Original Article

Comparative Effectiveness of High-intensity Laser Therapy and Radial Extracorporeal Shock Wave Therapy in Chronic Plantar Fasciitis: A Randomized, Single-blind Clinical Trial

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ABSTRACT

Objectives: To compare the effectiveness of high-intensity laser therapy (HILT) and radial extracorporeal shock wave therapy (rESWT) 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: Sirindhorn National Medical Rehabilitation Institute, Nonthaburi, Thailand

Subjects: Fifty-two patients suffering from chronic PF

Methods: Participants were randomly assigned to receive a total of 9 sessions of HILT or a total of 3 sessions of rESWT. Outcome measures were the visual analog scale (VAS) and the Thai version of the Foot and Ankle Ability Measure (FAAM) at 0, 3, and 7 weeks.

Results: There was no statistically significant difference between the two groups in VAS at baseline. The FAAM and VAS of both groups showed significant improvement at 3 and 7 weeks ($p < 0.05$). For instance, the FAAM scores of the rESWT group had significant improvement at 3 and 7 weeks ($p < 0.05$), while the FAAM scores of the HILT group had significant improvement only at 7 weeks ($p < 0.05$). There was no statistically significant difference in the VAS and total FAAM scores between the two groups. However, the rESWT group showed significant improvement compared to the HILT group in the ADL subgroup of FAAM at 3 weeks ($p < 0.05$).

Conclusions: HILT and rESWT for chronic PF have no statistical different pain reduction effect at 3 and at 7 weeks. Regarding foot function, rESWT helps improve ADL at 3 weeks but not in HILT. Both treatments improve overall foot function at 7 weeks.

Keywords: chronic plantar fasciitis, high-intensity laser therapy, radial extracorporeal shock wave therapy, physical therapy

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Introduction

Plantar fasciitis (PF) is a common foot disorder affecting 10% of adults during their lifetime. It accounts for 25% of all foot disorders in athletic populations, e.g., it affects up to 17.4% of runners. The pathology of PF is still unknown. Previous studies have reported secondary degenerative changes due to repetitive trauma in the plantar fascia without inflammation.[1,2] The usual symptoms include pain in the inner part of the heel that worsens with activities that include bearing weight and after periods of rest or non-weight-bearing.

PF has three phases: acute, subacute, and chronic. Acute PF pertains to the first 4 to 6 weeks following the onset. Subacute PF typically lasts 6 to 12 weeks. Chronic PF is diagnosed in individuals experiencing symptoms for beyond three months. Refractory PF is characterized as chronic PF that has not responded to conservative therapy for more than 6 months.[3] PF typically persists for an extended duration, with around 45% of individuals still enduring discomfort a decade later, resulting in extensive utilization of healthcare resources and a notable economic impact.[4,5]

Although previous studies have reported that 90% of PF patients achieved symptom resolution within 3-6 months with conservative treatment, the resolution of symptoms in some patients may take up to 18 months.[6,7] The 2010 updated clinical practice guidelines for heel pain recommended conservative treatments such as foot padding, orthotic insoles, anti-inflammatory medication, stretching exercises, orthotic devices, night splints, corticosteroid injections, botulinum toxin injections, physical therapy, cast immobilization, and extracorporeal shock wave therapy (ESWT) before considering surgical options.[8] Aside from surgical treatment, ESWT is one of the third-line treatments for PF which should be considered in chronic PF patients whose symptoms do not improve with other conservative treatments.[8] ESWT methods involve hyperstimulation analgesia, neovascularization stimulation, and collagen synthesis in degenerative tissues.[9] Nevertheless, there are still significant disadvantages and a lack of clarity regarding ESWT. Initially, common side effects include experiencing discomfort both during and after the treatment. According to a recent study, 20% of patients encountered

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adverse effects such as temporary skin redness and ecchymosis when undergoing ESWT treatment.[10] Secondly, contradicting results in many studies make it unclear to determine which type of ESWT, radial-ESWT or focused-ESWT, is superior.[9] Most studies have demonstrated the efficacy of ESWT for PF using a weekly routine of 3 to 5 sessions. However, there is currently no established standard protocol for using ESWT to treat chronic PF.[3]

