Original Article

A Comparison of the Efficacy of Thai Traditional Massage and Focused Extracorporeal Shockwave Therapy for the Treatment of Chronic Plantar Fasciitis: A Randomized, Single-Blind Clinical Trial

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ABSTRACT

Objectives: To compare the effectiveness of Thai traditional massage (TTM) and focused extracorporeal shockwave therapy (fESWT) in reducing pain and improving foot function in patients with chronic plantar fasciitis (PF)

Study design: A randomized, single-blinded, non-inferiority clinical trial

Setting: Department of Rehabilitation Medicine, Banglamung Hospital in Chonburi, Thailand.

Subjects: Sixty-six patients (≥ 18 years) with chronic plantar fasciitis

Methods: Participants were randomly assigned to one of two groups (n = 33 each) using a block-of-four method. The intervention group received TTM once a week for four weeks, and the control group received fESWT using a BJC-80414 device for the same period. Both groups were instructed to perform daily muscle stretching exercises. Outcomes were assessed using the visual analog scale (VAS) and the foot function Index (FFI) at baseline and at 2, 4, and 8 weeks.

Results: The patients' characteristics in the TTM and fESWT groups showed no significant differences. After treatment, however, The TTM and fESWT groups were significantly different, with the TTM group having lower pain scores than the fESWT group. Comparison of VAS and FFI at the two-week timepoint found they were not different in FFI (pain, disability, activity limitation) after TTM between the two groups. There was, however, a statistically significantly difference at weeks 4 and 8 at the $p = 0.05$ level. A comparison of VAS and FFI at baseline and after 2, 4 and 8 weeks of treatment showed the average VAS scores were statistically significant decreased, whereas FFI (pain, disability, activity limitation) scores were statistically significantly increased at those time points.

Conclusions: The treatment of chronic plantar fasciitis using either Thai traditional massage or focused extracorporeal shockwave therapy can statistically significantly reduce pain and improve foot functionality. However, there is no statistically significant difference in foot functionality between the two treatment methods.

Keywords: chronic plantar fasciitis, Thai traditional massage, extracorporeal shockwave therapy
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Introduction

Plantar fasciitis, also known as heel spur syndrome, is a condition in which the fascia under the sole of the foot becomes inflamed. It is the most common cause of foot pain in patients seeking treatment in hospitals. In the United States, about 2 million people receive treatment for plantar fasciitis each year, with a prevalence of 11.0-15.0% of patients with foot pain symptoms.[1] Globally, the incidence of plantar fasciitis is around 10.0%, most commonly occurring in individuals between 40-70 years old, with particularly overweight patients, athletes, and individuals with a sedentary lifestyle.[2,3]

Patients experience heel pain when first stepping on the ground after sleeping or sitting for extended periods, which gradually subsides after walking for a while. Physical examinations typically reveal tenderness near the front of the heel bone (calcaneus), closer to the inner side of the foot. When the ankle is flexed, the pain worsens. Although the exact cause of plantar fasciitis is unknown, pathological findings show tissue degeneration and repeated minor injuries at the attachment point of the fascia to the inner side of the heel bone (calcaneal tuberosity), leading to tearing and inflammation.[4,5]

Treatment for plantar fasciitis can be divided into two categories: conservative management and surgical intervention. Most patients receive conservative treatment, while surgery is reserved for cases where conservative measures fail.[6] Conservative treatments include nonsteroidal anti-inflammatory drugs (NSAIDs), appropriate footwear, shoe modifications, steroid injections, and physical therapy methods such as warm water baths, stretching exercises, ultrasound therapy, and shockwave therapy.[7]

Extracorporeal shockwave therapy (ESWT) is widely used for treating chronic plantar fasciitis. It stimulates new blood

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vessel formation and accelerates tissue repair by increasing growth factors, thereby reducing pain.[8] A study by Haimanot Melese et al. found that shockwave therapy can reduce pain and improve foot function in patients with chronic plantar fasciitis.[9] However, side effects may include pain, swelling, numbness, and bruising at the treatment site.[10] Due to the high cost of the equipment and treatment, shockwave therapy is not widely available in all healthcare settings.

