Clinical Case Report Competition

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Postoperative Achilles tendon rupture: Effects of combined Swedish massage and deep transverse friction massage

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Abstract

Achilles tendon ruptures are a commonly ruptured tendon in the human body. With surgery as a commonly sought out method of operation, there is a large number of individuals with residual symptoms associated with postoperative Achilles tendon ruptures. Stiffness and aching, reduced range of motion, and pain with activity of the affected ankle are the primary concerns. The objective of this study was to examine if Swedish massage, in conjunction with deep friction tendon massage, could alleviate any of the symptoms mentioned above, as well as decrease scar tissue diameter. The participant was a 23-year-old physically active male who received open surgery for a complete Achilles tendon rupture in 2012. The duration of this study continued for five massage therapy treatments. The patient had their affected ranges of motion recorded with a goniometer, and their scar tissue diameter measured. All measurements were taken pretreatment and posttreatment to observe any changes. The patient was questioned to examine if they experienced a decrease in pain, or stiffness with activity. An increased active range of motion of 10°, 9°, and 3° for dorsiflexion, plantarflexion, and eversion was observed by the end of the five massage therapy sessions. The patient's scar tissue diameter was also observed to have decreased by approximately 3 centimeters. Most importantly, the patient's subjective pain, discomfort, and stiffness were reduced during activity. In conclusion, it is evident that the techniques used in this study were beneficial for the patient who had a prior Achilles tendon rupture. Therefore, Swedish massage, in conjunction with deep friction tendon massage may be beneficial for other patients with postoperative Achilles tendon ruptures.

Key Words: Postsurgical Achilles rupture, Achilles tendon, Swedish massage, deep friction massage

Introduction

The Achilles tendon is the largest and strongest tendon in the human body, with a high capacity to withstand mechanical forces created during movement (1,2). Despite the strength and endurance of this tendon, the Achilles tendon is extremely prone to injury (2,3). With an increasing rate of incident, Achilles tendon ruptures are becoming a prevalent issue in modern society (4). In Canada, the annual average occurrence rate is 8.3 ruptures per 100,000 people, making the Achilles tendon the most commonly ruptured lower limb muscle of the human body (2,5).

Achilles tendon injuries affect a wide range of individuals. Physical activities such as recreational sports have been implicated as a major source of injury (6). In addition, insufficient warm up or stretching prior to exercise has been attributed to increased risk of Achilles tendon ruptures (2). Though less common, Achilles tendon ruptures have been observed to occur in situations that do not involve physical activity, with an incident rate of 24% in athletes and 6% in non-athletes (2,6,7). There appears to be a higher incidence of males with Achilles tendon ruptures, with an observed ratio of 12:1 male to female cases (8). It has been suggested that this skew towards occurrences in males may be due to the greater proportion of males involved in highly physical sport activities (2). Interestingly, studies show that rupture of the left Achilles tendon occurs at a higher rate than the right Achilles tendon (2). It has been proposed that this is due to a greater proportion of people who are right leg dominant, and as a result use their left leg to push off during physical activities (2). Though the occurrences are rare, bilateral Achilles tendon ruptures have been recorded (9). It is clear that Achilles tendon injuries

can occur in a wide variety of individuals through different methods, mainly due to strenuous physical activities.

There are primarily three positions in which an Achilles tendon is most prone to ruptures. In 53% of cases, the Achilles tendon ruptured when loading weight onto the forefoot with the unilateral knee in extension, followed by pushing off with the same foot (2). In 17% of cases, sudden dorsiflexion at the ankle resulted in instability, leading to a ruptured tendon (2). Lastly, in 10% of cases, sudden dorsiflexion while in plantarflexion, such as missing a step, resulted in a ruptured tendon. From these observed cases, it is clear that excessive plantarflexion and sudden dorsiflexion are the predominant position in which injury is most likely to occur.

