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Effectiveness of Myofascial Trigger Point Manual Therapy Combined With a Self-Stretching Protocol for the Management of Plantar Heel Pain: A Randomized Controlled Trial

STUDY DESIGN: A randomized controlled clinical trial.

OBJECTIVE: To investigate the effects of trigger point (TrP) manual therapy combined with a self-stretching program for the management of patients with plantar heel pain.

BACKGROUND: Previous studies have reported that stretching of the calf musculature and the plantar fascia are effective management strategies for plantar heel pain. However, it is not known if the inclusion of soft tissue therapy can further improve the outcomes in this population.

METHODS: Sixty patients, 15 men and 45 women (mean ± SD age, 44 ± 10 years) with a clinical diagnosis of plantar heel pain were randomly divided into 2 groups: a self-stretching (Str) group who received a stretching protocol, and a self-stretching and soft tissue TrP manual therapy (Str-ST) group who received TrP manual interventions (TrP pressure release and neuromuscular approach) in addition to the same self-stretching protocol. The primary outcomes were physical function and bodily pain domains of the quality of life SF-36 questionnaire. Additionally, pressure pain thresholds (PPT) were assessed over the affected gastrocnemii and soleus muscles, and over the calcaneus, by an assessor blinded to the treatment allocation. Outcomes of interest were captured at baseline and at a 1-month follow-up (end of treatment period). Mixed-model ANOVAs were used to examine the effects of the interventions on each outcome, with group as the between-subjects variable and time as the within-subjects variable. The primary analysis was the group-by-time interaction.

RESULTS: The 2 × 2 mixed-model analysis of variance (ANOVA) revealed a significant group-by-time interaction for the main outcomes of the study: physical function ($P = .001$) and bodily pain ($P = .005$); patients receiving a combination of self-stretching and TrP tissue intervention experienced a greater improvement in physical function and a greater reduction in pain, as compared to those receiving the self-stretching protocol. The mixed ANOVA also revealed significant group-by-time interactions for changes in PPT over the gastrocnemii and soleus muscles, and the calcaneus (all $P<.001$). Patients receiving a combination of self-stretching and TrP tissue intervention showed a greater improvement in PPT, as compared to those who received only the self-stretching protocol.

CONCLUSIONS: This study provides evidence that the addition of TrP manual therapies to a self-stretching protocol resulted in superior short-term outcomes as compared to a self-stretching program alone in the treatment of patients with plantar heel pain.

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Plantar fasciitis or plantar heel pain is the most common foot pain condition treated by healthcare providers.[28] It has been estimated that plantar fasciitis occurs in approximately 2 million Americans annually[10] and affects as much as 10% of the general population over the course of a lifetime.[29] In fact, some authors have reported that plantar fasciitis accounts for between 8% and 15% of foot complaints in nonathletic and athletic populations.[31,37] Plantar heel pain has a negative impact on foot-specific and general health-related quality of life,[20] and shows distinct patterns of disability on different functional domains.[30] To date, there is evidence that this condition may not be characterized by inflammation but, rather, by noninflammatory degenerative changes in the plantar fascia.[21] These findings suggest that this painful

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condition may be better referred to as plantar fasciopathy[32] or plantar heel pain. For this study we will use the term "plantar heel pain" to refer to the presentation of our clinical population.

Patients with plantar heel pain usually report insidious sharp pain under the heel, along the medial border of the plantar fascia to its insertion at the medial tuberosity of the calcaneus, upon weight bearing after a period of non-weight bearing.[1] The pain is worse in the morning, with the first steps after getting out of bed, after prolonged periods of inactivity (eg, sitting), or at the beginning of a workout.[3] The pain typically lessens with increasing activity (eg, walking, running) but tends to worsen toward the end of the day.[9] In some patients, these symptoms can induce considerable functional limitations and prolonged disability.

Both surgical and nonsurgical approaches have been proposed for the management of plantar heel pain.[26] Clinical practice guidelines[25] and the Cochrane Review[11] have concluded that there has been limited evidence for the effectiveness of corticosteroid therapy, conflicting evidence for low-energy extracorporeal shockwave therapy, and no evidence for therapeutic ultrasound or low-intensity laser, in reducing pain in individuals with plantar heel pain. Among nonsurgical interventions, stretching of the gastrocnemius muscle and the plantar fascia have shown moderate evidence of effectiveness for the management of plantar heel pain, although only in the short term.[11,25] Clearly, more studies are needed.

