

# The use of compression tuck and flossing along with lacrosse ball massage to treat chronic Achilles tendinopathy in an adolescent athlete: a case report

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**Background:** Achilles tendinopathy is an overuse injury that often affects individuals engaged in recreational or competitive level activity. Although most patients experience satisfactory results with therapy, a substantial portion fail to respond to traditional treatment. The purpose of this case study is to describe the successful use of compression tuck and flossing (CTF) with lacrosse ball massage (LBM) in the treatment of an adolescent athlete with Achilles tendinopathy who had failed to respond to traditional treatment.

**Case Description:** The patient was a 14-year old female diagnosed with chronic Achilles tendinopathy. She presented with 8/10 left posterior ankle pain during activity and scored 66/80 on the Lower Extremity Functional Scale (LEFS). After six weeks of PT consisting of eccentric exercise, proprioceptive training, and iontophoresis, the patient continued to report pain during sport and no significant improvements on the LEFS. With traditional PT failing to resolve symptoms, the patient was treated with CTF and LBM.

**Outcomes:** The outcomes of interest were the LEFS and the ability to participate in sport without pain. After only two sessions focusing on CTF and LBM, she had 0/10 pain during sport and scored a 79/80 on the LEFS. Patient was discharged to continue with a home exercise program consisting of CTF and LBM, and eccentric exercise.

**Discussion:** The patient's outcomes significantly improved after CTF and LBM was added to eccentric exercise. These results suggest that this intervention may be a viable adjunct treatment for Achilles tendinopathy; however further research, including controlled clinical trials and long-term outcome data, are warranted.

**Keywords:** Achilles tendinopathy, Adolescent

## Achilles Tendinopathy Case Study

Overuse injuries to the Achilles tendon have historically been referred to as Achilles tendonitis. Use of the word tendonitis suggests the presence of an inflammatory condition, and while inflammation of the tendon can occur, inflammatory cells are usually absent.<sup>1-3</sup> The term 'Achilles tendinopathy' has been suggested as a more accurate term for describing a disorder of this tendon.<sup>4</sup> Achilles tendinopathy is a common overuse injury that most often affects individuals who engage in activity at the recreational or competitive level. The incidence of mid-portion Achilles tendinopathy is 1.85 per 1000 in the general population.<sup>5</sup> Tendinopathies of the foot and ankle are the most common overuse injuries in dancers.<sup>6</sup>

The main symptom associated with Achilles tendinopathy is pain. Generally the pain is associated with exercise, however as the condition progresses, activities of daily living may be affected, and pain may even occur at rest.<sup>2</sup> In the acute stage, the tendon can be

diffusely swollen with tenderness and sometimes crepitus is noted in the mid-portion of the Achilles tendon.<sup>7</sup> In the more chronic phase of Achilles tendinopathy, exercise-induced pain is still the cardinal symptom while crepitus and swelling diminish.<sup>2</sup> In chronic tendinopathy, a tender nodular swelling is usually present and is believed to signify tendinosis.<sup>7</sup>

Conservative care has been shown to be successful in treating Achilles tendinopathies.<sup>8-11</sup> Conservative treatments may include rest from activity, iontophoresis, foot orthoses, stretching, and eccentric exercises.<sup>12</sup> Eccentric training, in particular, has repeatedly shown positive outcomes when used to treat athletic individuals with mid-portion Achilles tendinopathy.<sup>10,13-15</sup> Though there is no consensus on the appropriate eccentric training protocol<sup>16</sup> and the mechanisms behind its positive effects are not well understood, strong evidence supports its use to treat Achilles tendinopathy.<sup>12</sup> Even though most patients experience satisfactory results, a substantial portion fail to respond to conservative treatment, resulting in the inability

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to participate at their former level or needing to retire from their activity altogether.<sup>9,17</sup>

The purpose of this case study is to describe the use of compression tuck and flossing (CTF) with lacrosse ball massage (LBM) to treat an adolescent athlete with Achilles tendinopathy who failed to respond to traditional conservative treatment.