Anatomically, the Achilles tendon anchors three muscles – the gastrocnemius, soleus, and plantaris muscles – onto their insertion point, the calcaneal tuberosity. The gastrocnemius originates from the lateral and medial condyles of the femur, with the lateral head slightly shorter than the medial head (1,3). The soleus muscle originates from the head of the fibula, as well as the soleal line (1). Lastly, the plantaris muscle, which is absent in 8% of the population, originates from the lateral condyle of the femur (3). The gastrocnemius and plantaris muscle assist with flexion at the knee joint, and all three of these muscles are responsible for plantarflexion at the ankle joint (1). During an Achilles tendon rupture, many patients report hearing a loud, audible snap, with many feeling as if they were struck at the posterior calcaneal region (2,10). When ruptured, the function of the three muscles anchored by the Achilles tendon is greatly diminished. Immediately following injury, the patient will not be able to weight bear on the affected ankle. Swelling, pain, weakness, and stiffness follow promptly (2). The Achilles tendon receives

a poor supply of blood from the surrounding connective tissue, the musculotendinous junction and the bone-tendon junction. It has been suggested that this area of weak blood supply contributes to the tendon's inclination towards injury (2). Due to the poor supply of blood, the healing ability of the Achilles tendon is poor and slow.

Upon rupture of the Achilles tendon, two primary treatment methods may be employed: conservative, non-surgical methods, or surgical intervention (11). Non-surgical methods include casting and temporary immobilization of the affected region, with weight bearing within patient tolerance (12). Surgical intervention, such as open surgery, has been suggested to provide Achilles tendon rupture patients with a more rapid rate of rehabilitation. As such, patients who opt for surgery return to activity quicker, and muscle function is less likely to diminish (13). With a shorter recovery period, surgical intervention has a reduced chance of re-rupture, therefore establishing it as a more desirable option (2,8,11,12,13). Following surgery, a majority of Achilles tendon rupture patients report failure to produce the same functionality as pre-rupture. Only a minimal amount of improvement can be observed after a year postoperation, and of those, few manage to resume full function even after two years (14).

Tendon mobilization, as well as massaging the gastrocnemius, soleus, and plantaris muscle have been observed to assist rehabilitating Achilles tendon tendinopathies. Swedish massage techniques, such as longitudinal stroking, have been observed to benefit athletes recovering from sports injuries, as well as reduce pain during activity (15). Studies show that Swedish massage increases local blood circulation to the area of treatment (15,16). Since the Achilles tendon receives a poor supply of blood from the surrounding connective tissue, techniques increasing blood flow to the postoperative

Achilles tendon ruptures may assist in a more rapid recovery. Though the number of studies is limited, deep transverse friction massage has been shown to be promising in aiding recovery of injured tendons (16). It has been shown that deep transverse friction massage increased protein activity within the tendon cells, and has been suggested to be the mechanism of how the injured tendons recovered (17). Deep transverse friction massage is performed by identifying the site of adhesion, compressing the superficial tissue over the adhesion, and dragging the superficial tissue over the site of adhesion. As a result, adhesions are broken down, and normal motion can be achieved (16,18).

Although Swedish massage and deep traverse friction massage have individually been shown to be promising in treating postoperative symptoms, the effects of combining these two methods has yet to be established. In this study, I combined Swedish massage and deep traverse friction massage to determine the effectiveness of treating postoperative Achilles tendon ruptures. To determine treatment effectiveness, I measured scar tissue diameter, as well as the range of motion of the affected ankle by measuring active plantarflexion, dorsiflexion, and eversion. The results of this study may highlight the use of two non-invasive methods to effectively treat residual effects of postoperative Achilles tendon ruptures, leading to a better quality of life in patients

Methods

Profile of Patient

The patient is a 23 year-old, physically active Chinese male with two prior Achilles tendon ruptures. The first incident occurred during a basketball game in June 2012. The patient felt a sharp pain in his left Achilles tendon, and was immediately escorted to the hospital. The patient was diagnosed with a partial rupture of the Achilles tendon, and conservative methods were used for treatment. He had a cast for three months following the incident, and was prescribed to perform pain-free isometric contractions. The second occurrence was also during a basketball game, on November 2012. This time the patient fully ruptured his Achilles tendon. The patient had open surgery performed, followed by another three months of casting.