HILT is a new, painless treatment option. The use of HILT has been studied in many musculoskeletal disorders with favorable results,[11] including PF and calcaneal spur.[12] HILT's effects are due to its anti-inflammatory, anti-edema, and analgesic mechanisms. HILT can access and activate more extensive and profound regions of the fascia compared to a high-power laser.[13,14] However, HILT application protocols so far have been heterogeneous.[11]

A recent study investigating HILT and rESWT effects on PF showed that both interventions successfully reduced pain. However, HILT seemed to be more effective in improving foot function.[15] This study's population of interest is distinct from that of Thammajaree et al. as it specifically targets persistent PF, a condition more frequently encountered in clinical settings. This study aims to examine the efficacy of HILT in comparison to rESWT for treating chronic PF and assess the immediate and intermediate effects of both treatments.[15]

Methods

Study design

This study was a randomized closed-label trial conducted at the outpatient department of Sirindhorn National Medical Rehabilitation Institute (SNMRI), Nonthaburi, Thailand, from May 2020 to December 2022. The Sirindhorn National Medical Rehabilitation Institute ethical committee approved the trial protocol (63006/ April 2020) and it was registered in the Thai Clinical Trials Registry (TCTR20201226001/ December 2020).

Participants

Patients who met the following inclusion criteria were recruited: 1) age ≥ 18 years, 2) pain and tenderness at the medial tubercle of the calcaneus which was worse with the initial step in the morning or after an extended period of rest and decreasing initially after the first steps but exacerbated with increased activity, 3) unresponsiveness to conservative treatments for at least three months.[7] The exclusion criteria included: 1) receipt of HILT or rESWT within the previous three months, 2) receipt of steroid injections within one month, 3) a diagnosis of other foot pathologies, e.g., foot or ankle fracture, fixed foot deformity, 4) a diagnosis of systemic inflammatory arthritis, e.g., rheumatic disease, 5) a diagnosis of neuropathy of the heel, e.g., polyneuropathy, entrapment disorder, 6) other acute pathology, e.g., wounds or signs of inflammation, and 7) patients who were not able to communicate. All participants provided written informed consent.

Sample size

The number of participants included in this study was determined based on the studies of Yesil et al., 2019[13] and Yinilmez et al., 2018.[16] The visual analog scale (VAS) was selected as the primary data source. According to the results, Yesil et al. used the mean difference score of VAS on HILT, 2.4, which had a standard deviation of 1.2. Additionally, Yinilmez et al. used the mean difference score of VAS on ESWT, which was 1 with a standard deviation of 2. The sample size was based on a power of 80% (beta 0.2), a dropout rate of 20%, and a statistical significance (alpha 0.05) of 95% (p = 0.05). As a result, 52 patients were required, with 26 patients per group using the sample size formula based on a randomized, single-blinded, non-inferiority clinical trial.

The sample size formula: is

$$n_{trt} = \frac{(z_{1-\frac{\alpha}{2}} + z_{1-\beta})^2 \left[\sigma_{trt}^2 + \frac{\sigma_{con}^2}{r}\right]}{\Delta^2}$$

$$r = \frac{n_{con}}{n_{trt}}, \Delta = \mu_{trt} - \mu_{con}$$

Randomization and blinding

The randomization process was conducted by an independent investigator who did not participate in the treatment or data collection processes, using computer-generated randomization (mixed-size block randomization). The allocation was concealed by using nontransparent, sequentially numbered envelopes. Participants were allocated in a 1:1 ratio into either the HILT group or the rESWT group. The assessor 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 (Fig. 1).

