Performed
Scar tissue mobilization	Performed
Soft tissue mobilization	Increased focus on R anterior tibialis tendon/muscle, due to mild contracture, R gastrocnemius/soleus, Achilles tendon
PROM	Performed
Elliptical	8 min
Tibialis Anterior stretch	2x30 seconds
Cybox plantarflexion	50lbs, single leg, full ROM, PF focus
Single leg balance	Green foam, 2x30 seconds
Resisted sidestep/Monster walks	Green t-band, 3x20 feet
Squats	3x10, wood board under heel
Step up and overs	2x10, 4 inch
Bosu step up	10x, bilateral
Tandem stance on foam with ball toss	2x1 min, bilateral
Ice	10 minutes, R ankle

Week 4	
Joint mobilization	Performed
Soft tissue mobilization	R gastrocnemius/soleus, Achilles tendon
PROM	Performed
Exercises same as last week, progressed as tolerated	

Week 5	
Joint mobilization	Performed
Soft tissue mobilization	Performed, used instrument assist (graston tool) to R gastrocnemius/soleus muscle belly and anterior ankle joint
PROM	Performed
Exercises same as last week, progressed as tolerated	

Week 6	
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Joint mobilization	Performed
Soft tissue mobilization	R gastrocnemius/soleus, Achilles tendon
PROM	Performed
Static lunges	3x10, B
Toe walking	4 x 20 feet, with ski poles
Exercises same as last week, progressed as tolerated	

Week 7	
PROM	Performed
Soft tissue mobilization	R gastrocnemius/soleus, Achilles tendon
Seated straight leg ankle plantarflexion – cable column	3x30, 2.5kg
Seated marble transfers	30x, inversion to eversion
Seated plantarflexion with weight on bent knees	3x30, focus on full ROM
Resisted ankle inversion/eversion	2x15, 2 kg

Week 8	
Same exercises as last week	
Deloaded heel raises on step	2x10, 40 kg assistance
Neuromuscular re-education	Gait training

Week 9	
Same exercises as last week	Increased repetitions and weight as tolerated.
Cybex plantarflexion	50lbs, 5x10
Toe walking with ski poles	6x20 feet
Stride stance push off	2x10, focus on great toe extension and neutral ankle

Week 10	
Same exercises as last week	
Elliptical	10 minutes, level 4
Wall slides on physioball	3x10

Week 11	
Same exercises as last week	Progressed as tolerated
Sumo squats	15x, 7kg
15x stride stand lunge	15x, with ski poles
Fitter board	3x10 all directions
Gastrocnemius stretch on wedge	1 minute

One change to the intervention plan was to improve the mobility of the patient's right anterior tibialis muscle. The patient presented with a developing contracture in the right anterior tibialis



