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Effect of platelet-rich plasma in the treatment of chronic plantar fasciitis

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Abstract
Aim: The aim of this study was to evaluate the therapeutic effect of platelet-rich plasma (PRP) injections in the treatment of chronic plantar fascitis.
Methods: The study group comprised of 150 patients. In the corticosteroid group. PRP was obtained from the patients' own blood and injected in a single dose. Peppering technique was used for injecting the doses in the patients. Results were calculated using pre-injection and post-injection Visual Analog Scale (VAS), America Orthopedic Foot and Ankle Society (AOFAS) and Foot and Ankle Disability Index (FADI) at baseline, 6 weeks and 6 months.
Results: All patients enrolled in the study completed a 6 month follow-up. There were no complaints of any side-effects to the administered corticosteroid or platelet-rich plasma. No infection or any other complications were reported at the end of 3 months. The outcome between the 2 groups was comparable in terms of VAS, AOFAS and FADI scores.
Conclusion: PRP therapy proves to be effective in relieving pain in a long term for treatment of plantar fascitis.

Keywords: Growth factor, heel pain, plantar fasciitis, platelet-rich plasma

Introduction
Plantar fasciitis is the most common cause of heel pain in orthopedic practice. A typical patient complains of sharp pain along the heel that is maximum on taking the first step in the morning and also after periods of rest [1, 2]. Aggravating factors include prolonged standing, obesity, female gender and advancing age. It is most commonly seen in the age group of 40-60 years [3, 4].
The underlying pathological process that leads to plantar fasciitis is essentially a degenerative condition with myxoid degeneration, collagen necrosis, and angiofibroblastic hyperplasia [5, 6]. The diagnosis is usually made on history and clinical examination. Plantar fascitis is known to have a self-limiting course in approximately 80-90% of patients, however it requires a long period of rehabilitation. When the condition gets chronic, it can have a huge impact on daily lifestyle of the patient [7-9].
A large number of treatment options have been considered in treating plantar fasciitis including no steroidal anti-inflammatory drugs (NSAIDs), physiotherapy, and ultrasonic therapy, plantar fascia stretching exercises, modified footwear, customized insoles, and also extracorporeal shock-wave therapy. Corticosteroid injections locally have also been used over the past [11-14] Over the recent few years platelet-rich plasma (PRP) injections have also been used with promising results.
The purpose of this study was to evaluate the therapeutic effect of PRP injections in the treatment of chronic plantar fasciitis.

Materials and methods
The present retrospective study includes 160 consecutive patients diagnosed with chronic plantar fasciitis between December 2016 and August 2019. The diagnosis was done clinically by the same orthopedic team as characteristic heel pain lasting for more than a period of 6 months, localized along the medial aspect of the heel. All the patients had symptoms non-responsive or recurrence of symptoms following conservative and physical therapy.

Patients with previous history of fracture or surgery on the affected heel, those with previous history of steroid injections, infections or systemic diseases, arthritis, radiculopathy, and patients on anti-platelet medication and oral steroids were excluded from the study. All patients were instructed to stop taking NSAIDs 3 weeks before the procedure.

Procedure: 30ml of patients' blood was withdrawn and inserted into pre-packed PRP kits (Tricell) along with 5 ml of anticoagulant 10% sodium citrate. The PRP sample was prepared by a double centrifugation process. The first centrifuge was done at 3200 rpm for 4 min. The cellular component was separated from the fluid component and a second centrifuge was them performed at 3300 rpm for 3 min. Following this, approximately 3-4ml was obtained. The maximally tender spot on the medial heel was identified by palpation. The injection was done using the peppering technique, where multiple punctures were done on the plantar fascia. The study was explained to every patient and informed consent was obtained from them before the procedure.

After the procedure, all patients were advised non-weight bearing for the first 48 hours and gradual return to activities after 1 week of the procedure. Ice fomentation on the injection site was encouraged, and patients were advised to wear comfortable footwear.

Pre-procedure and on final follow-up, patients were assessed for their symptoms using visual analog scale (VAS), American Orthopedic Foot and Ankle Society score (AOFAS), and foot and ankle disability index (FADI).

