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Research Article

The Effects of Dry Needling on Symptoms of Persistent Overuse Syndrome of the Foot: A Pilot Study

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Abstract

Objective: Overuse clinical syndrome characterized by chronic pain and functional deterioration of tendon and fascia thickening. The aim of our study was to investigate the effects of dry needling on symptoms of persistent overuse syndrome of the foot, which cannot benefit from other treatments.

Methods: Fourteen participants (the mean age was 45.71 ± 10.21 years) who had chronic persistent Achilles tendinopathy or plantar fasciitis were joined the study. Dry needling was applied for twice a week until no morning pain and stiffness feeling on the affected area of the foot. The VISA-A questionnaire form was full filled by participants before and after the end of the treatment. Visual Analog Scale (VAS) for pain intensity and feeling pain and discomfort were used to determine outcomes. VAS and feeling pain and discomfort were evaluated before the treatment, 1st, 2nd and 3rd weeks after the baseline assessment.

Results: There were significant differences in the VISA-A score, VAS and the feeling pain and discomfort scores before and after the repeated assessment of 5 trial of dry needling treatment ($p < 0.05$).

Conclusion: The study suggests that approximate 5 times trial of dry needling is effective in treating chronic condition of Achilles tendinopathy and plantar fasciitis.

Keywords: *Dry Needling; Foot; Visual Analog Scale (VAS)*

Introduction

Sports activities or in individuals whose work requires long-term standing as well as sedentary populations are in risk of having overuse injury of the lower parts of superficial back line contains plantar fascia, Achilles tendon, gastrocnemius, and hamstrings [1].

Overuse clinical syndrome characterized by chronic pain and functional deterioration of tendon and fascia thickening [2]. Both intrinsic and extrinsic factors have been implicated in the etiology of tendinopathy. The histopathology of tendinopathy reveals the absence or minimal presence of inflammatory cells, which has been confirmed by gene array studies [3]. Histologically, the appearance of tendinosis entails fibrin deposition, neovascularization, reduction in neutrophils and macrophages, and an increase in collagen breakdown and synthesis. The resultant tissue consists of a disorganized matrix of hypercellular and hypervascular tissue that is painful and weak. It can be described as an unsuccessful healing response within the tendon or fascia tissue [2].

It may seem surprising to include Achilles tendinopathy in the differential diagnosis of plantar fascia. However, perhaps because of dermatomal innervation, some other neural cause, or anatomical continuity in fibers from the Achilles tendon to the plantar fascia, the

symptoms of chronic Achilles tendinopathy and chronic plantar fasciitis on occasion can be similar. Therefore, investigation of one entity can be followed by the diagnosis of the other, even with referrals from expert foot specialists. Consequently, both conditions should be carefully scrutinized even when symptoms point to one or the other [4].

There are a variety of approaches for treating tendinopathy and fasciitis with traditional methods (i.e. non-steroidal anti-inflammatory drugs and activity modification, rehabilitative interventions) and still advocated as first-line management. Numerous rehabilitative interventions have been described for the treatment of tendinopathy and fasciitis that include the following: orthotic devices [5], taping [6], injection [7], modalities [8], stretching and strengthening exercises [9], manual therapy [10] and dry needling [11].

In cases where conservative treatments fail, there are different options that have been shown in recent years to stimulate tissue regeneration. Some of these treatments include topical nitroglycerin patches, extracorporeal shock-wave therapy, dry needling, autologous blood products, and platelet-rich plasma (PRP). All these options are proposed treatments to assist in the healing of the tendon by promoting the introduction of healing factors to the tendon, and all have demonstrated mixed results in the literature [2].

The dry needling technique consists of multiple tendon perforations without injecting any substances. Dry needling causes bleeding in the tendon, which can increase inflammation and induce the release of beneficial growth factors. This, in turn, is thought to lead to organized collagen formation and ultimately healing of the tendon injury [2,12]. Consequently, it is thought that the needling of a tendon and fascia, with or without injecting any substances, exerts a positive clinical impact on rehabilitation [2].

Purpose of the Study

The purpose of our study was to evaluate the effectiveness of dry needling for treatment of persistent Achilles tendinopathy and plantar fasciitis.

Materials and Methods

Participants

14 adult participants (mean age 45.71) who had diagnosed with Achilles tendinopathy or plantar fasciitis more than 6 months by an orthopedic doctor were accepted to the study.

Exclusion criteria; patients who had bleeding disorders, dermatological problems, needle fear, pregnancy.

Written consent form was obtained from all the participants of the study.