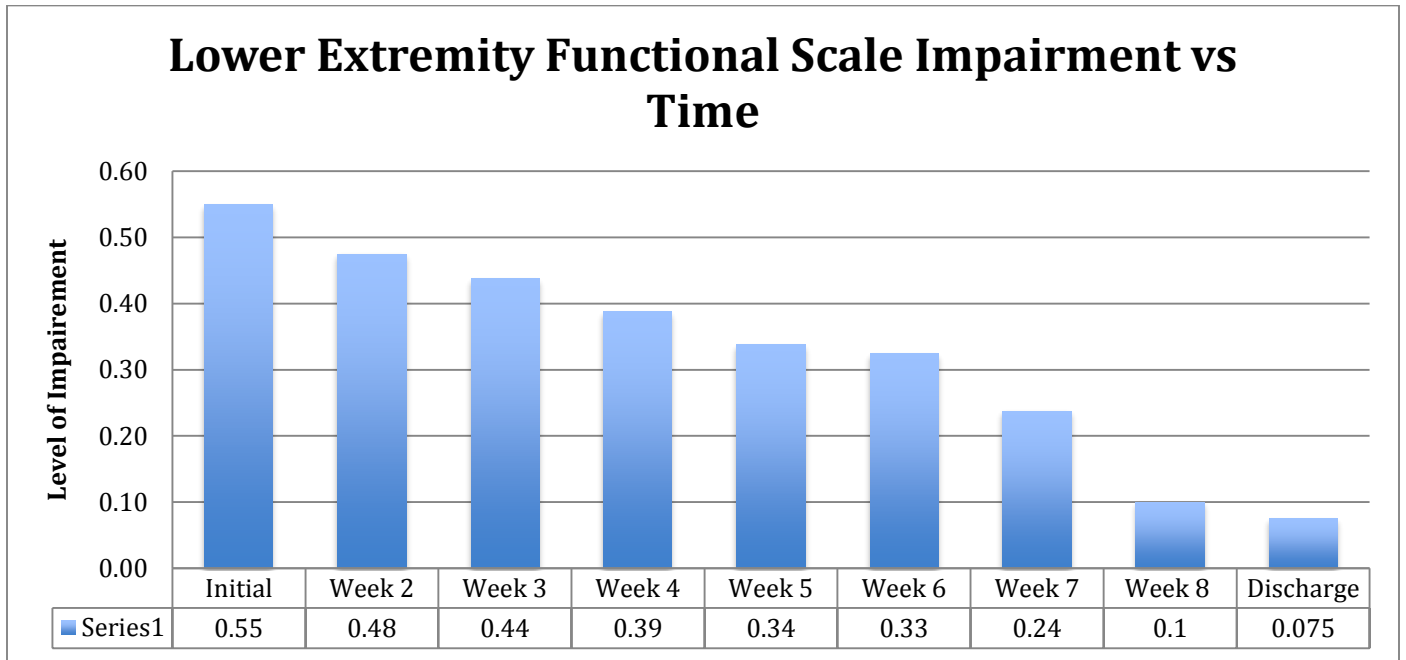
muscle. Following soft tissue mobilization to the tendon and muscle, PF range of motion was increased. Another change in the intervention plan was to incorporate increased isometric contractions into the exercise prescription. The patient gained strength at a slower rate than expected and was having trouble with muscle recruitment. The addition of isometric exercises was intended to help the patient improve his muscle recruitment ability and strength with plantarflexion at an improved rate.

## Outcomes

Tests and Measures	Impairments at Examination (6/2015)	Impairments at Discharge (9/2015)
Pain intensity Level	Right Achilles/Right Plantar Fascia/Right Heel Pad: 8/10 at worst	Right Achilles: 1/10 when barefoot, 0/10 currently Right Plantar Fascia: 0/10 Right Heel Pad: 1/10 at worst
Active ROM	Dorsiflexion: R=6° Plantarflexion: R=26° Inversion: R=25° Eversion: R=16°	Dorsiflexion: R=18° Plantarflexion: R=40° Inversion: R=28° Eversion: 18°
Passive ROM	Dorsiflexion: R=10° Plantarflexion: R=35° Inversion: R=33° Eversion: R=18° Great toe extension: R=42°	Dorsiflexion: R=19° Plantarflexion: R=53° Inversion: R=42° Eversion: R=21° Great toe extension: R=65°
Girth Measurements	Superior medial malleolus: L: 24 cm, R: 26.5 cm Calcaneus: L: 28.2 cm, R: 31cm	Superior medial malleolus: L: 24 cm, R: 25.8 cm L: 28.2 cm, R: 30 cm
MMT	Dorsiflexion: R=5/5 Plantarflexion: not tested Inversion: R=4+/5 Eversion: R=4-/5	Dorsiflexion: R=5/5 Plantarflexion: 3+/5 Inversion: R=4+/5 Eversion: R=4-/5
Functional Single-leg heel raise in standing	Unable to perform on right compared to 5 inches on left	2 inches on right, compared to 5 inches on left
Balance	SLS – R: 4 seconds	SLS – R: 15 seconds
Gait	Antalgic gait, R leg/foot externally rotated, lacking	Decreased LE external rotation, decreased push-

	heel-to-toe gait pattern, decreased push-off	off due to PF weakness/great toe extension limitation
Lower Extremity Functional Scale	36/80	72/80

**Figure 1**





\*Photos taken 6/2015, demonstrating lymphatic fan kinesiotape method and edema R ankle. Also seen is muscle atrophy and lack of muscle definition in the right gastrocnemius when compared to the left.