The patient's treatment history primarily consisted of active rehabilitation, and physiotherapy. Strengthening exercises such as isometric contractions, eccentric heel drops, and calf raises were encouraged, but the patient did not regularly perform these exercises. As a consequence of the injury, the patient was unable to participate in any sports activities until eight months posttreatment. The condition of the patient's affected ankle remained the same for the past year and he has not sought out additional rehabilitative or therapeutic treatments. Though the patient may now play sports, a stiffness that dissipates with activity remains, and he has noted a decrease in athletic performance.

Recommended by their family member, the patient was initially unaware that massage therapy could be beneficial for postoperative Achilles tendon ruptures. Originally, the patient was skeptical of the benefits of massage therapy. Upon research,

the patient decided to make contact and accepted the potential therapeutic offers. Upon interview, the patient primarily complained of stiffness, pain, and decreased range of motion at the affected ankle. Physical activity, especially involving running, increased the grade of pain the patient felt compared to other types of movement. It has been noted by the patient that adequate warm up prior to activity decreased stiffness and pain. During exercise, the patient characterized the affected ankle's performance as "less explosive" compared to the state of his ankle prior to injury. The patient described a slight desensitization around the bulk of the scar tissue on the left ankle. The chief complaint of the unaffected right ankle was frequent muscle tightness, and occasional cramping in the gastrocnemius-soleus complex. Additional symptoms felt by the patient includes shoulder and lower back pain he did not previously have, likely to be due to the long duration of casting and crutches he endured for his injury.

During active and passive range of motion, the patient had significantly less range of motion in dorsiflexion, and eversion in the affected ankle compared to the unaffected ankle. Upon palpation, bilateral hypertonicity of the hamstrings, which consists of bicep femoris, semimembranosus and semitendinosus, and the gastrocnemius and soleus muscles were present. Tenderness was observed with palpation to the calves bilaterally, with specific referral patterns, implying the possibility of trigger points. Manual muscle testing was performed on the gastrocnemius, soleus, and tibialis anterior muscles, each with a grade of 5, signifying full strength. No neurological symptoms were observed.

With the exception of a constant stiffness during functional testing, the patient had no significant complaints squatting or jumping. Range of motion was within normal limits for a squat and rise, and no pain was present. The anterior and posterior drawer test

was performed to identify whether the patient had ligamentous damage to the affected ankle. An anteriorly and posteriorly directed force to the affected foot was administered with the tibia stabilized (16). Excessive movement was not observed, therefore indicating the patient did not have ligamentous damage. To differentiate between gastrocnemius and soleus tightness, the dorsiflexion maneuver was performed. The patient's affected foot was passively moved from neutral to dorsiflexion with the knee in extension, and performed again with the knee in flexion. Increase of dorsiflexion was observed bilaterally with the knee flexed, compared to the knee in extension, therefore signifying tighter gastrocnemius muscles in comparison to the soleus muscle. The Thompson squeeze test was performed to observe if the patient's affected ankle would move into plantarflexion when a constricting force was applied to the calf (2). Plantarflexion occurred with an application of force, indicating the patient did not currently have an Achilles tendon rupture.

Treatment goals which the patient and I both agreed would be most beneficial included decreasing scar tissue diameter, decreasing pain with activity, increasing tissue mobility around the affected site, and increasing the affected ranges of motion. All modalities and treatment techniques were organized to accomplish these goals.