Interventions

High-intensity laser therapy (HILT)

The HILT group received pulsed laser treatment using an HIRO 3 device, which employs a pulsed Nd: YAG laser therapy source with a wavelength of 1,064 nm, from ASA Arcugnano, Italy. The HILT protocol used in this study was modified from Yesil et al., with changes made to the session frequency. The number of sessions was reduced from 15 to 9 (3 sessions per week for three weeks) to improve feasibility and practicality. The device emits pulsed radiation at a wavelength of 1,064 nm with a peak power of 3 kW. The energy density ranges from 360 to 1,780 mJ/cm^2, with a short duration of 120 to 150 microseconds, a mean power of 10.5 W, a low frequency of 10 to 40 Hz, a duty cycle of approximately 0.1%, a probe diameter of 0.5 cm, and a spot size of 0.2 cm^2. A three-phase treatment regimen was administered on the plantar fascia area. The total energy used in one session was 1,281.1 joules. The laser fluency was adjusted to three different levels: 970 mJ/cm^2, 1,070 mJ/cm^2, and 1,170 mJ/cm^2, resulting in a total of 624 J in the initial phase. The second phase included exposure to fluences of 360 mJ/cm^2, 510 mJ/cm^2, 610 mJ/cm^2, and 360 mJ/cm^2, amounting to a total of 33.1 J. The third phase involved intentional manual scanning. 624 joules of energy were administered during this phase.[13]

Radial extracorporeal shock wave therapy

The rESWT protocol followed the Yinilmez study, consisting of one session per week for three weeks, totaling three sessions of rESWT using a Duolith® SD1 device from Storz Medical AG, Tägerwilen Switzerland. The treatment was administered with a transmitter (R15, 15 mm) delivering an energy flux density/penetration depth of 0.38 mJ/mm^2 up to a depth of 40 mm. The protocol contained an energy density of 2 bars with a frequency of 2,000 shocks per minute at 10 Hz. ESWT was administered in a circular motion, delivering 1,000 shocks at the plantar fascia insertion point and another 1,000 shocks along the fascia.[16]

Additional treatments

The following standard treatments were given to both groups: 1) patient education about self-care of acute pain and proper shoes that cushion and support heels and 2) plantar fascia stretching exercise. A brochure containing all exercise recommendations was given to all participants, and they were instructed to exercise at home twice daily. 3) Participants were allowed to use oral acetaminophen for pain relief; exercises and acetaminophen use were recorded in a log book.

Outcome measurements

The primary outcome measure was subjective pain intensity using a 10-cm horizontal Visual Analog Scale (VAS) three times each day: at the first step in the morning, during daily activities, and the maximal pain level of the day. The secondary outcome was foot function using the Thai version of Foot and Ankle Ability Measure (FAAM). The FAAM is a 29-item self-reported questionnaire that is divided into two subscales: a 21-item ADL subscale and an 8-item sport subscale. Each question is scored on a 5-point Likert scale (from 0 to 4), and each subscale score is calculated as a percent ranging from 0-100 (worst to best outcome). The reliability measurement revealed a high intra-class correlation coefficient of 0.8 and 0.77, respectively, between the test and retest. The internal consistency was strong (Cronbach alpha = 0.94 and 0.88, respectively).[17] All patients in both groups were assessed for VAS and FAAM at baseline (week 0), at 3 weeks, and 7 weeks.

Statistical analysis

Statistical analyses were performed using STATA version 17.1 (StataCorp®, Texus, USA), with a statistical significance threshold of P 0.05 (2-sided). Descriptive data are presented as mean and standard deviation. Baseline demographic data is presented as the mean and standard deviation for quantitative data and as a number and percentage for qualitative data. The corresponding data from the HILT and rESWT groups were compared using the t-test and the chi-squared test (or Fisher's exact test where appropriate). A multilevel mixed-effects linear regression (mixed-effects model method) was used to analyze the primary outcome with repeated measures after randomization. Six dropout participants were not included in the analysis. However, since the dropout rate was less than 20% of the calculated sample size, the analysis in this study was considered sufficient per protocol analysis.