## **Discussion**

Neglected Achilles tendon ruptures can create complications during the rehabilitation process. Several studies have shown that post-operative functional rehabilitation, which include early active motion and weight-bearing, will improve tendon-healing as opposed to immobilization following the repair.<sup>22</sup> This patient was immobilized for 3 months following the repair of his rupture, in addition 3 months between his injury and repair. These factors likely played a large role in his prolonged rehab. Studies also showed that patients who were immobilized following the repair had increased tendon thickening, as was the case in this case report.<sup>22</sup>

The patient made slow, but steady progress in terms of regaining ROM and strength once he began physical therapy. Dorsiflexion ROM returned more quickly than plantarflexion ROM,

perhaps suggesting that his Achilles tendon had lengthened. Plantarflexion strength was significantly impaired but made dramatic improvements toward the end of this bout of therapy. Neglected Achilles tendon ruptures often present clinically through muscle weakness and tendon lengthening.<sup>22</sup> As his strength and ROM improved, his gait pattern began to normalize with increased push off and decreased out-toeing.

Factors that may have made the biggest difference for this patient was modifying his exercise program to directly isolate the right soleus and gastrocnemius recruitment patterns through their full active range of motion. Furthermore, the patient improved his compliance with his home exercise program, which also may have factored into his improvement. Due to these improvements, he was able to confidently return to work without fear of not being able to perform his normal work duties or reinjuring his Achilles tendon.

The findings of this case report indicate that a combination of manual therapy and strengthening and stretching exercises may yield positive results in improving a patient's functional mobility by improving ankle joint mechanics, strength, and ROM. Muscle specific strengthening exercises through their full active ROM appear to be most beneficial. Furthermore, strong compliance with a home exercise program is favorable to enhance rehabilitation outcomes.

Future studies would be beneficial for patients with neglected Achilles tendon injuries. These studies could focus on examining the most effective ways to mobilize scar tissue following Achilles tendon repair. Other studies could focus on improving strength and ROM in this population.

## References

1. Roda D. Achilles tendon rupture. In: Ferri FF. *Ferri's Clinical Advisor: 5 Books in 1*. Philadelphia, PA: Elsevier Mosby; 2015:33.
2. Kisner C, Colby LA. The ankle and foot. Chapter 22. In: *Therapeutic Exercise: Foundations and Techniques*. 6th ed. Philadelphia, PA: FA Davis Company; 2012:876-83.
3. Dressendorfer R, Lombara A. Achilles Tendon Rupture. [Clinical Review]. Ipswich, MA: EBSCO Publishing; 2015.  
<http://web.a.ebscohost.com.une.idm.oclc.org/rrc/pdf?sid=29dd918c-f5e6-449d-88d4-c66294ada520%40sessionmgr4004&vid=6&hid=4204>. Accessed August 2, 2015.
4. Jielile J, Badalihan A, Qianman B, et al. Clinical outcome of exercise therapy and early post-operative rehabilitation for treatment of neglected Achilles tendon rupture: a randomized study. *Knee Surgery, Sports Traumatology, Arthroscopy*. 2015.
5. Nandra RS, Matharu GS, Porter KM. Acute Achilles tendon rupture. *Trauma* 2011:67–81.
6. Bhandari M, Guyatt GH, Siddiqui F, Morrow F, Busse J, Leighton RK, et al. (2002) Treatment of acute Achilles tendon ruptures a systematic overview and metanalysis. *Clinical Orthopaedic Related Research* 400: 190-200
7. Khan RJK and Carey Smith RL (2010) Surgical interventions for treating acute Achilles tendon ruptures. *Cochrane Database of Systematic Reviews* 9 (Art. No.: CD003674: DOI 10.1002/14651858