Recently, alternative treatments such as Thai traditional massage have gained popularity for musculoskeletal conditions due to their effectiveness, fewer complications, and proven benefits, especially for pain relief.[11] Massage stimulates blood circulation and relaxes muscles and tendons.[12] Thai traditional massage can help alleviate plantar fasciitis by stimulating blood circulation, reducing tension in the plantar fascia, and improving the flexibility of the foot and leg muscles.[13] Both manual therapy and kinesiotherapy (taping and stretching) can enhance plantar mobility and the quality of life of patients with plantar fasciitis. Which may help reduce pain and inflammation.[14] A study by Saban et al. found that posterior calf muscle massage was more effective in reducing pain than ultrasound therapy for plantar fasciitis.[15] However, another study by Somphrai et al., found that physical therapy was more effective than Thai traditional massage.[16] These differing results may be due to the different types of massage used and to variations in study designs. The present study compared the effects of Thai traditional massage and focused extracorporeal shockwave therapy on patients with chronic plantar fasciitis.

Methods

Study design

This study is a single-blind randomized controlled trial conducted at Banglamung Hospital between September 2021 and August 2022. The Chonburi Provincial Public Health Office approved the trial protocol (Ref. No. 031-2563) on August 17, 2021. The Thai clinical trials registry number is TCTR20250402001.

All participants provided written informed consent prior to participation. This study was reported following the CONSORT 2010 guidelines for randomized controlled trials.

Participants

The participants were adults age 18 or older who had been diagnosed with chronic plantar fasciitis. Patients who met the following inclusion criteria were recruited: 1) aged ≥ 18 years who had been diagnosed with chronic plantar fasciitis, 2) the diagnosis of plantar fasciitis was based on medical history and physical examination, as well as where the patient experienced pain in the plantar medial heel, especially during the initial weight-bearing steps after waking up or after prolonged periods without weight-bearing. Tenderness was present in the medial tubercle of the calcaneus, 3) symptoms had persisted for more than 6 months, and 4) pain level was 4 or higher based on Visual Analog Scale (VAS) assessment.[17,18]

The exclusion criteria included: 1) foot deformities such as hallux valgus or Charcot's foot, 2) a history of using anti-inflammatory pain medication within 2 weeks prior to the study, 3) a history of receiving injections in the heel area within 3 months prior to the study, 4) a history of previous heel or foot surgery, 5) a history of underlying conditions such as diabetes, peripheral neuropathy, arthritis, or blood disorders, 6) presence of wounds on the heel, 7) being pregnant, and 8) the current use of immunosuppressants or anticoagulant medications.

Sample size

The number of participants included in this study was determined based on studies by Traijiwaran et al., 2016.[19] The pain VAS was selected as the primary data source. According to the Pornsri study, the mean difference score of VAS on fESWT was 4.9, which had a standard deviation (SD) of 2.6. The sample size was based on a power of 90% (beta 0.1), a dropout rate of 20.0%, and a statistical significance (alpha = 0.05) of 95% (p = 0.05). As a result, 66 patients were required, with 33 patients per group using the sample size formula based on a randomized, single-blinded, non-inferiority clinical trial.

The sample size for the present study was calculated using the formula by Chow et al.[20] as shown below.

$$n_2 = \frac{(z_{1-\alpha}+z_{1-\beta})^2\sigma^2(1+\frac{1}{k})}{(\epsilon-\delta)^2}$$
$$\epsilon = \mu_2 - \mu_1$$
$$k = \frac{n_1}{n_2}$$
$$n_1 = kn_2$$

Randomization and blinding

Randomization and allocation concealment. The sample was randomized using the block of 4 method. Allocation concealment was ensured by placing the randomization results in sealed opaque envelopes. A research nurse in the outpatient department of Banglamung Hospital distributed the envelopes to the participants. The nurse did not participate in the treatment or the data collection processes. The individual responsible for sealing the envelopes was different from the person distributing them. Participants were allocated in a 1:1 ratio to either the intervention group or the control group. The analyzer was blinded to the treatment allocation, but the participants were not blinded due to the different nature of the intervention in each of the groups (Figure 1).