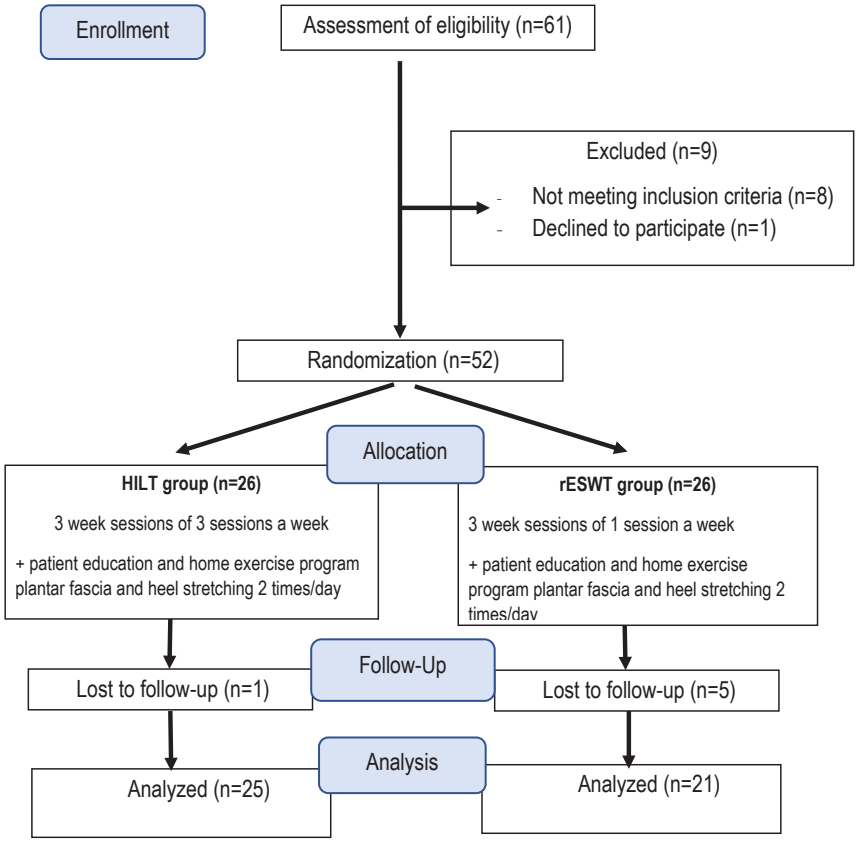

Figure 1. CONSORT flow chart of the participants. HILT, high intensity lower therapy; rESWT, extracorporeal shock wave therapy

Results

Fifty-two participants were enrolled and randomly assigned to either the HILT (n = 26) or the rESWT group (n = 26). Six participants did not complete the intervention: one in the HILT group and five in the rESWT group (Fig. 1). The reasons for the loss of follow-up were unrelated to post-therapy effects. There were two transportation problems, one COVID-19 infection, one ankle fracture, one case of myalgia, and one of post-vaccine fever. The data on the dropout participants was not included in the analysis. No side effects were reported in either the HILT or the rESWT groups. Both groups had similar demographic characteristics (Table 1). Both group's VAS and FAAM scores were not significantly different at baseline.

At the end of the study, there was no statistically significant difference in VAS and FAAM scores between the two groups at 3 and 7 weeks, except the ADL subgroup of FAAM at 3 weeks. The mean activities of daily living (ADL) scores of FAAM in the rESWT group were higher than in the HILT group in the third week (Table 2). The VAS of both groups revealed significant improvement at 3 and 7 weeks. The FAAM scores of the rESWT group revealed significant improvement at 3 and 7 weeks, while the FAAM scores of the HILT group showed significant improvement only at 7 weeks. (Table 3)

Discussion

Many recent studies have reported on the effects of HILT on musculoskeletal disorders, including PF. Still, there are as yet no recommended guidelines for treating PF.[19-21] A few studies have compared HILT to the standard treatments during chronic PF.[12,13,15] The present study evaluates the effectiveness of HILT compared with rESWT in chronic PF.