Simons et al[34] have suggested that taut bands myofascial/muscle trigger points (TrPs) in the gastrocnemius muscles may be involved in the development of plantar heel pain. TrPs are defined as hyperirritable areas associated within a taut band of a skeletal muscle that are painful on compression, contraction, or stretching of the muscles, and elicit a referred pain distant to the TrP.[34] Active TrPs are those which local and referred pains that reproduce the symptoms reported by the patient.[34] In addition, the authors of a recent study have found that the stiffness of TrP taut bands was 50% greater than that of the surrounding muscle tissues.[5] It is probable that the increased stiffness induced by taut bands with TrPs may reduce the effectiveness of muscle stretching for the management of plantar heel pain.

Therefore, as soft tissue work may help further improve effectiveness of stretching in the management of plantar heel pain, the aim of this randomized controlled clinical trial was to compare the effects of combined stretching and TrP manual therapy to stretching alone in patients with plantar heel pain.

METHODS

Participants

Patients presenting to a physical therapy clinic in Brazil with a primary report of unilateral plantar heel pain were screened for possible inclusion in this study. Inclusion criteria required patients to be between the ages of 18 and 60 years, with a primary report of unilateral plantar heel pain with the following clinical features[1,3,9]: (1) insidious onset of sharp pain under the plantar heel surface upon weight bearing after a period of non-weight bearing; (2) plantar heel pain that increases in the morning with the first steps after waking up; and (3) symptoms decreasing with slight levels of activity, such as walking. Clinical history intake of the participants included questions related to the onset of pain and duration of the symptoms, and previous medication and treatments. Patients were excluded if they exhibited any of the following: (1) red flags to manual therapies (ie, tumor, fracture, rheumatoid arthritis, osteoporosis, severe vascular disease, etc), (2) prior surgery in the lower extremity, (3) diagnosis of fibromyalgia syndrome,[42] or (4) previous manual therapy interventions for the foot region. The study was approved by the Ethical Research Committee of the Escola de Osteopatía de Madrid (Sao Paulo, Brazil), and the patients signed the informed consent form prior to participation.

The sample size and power calculations were performed with the ENE 2.0 software (GlaxoSmithKline, Universidad Autónoma, Madrid, Spain). The calculations were based on detecting a within-group difference of 20 points, with a standard deviation of 10 points, a between-group difference of 7.8 points (which represents the minimal clinically important difference [MCID] for bodily pain and physical function subscales of the SF-36 questionnaire at follow-up[2]), an alpha level of .05, and a desired power of 80%. These parameters generated a sample size of at least 27 patients per group.

Outcome Measures

As plantar heel pain has a negative impact on general health-related quality of life,[20] the primary outcomes of the current study were physical function and bodily pain domains of the SF-36 questionnaire. The SF-36 is a self-administered, 36-item questionnaire assessing health-related functions in 8 domains: physical function, role limitations due to physical problems, bodily pain, vitality, general health, social functioning, role limitations due to emotional problems, and mental health.[40] After summing Likert-scaled items, each domain is standardized, ranging from 0 (lowest level of functioning) to 100 (highest level), according to international standard guidelines.[24,41]

Pressure pain thresholds (PPT), the minimal pressure when the sensation of pressure changes to pain,[38] were assessed with a mechanical pressure algometer (Baseline FPK 20). The device consists of a round rubber disk (1 cm^2) attached to a force gauge (kg). The pressure (force divided by the surface area) was applied at a rate of approximately 0.1 $kg/cm^2/s$. The mean of 3 trials was calculated for each tested location and used for the main analysis. Thirty seconds was used between each trial. To investigate hypoalgesic effects of both interventions, PPT was assessed at 3 predetermined locations on the affected leg: gastrocnemii (middle

FIGURE 1. Standing self-stretching of the calf muscles. (A) Soleus muscle: the knee is bent, then the patient leans forward while keeping the heel on the floor until a feeling of stretch in the calf and/or Achilles region is felt. (B) Gastrocnemius muscle: same as above but keeping the knee of the affected limb in extension.

