Platelet-rich plasma versus dry needling of myofascial meridian trigger points in the treatment of plantar fasciitis

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Background
Plantar fasciitis (PF) is the most common cause of heel pain, which results from repetitive trauma with degenerative changes in the plantar tissue. Platelet-rich plasma (PRP) and dry needling showed promising results as regards pain resolution and healing effect, and hence our aim was to compare their efficacy in the treatment of chronic PF.

Patients and methods
Thirty patients diagnosed with unilateral PF were subjected to full clinical assessment for foot function using the foot function index (FFI) and assessment of trigger points along the meridians. Ultrasonographic examination of plantar fascia thickness, echogenicity, and power Doppler was carried out. Patients were divided randomly into two groups of 15 each: group A received a single injection of PRP at the plantar fascia, and group B was treated with dry needling protocol in myofascial meridians trigger points along the superficial back line. Follow-up after 6 and 12 weeks included clinical re-evaluation, FFI determination, and ultrasonography. Our results showed a significant improvement in the clinical outcome of the FFI in group B ($P<0.03$) and a highly significant improvement in the clinical outcome within the PRP group by the 12th week ($P<0.009$). A significant decrease in thickness, heterogeneity, and Doppler signals ($P<0.04$, $P<0.003$, and $P<0.03$, respectively) was observed within the PRP group at the 12th week.

Conclusion
PRP injection is a promising line of treatment for chronic PF with documented ultrasonographic healing effect. Dry needling is a simple and safe technique for treating pain associated with PF, yet it is more invasive and less effective compared with PRP injection.

Keywords:
dry needling, myofascial meridian trigger points, plantar fasciitis, platelet-rich plasma

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Introduction

Plantar fasciitis (PF) is mainly a clinical diagnosis characterized by heel pain, which is often worse with the first few steps in the morning. It is the most common cause of plantar heel pain, and is more common in obese patients, in those standing for prolonged periods at work, or those walking on hard surfaces [1].

The underlying condition that causes plantar fasciopathy is a degenerative tissue condition that occurs near the site of the origin of the plantar fascia at the medial tuberosity of the calcaneus [2].

Plantar fascia pathology may be similar to tendinopathy with the fusiform thickening of the plantar fascia being a well-established feature of PF, and is thought to be the result of an increased secretion of ground substance proteins such as proteoglycans and subsequent tissue edema [3].

Conservative noninvasive lines of treatment, including NSAIDs, heel pads or orthotics, physical therapy, stretching exercises, and extracorporeal shockwave therapy, are considered the mainstay of treatment and provide substantial relief to about 80% of patients [4]. Nevertheless, these medications and modalities may not be curative for all cases of PF.

A new frontier in the treatment of orthopedic injuries is the growing science of orthobiologics or the science of injectables to promote healing through the use of the patient's own biological tissues, which can be exogenously applied to various tissues where it releases

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high concentrations of platelet-derived growth factors that enhance wound, bone, and tendon healing [5].

Researchers have documented that platelet-rich plasma (PRP) has four to six times the normal level of growth factors, which results in fibrocyte migration and induction of neurovascular growth [6,7]. As degranulation of platelets' granules occurs, they will release specific growth factors. These growth factors are as follows: transforming growth factor, which stimulates the different cell types involved in the healing process; platelet-derived growth factor, which attracts monocytes and stimulates fibroblasts; vascular endothelial growth factor, which stimulates new blood vessel formation for better vascularity; and fibroblast growth factor, which enhances the growth of extracellular matrix [8].

Current studies have revealed that local injection of PRP provides significant relief from pain and improvement in function [9].

Myofascial pain syndrome or myofascial meridians are believed to be an explanation for the pathological process of PF. Myofascial trigger point (MTrP) is a hyperirritable spot in the skeletal muscle and is associated with a hypersensitive palpable nodule in a taut band and may result in characteristic referred pain, tenderness, motor dysfunction, and autonomic phenomena [10].

In addition, the lower parts of the superficial back line (SBL) contain plantar fascia, Achilles tendon, gastrocnemius, hamstrings, sacrotuberous ligament, and erector spinae. Strain or tenderness in the above-mentioned anatomical trains' line might be considered in treating PF [10].

Dry needling [11] is a well-known popular method in treating myofascial pain syndrome by inserting a fine filament needle into the trigger points [12]. However, there is limited evidence supporting its role in PF [13], together with limited studies on the efficacy of different meridians in the treatment of PF.

Aim of the work

The aim of this work was to compare the value of PRP injection versus trigger point dry needling in the treatment of chronic PF.