Table 1. Demographic and clinical characteristics of patients

Characteristics	HILT (n = 25)	ESWT (n = 21)	*p-value
Age (years)	51.2 (14.9)	47.5 (13.2	0.379
Sex, n (%)			
Male	11 (44.0)	4 (19.0)	0.072
Female	14 (56.0)	17 (81.0)	
Weight (Kg.)	65.2 (19.7)	65.4 (16.1)	0.970
Height (meter)	1.6 (0.1)	1.6 (0.1)	0.502
BMI* (kg/m^2)	26.3 (6.0)	25.1 (5.1)	0.465
Standing/walking time (hour)	5.6 (3.4)	6.4 (2.9)	0.376
Duration of pain (month)	11.0 (12.0)	8.0 (6.4)	0.325

Data are presented as mean (SD); BMI, Body mass index; *p < 0.05 indicates statistical significance

Table 2. VAS and FAAM at baseline, at the 3 weeks, and at the 7 week

Prarameters	HILT (N = 25)	ESWT (N = 21)	MD (95% CI)	*p-value
VAS score, first step				
Baseline	5.4 (2.3)	4.8 (2.3)	-0.60 (-1.91, 0.71)	0.367
At 3 weeks	3.0 (2.4)	2.5 (2.2)	-0.53 (-1.84, 0.78)	0.425
At 7 weeks	2.5 (2.4)	1.9 (2.1)	-0.52 (-1.84, 0.80)	0.437
VAS score, daily activities				
Baseline	5.9 (1.7)	4.9 (1.8)	-1.00 (-2.23, 0.23)	0.110
At 3 weeks	3.3 (2.2)	3.4 (2.4)	0.11 (-1.12, 1.33)	0.866
At 7 weeks	2.9 (2.6)	2.2 (2.1)	-0.65 (-1.89, 0.59)	0.303
VAS score, maximal pain				
Baseline	7.0 (1.9)	6.9 (2.0)	-0.09 (-1.49, 1.31)	0.897
At 3 weeks	4.1 (2.5)	4.3 (2.8)	0.25 (-1.15, 1.65)	0.723
At 7 weeks	3.6 (2.6)	3.5 (2.8)	-0.04 (-1.46, 1.39)	0.961
FAAM, Activities of daily living (ADL)				
Baseline	71.1 (18.4)	74.7 (12.3)	3.95 (-6.22, 14.12)	0.447
At 3 weeks	73.6 (16.0)	83.9 (15.3)	10.82 (0.82, 20.82)	0.034*
At 7 weeks	81.8 (21.3)	88.5 (11.1)	6.89 (-2.65, 16.43)	0.157
FAAM, Sport				
Baseline	72.5 (19.8)	76.6 (15.1)	3.95 (-5.68, 13.57)	0.422
At 3 weeks	80.0 (16.6)	85.6 (17.2)	5.79 (-3.96, 15.54)	0.244
At 7 weeks	85.6 (14.2)	87.9 (14.8)	2.48 (-7.06, 12.03)	0.610

Data are presented as mean (SD); *p < 0.05 indicates statistical significance

MD, Mean difference; CI, Confidence interval; VAS, visual analog scale; FAAM, foot and ankle ability measure

Table 3. VAS and FAAM by time period compared to baseline in the HILT and rESWT groups

Parameters	HILT		RESWT	
	MD (95% CI)	*p-value	MD (95% CI)	*p-value
VAS score, first step				
Baseline	0		0	
At 3 weeks	-2.37 (-3.47, -1.28)	<0.001*	-2.30 (-3.31, -1.30)	<0.001*
At 7 weeks	-2.99 (-4.11, -1.89)	<0.001*	-2.93 (-3.93, -1.93)	<0.001*
VAS score, daily activities				
Baseline	0		0	
At 3 weeks	-2.58 (-3.59, -1.57)	<0.001*	-1.47 (-2.36, -0.58)	0.001*
At 7 weeks	-3.02 (-4.04, -2.00)	<0.001*	-2.69 (-3.58, -1.80)	<0.001*
VAS score, maximal pain				
Baseline	0		0	
At 3 weeks	-2.95 (-4.01, -1.88)	<0.001*	-2.60 (-3.73, -1.47)	<0.001*
At 7 weeks	-3.53 (-4.62, -2.44)	<0.001*	-3.49 (-4.62, -2.36)	<0.001*
FAAM, ADL				
Baseline	0		0	
At 3 weeks	1.18 (-6.06, 8.41)	0.749	8.49 (1.46, 15.52)	0.018**
At 7 weeks	9.86 (3.03, 16.69)	0.005*	13.18 (6.15, 20.20)	<0.001*
FAAM, Sport				
Baseline	0		0	
At 3 weeks	7.39 (-0.29, 15.07)	0.059	9.22 (0.83, 17.62)	0.031**
At 7 weeks	12.87 (5.28, 20.45)	0.001*	11.41 (3.10, 19.73)	0.007**