FIGURE 2. Plantar fascia-specific self-stretching. With the affected foot over the contralateral thigh, the patient places the fingers over the base of the toes, and pulls the toes up towards the shin.

point over the muscle belly), soleus (centered point of the muscle belly at 10 cm over Achilles tendon) muscles, and over the posterior aspect of the calcaneus. The reliability of algometry has been reported to be high (intraclass correlation coefficient [ICC] = 0.91; 95% CI: 0.82, 0.97).[6] In the current study, intra-examiner reliability ($ICC_{3,1}$) was calculated from the 3 trials over each location and ranged from 0.91 to 0.94, suggesting high repeatability of the measurement.

Study Protocol

Participants were randomly assigned to 2 groups using a table of random numbers created by on-line software (www.randomization.com): a self-stretching (Str) group who received a stretching protocol, and a self-stretching and soft tissue TrP manual therapy (Str-ST) group who received TrP manual interventions in addition to the same self-stretching protocol. Both groups were treated by a clinician with 5 years of postgraduate orthopaedic manual therapy training and 6 years of clinical experience in the management of foot pain disorders. All participants attended the physical therapy clinic 4 days per week for 4 weeks. At each session the therapist explained and corrected, if necessary, the self-stretching exercises. The Str-ST group also received the above-mentioned TrP manual therapies, depending on clinical findings related to the location of the TrP. The treatment, either self-stretching alone or self-stretching and TrP therapy, was only applied to the affected side.

Outcome measures were captured at baseline and at a 1-month follow-up, which corresponded to the end of the treatment period. PPT levels and SF-36 scoring were assessed by an assessor blinded to group assignment. Patients were unaware of the true objective of the study in that they were aware of the ethical implications without revealing the details of the intervention that was being evaluated. All subjects were informed of the true nature of the study at the end of the study.

Self-Stretching Protocol

All participants were instructed in a self-stretching protocol, including calf muscles and plantar fascia-specific exercise, which has moderate evidence of effectiveness for the management of plantar heel pain.[25] The dosage for calf and plantar fascia-specific self-stretching exercises was 2 times per day, using intermittent stretching of 20 seconds, followed by 20 seconds rest for a total of 3 minutes for each stretch. Hence, the total self-stretching protocol lasted 9 minutes. Patients were instructed to conduct the following self-stretching exercises.

Standing Self-Stretching of the Calf Muscles In standing, with the affected foot furthest away from the wall, the patient leaned forward, while keeping the heel on the floor. To focus the stretching on the soleus muscle, the affected knee was bent (**FIGURE 1A**), whereas to focus on the gastrocnemius muscle the affected knee was kept in full extension (**FIGURE 1B**). In this position, patients leaned forward until they felt a stretch in the calf and/or Achilles region. All patients completed both versions of the stretch.

Plantar Fascia-Specific Self-Stretching In sitting, patients crossed the affected foot over the contralateral thigh. The patient placed his/her fingers over the base of the toes, grasped the base of the toes and pulled the toes back towards the shin, until a stretch was felt in the plantar fascia (**FIGURE 2**). Patients were instructed to start gently at first then work more aggressively as tolerated.[12]

Myofascial/Muscle Trigger Point Therapy

Patients were examined for the presence of active TrPs in the gastrocnemius muscles by a clinician with more than 5 years of experience in the management of TrPs. TrP diagnosis was conducted according to previous guidelines[34]: (1) presence of a palpable taut band, (2) presence

FIGURE 3. Referred pain pattern from the gastrocnemii (A) and soleus (B) muscles. Modified with permission from Simons DG, Travell J, Simons L. *Myofascial Pain and Dysfunction: The Trigger Point Manual: Volume 1*. 2nd ed. Baltimore, MD: Williams & Wilkins; 1999.

FIGURE 4. Trigger point pressure release technique over the medial gastrocnemius muscle.

FIGURE 5. Neuromuscular technique applied over trigger point taut band.

of a hypersensitive area in the taut band, (3) local twitch response provoked by the snapping palpation of the taut band, or (4) reproduction of referred pain (**FIGURE 3**) in response to compression. These criteria have exhibited good interexaminer reliability (κ = 0.84-0.88).[17] However, information about TrP reliability is related to the presence or absence of TrPs and not the distinction between active and latent TrPs.[23]

Different manual approaches have been proposed for the management of muscle TrPs.[14] A recent systematic review found moderate to strong evidence supporting the use of TrP pressure release for immediate pain relief of muscle TrPs.[39] Therefore, in the current study, patients received a TrP pressure release technique over both gastrocnemii muscles if indicated (**FIGURE 4**, **ONLINE VIDEOS**). Pressure was applied over TrPs until an increase in muscle resistance (tissue barrier) was perceived by the clinician.[22] The pressure was maintained until the therapist perceived release of the taut band. At this stage, the pressure was increased to return to previous level of muscle TrP tension and the process was repeated for 90 seconds (usually 3 repetitions).