Results

The present study included 150 patients. The mean age of patients was 44.44 years, comprising a total of 65 males (43%) and 85 females (57%). the right heel was affected in 61 patients (41%) whereas the left heel was affected in 89 patients (59%). Table I illustrates the patient characteristics at baseline.

None of the patients included in the study. There were no complaints of any side effects to the administered corticosteroid or PRP. No infection or any other complications were reported at the end of 6 months. The results were evaluated using the Mann- Whitney U test. A value of $p<0.05$ was accepted as statistically significant. The mean VAS score at baseline, at 6 weeks follow-up and at 6 months follow-up were 8.3 ±1, 1.5 ±0.8 and 0.8 ±0.8. The mean AOFAS score at baseline, at 6 weeks follow-up and at 6 months follow-up were 56.3 ±8.6, 83.2 ±4.5 and 93.7 ±2.4. The mean FADI score at baseline, at 6 weeks follow-up and at 6 months follow-up were 68.1 ±5.7, 75.3 ±4.8 and 86.5 ±4.3. The differences in the pre-treatment scores and follow up scores were statistically significant. (Table II, Figure I-III)

Discussion

The present study aimed to compare the efficacy of PRP in the treatment of chronic plantar fasciitis. In our study, we found significant differences relative to VAS, AOFAS, and FADI scores before treatment, 6 weeks after treatment and 5 months after treatment. In our previously published study, we had compared the efficacy of corticosteroid versus PRP in the treatment of chronic plantar fasciitis. In that study, we showed that corticosteroid and PRP both have a significant therapeutic effect in treating plantar fasciitis; however, PRP had been proven to be superior to corticosteroid [15].

In our study, PRP was administered at the point of maximum tenderness of the heel. Ultrasound guided injections have been suggested in many studies in literature for improved accuracy of drug delivery. However, in a study conducted by Kane *et al.*, they concluded Ultrasound-guided injection to be effective in the management of plantar fasciitis but not more effective than palpation-guided injection [16]. Similar results were documented by Tsai *et al.* in their study of local steroid delivery in the plantar fascia comparing Sonography and palpation guidance [17].

The results of our study suggested that PRP was associated with significant improvement in VAS, AOFAS and FADI scores. Our results were consistent with other studies in literature. Seet Khing Chiew *et al.* in 2016 performed a systematic review encompassing 455 patients who received PRP injection for plantar fascitis. They concluded PRP to be an effective alternative to conservative management with no obvious side-effect or complication [18]. Similarly, a meta-analysis performed by Hsiao *et al.* compared the efficacy of autologous blood-derived products (ABPs), CSs and shock-wave (SW) therapy in the treatment of plantar fasciitis. Their study indicated that an ABP regimen consisting of platelet-rich plasma improves treatment efficacy [19].

Since PRP obtained from autologous blood, there is no risk of immune reaction or disease transfer. There are no studies in the literature warning of hyperplasia, carcinogenesis or tumor growth of PRP [20-22]. In our study, No complications were encountered in any patient. Muto *et al.* performed a study on the effect of PRP and corticosteroids on human rotator-cuff derived cells. In their study, they showed that while PRP and corticosteroids both show a progressive decrease in inflammatory markers on the target tissue, corticosteroids have shown to have an increase in degenerative markers in contrast to PRP which shows a decrease in the degenerative markers on the target tissue. This may explain the predisposition of corticosteroids to rupture of the plantar fascia and also to recurrence of symptoms in many studies in literature [23]. In a study performed by Acevedo and Beskin, they studied a total of 765 patients with plantar fasciitis. From these, 51 patients suffered a rupture of the plantar fascia and 44 of these were directly attributed to corticosteroid injection [24].

Our study had a few limitations. First, we did not have a control group. Peppering technique was used to administer corticosteroids as well as PRP to the target tissue; hence, the response obtained could be attributed to the technique itself. We did not use ultrasound guidance to administer the injections; hence, we were not aware of the pre-procedure thickness of the plantar fascia. With the use of PFP, we did not measure the pre-centrifuge and post-centrifuge platelet concentration in any of the samples; hence, no standard dose of administration could be quantified.