Intervention

Thai traditional massage (TTM)

Participants in the TTM group received traditional Thai massage once a week for four consecutive weeks. The treatment was administered by a Thai traditional medicine practitioner with at least five years of experience. Each weekly

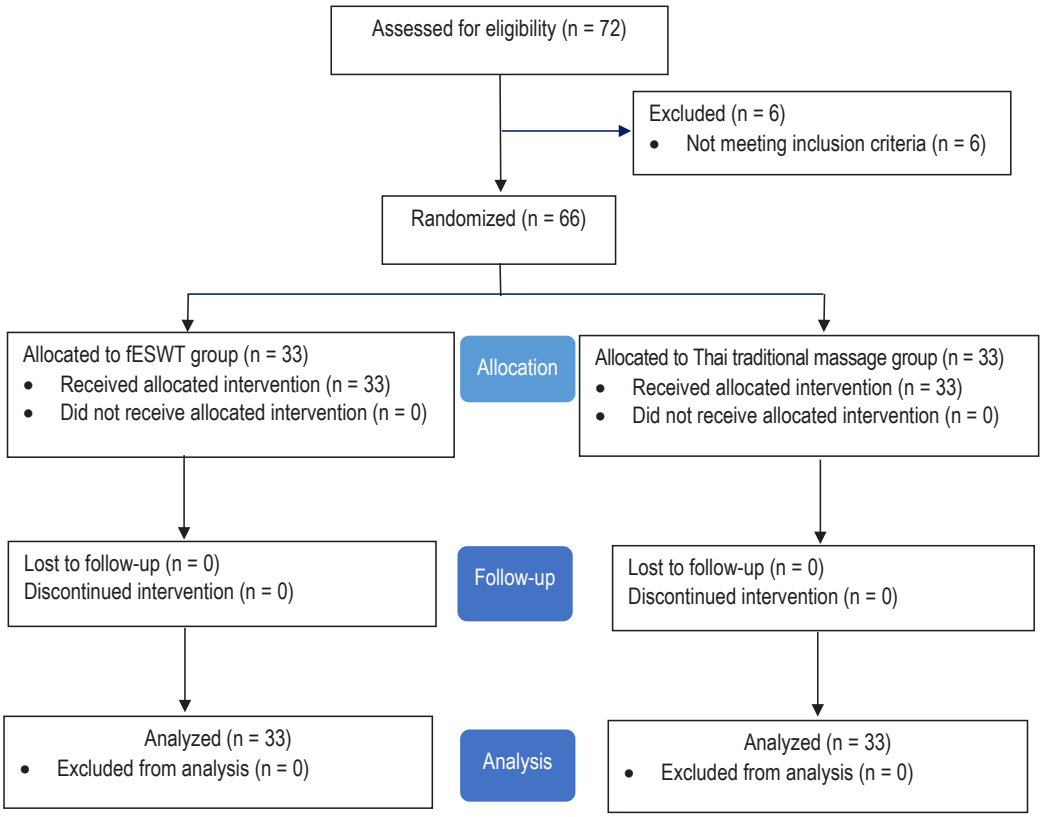

Figure 1. CONSORT diagram of the study

session lasted 30 minutes and was repeated for four consecutive weeks.[21] The Thai traditional massage procedure involved the following steps.[14,22]