Treatment Plan

The process of the assessment, total therapeutic massage time, and reassessment is summarized in Figure 1. Each treatment consisted of approximately 15 minute assessments. With the use of a goniometer, active range of motion of the affected ankle in dorsiflexion, plantarflexion, and eversion were recorded pre- and posttreatment to

observe any changes (Figure 2, Figure 3). The range of motion of the unaffected ankle was taken on the first and last treatment as a point of reference. Scar tissue diameter was measured at three points, from the calcaneal tuberosity, to four inches above (Figure 4). Each inch was marked, and the diameter of the corresponding points was recorded. Treatment dates were appointed for the patient's convenience on September 16th, September 23rd, October 3rd, October 10th, and October 12th.

Total treatment time consisted of approximately 60 minutes of direct, therapeutic massage to address the compensatory structures, areas affected during immobilization and use of a crutch, and the affected Achilles tendon and associated structures. Treatment to the compensatory structures consisted of approximately 45 minutes of therapeutic massage. Longitudinal stroking and kneading techniques were performed on the upper and lower back, and muscles around the scapulae to decrease stiffness caused by the prolonged use of crutches. Picking up, kneading, and compression of the hamstrings were performed to decrease muscle hypertonicity of the associated muscles, bicep femoris, semimembranosus, and semitendinosus. On the unaffected ankle, longitudinal stroking and kneading techniques were performed to decrease muscle tightness in the gastrocnemius, soleus, and plantaris muscles. The affected ankle received approximately 15 minutes of direct, therapeutic work. Stroking, kneading, picking up, and compressions were used to increase circulation around the Achilles tendon and the associated structures of the affected leg. Deep transverse friction massage was performed in 30 second intervals, followed by passive range of motion at the ankle. Four intervals were performed on the medial and lateral sides, and directly over Achilles tendon for a total of 6 minutes of deep transverse friction massage to the affected Achilles tendon.

The patient was reassessed following treatment. Active range of motion of the affected ranges of the ankle, and scar tissue diameter were retaken. As deep friction tendon massage may cause an irritation and an inflammatory response, icing procedures were encouraged, and explained to the patient (16). To isolate Swedish and deep friction massage as a modality for chronic, postoperative Achilles tendon ruptures, homecare, such as remedial exercise and hydrotherapy, were excluded.

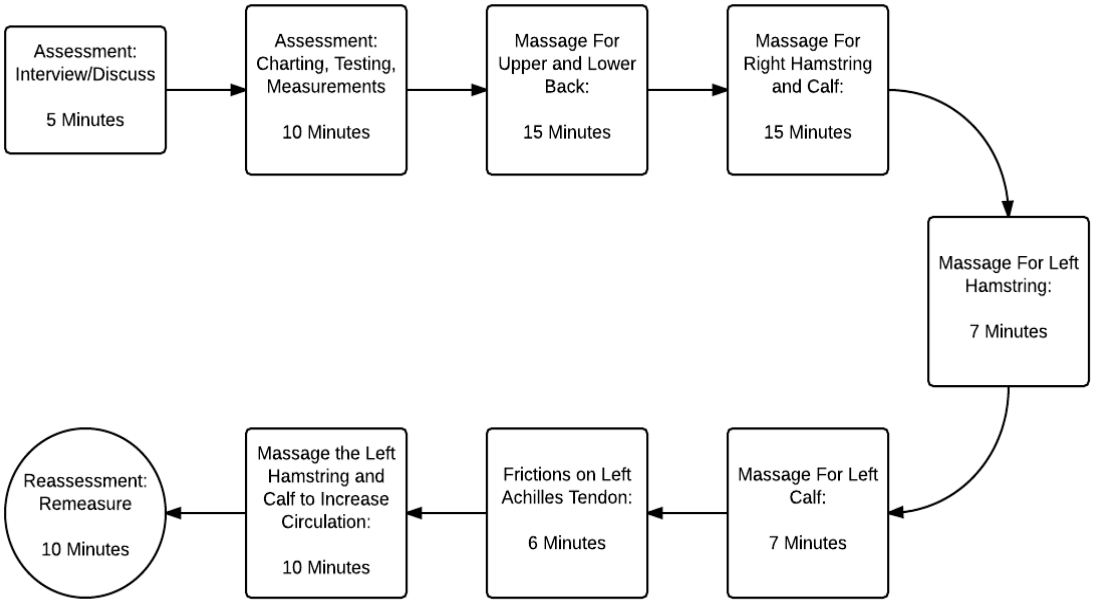

Figure 1: Breakdown of assessment, total therapeutic massage time, and reassessment.