Treatment

Patients were undergoing dry needling for Achilles tendinopathy or plantar fasciitis twice a week until no morning pain and stiffness feeling on the affected area of the foot. Treatment was applied in the following manner. The patient lay prone on a treatment table in a relaxed position. Before the dry needling began, the pain points were identified. The dry needling procedure was performed using a standard needle (Shanghai Tai Cheng Medical Instrument, Shanghai, China) with 25 mm of length. The diameter of the needles was 0.25 mm. The areas of tenderness were punctured simultaneously. Following insertion, the needle was withdrawn partially and pressed in repeatedly to reach deep of the tendon and fascia. The needle was left in the area for about 5 minutes. During the dry needling treatment, the therapist taught calf muscle and plantar fascia stretching exercises to the patient.

Assessments

The severity of the tendinopathy was assessed with the VISA-A questionnaire. The VISA-A questionnaire form was full filled by participants before and after the end of the treatment. Visual Analog Scale (VAS) was asked of the participants before and after 1-2-3

weeks after the treatment for pain severity. Feeling pain and discomfort were asked the patient after every 2 sessions. Responses were graded as excellent (> 75% pain score improvement), good (50 - 74%), fair (25 - 49%) and poor (< 25% relief). The number of treatment was recorded for each participant. The follow chart of the study is seen in figure 1.

As the patient reached the condition that no more morning first step pain and stiffness, treatment ended otherwise treatment continued (Figure 1).

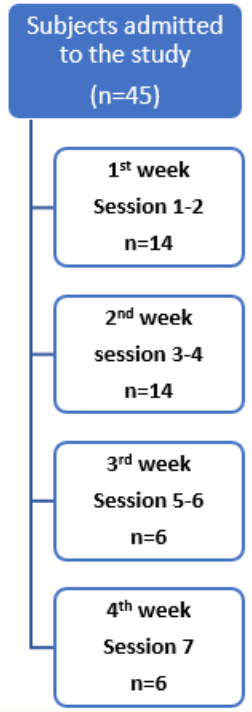

Figure 1: *Flowchart diagram of the study.*

Statistical analysis

The data was analyzed using statistical software (SPSS version 17, Inc., Chicago, IL, USA). Frequency, means and standard deviations (x ± SD) were calculated for variables determined by measurements. Comparison between groups (before and after treatment) was analyzed with Friedman Analysis. Non-Parametric Wilcoxon test signed rank test was used for comparison of the average of two dependent samples. All the statistical analyses were set a priori at an alpha level of $p < 0.05$.

Result

The clinical characteristics and outcome measures of the participants are shown in table 1. There were significant improvements for VISA-A, VAS 1-2-3 weeks scores and Feeling Pain and Discomfort 1-2-3 weeks scores between pretreatment and post treatment after the application ($p < 0.05$) (Table 2).

	Min	Max	X ± SD
Age, years (X ± SD)	28.0	61.0	45.71 ± 10.21
Number of treatment sessions, n	4.0	7.0	4.78 ± 1.05
VISA-A			
Before treatment	18.0	67.0	34.07 ± 15.27
After treatment	85.0	96.0	91.07 ± 3.24
VAS			
Before treatment	5.0	8.0	6.07 ± 0.91
1st week	2.0	5.0	3.57 ± 0.85
2nd week	0.0	3.0	1.92 ± 0.99
3rd week	1.0	2.0	1.33 ± 0.51
Feeling Pain and discomfort score, n (%)			
1st week			
1-Poor (< 25% relief)	0 (0)		
2-Fair (25 - 49% relief)	7 (50)		
3-Good (50 - 74% relief)	7 (50)		
4-Excellent (> 75% relief)	0 (0)		
All subject felt better at least more than %25 and above			
2nd week			
1-Poor (< 25% relief)	0 (0)		
2-Fair (25 - 49% relief)	0 (0)		
3-Good (50 - 74% relief)	5 (35.7)		
4-Excellent (> 75% relief)	9 (64.3)		
All subject felt better at least more than %50 and above			
3rd week			
1-Poor (< 25% relief)	0 (0)		
2-Fair (25 - 49% relief)	0 (0)		
3-Good (50 - 74% relief)	0 (0)		
4-Excellent (> 75% relief)	6 (42.9)		

Table 1*: The clinical characteristics of the subjects.*

SD: Standard Deviation, n: Number.

Outcome measures	p
VISA-A score, before and after the treatment	,001*
VAS before and 1 week after the treatment	,001*
VAS before and 2 week after the treatment	,001*
VAS before and 3 week after the treatment	,026*
VAS 1 and 2 weeks after the treatment	,002*
VAS 1 and 3 weeks after the treatment	,023*
VAS 2 and 3 weeks after the treatment	,024*
Feeling pain and discomfort week 1 and 2 weeks after the treatment	,001*
Feeling pain and discomfort week 1 and 3 weeks after the treatment	,023*
Feeling pain and discomfort week 2 and 3 weeks after the treatment	,025*

Table 2: *The differences between before and after the dry needling.*

**p < 0.05.*

Discussion

Tendinopathy is a chronic non-inflammatory process that can affect a wide range of patients across a wide age range and different tendons and fascia. Regardless of numerous treatment protocols [13,14], there is no strong evidence that supports the effectiveness of any specific treatment [2].