1. Basic leg massage focusing on the ankle area for 7 minutes to "open the wind gates."
2. Basic leg massage along with the signals 1 (press the fascia covering the gluteus medius muscle), 2 (press the gluteus medius muscle through the tensor fascia lata muscle), 3 (press the gluteus maximus muscle), 4 (press the biceps femoris and Iliotibial band muscles), 5 (press the fibularis longus muscles) on the outer leg for 8 minutes.
3. Basic leg massage along with the signals 1 (press the semimembranosus muscle), 2 (press the adductor magnus muscles), 3 (press the vastus medialia muscle), 4 (press the popliteal fossa), 5 (press the tendon of tibialis posterior) on the inner leg for 7 minutes.
4. Focus on the heel and painful points, massaging the Achilles tendon area, both inside and outside, for 8 minutes.[23]

The fESWT group was treated with a BJC-80414 focused shockwave device (EMS electro medical systems SA, Switzerland), with the probe placed on the inner heel. Patients received a total of 2,000 pulses at a rate of 4 Hz at each treatment session. The treatment was administered by a rehabilitation physician with at least five years of experience. Each session lasted 30 minutes and was repeated once a week for four weeks.[24]

Additional treatments

The same standard treatment (plantar fascia stretching exercises) was provided to both groups. Participants were instructed to sit in a cross-legged position and to use the hand on the same side as the affected foot to grasp all toes on that foot and gently pull them backward until a stretch was felt in the sole. The stretch was then held for a count of 1 to 10. Each session consisted of 10 repetitions which were repeated three times per day. Participants were encouraged to perform the exercises regularly at home throughout the study period.[25]

Outcomes measurement

The primary outcomes of this study were pain level and Foot Function Index (FFI) including pain level, loss of function, and limitation in performing activities. All of outcomes were measured before the study and at 2, 4 and 8 weeks. For pain level assessment (VAS), a pain measurement tool consisting of a 10 cm straight line was used on which participants marked their pain level. A measurement of 0 cm (VAS = 0) represents no pain, and a measurement of 10 cm (VAS = 10) represents the worst pain possible. FFI, a questionnaire assessing problems related to the feet and ankles was used. It consisted of 23 items divided into three sections: 1) assessment of pain (FFI pain) with 9 items, 2) assessment of disability (FFI disability) with 9 items, and 3) assessment of activity limitations (FFI activity) with 5 items. The questionnaire had been translated into Thai, and each part had a

rating scale of 0-9. A score of 0 means no pain, no difficulty, or never experienced the issue, while a score of 9 means the highest level of pain, extreme difficulty, or always experiencing the issue.[26-28]

Statistical analysis

Statistical analyses were performed using SPSS version 23 with a statistical significance threshold of $p < 0.05$. Baseline and clinical characteristics of both groups are shown as mean and standard deviation for continuous data and number (%) for categorical data. Normality of distribution and equality of variance of VAS and FFI scores were assessed to confirm that parametric tests could be used. The comparison of VAS and FFI was conducted for both the TTM and the fESWT groups, both within and between groups, before the experiment and after 2, 4, and 8 weeks of treatment. Repeated Measure ANOVA was employed for this analysis.

Results

Sixty-six participants were enrolled and randomly assigned to either the TTM (n = 33) or the fESWT group (n = 33). No participants were withdrawn from the study. All participants' data were included in the analysis (Figure 1). Comparison of the general data such as age, gender, body mass index (BMI), affected foot, duration of pain, standing and walking time per day, previous treatment, and pretreatment FFI score comparison between the two groups showed no statistically significant differences (Table 1).

A comparison of VAS and FFI in patients with chronic plantar fasciitis between the TTM and fESWT groups was conducted before the experiment and after 2, 4, and 8 weeks of treatment. It was found that the average levels of pain, functional ability, and limitations in performing activities in both the experimental and control groups significantly decreased at statistical statistically significantly at all levels (between 0.01 and 0.001). There was at least one occasion where differences were observed compared to other time points (Table 2).

A comparison of VAS between the TTM and fESWT groups was conducted before the start of treatment and after 2, 4, and 8 weeks of treatment. It was found that the VAS between the TTM and fESWT groups differed at a statistically significant level of 0.01. (Table 3). However, the levels of FFI across the three aspects did not show any significant differences (Table 3).