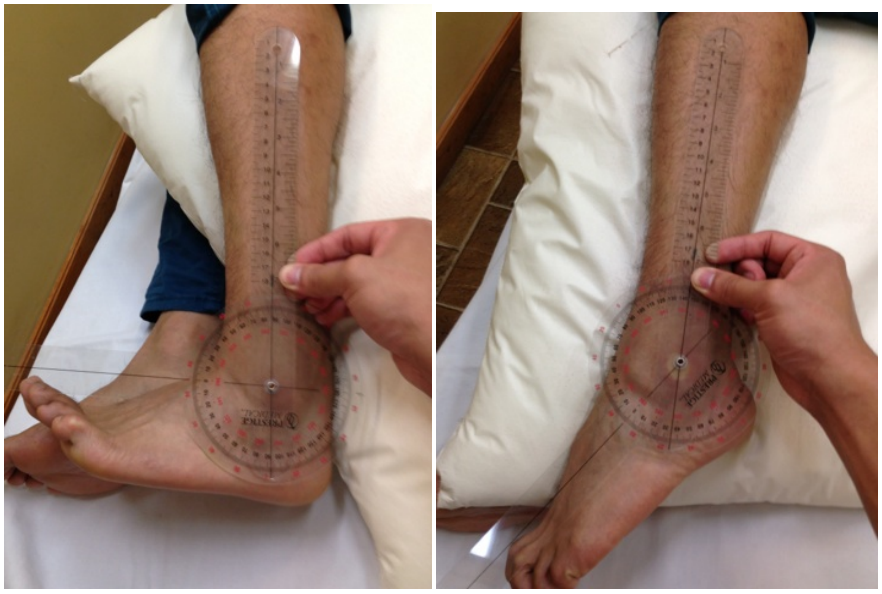

Figure 2: Dorsiflexion measurement (left), and plantarflexion measurement (right) with the use of a goniometer to measure the available range of motion of the affected joint.

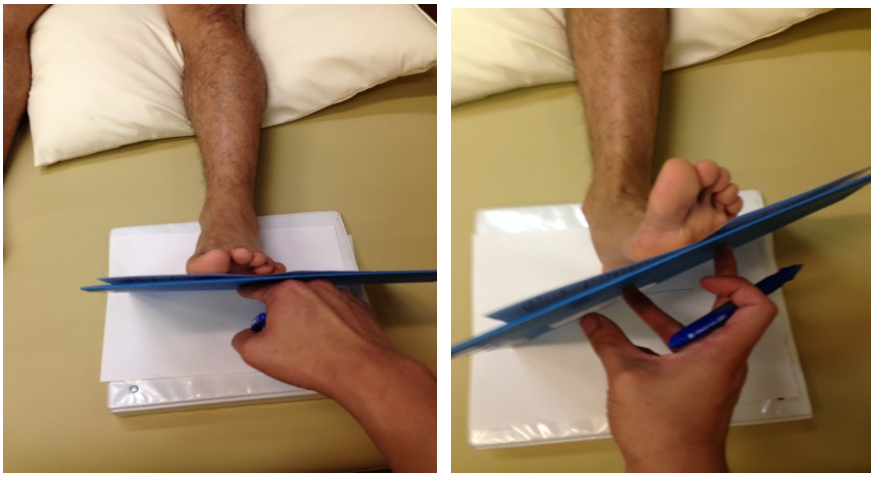

Figure 3: Active eversion measured with the use of a goniometer. A line was drawn with the foot in neutral, and the foot in eversion. The angle was then recorded.