Secondly, patients also received a neuromuscular technique (longitudinal stroke)[4] over the gastrocnemius muscle. This technique has been found to be effective for reducing TrP pressure sensitivity.[19] With the patient in prone, the thumb of the therapist was placed over the taut band and 3 longitudinal strokes were performed from caudal (ankle) to cranial (knee) (**FIGURE 5**, **ONLINE VIDEOS**). Strokes were applied slowly, with moderate pressure that was not painful for the patient. TrP manual therapies were applied depending on clinical findings related to the location of the TrP on the affected leg. No predetermined TrP location was considered.

Statistical Analyses

Statistical analysis was conducted with SPSS Version 16.0 (SPSS Inc, Chicago, IL). Mean, standard deviation, and 95% confidence intervals for each outcome measure are presented. The Kolmogorov-Smirnov test showed a normal distribution of the data (P>.05). Baseline features and scores on the SF-36 questionnaire were compared between groups using independent t tests for continuous data and χ^2 tests of independence for categorical data. Separate 2 × 2 mixed-model ANOVAs, with time (preintervention, postintervention) as a within-subject variable and group (Str, Str-ST) as a between-subject variable, was used to examine the effects of interventions on SF-36 questionnaire domains, including primary outcomes, and also PPT. The hypothesis of interest was the group-by-time interaction at an alpha level of .05. In addition, within-group and between-group effect sizes were calculated using Cohen d coefficient.[8] Effect sizes of 0.2 were considered small, 0.5 moderate, or 0.8 large.[8] P values lower than .05 were considered as statistically significant for all analyses.

RESULTS

Sixty-five consecutive patients were screened for possible eligibility criteria. Sixty patients (92%; mean ± SD age, 44 ± 10 years; 15% males) satisfying the eligibility criteria agreed to participate and were randomized to the Str-ST (n = 30) or Str (n = 30) group. The reasons for ineligibility were previous foot surgery (n = 3) and diagnosis of fibromyalgia (n = 2). The right foot was affected for 14 of the patients (46%) in the Str-ST group and 17 (56%) of the patients in the Str group (χ^2 = 0.601, P = .438). No significant differences were found for gender distribution (χ^2 = 0.890, P = .766), age (t = 0.673, P = .503), weight (t = 0.959, P = .441), height (t = 1.058, P = .394), or pain duration (t = 0.844, P = .402) between groups. Additionally, baseline PPTs (P>.211) and scores on the various domains of the SF-36 questionnaire (P>0.220) were not significantly different between groups (**TABLE 1**).

Changes in the SF-36 Questionnaire

The group-by-time interaction for the 2 × 2 mixed-model ANOVA was statistically significant for the main outcomes of the study: physical function (F = 11.964, P =.001) and bodily pain (F = 8.601, P = .005). Patients receiving the combina-

tion of self-stretching and TrP intervention experienced a greater improvement ($P<.01$) in physical function and a greater reduction in pain as compared to those receiving the self-stretching protocol. Within-groups and between-groups effect sizes were large for both outcomes (**TABLE 2**).

In addition, significant group-by-time interactions for general health ($F = 4.222$, $P = .045$) and emotional role ($F = 6.171$, $P = .016$) were also found in favor of the group receiving the combination of stretching and soft tissue manual therapy. No significant group-by-time interactions for physical role ($F = 2.053$, $P = .155$), vitality ($F = 0.19$, $P = .890$), social function ($F = 0.994$, $P = .323$), and mental health ($F = 0.364$, $P = .549$) were found. Within-group and between-group effect sizes ranged from moderate to large, depending on the domain of the questionnaire. **TABLE 2** shows within-group and between-group differences and associated 95% confidence intervals for each domain of the SF-36 questionnaire.