Discussion

Patients with chronic plantar fasciitis in the TTM and fESWT groups were assessed before the trial and at 2, 4, and 8 weeks after the start of the intervention. The average levels of pain and foot functionality, including pain severity, loss of ability, and limitations in performing activities, significantly decreased in both groups at statistically significance levels of 0.01 or 0.001 in all measurements. Both groups underwent supportive treatments for plantar fasciitis, emphasizing pain management through various methods such as NSAIDs, appropriate footwear selection, steroid injections, and physical

Table 1. General background information of the research participants

Characteristics	TTM (n = 33)	fESWT (n = 33)	*p-value
Age (years)[1]	54.3 (12.9)	55.1 (8.7)	0.949[a]
Sex[2]			
Male	7 (50.0)	7 (50.0)	1.000[b]
Female	26 (50.0)	26 (50.0)	
BMI[1]	26.6 (3.9)	25.1 (3.3)	0.346[a]
Affected foot[1]			0.868[b]
Right	12 (54.5)	10 (45.5)	
Left	7 (46.7)	8 (53.3)	
Both	14 (48.3)	15 (51.7)	
Duration of pain (months)[1]	7.0 (1.9)	7.2 (2.5)	0.840[a]
Standing/walking time per day (hours)[1]	2.3 (0.9)	2.2 (0.8)	0.677[a]
Previous treatment (VAS)[1]	6.2 (1.1)	6.3 (1.2)	0.696[a]
Pretreatment FFI score[1]			
Pain	40.0 (17.0)	40.9 (16.2)	0.900[a]
Disability	41.8 (16.6)	42.1 (22.7)	0.941[a]
Activity limitation	4.2 (4.6)	5.9 (8.2)	0.989[a]
Total	86.4 (35.2)	88.9 (41.7)	0.790[a]
Previous treatment[2]			
No	10 (47.6)	11 (52.4)	0.792[b]
Yes	23 (51.1)	22 (48.9)	

[1]Mean (SD), [2]number (%); [a]Mann-whitney U test, [b]Chi-square, *$p < 0.05$ indicates statistical significance
BMI, body mass index; VAS, Visual Analogue Scale; FFI, foot function index; TTM, Thai traditional massage; fESWT, focused extracorporeal shockwave therapy

Table 2. Visual Analogue Scale and Foot Function Index at baseline, 2 weeks, 4 weeks, and 8 weeks

Outcomes	Before	After 2 weeks	After 4 weeks	After 8 weeks	*p-value (1-tailed)
Visual Analogue Scale					
TTM	6.21 (1.08)	5.09 (0.98)	3.73 (1.00)	2.94 (1.00)	< 0.001
fESWT	6.30 (1.18)	5.91 (1.49)	4.88 (1.39)	4.36 (1.32)	< 0.001
Foot Function Index					
• Pain					
TTM	40.42 (17.04)	34.70 (15.04)	26.55 (14.96)	23.64 (15.68)	< 0.001
fESWT	40.94 (16.17)	39.82 (15.34)	34.30 (15.05)	32.36 (15.11)	< 0.001
• Disability					
TTM	41.76 (16.59)	37.39 (15.01)	29.09 (15.05)	26.12 (15.05)	< 0.001
fESWT	42.12 (22.66)	42.00 (21.82)	36.00 (17.70)	34.58 (16.84)	0.002
• Activity limitation					
TTM	4.24 (4.62)	2.94 (3.75)	0.73 (1.21)	0.24 (0.71)	< 0.001
fESWT	5.88 (8.23)	4.91 (7.07)	3.52 (6.48)	3.09 (6.57)	0.001

Data are presented as mean (SD); TTM, Thai traditional massage; fESWT, focused extracorporeal shockwave therapy, *$p < 0.05$ indicates statistical significance