8. Willitis K, Amendola A, Bryant D, Mohtadi NG, Giffin JR, Fowler P, et al. (2010) Operative versus nonoperative treatment of acute Achilles tendon ruptures: A multicenter randomized trial using accelerated functional rehabilitation. *The Journal of Bone and Joint Surgery* 92(17): 2767-2775.
9. Abraham, E. & Pankovich, A. (1975). Neglected rupture of the Achilles tendon. Treatment by V-Y tendinous flap. *The Journal of Bone and Joint Surgery*, 57A, pp. 253-255.
10. Ozaki, J.; Fujiki, J. & Sugimoto, K. et al. (1989). Reconstruction of the neglected Achilles tendon rupture with Marlex mesh. *Clinical Orthopaedics and Related Research*, 238, pp. 204-208.
11. D. Porter, F. Mannarino, D. Snead, S. Gabel, M. Ostrowski, 1997 Primary repair without augmentation for early neglected Achilles tendon ruptures in the recreational athlete. *Foot and Ankle International*, 18, 9, 557-564
12. O'Sullivan SB, Schmitz TJ, Fulk G. *Physical Rehabilitation*. F.A. Davis; 2013.
13. Krebs DE, Edelstein JE, Fishman S. Reliability of observational kinematic gait analysis. *Physical Therapy*. 1985;65(7):1027-33.
14. Kaltenborn FM, Evjenth O, Kaltenborn TB et al. *Manual Mobilization of the Joints, Joint Examination and Basic Treatment: The Extremities*. Orthopedic Physical Therapy & Rehabilitation Produ; 2011.
15. Hoppenfeld S, Hutton R. *Physical Examination of the Spine and Extremities*. Prentice Hall; 1976.
16. Kendall FP. *Muscles, Testing and Function with Posture and Pain*. Lippincott Williams & Wilkins; 2005.

17. Cuthbert SC, Goodheart GJ. On the reliability and validity of manual muscle testing: a literature review. *Chiropractic & Osteopathy* 2007;15(1):4.
18. Norkin CC, White DJ. *Measurement of Joint Motion, A Guide to Goniometry*. F A Davis Company; 2009.
19. Smith JR, Walker JM: Knee and elbow range of motion in healthy older individuals. *Physical and Occupational Therapy in Geriatrics* 2(4):31-38, 1963.
20. Binkley JM, Stratford PW, Lott SA, Riddle DL. The Lower Extremity Functional Scale (LEFS): scale development, measurement properties, and clinical application. North American Orthopaedic Rehabilitation Research Network. *Physical Therapy*. 1999;79(4):371-83.
21. *Guide to Physical Therapist Practice 3.0*. Alexandria, VA: American Physical Therapy Association; 2014. Available at: <http://guidetoptpractice.apta.org/>. Accessed September 15, 2015.
22. Calder JD, Saxby TS (2005) Early, active rehabilitation following mini-open repair of Achilles tendon rupture: a prospective study. *British Journal of Sports Medicine* 39:857–859.

# Appendix 1

## LOWER EXTREMITY FUNCTIONAL SCALE

**Patient's Name:** \_\_\_\_\_

**Date:** \_\_\_\_\_

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

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

<u>ACTIVITIES</u>	Extreme Difficulty or unable to perform activity	Quite a bit of difficulty	Moderate Difficulty	A little bit of Difficulty	No Difficulty
a. Any of your usual work, housework or school activities	0	1	2	3	4
b. Your usual hobbies, recreational or sporting activities	0	1	2	3	4
c. Getting into or out of the bath	0	1	2	3	4
d. Walking between rooms	0	1	2	3	4
e. Putting on your shoes or socks	0	1	2	3	4
f. Squatting	0	1	2	3	4
g. Lifting an object, like a bag of groceries from the floor	0	1	2	3	4
h. Performing light activities around your home	0	1	2	3	4
i. Performing heavy activities around your home	0	1	2	3	4
j. Getting into or out of a car	0	1	2	3	4
k. Walking 2 blocks	0	1	2	3	4
l. Walking a mile	0	1	2	3	4
m. Going up or down 10 stairs (about 1 flight of stairs)	0	1	2	3	4
n. Standing for 1 hour	0	1	2	3	4
o. Sitting for 1 hour	0	1	2	3	4
p. Running on even ground	0	1	2	3	4
q. Running on uneven ground	0	1	2	3	4
r. Making sharp turns while running fast	0	1	2	3	4
s. Hopping	0	1	2	3	4
t. Rolling over in bed	0	1	2	3	4
<b>Column Totals:</b>	0	1	2	3	4

**SCORE:** \_\_\_\_\_/80