TABLE 1 Baseline Demographics for Both Groups*

	Str	Str-ST
Clinical features		
Gender (male/female)	7/23	8/22
Age (y)	45 ± 10	44 ± 11
Pain duration (mo)	4.6 ± 1.0	4.8 ± 0.9
Height (cm)	166 ± 1	163 ± 1
Weight (kg)	73.5 ± 12.3	70.1 ± 15.0
Pressure pain thresholds (kg/cm^2)		
Gastrocnemius muscle	1.8 ± 0.7	1.3 ± 0.5
Soleus muscle	2.1 ± 0.5	1.9 ± 0.6
Calcaneus	2.3 ± 1.1	1.7 ± 0.8
SF-36 questionnaire (0-100)		
Physical function	41.2 ± 16.2	44.3 ± 16.8
Physical role	29.6 ± 34.7	30.3 ± 31.6
Bodily pain	31.7 ± 18.4	35.3 ± 18.2
General health	54.1 ± 15.9	54.6 ± 17.3
Vitality	36.5 ± 18.5	41.1 ± 18.4
Social function	46.2 ± 28.5	52.7 ± 24.6
Emotional role	40.8 ± 39.6	47.6 ± 36.7
Mental health	51.1 ± 25.7	55.3 ± 18.0

*Abbreviations: Str, self-stretching; Str-ST, self-stretching and soft tissue trigger point manual therapy. *Values are mean ± SD, except where otherwise indicated. There were no significant differences between groups (P>.05).*

Changes in Pressure Pain Thresholds

The 2 × 2 mixed-model ANOVA revealed significant group-by-time interactions for changes in PPT over the gastrocnemii ($F = 24.606$, $P<.001$) and soleus ($F = 21.142$, $P<.001$) muscles, and over the calcaneus ($F = 15.944$, $P<.001$). Patients receiving the combination of self-stretching and TrP intervention demonstrated a greater improvement in PPT, as compared to those who received only the self-stretching protocol ($P<.03$). **TABLE 3** summarizes within-group and between-group differences and associated 95% confidences intervals for PPT levels in both groups.

DISCUSSION

The results of the current study suggest that the addition of TrP manual therapies to a self-stretching protocol results in superior short-term outcomes, compared to those of self-stretching alone, in the treatment of individuals with plantar heel pain. In addition, the magnitude of this benefit was clinically important, as noted by the moderate and large between-group effect sizes and by the between-group differences in the primary outcomes, physical function, and bodily pain, which were equal to or surpassed the MCID of 7.8 points.[2] However, we should recognize that the lower bound estimate of the 95% CI for between-group changes includes the MCID for the primary outcomes.

The data from the present study indicate that both groups experienced improvements in function and pain. In fact the lower bound estimate of the 95% CI for within-group changes in both groups excludes the MCID for the primary outcomes, supporting a clinically meaningful improvement. Our results for the individuals in the Str group are consistent with the outcomes of previous studies in which calf muscles and plantar fascia-specific stretching were effective for the management of plantar fasciitis or plantar heel pain at short-term[12,25] and long-term[13] follow-ups. Conversely, Radford et al[27] have recently reported that a self-stretching program provides no significant short-term benefits in pain and function in patients with plantar heel pain. But treatment in Radford et al[27] study was applied for 2 weeks, in contrast to 4 weeks in the current study. The exact mechanisms of the efficacy of stretching in the management of plantar heel pain are unclear, but they may be related to a decrease in tension over the plantar fascia or decrease of risk factors, such as tightness of the gastrocnemii and soleus muscles and restricted ankle dorsiflexion.[29] Therefore, the current study further supports self-stretching of the calf muscles and the plantar fascia as being effective for improving pain and function, at least in the short term, in patients with plantar heel pain, which is in agreement with the conclusions of the Cochrane Review.[11] Future stud-

TABLE 2 Baseline, Final Treatment Session, Change Scores, and Effect Sizes for SF-36 Questionnaire*