Patients and methods

The study included 30 adult patients who met the inclusion criteria of clinical PF out of those presented to the Physical Medicine, Rheumatology and Rehabilitation clinic of Ain Shams University Hospitals.

Inclusion criteria

Adult patients over 18 years of age diagnosed clinically with unilateral PF who met the [14] criteria for clinical diagnosis of plantar heel pain in accordance with the Clinical Guidelines linked to the International Classification of Function, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association, which is pain in the plantar medial heel region that is aggravated by weight-bearing activities and worse in the morning and/or upon weight-bearing after periods of rest that lasts more than 1 month, associated with pain on palpation of the medial calcaneal tubercle, were included in the study.

Patients willing not to receive analgesics except paracetamol up to 4 g/day, taken by mouth for the duration of the trial, and patients with failed physiotherapy or local injection and who were not under medical or any intervention for their heel pain within the last 3 months before their inclusion in this study were all included in study.

Patients were asked to stop antiplatelet and NSAIDs before each of the procedure was performed.

Exclusion criteria

Patients with connective tissue disease, osteoarthritis of the foot and/or ankle, malignancy, history of surgery to the plantar fascia, calcaneal fracture, osteomyelitis, systemic disorders (renal or hepatic disorders, diabetes mellitus, or peripheral arterial vascular disease), dermatological disease within the area, previous medical treatment, or local injection in the last 3 months were excluded from the study. Patients with a known hypersensitivity to metals (cases assigned for dry needling) were excluded from the study. A full description of all procedures was given to each patient.

Written consent, which was approved by the Ain Shams Ethical Committee, was obtained from all patients after a full explanation of the study.

All patients were subjected to the following:

(1) Full medical history taking.
(2) Full clinical examination to confirm PF and exclusion criteria.

(3) Assessment of foot function using the foot function index (FFI), which is a 23-item questionnaire (three groups of questions: pain subscale, disability subscale, and activity limitation subscale) designed to assess foot function over the past week of assessment. Each question is rated from 0=no pain or difficulty to 10=worst pain imaginable.

The pain subscale evaluates how severe one's foot pain is.

Foot pain at its worst?	Pain standing with shoes?
Foot pain in the morning?	Pain walking with orthotics?
Pain walking barefoot?	Pain standing with orthotics?
Pain standing barefoot?	Foot pain at the end of the day?
Pain walking with shoes?	

The disability subscale evaluates how much difficulty one has in perfoming the following.

Difficulty walking in house?	Difficulty standing on tiptoe?
Difficulty walking outside?	Difficulty getting up from chair?
Difficulty walking 4 blocks?	Difficulty climbing curbs?
Difficulty climbing stairs?	Difficulty walking fast?
Difficulty descending stairs?	

The activity limitation subscale evaluates how much of the time one spends doing the following:

Stay inside all day because of pain in feet?	Use assistive device indoors?
Stay in bed because of pain in feet?	Use assistive device outdoors?
Limit activities because of pain in feet?	

with the highest score 230 [15].

(1) Laboratory investigations, to exclude any systemic disorder: complete blood picture, erythrocyte sedimentation rate, C-reactive protein, serum uric acid, glycosylated hemoglobin, liver profile, and renal profile.

(2) *Radiography:* Plain radiograph of feet, antero-posterior and lateral views, to detect the presence of calcaneal spur or any of the exclusion criteria.

(3) Ultrasonographic examination.

Ultrasonography (US) was performed using General Electric Logiq P5 R4.0. with a multifrequency linear transducer probe 3–12 MHz (General Electric, Milwaukee, Wisconsin, USA). US was performed by a certified sonographer who was blinded to the clinical diagnosis to confirm the diagnosis of PF; it is considered present when two or more of the following findings are detected: local inflammatory changes such as swelling and edema and increased vascularity, fibrous tissue or calcified tissue around the medial calcaneal tuberosity [16], thickened plantar fascia more than 4 mm, and or decreased echogenicity [17].

Included patients were divided randomly in two groups (15 patients each):

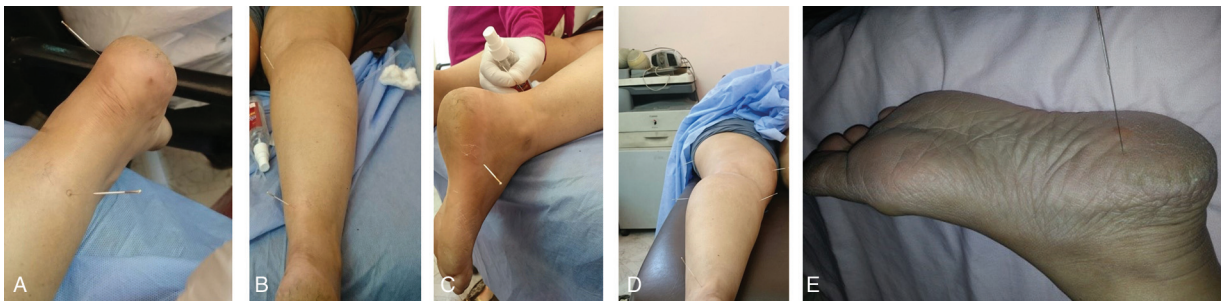
Group A (15 patients)

Group A received just one PRP injection, which was prepared as follows.