Table 3. Visual Analogue Scale and Foot Function Index between groups at baseline and at 2, 4, and 8 weeks

Source of variation	Sum-of-squares	Degrees of freedom	Mean squares	F ratio	*p-value
Visual Analogue Scale					
Between groups					
Group	50.09	1	50.09	10.61	0.002
Error	302.29	64	4.72		
Foot Function Index					
• Pain					
Between groups					
Group	2,018.56	1	2,018.56	2.23	0.140
Error	57,884.76	64	904.45		
• Disability					
Between groups					
Group	1,705.46	1	1,705.46	1.53	0.221
Error	71,539.15	64	1,117.80		
• Activity limitation					
Between groups					
Group	352.37	1	352.37	3.38	0.071
Error	6,672.53	64	104.26		

*$p < 0.05$ indicates statistical significance

therapies. Physical therapy included warm water immersion, muscle stretching, ultrasound therapy and shockwave therapy. These supportive treatments contributed to symptom improvement over time. If these treatments proved ineffective, surgical intervention remained an alternative.

Pain levels and foot functionality in chronic plantar fasciitis patients between the TTM and fESWT groups differed statistically significantly after 2, 4, and 8 weeks of intervention at the *p* value of 0.01. Pairwise testing using the Bonferroni method revealed significant differences across all four evaluations. Thai traditional massage has been demonstrated to beneffective in managing various pain syndromes, particularly in alleviating pain.[11] Massage is one of the processes which promote relaxation of the body as well as increasing blood circulation and reduction of swelling, and also relaxes muscles and tendons.[12] A study by Bernice Saban and colleagues found that posterior calf muscle massage was more effective in reducing pain than ultrasound therapy.[13] Conversely, research by Supamas Somphrai et al. indicated that physical therapy combined with ultrasound therapy was superior to Thai traditional massage in pain reduction.[14] In those studies, both treatments demonstrated good therapeutic outcomes with minimal complications. Systematic reviews have shown that shockwave therapy effectively reduces pain and improves foot function in chronic plantar fasciitis patients, with potential adverse effects such as pain, swelling, numbness, and bruising at the treatment site.[9,10] However, the levels of foot functionality (pain, loss of ability, limitations in performing activities) were not significantly different between the treatments. Both TTM and fESWT stimulate blood circu-

lation, alleviate body pain, and promote relaxation. However, the high cost of focused extracorporeal shockwave therapy devices limits accessibility in healthcare facilities nationwide, making widespread use in Thailand challenging. This study suggests that incorporating Thai traditional massage could play a significant role in managing this condition without involving excessive cost.

Study limitations

There are some limitations to this study. Due to the small sample size in both groups, the effectiveness may not be as significant as could be desired. Further study may be needed with a larger sample size. Furthermore, non-significant results in this study may be due to the short follow-up period; hence, a longer follow-up should be considered in future studies.

Conclusions

The study found that a Thai traditional massage program administered for 30 minutes per session, once a week, over a period of 4 weeks is an appropriate supportive treatment for patients with chronic plantar fasciitis. This approach can be implemented in healthcare facilities at all levels where Thai traditional medicine practitioners are available. Facilities without access to focused extracorporeal shockwave therapy (fESWT) should consider incorporating this method as an alternative treatment option for patients.

Conflict of interest declaration

The authors confirm that there is no conflict of interest related to the manuscript.

Generative AI declaration

The authors confirm that no large language models (LLMs) or artificial intelligence (AI) tools were used in the creation of this manuscript, including the writing, editing, or preparation of figures and tables, with the exception of Grammarly for basic spell-checking.

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Data availability

The data that support the findings of this study are available from the corresponding author, Krongkaew Tochaiwat, upon reasonable request.

Author contributions

Krongkaew Tochaiwat: conceptualization, methodology, software, writing- original draft preparation, writing – review & editing, visualization, investigation, supervision, validation,
Suttatip Yingdilukpantakul: data curation,
Jiraporn Tantipongsirikul: software.

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