The studies for the effectiveness of dry needling in musculoskeletal pain are developing. Different methodologies and heterogeneity of knowledge among therapists may be the cause of various outcomes [1].

Therefore, the primary aim of this study is to evaluate whether dry needling is effective in reducing plantar heel and Achilles pain. The secondary aim is to evaluate whether dry needling results in changes to symptom severity, pain and recovery in people with chronic persistent plantar heel and Achilles pain [15].

At the primary end point of treatment, statistically significant improvement in first-step pain (measured on a VAS), feeling pain and discomfort scores and foot function (measured on the VISA-A) were found.

Our findings are similar to those of studies that evaluated the effectiveness of trigger point needling for plantar heel pain in after third and fourth needling. Tillu and Gupta found significant improvement in 18 adults with plantar heel pain (68% improvement) with 2 weeks (1 treatment per week) of dry needling of the calf and heel regions [16]. Perez-Millan and Foster also demonstrated a significant reduction in pain (46% improvement) in 18 participants with plantar heel pain with a 6-week (1 treatment per week) program of dry needling of the heel and arch [11]. Bell., *et al.* found significant improvement in Achilles tendon dry needling in pain and function [17]. Heaver., *et al.* reported that at 2 weeks: 1 foot lost to follow-up. 43/54 feet had excellent or good pain relief. At 6 weeks: 5 feet (4 patients) were lost to follow up. 37 feet (28 patients) reported excellent or good pain relief. 11/13 feet patients with fair to poor response underwent a repeat procedure [18]. David., *et al.* showed that Achilles tendinosis, the subjective Victorian Institute of Sport Assessment-Achilles (VISA-A) score improved by 19.9 (significant change > 10) (95% CI, 13.6 - 26.2) from baseline, our result were similar that there were significant improvement on VISA-A results [2].

A number of mechanisms might help explain the effect of dry needling in this study; dry needling has been proposed to influence pain by affecting the biochemical environment and local blood flow surrounding a trigger point, and ultimately the central nervous system. Shah., *et al.* found that dry needling significantly reduced the concentration of substance P and calcitonin gene-related peptide surrounding an trigger point following the elicitation of a local twitch response, albeit only temporarily, in participants with myofascial pain of the neck [19]. In an animal model, Hsieh., *et al.* found that levels of substance P were reduced following a single dry needling intervention of the biceps femoris muscle, which was accompanied by a short-term increase in endorphin in local tissue and serum, suggesting a short-term analgesic effect for dry needling [20]. Cagnie., *et al.* found that a single dry needling intervention of an trigger point within the upper trapezius muscle increased blood flow and oxygen saturation in the immediate vicinity of the trigger point for 15 minutes after removal of the needle [21]. It has been proposed that increased blood flow to the region might aid the removal of pain-inducing substances [19].

Limited data exists on the benefits of tendon needling (also known as percutaneous needle tenotomy or tendon fenestration) as a stand-alone treatment for tendinopathy, although there are encouraging results in case series in the literature [22]. Tendon needling involves repeatedly fenestrating the affected tendon, which is thought to disrupt the chronic degenerative process and encourage localized bleeding and fibroblastic proliferation. This, in turn, is thought to lead to ordered collagen formation and ultimately healing of the tendon [23]. In addition to needling alone, the use of blood growth factors in treating tendinopathies has been more extensively researched, and interest has grown in their use for the treatment of tendon, soft tissue, and bony injury [2]. In addition to local effects, dry needling is proposed to produce analgesia by influencing neural mechanisms [24]. In a recent meta-analysis of changes in brain activity associated

with acupuncture needle insertion, Chae., *et al.* found that the insertion of an acupuncture needle activated and deactivated areas of the brain involved in the sensory, cognitive, and affective dimensions of pain [25]. Hence, the small, specific effect of needling found in our study might be explained by differences in the extent to which the pain matrix of the brain was influenced.

Study Limitations

There was no control group and no follow-up term in our study. Our sample size was not enough.

Conclusion

In summary, our findings are important for the treatment of Achilles and plantar heel pain, as they demonstrate that dry needling has some beneficial effect on the pain associated with this condition. It also is possible that dry needling may have larger effects when combined with other treatments. Therefore, future work could add to this study by evaluating the effectiveness of this intervention when used in a multimodal approach.

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