Outcome/Group	Baseline	End of Treatment	Within-Group Changes	Within-Group Effect Sizes	Between-Group Differences	Between-Group Effect Sizes
Physical function (0-100)					9.3 (3.9, 14.8)	2.3
Str	41.2 ± 16.2	52.8 ± 19.4	11.6 (8.0, 15.0)	1.11		
Str-ST	44.3 ± 16.8	65.2 ± 12.2	20.9 (16.5, 25.2)	1.92		
Physical role (0-100)					11.9 (4.7, 28.4)	1.3
Str	29.6 ± 34.7	50.9 ± 32.9	21.3 (8.2, 34.3)	0.63		
Str-ST	30.3 ± 31.6	63.5 ± 27.6	33.2 (22.2, 44.1)	1.28		
Bodily pain (0-100)					7.8 (2.5, 13.3)	2.6
Str	31.7 ± 18.4	44.7 ± 17.5	13.0 (9.4, 16.5)	1.04		
Str-ST	35.3 ± 18.2	56.1 ± 13.8	20.8 (16.6, 25.0)	2.11		
General health (0-100)					5.4 (0.1, 10.6)	1.9
Str	54.1 ± 15.9	54.9 ± 16.2	0.8 (−2.6, 4.2)	0.26		
Str-ST	54.6 ± 17.3	60.8 ± 12.2	6.2 (2.1, 10.3)	0.60		
Vitality (0-100)					3.4 (2.9, 6.8)	1.1
Str	36.5 ± 18.5	44.1 ± 19.0	7.6 (3.7, 11.4)	0.79		
Str-ST	41.1 ± 18.4	52.1 ± 15.7	11.0 (2.7, 13.3)	0.61		
Social function (0-100)					4.8 (3.9, 14.7)	1.1
Str	46.2 ± 28.5	57.0 ± 17.8	10.8 (2.9, 18.6)	0.51		
Str-ST	52.7 ± 24.6	68.3 ± 18.8	15.6 (9.2, 22.0)	0.93		
Emotional role (0-100)					19.9 (3.8, 35.8)	2.9
Str	40.8 ± 39.6	51.9 ± 32.5	11.1 (0.8, 21.5)	0.42		
Str-ST	47.6 ± 36.7	78.6 ± 27.5	31.0 (18.3, 43.6)	1.01		
Mental health (0-100)					−2.3 (−5.0, −1.4)	0.8
Str	51.1 ± 25.7	60.1 ± 22.2	9.0 (3.3, 14.9)	0.61		
Str-ST	55.3 ± 18.0	62.0 ± 19.8	6.7 (1.2, 12.3)	0.48		

Abbreviations: Str, self-stretching; Str-ST, self-stretching and soft tissue trigger point manual therapy.
**Values are expressed as mean ± SD for baseline and end of treatment and as mean (95% confidence interval) for within-group and between-group change scores (higher values indicate greater function and lower levels of pain). Significantly greater improvement was found in the Str-ST group for the domains of physical function, bodily pain, general health, and emotional role (P<.05).*

ies should investigate if these benefits of stretching are maintained in the long term.

Cleland et al[7] have recently demonstrated that patients with plantar heel pain treated with an impairment-based manual therapy approach experienced better outcomes than those receiving a combination of ultrasound, iontophoresis, and exercise. However, no specific TrP therapies were included in this multimodal treatment protocol. As muscle TrPs have been advocated as a potential source of plantar heel pain,[34] a clinical intervention approach including TrP treatment should also be considered in the management of plantar heel pain. The current study shows that addition of TrP manual therapies to a stretching protocol resulted in a greater decrease of pain and a greater improvement of physical function in patients with plantar heel pain, as compared to using stretching exercises alone. In fact, the mean magnitude of this benefit was clinically important, as between-group differences were equal or exceeded the MCID.[2] In addition, patients also exhibited improvement in general health and emotional role domain supporting a general recovery of the patients.

We found active TrPs in all patients within the Str-ST group, suggesting a possible role of TrPs in plantar heel pain. Epidemiological studies investigating the prevalence of active TrPs in patients with plantar heel pain are needed to clarify this finding. The exact mechanisms why TrP treatment may be effective for the management of plantar heel pain are beyond the scope of this study, nevertheless, some hypotheses can be proposed. First, taut bands with TrPs have greater stiffness than surrounding tissue[5]; therefore, it is possible that TrP treatment decreases muscle stiffness, hence increasing the effectiveness of stretching. In fact, it has been proposed that compressing the sarcomeres by direct pressure, combined with active contraction or stretching of the involved muscle, may equalize the length of the sarcomeres and consequently decrease the pain[33]; however, this theory has not been scientifically investigated.[15] Others suggested that pain relief from TrP pressure may result from reactive hyperemia within the TrP or a spinal