### Case Description

The patient was a 14-year-old female who presented to physical therapy (PT) with a chief complaint of left Achilles tendon pain that had limited her ability to participate in sports for the past year. Patient reported that her pain gradually increased with sport and does not remember a particular injury. She was referred to PT by her sports medicine physician with a diagnosis of Achilles tendinopathy. She is a recreational dancer and high school cheerleader and participates in her sports 7–8 h a week. Both patient and parents denied any significant medical history. Patient was prescribed dexamethasone 4 mg/ml to be administered by iontophoresis; she was not taking any other prescription or over-the-counter medications. Her previous treatments included the following: rest of one month from sports, orthotic arch support, chiropractic care, and PT at another clinic without resolution of her symptoms. Radiographs and magnetic resonance imaging (MRI) were performed by her physician prior to referral. Radiographs of the left ankle appeared normal and the MRI revealed mild Achilles tendinosis. The patient and her parents' goals for PT were to no longer have Achilles pain during dance and cheer. No Institutional Review Board approval was required for a single case report. The patient and parents granted approval for her participation in this case study.

### Examination

The patient presented to the initial evaluation with 8/10 left posterior ankle pain during activity and 1/10 pain at rest on the numeric pain rating scale (NPRS). She scored a 66/80 on the Lower Extremity Functional Scale score (LEFS). The NPRS is an 11-point pain-rating scale ranging from 0 (no pain) to 10 (worst imaginable pain) and was used with this patient to assess pain intensity at rest and during sport. The NPRS has been validated for use in adolescent patients and has been found to have a minimal detectable change of 2 points.<sup>18</sup> The LEFS is a self-reported 20-item questionnaire related to various levels of current lower extremity function. Each item is scored from 0–4 and responses are summed to provide an overall score of 0–80, with a score of 80 representing very high function. The LEFS is found to be valid and reliable in patients 16 years and above with a lower extremity condition and a test–retest reliability of 0.90–0.98.<sup>19–21</sup> A change of nine points represents the minimal clinically important difference (MCID).<sup>20</sup> Although the patient's age is outside of the validated range for the LEFS, the outcome measure

was easily understood and measured relevant functional activity for the patient.

Lumbar spine range of motion (ROM) was considered normal with no pain or compensations noted during motion. Neural tension testing using the straight leg test with tibial nerve bias was normal and did not reproduce the patient's symptoms. Her neurovascular exam revealed intact sensation throughout, normal pulses at the dorsalis pedis and tibialis posterior arteries, and 2 s capillary refill distally. No red flags or comorbidities were noted during the evaluation.

The patient demonstrated 5/5 strength throughout bilateral lower extremities (LE) with manual muscle testing. She was able to perform 20 single-leg heel raises on her left LE but reported increased pain with each repetition. Gastrocnemius flexibility was measured using a goniometer in a non-weight bearing position with the knee in a fully extended position and soleus flexibility was measured with the patient in prone and the knee flexed to 90°. She demonstrated limited left ankle dorsiflexion with knee extended, with ROM of 4°. Soleus flexibility was considered normal, with ROM of 40°. All other lower extremity motions were within normal limits. The patient had marked tenderness to palpation of the posterior tibialis tendon and mid-portion of Achilles tendon. In addition, she had mild edema noted around her Achilles tendon.

Following the examination the physical therapist agreed with the physician's diagnosis of chronic Achilles tendinopathy and proceeded with traditional conservative care. The patient had 12 PT visits over a 6-week period. Her treatment consisted of eccentric plantar flexor exercises, ankle stability training, soft tissue massage, and eight treatments of iontophoresis to the Achilles tendon. Three sets of 15 repetitions of eccentric exercises were prescribed for home every day. The patient was instructed to perform the eccentric exercises through pain and the patient reported excellent compliance. Soft tissue massage was performed using longitudinal friction massage done by hand to both the gastrocnemius and soleus with moderate to firm pressure. Iontophoresis was administered using a 1 mL dose of Dexamethasone to the Achilles tendon using a 4 h extended release patch. In addition to the interventions specifically targeting the Achilles tendon, exercises that focused on improving lower extremity mechanics were performed. At the end of 6 weeks of PT, the patient was still having 4/10 pain with dance and cheer and did not have significant improvement in her LEFS score. The patient was told she could still participate in dance and cheer as long as her pain did not increase. While she was still able to participate in sport, she needed to rest and ice every 30 min of dance to keep her pain from significantly increasing. She still had limitations in dorsiflexion motion and tenderness of the mid-portion of the Achilles tendon. After re-evaluation, the physical therapist concluded that the patient's symptoms were still consistent with chronic Achilles tendinopathy.