Blood was drawn from the patient (autologous) (30 ml) into a 50-ml tube that contained 4 ml of sodium citrate. The blood was centrifuged for ~6 min at 1500 rpm, and then again at 3500 rpm for 15 min using a desktop centrifuge (Centruion CR 2000; Quadrex Technologies, United Kingdom).

At this point, the PRP was collected. The resulting platelet concentrate contains ~6–8 times the concentration of platelets compared with baseline whole blood [18]. To estimate the concentration of the PRP extraction, blood samples of group A patients (normal blood test parameters) were examined and compared.

Figure 1



Different sites of dry needle insertion: (a) the lower medial gastrocnemius; (b) the upper medial gastrocnemius; (c) 10 cm above insertion of tendo-Achilles; (d) combined medial and lateral gastrocnemius, the semimembranosus, and the biceps femoris; (e) calcaneal attachment (medial tuberosity).

Table 1 Comparison between the studied groups as regards demographic data

Variables	PRP (*N*=15)	Needle (*N*=15)	*t*-Test	*P*	Significance
Age	43±10	45±9	0.7	0.67	NS
Disease duration (years)	2.6±1.6	2.3±0.9	0.8	0.50	NS
Sex [*n* (%)]					
Male	5 (33.3)	4 (26.7)	Fisher	0.34	NS
Female	10 (66.7)	11 (73.4)			
Previous ttt [*n* (%)]	15 (100)	15 (100)	–	–	

NS, nonsignificant; PRP, platelet-rich plasma. Unpaired *t*-test. Medical treatment in form of NSAID, physiotherapy, and corticosteroid injection.

Table 2 Comparison between the studied groups as regards clinical score baseline and after follow-up

Variables	PRP (*N*=15)	Needle (*N*=15)	*t*-Test	*P*	Significance
Clinical 0 level	161±37	147±34	1.4	0.3	NS
After 6 weeks	62.5±10.3	56.9±10.7	1	0.80	NS
After 12 weeks	60±12.9	55.8±11	2.3	0.03	S
% of change	5.3±4	−1.9±2	3	0.01	S

NS, nonsignificant; PRP, platelet-rich plasma; S, significant. Mann–Whitney test.

Patients were injected with 3 ml of the extracted PRP at the insertion of plantar fascia guided with the US scan under complete aseptic techniques.

Group B (15 patients)

Myofascial meridian trigger points along the SBL were detected as follows:

(1) Tenderness during palpation of the calcaneal attachment of the plantar fascia and the transverse arch below the first and fifth metatarsal heads.
(2) Tenderness along the lower parts of the SBL, which is a line of a fascia that starts at the plantar surface and connects along the posterior of the body, ending in the frontal area of the head.
(3) Local palpation to identify MTrPs as one of the following [19]: tender point within a taut band of skeletal muscle, a characteristic pattern of referred pain, patient recognition of pain on sustained compression over the tender point, or a local twitch response elicited on dry needling of the taut band. A flat palpation or pincer technique was used to palpate MTrP depending on the muscle being assessed.

They were treated with dry needling protocol for plantar heel pain at the myofascial meridian trigger points detected along the SBL, mainly at the following points:

(1) Calcaneal attachment (medial tuberosity).
(2) 10 cm proximal to the insertion of Achilles tendon.

Table 3 Comparison within each group at 6 weeks and 12 weeks as regards clinical score

Variables	PRP (*N*=15)	Needle (*N*=15)
After 6 weeks	62.5±10.3	56.9±10.7
After 12 weeks	60±12.9	55.8±11
P	0.009 S	0.2 NS

NS, nonsignificant; PRP, platelet-rich plasma; S, significant.

(3) The medial gastrocnemius and the lateral gastrocnemius.
(4) The soleus muscle.
(5) The biceps femoris.
(6) The semimembranosus and the ischial tuberosity (Fig. 1a–e).

Dry needling protocol for plantar heel pain [20] treatment was conducted within a 30-min timeframe with the patient lying down prone.

Rational for using dry needling

Rationale dry needling of myofascial meridians trigger points.