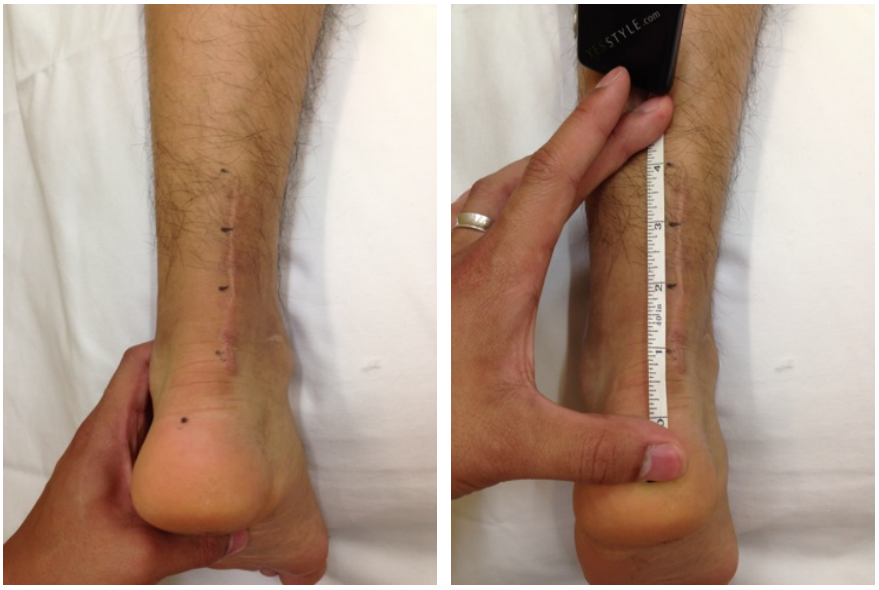

Figure 4: Scar tissue diameter was measured at three points, from the calcaneal tuberosity, to four inches above. Point 1 at 1 inch, Point 2 at 2 inches, Point 3 at 3 inches. Diameter was measured across the leg at the corresponding points to determine the diameter.

Results

Over the course of five massage therapy sessions, significant developments in regards to the patient's affected ankle were observed (Table 1). Slight increase in range of motion on the unaffected ankle during plantarflexion and eversion were observed, 3 and 1 degrees, respectively. No change in active range of motion during dorsiflexion was identified on the unaffected ankle. On the affected ankle, active dorsiflexion, plantarflexion, and eversion were increased. Dorsiflexion increased by 10 degrees, plantarflexion increased by 9 degrees, and eversion increased by 3 degrees. During the first three treatments, a decrease in active range of motion on the affected ankle during dorsiflexion was observed from the beginning to end of a single session, but the succeeding treatment's active range of motion increased. This may be due to the nature of transverse frictions and their side effects of causing minor tissue damage, and inflammation in the area in which they were performed (16). When physically mobilizing the tendon by themselves, the patient noticed an increase in pliability and flexibility at their affected tendon.

Range of Motion of Left Ankle Pre- and Posttreatment

	Active DorsiFlexion	Active Plantar Flexion	Active Eversion
Pre treatment 1	6°	48°	4°
Post treatment 1	4°	48°	4°
Pre treatment 2	9°	48°	4°
Post treatment 2	6°	50°	4°
Pre treatment 3	10°	51°	5°
Post treatment 3	8°	52°	6°
Pre treatment 4	12°	54°	6°
Post treatment 4	14°	55°	7°
Pre treatment 5	14°	56°	7°
Post treatment 5	16°	57°	7°

Table 1: Range of Motion of Affected Ankle

A decrease in scar tissue diameter occurred from a session to session basis (Table 2). Initially, the diameter around the left ankle was measured to be 21, 21, and 22 centimeters (CM). During the last treatment, a diameter of 18, 19, and 18 CM was measured. A total drop of 3, 2, and 4 cm occurred in three separate points measured vertically along the affected Achilles tendon.