MD, Mean difference; CI, Confidence interval; HILT, high-intensity laser therapy; rESWT, Radial Extracorporeal shock wave therapy

* < 0.001 indicates statistical significance

** $p < 0.05$ indicates statistical significance

There was no statistically significant difference between the two groups according to the VAS and FAAM with the exception of the ADL subgroup of FAAM in the third week, in which rESWT showed better results.

Regarding pain as the primary outcome of this study, the results are consistent with Ordahan et al. that HILT is effective in chronic PF.[14] Our study show a positive result at a longer follow-up of 7 weeks. Additionally, both groups were instructed to record additional treatments in a logbook, including exercise and oral acetaminophen. The as well as calf muscle and plantar fascia-specific stretching.[25] We found an average of 4.8 days per week of exercise in the HILT group and 4.5 days per week in the rESWT group. This result shows good exercise compliance that may affect positive outcomes in the seventh week, although the patients finished the treatment in the third week. As a result, This indicates that PF stretching exercises provide good benefits.[22] Moreover, 4 HILT group participants and none of the rESWT group used oral acetaminophen for pain relief, which could have affected HILT positive outcomes. These could be confounding factors for good potentially affecting outcomes. In a further study, HILT and rESWT without plantar stretching and oral acetaminophen should be investigated.

Regarding the foot function using FAAM, there was no significant difference found between the groups regarding foot function using FAAM except in the ADL subgroup which had a notable improvement after three weeks. rESWT assistance helped improve ADL, including standing, walking, home responsibilities, personal care, light to moderate work, heavy work, and recreational activities after three weeks. However, there was no significant improvement in sports activities.

Before the present study, two randomized studies evaluated the effectiveness of HILT in PF. However, the results of those studies were difficult to compare due to differences in method and measurement. First, Ordahan et al. reported that HILT was more effective than LLLT in improving pain and foot functions in the third week.[14] Nonetheless, most cases in that study were subacute PF with a mean duration of 8±1.5 weeks, and only immediate outcomes at the third week were measured. On the contrary, our study was performed on people with chronic PF with a longer measurement duration of seven weeks. Second, Yesil et al. found that both HILT plus exercise and placebo HILT plus exercise could improve pain and function at 4 and 12 weeks in the painful calcaneal spurs and PF population. Still, only HILT showed a significant improvement in dynamic pedographic measurement and had improvement significantly better than placebo in some foot function subscales.[13] However, in the Yesil et al. study, the number of PF cases could not be differentiated from those with calcaneal spurs. Moreover, patients at varying stages, ranging from acute to chronic, were included in that study. This population differs from our study which included only patients with chronic PF. All in all, regardless of disease duration, HILT tended to show positive outcomes on PF.

Regarding the treatment protocols, the current HILT protocols are heterogeneous.[1] At the time of the present study other studies had yet to investigate the effectiveness of varying intensity and frequency in HILT treatment. However, In this study, the HILT group had 9 sessions (3 sessions per week for 3 weeks), and the rESWT group had only 3 sessions (1 session per week for 3 weeks). The rESWT protocol once proved has previously been reported to be sufficient to provide a therapeutic effect.[23] Additionally, the different mechanisms of the two treatments were operationally equal in frequency for both groups. We used rESWT with an energy density of 2 bars with a frequency of 2,000 shocks per session, which does not affect post-treatment pain compared to unlike other studies which used more than 2,000 shocks.[24]

Although the 9-session HILT protocol might still cause some inconvenience for patients compared with the 1 session per week for three weeks rESWT protocol, HILT has some advantages not found with rESWT. One advantage of HILT is that it is not only non-invasive but also has photochemical and photothermic effects that can help stimulate tissue healing and reduce pain.[20,25] These mechanisms are comparable to those of rESWT. Furthermore, the anti-inflammatory effect of HILT helps reduce inflammation, suggesting that pain reduction may be faster in cases of acute inflammation. However, the results of our study do not show the differences. This finding any difference which could be due to the selection of chronic PF patients as the participants.