Dry needling details

(1) *Brand of acupuncture needle*: Tian Xie SuzhouTianxie Acupuncture Instrumentsco Ltd (China; http://www.tianxie.com) (commerically available in Egypt).
(2) *Needle length and diameter*: Needle length ranged from 30 to 75 mm. The diameter of the needle was 0.30 mm.
(3) *Muscles that were dry needled*: Muscles that were assessed before; harboring MTrPs that could be responsible for the patient's pain.
(4) *Needle insertions per muscle*: The number of needle insertions per muscle ranged from just one site up to three depending on the number of MTrPs detected by palpation and patient's tolerance to multiple needle insertions.
(5) *Response elicited*: Dry needling of a MTrP was attempted to elicit any of the following responses such as a local twitch response, dull aching sensation, distension, pressure, or even a reproduction of the patient's symptoms of aching.

Table 4 Comparison between the two groups as regards plantar fascia thickness at baseline, 6 weeks, and 12 weeks

Variables	PRP (*N*=15)	Needle (*N*=15)	*P*	Significance
Thickness at 0 level	6.21±0.5	5.6±0.6		NS
Thickness after 6 weeks	6.04±00.8	5.6±0.6	0.10	NS
Thickness after 12 weeks	5.9±0.7	5.6±0.6	0.28	NS
% of change	−2±0.7	0	–	

NS, nonsignificant; PRP, platelet-rich plasma.

Table 5 Comparison within each group as regards the plantar fascia after 6 weeks versus 12 weeks

Variables	PRP (*N*=15)	Needle (*N*=15)
Thickness at 0 level	6.21±0.5	5.6±0.6
Thickness after 6 weeks	6.04±0.8	5.6±0.6
Thickness after 12 weeks	5.9±0.7	5.6±0.6
P Significance	0.04 S	–

PRP, platelet-rich plasma; S, significant.

(6) *Manipulation of the acupuncture needle*: After insertion, the needle was withdrawn and advanced repeatedly to produce an appropriate response.
(7) *Needle retention time*: The needle was left in the muscle *in situ* for 5 min.

This needling technique was performed once per week for 6 consecutive weeks unless recovery of pain occurred before that.

Re-evaluation

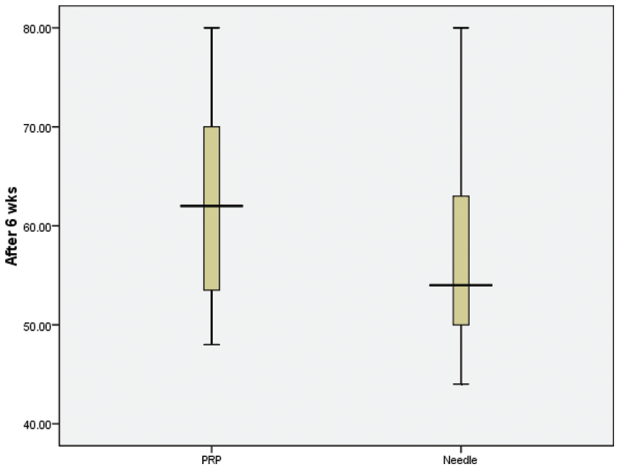
Patients of both groups were asked to come for follow-up after 6 weeks and 12 weeks for re-evaluation, clinically at the control visits using the following: (a) the FFI; (b) US, to detect and compare changes in the structure of plantar fascia.

Statistical methods

Analysis of data was carried out with an IBM computer using statistical program for social science version 18 software and services (released 2009, PASW Statistics for Windows, version 18.0; SPSS Inc., Chicago, Illinois, USA).

(1) Quantitative variables were described as mean, SD, and range.
(2) Qualitative variables were described as number and percentage.
(3) The χ^2-test was used to compare qualitative variables between groups.
(4) The Fisher exact test was used instead of the χ^2-test when one expected cell less than 5.
(5) The unpaired *t*-test was used to compare two groups as regards quantitative variables.
(6) The Mann–Whitney Wilcoxon *U*-test was used instead of the unpaired *t*-test in nonparametric data (SD>50%mean) [21].

Figure 2



Box plot for comparison between the two groups after 6 weeks as regards clinical score in both groups.

(a) A *P* value greater than 0.05 was considered nonsignificant.
(b) A *P* value less than 0.05 was considered significant.
(c) A *P* value less than 0.001 was considered highly significant.

Results

Demographic data

Table 1 presents comparison between the studied groups as regards demographic data.