Scar Tissue Diameter of Affected Ankle (CM)			
	Point 1	Point 2	Point 3
Treatment 1	21	21	22
Treatment 2	20.6	20.8	21
Treatment 3	19.3	20.3	20.6
Treatment 4	18.7	19.6	19.8
Treatment 5	18	19	18

Table 2: Scar Tissue Diameter of Affected Ankle

Though significant increases in range of motion and decreases in scar tissue diameter were observed, the patient continued to report stiffness at the ankle throughout the five massage therapy treatments. Based on the patient's subjective description of their ankle during activity, stiffness and slight pain were reported for the first two weeks. However, decreases in stiffness and pain were observed to occur gradually, but at a constant rate throughout the remainder of the treatments.

Discussion

An Achilles tendon rupture is the most common tendon rupture of lower limb in the human body, and surgical intervention is the most successful option for many patients (2). Though surgical procedures used to repair a ruptured Achilles tendon may yield better results compared to conventional methods, symptoms are often chronic, debilitating, and may affect the patient's quality of life (11). Compensatory structures, such as the unaffected leg, and areas affected by crutching and immobilization must be addressed to prevent chronic issues from occurring or worsening. Rehabilitative and strengthening plans should be implemented to prevent re-rupturing, and strengthening of the tendon. As such, remedial homecare exercises, such as pain free isometric contractions and toe raises should be performed by the patient.

In this study, Swedish massage in conjunction with deep transverse friction massage was effectively used to treat postoperative Achilles tendon rupture symptoms in a single patient with two prior Achilles tendon ruptures. Prior to this study, the effects of Swedish massage and deep transverse friction massage on chronic, postoperative Achilles tendon ruptures were not clear. However, this case identified several features regarding the benefits of massage therapy to alleviate symptoms for this condition, or similar conditions.

To determine treatment effectiveness, I measured scar tissue diameter, as well as the range of motion of the affected ankle by measuring active plantarflexion, dorsiflexion, and eversion. The patient was treated over a period of five massage therapy sessions, and significant developments in regards to the patient's affected ankle were observed (Table 1). Active dorsiflexion was greatly improved, and plantarflexion and eversion were also

improved, although to a lesser degree. In the unaffected ankle, slight increases in the range of motion during plantarflexion and eversion were observed, suggesting that Swedish massage and deep transverse friction massage may slightly increase the range of ankle motion in general. However, there was no change to the dorsiflexion range of motion, indicating these techniques may be limited to specific regions in the unaffected ankle. During the first three treatments, a decrease in active range of motion during dorsiflexion was observed from the beginning to end of a single session. It has previously been shown that deep transverse friction massage may worsen the patient's symptoms two days post treatment, but will not be detrimental overall (16). Therefore, the initial decrease in the range of motion may be due to the side effects of transverse friction massage causing minor tissue damage and inflammation in the area in which they were performed. Transverse friction massage has been speculated to prevent abnormal tissue scarring, increase protein productivity within the tendon, and break down adhesions affecting the tendon (16,17,18). Indeed, the techniques used in this study led to a decrease in scar tissue diameter from a session to session basis (Table 2). The scar decreased 3, 2, and 4 cm in three separate points measured vertically along the affected Achilles tendon.

The results in this study identify a clear pattern of active range of motion increase, scar tissue diameter decrease, and decreased stiffness and pain with activity. It is evident that symptoms associated with a chronic, postoperative Achilles rupture in a single patient was reduced by Swedish massage in conjunction with deep transverse friction massage. This study showed that using two non-invasive massage therapy methods together were effective at treating chronic symptoms of postoperative Achilles tendon ruptures, which could be expanded to treating more patients with similar symptoms. It is

clear that massage therapy is an effective method at improving symptoms associated with postoperative Achilles tendon ruptures.

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