Recently, Thammajaree et al. studied the effects of rESWT versus HILT in individuals with PF and found no significant difference in VAS outcomes. Regarding foot function outcomes, a study by Thammajaree et al. found no statistically significant difference in foot function index (FFI) between the two groups. That finding differs from our study, in which rESWT showed better outcomes in the ADL subgroup of FAAM in the third week.[15] Although Thammajaree et al. and our study compare the same interventions in the PF population, some differences in the methodology may be a cause of the different results. First, Thammajaree et al. used different treatment protocols in both groups, e.g., a total of six sessions of rESWT for three weeks, while our study used once a week sessions for three weeks. Moreover, Thammajaree et al. assessed patients at the immediate post-treatment point of 3 weeks, while our study assessment was after the longer duration of 7 weeks. Second, the measurement tools for foot function assessments in the studies were different. FFI uses a different aspect of FAAM to evaluate foot function.[17] FFI contained includes measurement of pain, disability, and activity limitation. The validity and reliability of FFI can only be generalized to individuals with rheumatoid arthritis, unlike the Thai FAAM score, including the Activity of Daily Life (ADL) and Sports subscale, which are region-specific measures of changes in physical function specifically related to the foot and ankle and correlated with SF-36.[17] Lastly, the Thammajaree et al. included a population of PF of any duration. In contrast, our study included only those with chronic PF for whom other conservative treatments had failed. Despite these differences, it is evident that HILT and rESWT do not differ in terms of pain reduction in PF patients regardless of the time since onset. Minor differences in foot function results could be due to differences in treatment protocol and population selection.

Regarding the research design, the sample size formula used in this study is based on a non-inferiority clinical trial. According to the data collection, in the current study, there were six dropouts. Only 46 patients were analyzed, which is compatible with the per-protocol analysis. However, this small sample size problem can bias results towards non-inferiority trials and give rise to misleading results. Future studies should apply both per protocol and intention-to-treat analysis with prespecified imputation techniques to avoid bias from applying only per protocol analysis.[26]

Lastly, no adverse effects were reported in either group. However, according to other studies, rESWT may have side effects, such as pain during and after treatment, while no significant side effects were found with HILT.[27]

Study limitations

There are some limitations to this study. First, there was no control group. An additional sham group might have allowed discarding the placebo effect in this study. Second, the short follow-up period does not show the long-term effect of HILT on chronic PF. Third, more ultrasonographic findings are needed to evaluate the outcome.[28-30] Fourth, due to the differences between this study and the study we used to calculate our sample size, i.e., using non-active and active control intervention, the sample size of this study may not reflect the most appropriate effect sample size, which might be larger than that in this study. Further study may be needed to ensure an appropriate sample size for population inference using the results of this study as a reference.

Additionally, future research, including each modality's unit cost to determine each treatment's feasibility, would provide useful information for clinical practice.[31] Additionally, future research with focused ESWT could be valuable. Focused ESWT can result in more pain reduction and less pain after treatments than rESWT in chronic PF patients.[9]

Conclusions

In this study we compared the effect of HILT with rESWT for chronic PF. We found no statistically significant difference between the two groups. The results of our study suggest that among the 46 patients in the study, both treatments for chronic PF had the same pain reduction after three weeks and at a longer follow-up of seven weeks. Regarding foot

function, rESWT helps improve ADL after three weeks. Also, both treatments improve overall foot function at a longer follow-up of 7 weeks. Based on our findings, we recommend that clinicians select either HILT or rESWT to help reduce pain and improve foot function in patients with chronic PF.

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