This study included 30 patients with PF who were further subdivided into two groups. The first group (15 patients) received PRP injection and included 10 female (66.7%) and eight male patients (33.3%). Their ages ranged from 43.0 to 53.0 years with a mean age of 43.0±10.0 SD, and their disease duration ranged from 2.6 to 4.0 years, with a mean of 2.6±1.6 SD. The second group received dry needling and included 11 female (73.4%) and four male patients (26.7%). Their ages ranged from 45.0 to 54.0 years, with a mean age of 45.0±9.0 SD, and their disease duration ranged from 2.3 to 3 years, with a mean of 2.3±0.9 SD. All patients in both groups had received previous treatment (not in last 3 months) in the form of physiotherapy and medical treatment either oral or

Table 6 Comparison between the two groups as regards heterogeneity and PD after 6 weeks and 12 weeks

Variables	PRP (*N*=15)	Needle (*N*=15)	*P*	Significance
Heterogencity 6 weeks [*n* (%)]			0.48	
0	0	0		NS
1	6 (40)	5 (33.3)		
2	5 (33.3)	8 (53.3)		
3	4 (26.7)	2 (13.3)		
Heterogencity 12 weeks [*n* (%)]			0.002	S
0	7 (46.7)	0		
1	7 (46.7)	5 (33.3)		
2	1 (6.7)	8 (53.3)		
3	0	2 (13.3)		
PD after 6 weeks [*n* (%)]			0.50	NS
0	11 (73.3)	12 (80)		
1	4 (26.7)	3 (20)		
PD after 12 weeks [*n* (%)]			0.22	NS
0	15 (100)	12 (80)		
1	0	3 (20)		

NS, nonsignificant; PRP, platelet-rich plasma; S, significant.

Table 7 Comparison between the two groups as regards heterogeneity and PD after 6 weeks and 12 weeks

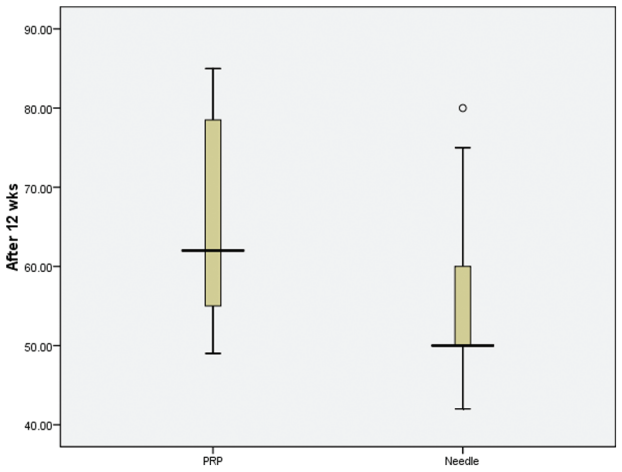
Variables	PRP (*N*=15)	Needle (*N*=15)
Heterogenicity at 6 weeks [*n* (%)]		
0	0	0
1	6 (40)	5 (33.3)
2	5 (33.3)	8 (53.3)
3	4 (26.7)	2 (13.3)
Heterogenicity at 12 weeks [*n* (%)]		
0	7 (46.7)	0
1	7 (46.7)	5 (33.3)
2	1 (6.7)	8 (53.3)
3	0	2 (13.3)
χ^2	13	–
P	0.003	
Significance	S	
PD after 6 weeks [*n* (%)]		
0	11 (73.3)	12 (80)
1	4 (26.7)	3 (20)
PD after 12 weeks [*n* (%)]		
0	15 (100)	12 (80)
1	0	3 (20)
χ^2	4.6	–
P	0.03	
Significance	S	

local steroid injection. This table shows no statistically significant difference between the two groups.

Dry needling at meridian trigger points

All patients in group B (15 patients; 100%) were injected at the insertion of the plantar fascia at the medial tuberosity of the calcaneus and the site located 10 cm proximal to the insertion of Achilles tendon, and the medial gastrocnemius was injected in 10 patients (66.6%), the lateral gastrocnemius was injected in nine patients (60%), the soleus muscle was injected in five patients (33.3%), the biceps femoris was injected in five patients (33.3%), the semimembranosus was injected in four patients (26.6%), and the ischial tuberosity was injected only once (one patient) (6.6%). None of our patients in this group experienced any complication from needling that required discontinuation from the study (Fig. 1).

Figure 3



Box plot for comparison between the two groups as regards clinical score after 12 weeks; the needle group had a lower score compared with the platelet-rich plasma (PRP) group with % of change statistically significantly different between the two groups.

Comparative data

Clinical assessment

On comparing the clinical outcome score at baseline and after 6 and 12 weeks in both the PRP group and the needle group, there was a statistically significant improvement ($P<0.05$) (Table 2). Table 2 shows comparison between the studied groups as regards clinical score baseline and after follow-up.