## Clinical Impression

Due to the lack of full resolution of symptoms with traditional conservative care, the physical therapist felt the patient may benefit from CTF and LBM. The PT believed the patient was a good candidate for these interventions due to her continued restrictions in motion and the chronic nature of Achilles tendinopathy. The patient demonstrated good capillary refill and no signs of nerve impairment and was able to follow the instructions of the PT. A deficit of any of the above would have been a contraindication for treatment. The patient had no comparable sign in the clinic to assess the effectiveness of the interventions. The PT decided that the patient's ability to dance and cheer without pain and her LEFS score would determine the success of the novel interventions. The PT spoke with the physician who agreed with the change in plan of care for this patient.

## Intervention

CTF is a mobilization technique performed during motion using an elastic band wrapped above and below the Achilles tendon.<sup>22</sup> With this patient, a black Theraband© was wrapped around the Achilles tendon as well as gastrocnemius and soleus muscles starting at the calcaneus and finishing just below the knee. The band was wrapped distal to proximal direction with half of the band overlapped on each successive wrap. A 75–90% stretch on the band was maintained while wrapping the Achilles tendon. (Supplemental video 1) The patient was then instructed to perform a 'flossing motion' which involved slightly shifting weight forward and backwards over back foot and ankle in a standard soleus stretch position. (Fig. 1) (Supplemental video 2) She performed 3 sets of 10 of CTF daily. The patient was instructed that mild discomfort was expected with this technique, but was told to remove the wrap if she experienced numbness or tingling or if her limb became pale or blue in color.<sup>22</sup>

LBM is a patient-guided soft tissue mobilization. (Fig. 2) The patient was instructed to apply firm but comfortable pressure with the lacrosse ball while rotating the ball slightly to achieve a skin lock.<sup>22</sup> Posteroanterior and superoinferior mobilizations were then applied to the medial and lateral sides of the Achilles tendon along its entire length. (Supplemental video 3) Afterward, the patient was instructed to perform LBM on a daily basis.

In addition to the CTF and LBM, the patient continued to perform eccentric strengthening of the plantar flexor muscles daily. Eccentric exercises were performed off the edge of a step in the patient's home. The eccentric strengthening of the gastrocnemius was performed with the knee in full extension, while strengthening of the soleus was done with the knee flexed to 45°. Both exercises were performed for 2 sets of 20 repetitions.

## Outcome

After two sessions focusing on CTF and LBM over a one-week period, the patient was able to participate in



**Figure 1** Compression tack and floss (CTF). Patient performs a flossing motion with band compression near end range of available dorsiflexion motion



**Figure 2** Lacrosse ball massage(LBM)

all aspects of dance and cheer without pain and demonstrated significant improvement on the LEFS. The 13-point improvement the patient demonstrated on the LEFS and the 8-point decrease on the NPRS since the start of care was considered clinically significant. (Table 1) She had no limitations in dorsiflexion motion, demonstrating 12° of dorsiflexion with the knee in extension. She was also able to perform 20 single-leg heel raises without pain. With the

**Table 1 Patient reported outcomes**

	Initial Evaluation	Six weeks post-evaluation	Discharge (after 1 week of CTF and LBM)	One-month Follow-up	Nine-month Follow-up
LEFS score	66/80	73/80	79/80	79/80	76/80
Pain with sport (NPRS)	8/10	4/10	0/10	0/10	3/10

full resolution of symptoms, the patient was discharged to a home exercise program consisting of CTF and LBM, and eccentric exercise. The patient was followed up with one month later and was still participating in sport without pain and maintained a 79/80 on the LEFS.