TABLE 3 Baseline, Final Treatment Session, Change Scores, and Effect Sizes for Pressure Pain Thresholds*

Location/Group	Baseline	End of Treatment	Within-Group Changes	Within-Group Effect Sizes	Between-Group Differences	Between-Group Effect Sizes
Gastrocnemius muscle					0.9 (0.4, 1.3)	1.52
Str	1.8 ± 0.7	2.3 ± 0.5	0.5 (0.3, 1.7)	0.60		
Str-ST	1.3 ± 0.5	2.7 ± 0.6	1.4 (1.0, 1.6)	1.63		
Soleus muscle					0.8 (0.4, 1.2)	1.45
Str	2.1 ± 0.5	2.4 ± 0.5	0.3 (0.1, 0.4)	0.48		
Str-ST	1.9 ± 0.6	3.0 ± 0.9	1.1 (0.7, 1.5)	1.22		
Calcaneus					1.2 (0.7, 1.7)	1.63
Str	2.3 ± 1.1	2.6 ± 0.9	0.3 (0.1, 0.5)	0.59		
Str-ST	1.7 ± 0.8	3.2 ± 1.3	1.5 (1.0, 1.9)	1.25		

Abbreviations: Str, self-stretching; Str-ST, self-stretching and soft tissue trigger point manual therapy.
**Values are expressed as mean ± SD kg/cm² for baseline and end of treatment and as mean (95% confidence interval) for within-group and between-group change scores. Significantly greater improvement was noted in the Str-ST group for all 3 locations (P<.05).*

reflex mechanism induced by the relief of muscle tension.[18] Current results support that inclusion of TrP treatment into a self-stretching protocol is effective for improving function and decreasing pain in patients with plantar heel pain. Nevertheless, we do not know if the specific soft tissue manual therapy technique that was applied over the TrP was the most effective. It is possible that other manual techniques, such as Swedish massage, transverse friction massage, or myofascial release might be similarly or more effective as the specific techniques used in this study. Future studies investigating the effectiveness of different TrP manual therapies applied in individuals with plantar heel pain are needed.

Additionally, we also found an increase in PPT over the affected leg within the TrP group. Again effect sizes were large, supporting a clinical effect of the intervention over mechanical pain sensitivity; nevertheless, we should recognize that MCID of PPT in TrPs or muscle tissues has not been previously studied. Our results support that TrP treatment decreases pressure pain sensitivity, which is in agreement with previous studies demonstrating that TrP treatment induces segmental antinociceptive effects.[35,36] The fact the Str group exhibited small PPT changes supports antinociceptive effects as related to the TrP treatment and not to the stretching intervention.

According to the CONSORT guideline, adverse events of randomized controlled trials should be provided. In the current study, 2 patients within the Str group and 4 within the Str-ST group experienced slight soreness after the treatment for 2 days after the first 2 sessions.

The main limitation was the absence of a true control/sham/placebo group.[16] The Str-ST group received greater therapist-patient interaction, potentially introducing attention bias. Therefore, without a real control/sham/placebo group, it is not possible to state that the specific TrP release techniques applied in this study would be more effective than a sham "laying on of hands" or nontherapeutic manual contact. A second limitation was that we only assessed the short-term effects. We do not know if these effects would be maintained at a long-term follow-up. A third limitation may be that patients within the Str-ST group were treated by the same therapist, making it difficult to generalize the results to different clinicians. Finally, we recognize that we used a general questionnaire rather than a condition-specific outcome measure, such as the Lower Extremity Functional Scale or the Foot and Ankle Ability Measure. Future multicenter studies addressing these limitations are needed to further elucidate the effectiveness of TrP interventions in the management of individuals with plantar heel pain.

CONCLUSIONS

The current study demonstrated that the addition of TrP manual therapies to a self-stretching protocol is superior to the sole application of self-stretching in the treatment of individuals with plantar heel pain at short term. The magnitude of this benefit was clinically important for the main outcomes, physical function and bodily pain. In addition, significant increases in PPT levels within the TrP group were also found supporting antinociceptive effects of TrP therapy. ◉

KEY POINTS

FINDINGS: The addition of TrP manual therapies to a self-stretching protocol is superior to the sole application of self-stretching in the treatment of individuals with plantar heel pain at short-term.

IMPLICATIONS: Physical therapists should consider using TrP therapies in addition to stretching of the calf musculature and plantar fascia for the treatment of plantar heel pain.