Moreover, on studying the effect of dry needling and PRP injection on the improvement of clinical outcome score per patient, we found the following:

(1) At 6 weeks, the PRP group showed improvement in seven patients of 15 (46.7%) compared with eight patients in the dry needling group (53.3%).
(2) At week 12, there was improvement in 14 patients of the PRP group (93.3%) in comparison with 12 patients in the dry needling group (80%).

Thus, the needle group had a lower score after 12 weeks compared with the PRP group. The % of change was statistically significantly different between the two groups using the unpaired *t*-test (Figs 2 and 3).

Figure 2 presents the box plot for comparison between the two groups after 6 weeks as regards clinical score in both groups.

Figure 3 presents the box plot for comparison between the two groups as regards clinical score after 12 weeks; the needle group had a lower score compared with the PRP group, with % of change being statistically significantly different between the two groups.

On comparing the effect of PRP after 6 and 12 weeks, there was a statistically significant improvement in the clinical score after 12 weeks in the PRP group using the paired *t*-test. However, there was no significant change in the needle group between 6 and 12 weeks, as shown in Table 3.

Table 3 presents the comparison within each group at 6 weeks and 12 weeks as regards clinical score.

Ultrasonographic assessment

Plantar fascia thickness: On comparing the plantar fascia thickness at 0 level and after 6 and 12 weeks in both the PRP group and the needle group, there was no statistically significant difference between the two groups using the unpaired *t*-test (Table 4).

Table 4 presents the comparison between the two groups as regards plantar fascia thickness at baseline, 6 weeks, and 12 weeks.

However, on comparing thickness in the PRP group between 6 and 12 weeks of follow-up, it showed a statistically significant difference, but it was nonsignificant in the needle group using the paired *t*-test (Table 5).

Table 5 presents the comparison within each group as regards plantar fascia thickness after 6 weeks versus 12 weeks.

Heterogeneity and power doppler (PD): US showed a heterogeneity of grade 3 at week 12, which was more frequent in the needle group, whereas heterogeneity of grade 0 was more common in the PRP group, with a statistically significant difference using the χ^2-test (Table 6 and Fig. 4). However, no statistically significant difference was found as regards other variables.

Table 6 presents the comparison between the two groups as regards heterogeneity and PD after 6 weeks and 12 weeks.

Figure 4 shows the comparison between the two groups as regards heterogeneity after 12 weeks, which was statistically significantly different.

In the PRP group, a heterogeneity of grade 3 declined after 12 weeks, and also PD significantly changed after follow-up using the χ^2-test (Table 7 and Figs 5 and 6).

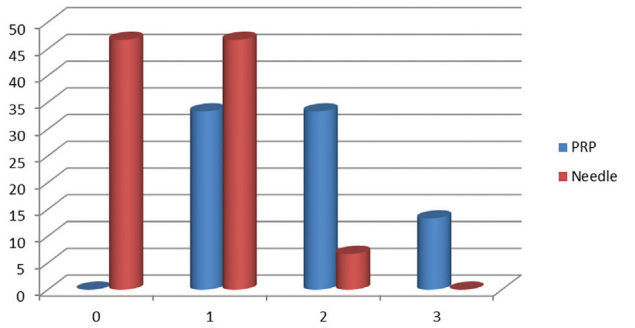
Table 7 presents the comparison between the two groups as regards heterogeneity and PD after 6 weeks and 12 weeks.

Discussion

PF is one of the most disabling foot problems affecting middle-aged, older adults, and athletic population, with its devastating impact on health-related quality of life [22].

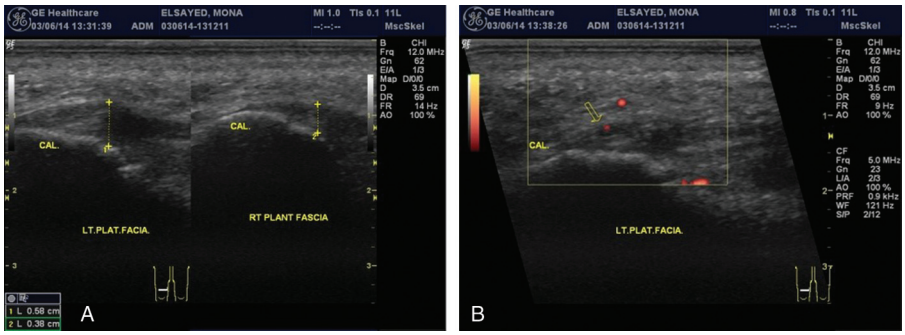
It is now believed that PF is a degeneration rather than inflammation at the site of its insertion to the medial calcaneal tuberosity, which is documented histologically by the absence of inflammatory cell invasion and the presence of microtears of the fascia