At the nine month follow-up completed over the telephone, she reported that she has been doing very well and has begun competitive dance. With competitive dance, she practices nine hours a week with practices as long as 5 h per session. Patient reported that she was compliant with her home exercise program of eccentric exercise, CTF, and LBM for a little over a month following discharge. She states she stopped because she was no longer having symptoms. Once she began competitive dance, she reported mild Achilles pain returned, with as much as 3/10 Achilles pain at the end of a 5-h dance session. She has not needed to stop participation in sport due to pain nor take pain medication, and has been able to manage her symptoms using her home exercise program. At nine month follow-up, she scored 76/80 on the LEFS. Even though her pain increased and her LEFS decreased slightly at the nine month follow-up, her participation in sport significantly increased. Prior to beginning the CTF and LBM intervention the patient was unable to participate in sport longer than 30 min without needing to rest due to pain. At the nine month follow-up she was participating in all aspects of sport with no limitations for as long as 5 h at a time.

## Discussion

Although there is good evidence to show that many patients will respond favorably to conservative care for the treatment of Achilles tendinopathy, the fact that one of eight patients will continue to have symptoms leaves many with an unsuccessful outcome.<sup>9</sup> This case study describes the use of a manual treatment that successfully resolved a patient's Achilles tendinopathy symptoms who had previously failed to respond to traditional conservative care. The positive response in such a short period of time to adding CTF and LBM to eccentric exercise following previously unsuccessful treatments is promising for this treatments use as an adjunct to traditional conservative care.

The evidence to support the use of manual therapy for the treatment of Achilles tendinopathy is primarily anecdotal.<sup>12,23</sup> Compression tuck and flossing is theorized to

create a shearing effect in the tendon which is intended to restore gliding function of the tendon and surrounding structures.<sup>22</sup> To the authors' knowledge, there is no research assessing the effectiveness of CTF for any injury. LBM of the Achilles tendon, similar to other types of tendon massages, has been theorized to increase fibroblast production in the tendon structure promoting a healing response.<sup>24</sup> Conversely, recent research of other similar manual therapy techniques has shown that a cascade of neurophysiological responses from the peripheral and central nervous systems may be more likely to explain these clinical outcomes than a theorized mechanical action.<sup>25</sup>

A singular benefit of CTF and LBM compared to other manual therapy techniques is that they can easily be done by the patient as a part of a home exercise program. The benefits of this are twofold: (1) the manual treatments can be done on a daily basis, not just when the patient is able to come to the clinic; (2) the patient becomes an active participant in their care. Making the patient an active participant in their care can build self-efficacy in the rehabilitation process. This may be more desirable than having the patient passively receiving treatment.<sup>26</sup>

Future research is needed to clarify the potential efficacy of using CTF and LBM as an adjunct treatment to traditional conservative care. Since there is limited evidence to support the use of manual therapy in treating tendinopathies, it is the authors' opinion that a randomized controlled trial assessing the efficacy of these techniques for the treatment Achilles tendinopathy is warranted. Possible future research would need to control for a placebo effect using a sham manual treatment. Of particular interest would be research addressing the efficacy of these interventions in all patients with Achilles tendinopathy, rather than only patients who have failed to respond to traditional conservative care.

There are limitations to this case study. Given the lack of research to support the manual therapy techniques used to treat this patient, and the single case study design, we cannot infer a cause and effect relationship with the treatment and the patient's successful outcomes. The patient's young age and activity level were favorable conditions for a successful outcome. Furthermore, the LEFS was validated in an older population and the MCID used to determine clinical significance may not be generalizable to this case. It is unclear one or combination of CTF, LBM and eccentric exercise contributed to the patient's positive outcomes. No other joint mobilization or manipulation were performed with this patient, it is unclear if similar results would have been observed using other manual techniques.

## Conclusion

This case report describes the successful treatment of Achilles tendinopathy with the addition of CTF and LBM after tradition PT had failed. These results suggest that this intervention may be a viable adjunct treatment for Achilles tendinopathy; however further research, including

controlled clinical trials, are warranted before conclusions can be drawn regarding the efficacy of these techniques in the management of Achilles tendinopathies.

### Conflict of interest statement

The authors have no conflict of interests to disclose for this research.

### Disclosure statement

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