CAUTION: We only assessed short-term effects, so we do not know if these effects would be maintained at long-term follow-up.

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Heel Pain

Hands-on Physical Therapy and Stretching Prove Effective for Treating Heel Pain

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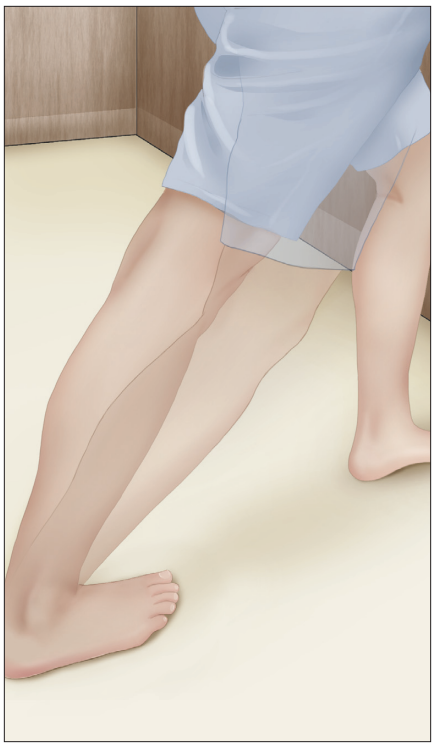
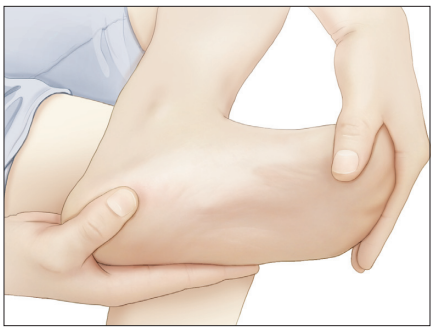
Do you ever wake up with pain in the heel of your foot first thing in the morning? If so, you may have plantar fasciitis, the most common type of heel pain. People with heel pain typically report a sharp pain under their heel that may spread into the arch of the foot. The pain is often worse when the person stands after lying down or following a period of sitting—for example, taking the first couple of steps in the morning or standing up after watching TV. Although the pain may actually decrease with activity, such as walking, it tends to return at the end of the day. Plantar fasciitis is not typically the result of an injury. Instead, this condition usually develops gradually and, if untreated, may get worse over time. By current estimates, 2 million Americans develop heel pain each year, and about 10% of all people will have heel pain at some point in their lives. The February 2011 issue of *JOSPT* published a research study that provides new evidence that can help people who suffer from heel pain.



CALF STRETCHES. While standing with your foot straight ahead, lean forward and keep your heel on the floor until you feel a stretch sensation in your calf. Perform this stretch first with the back leg straight and then repeat it with the back knee bent.



FOOT STRETCH. While seated, grab the base of your toes and pull them toward your shin.

HANDS-ON THERAPY. An example of a trigger point pressure release technique that can be performed on your calf muscles by your physical therapist.

NEW INSIGHTS

In this study, 60 patients with heel pain were randomly placed into 1 of 2 treatment groups. One group of patients performed calf and foot stretches and had hands-on therapy provided by a physical therapist (see drawings at left), while the other group only performed the stretches. The treatment performed by the physical therapist focused on treating sore points, sometimes called "trigger points." Trigger points are small sections of muscles that feel "knotty" and, when pressed, become more painful. The researchers found greater improvements in patients who both performed the stretches and received hands-on therapy. This finding is important because it suggests that people who are not getting better on their own may benefit from hands-on treatment.

PRACTICAL ADVICE

Although stretching the calf and foot can reduce heel pain, the addition of hands-on physical therapy resulted in better pain relief and greater improvements in function during the first month of treatment. The 3 stretches in this study were performed using a 20-second hold, 20-second recovery time and were repeated 3 times, twice a day. If you have heel pain, you may wish to seek the help of a physical therapist who can instruct you on the proper stretching techniques to perform. The physical therapist can also determine if you are a candidate for trigger point soft tissue techniques applied to your calf muscles, as were used in this study. For more information on the management of heel pain, contact your physical therapist specializing in musculoskeletal disorders.

For this and more topics, *visit* JOSPT *Perspectives for Patients online at* ***www.jospt.org***.

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