Figure 4



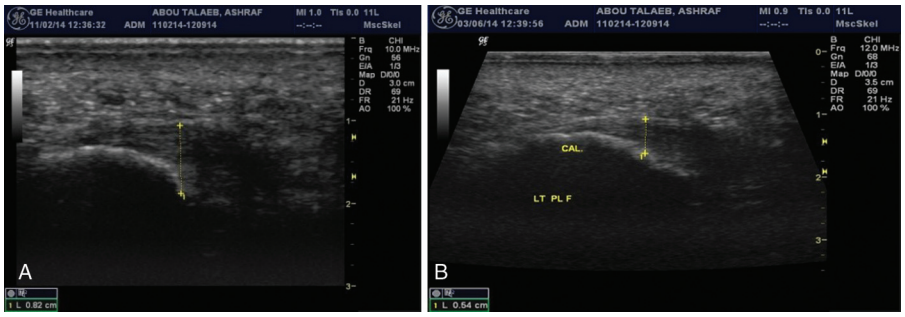
Comparison between the two groups as regards heterogeneity after 12 weeks, which was statistically significantly different.

Figure 5



(a) Longitudinal ultrasound scan of bilateral plantar fascia showing heterogeneous echogenicity with a markedly increased thickness of the left side in comparison with the right side; left plantar fasciitis. (b) Plantar fascia exhibiting power Doppler signal (one single vessel) same patient.

Figure 6



(a) Longitudinal ultrasound scan of the left plantar fascia showing heterogeneous echogenicity and increased thickness (0.82 cm). (b) Post-platelet-rich plasma (PRP) injection ultrasound showing markedly reduced thickness (0.54 cm) and improvement in heterogeneity in the same patient.

[23–25]. This new scope of PF pathology had led to the idea of using PRP injection to the site of the lesion to ensure the delivery of platelets with their cytokines released from α-granules, which enhance healing process through fibroblast migration and proliferation with increasing vascularity and collagen deposition in such inaccessible hypovascular, hypocellular area [26,27].

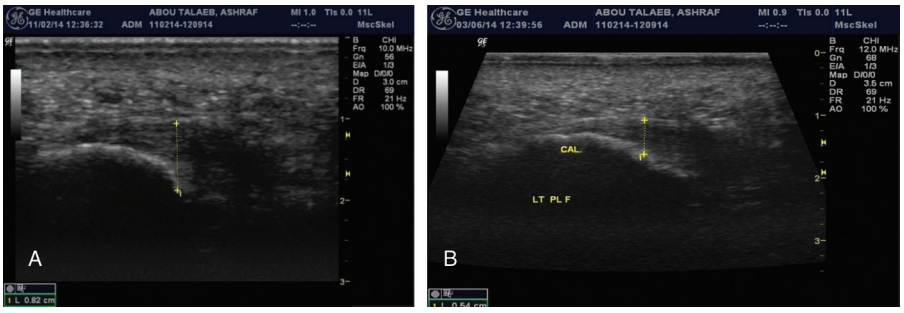
Moreover, another etiological mechanism was suggested for the etiology of PF, which is the disturbance in the maintenance of postural function. Recent studies showed the importance of studying the plantar fascia as a distal part of the SBL. This SBL is concerned with protecting the body in full upright extension and preventing its flexion tendency. However, daily postural function requires a high proportion of slow-twitch, endurance muscle fibers in the muscular portions of this myofascial band, augmenting that myofascial pain syndrome or myofascial meridian trigger points is believed to be an explanation of PF, and should be considered in its treatment [10].

Our study aimed to compare the value of PRP injection versus dry needling at myofascial meridian trigger points in the treatment of chronic PF in two groups of patients. These groups were randomly assigned to receive either PRP or dry needling. The two groups showed no significant differences as regards demographic data (age, sex, disease duration, and previous treatments); the mean age of the two groups was 43 and 45 years, respectively. This is similar to the study by Pankaj *et al.* [18], in which the mean age of the patients was 30.7, 33.9, and 35.4 years, respectively, and also the study by Tiwari and Bhargava [28], who stated that the range of their patient's age reflected that PF pain affects adults, especially those in middle-to-later age of life.

We studied the clinical outcome of both groups by comparing the FFI initially before any procedure, at 6 weeks, and at 12 weeks. The FFI was chosen to be our tool in clinical evaluation as it has been validated and determined to be a reliable instrument for patients with nontraumatic foot or ankle problems [29].

Our clinical state was not different initially or at 6 weeks; however, it was significantly different in the 12th week for the needling group, with a

Figure 7



(a) Longitudinal ultrasound scan of left planter fascia showing heterogeneous echogenicity & increased thickness (0.82 cm); (b) Post PRP injection showing marked reduced thickness (0.54 cm) & improvement of heterogenicity of the same patient.

significant percent of change (only for the pain scale), whereas on comparing the improvement in the clinical outcome within each group there was a significant difference for the group injected with PRP in the 12th week than in the sixth week, denoting more improvement and healing with time (Figure 7). This difference was not seen in the needling group. These findings are supported by those of Tiwari and Bhargava [28], who found that among patients who were receiving PRP therapy visual analogue scale score falls at 3 months and remains constant until 6 months.

Earlier studies also support our data, in which 14 patients (93.3%) of 15 (group A) showed improvement in pain and function by the 12th week, as in the study by Barrett and Erredge [2], who reported complete resolution of symptoms at 1 year in ~78% of patients with PF treated with PRP.

As regards patients of group B treated with myofascial meridian trigger point dry needling, they showed improvement in pain scale only for eight patients (53.3%) and 12 patients (80%) at the sixth and 12th week, respectively. This is near to the results of Tillu and Gupta [30], who found a significant improvement in plantar heel pain, as measured on a visual analogue scale (67.9% improvement), with a 4-week (one treatment per week) period of acupuncture, followed by 2 weeks of dry needling of the calf and heel regions, and Perez-Milan and Foster [11] also demonstrated a significant reduction in pain (46% improvement) with a 6-week (one treatment per week) program of acupuncture and dry needling of the heel and arch.

However, these studies gave little evidence for the effectiveness of dry needling usage with or without injections of MTrPs in chronic PF [13]; however, other studies such as that by Cotchett *et al.* [31] stated that dry needling provided statistically significant reductions in plantar heel pain. Behnam and colleagues also demonstrated improved symptoms of recurrent PF in a case report, in which pain reduced to 60% in 2 weeks of treatment (twice per week) with myofascial meridian trigger point dry needling. They concluded that this rapid relief of this patient's pain after 2 weeks of dry needling and other locations along the meridians and the SBL highlighted a more global view in the management of chronic recurrent heel pain [20].

In our study, we tried to document the healing effect of PRP and dry needling using musculoskeletal US to study the change in thickness, heterogeneity, and Doppler signals of the plantar fascia. Our data showed a significant decrease in thickness (healing) within the group injected with PRP from the sixth to the 12th week, together with decreased heterogeneity (especially grade 3) and a marked decrease in Doppler signals, which was not seen in the group treated with dry needling. This denoted the real healing effect of PRP when administered with guided US at the point of maximum tenderness of the heel, which is similar to some studies that recommended an US-guided technique for PRP injection in PF [32,33].

Given the thickening of the plantar fascia as a commonly observed finding with US in patients with PF, Tsai and colleagues postulated that there should be a decrease in plantar fascia thickness to improve symptoms with treatment. Thus, injection of PRP into the affected tissues addresses the healing stages necessary to reverse the degenerative process that is occurring in the base of the plantar fascia leading to thickness reduction [32].

A similar result was concluded in a review of the literature, which suggested that dry needling is

effective in the management of pain associated with trigger points, and it did not have any effect on function, quality of life, depression, range of motion, or strength [34].

Other studies showed a similar healing response produced by administration of PRP. Within addition, its safety (autologous) and ease of preparation make it a superior line of treatment, unlike corticosteroid injection, which carries the risks for plantar fascia rupture and soft tissue atrophy [35]. Pankaj *et al.* [18] stated that PRP injection is as effective as or more effective compared with ordinary corticosteroid injection for chronic PF in a study of 3 months' follow-up.

Conclusion

PRP injection is a promising, safe line of treatment for chronic PF, carrying no complications as it is autologous blood, with a documented ultrasonographic healing effect. Although dry needling of myofascial meridian trigger points is a simple technique for treating pain associated with PF, it is invasive but does not need any preparations and is easy to be repeated. However, it requires frequent patient visits and is less tolerable by some patients as the patient experienced more pain through multiple site injection and through the manipulation necessary for dry needling, which necessitates moving the needle through these trigger points in many directions. The two modalities are considered an option for treatment and it is the patient's decision to choose. However, the results of PRP are considered more encouraging. The effect of regain of postural function cannot be ignored and could be achieved by combining stretching and strengthening exercises of the SPL muscles with PRP.

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Conflicts of interest

There are no conflicts of interest.

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