Conclusion

In conclusion, although limited by a few factors, the present study suggested that PRP was as effective as other treatments in terms of pain and functional results in the treatment of patients with plantar fasciitis.

Table 1: Comparison of patients' characteristics at baseline

	n = 150		p value
	n	Mean±SD	
Age		44±6.4	≥0.05
Male / Female	65/85		≥0.05
Affected Foot (Right / Left)	61/89		≥0.05
VAS		8.3±1	≥0.05
AOFAS		56.3±8.6	≥0.05
FADI		66.1±5.7	≥0.05

VAS: Visual Analog Scale
AFAS: American Orthopedic Foot and Ankle Society score
FADI: Foot and Ankle Disability Index
SD: Standard Deviation

Table 2: Comparison of VAS, AFOAS and FADI scores at baseline, 6 weeks and 6 months

	n = 150 Mean ± SD	p*
VAS Baseline 6 weeks 6 months	 8.3 ± 1 1.5 ± 0.8 0.8 ± 0.8	 ≥0.05 < 0.001 < 0.001
AOFAS Baseline 6 weeks 6 months	 56.3 ± 8.6 83.2 ± 4.5 93.7 ± 2.4	 ≥0.05 < 0.001 < 0.001
FADI Baseline 6 weeks 6 months	 66.1 ± 5.7 75.3 ± 4.8 86.5 ± 4.3	 ≥0.05 < 0.001 < 0.001

* Mann-Whitney U Test
VAS: Visual Analog Scale
AFAS: American Orthopedic Foot and Ankle Society score
FADI: Foot and Ankle Disability Index
SD: Standard Deviation.

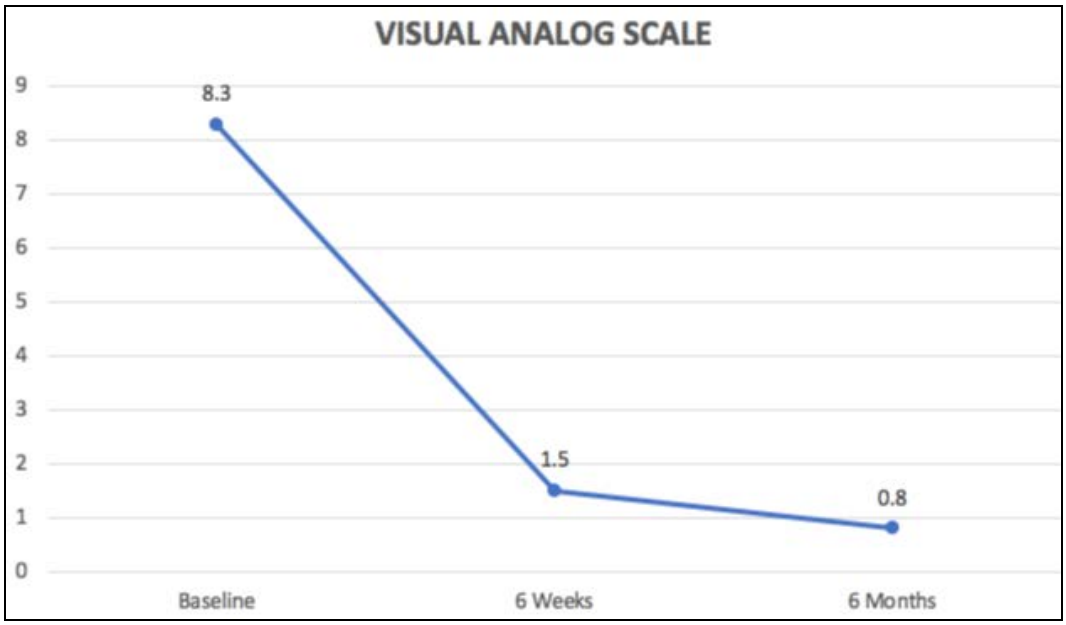

Fig 1: VAS Score: Baseline, 6 weeks and 6 months

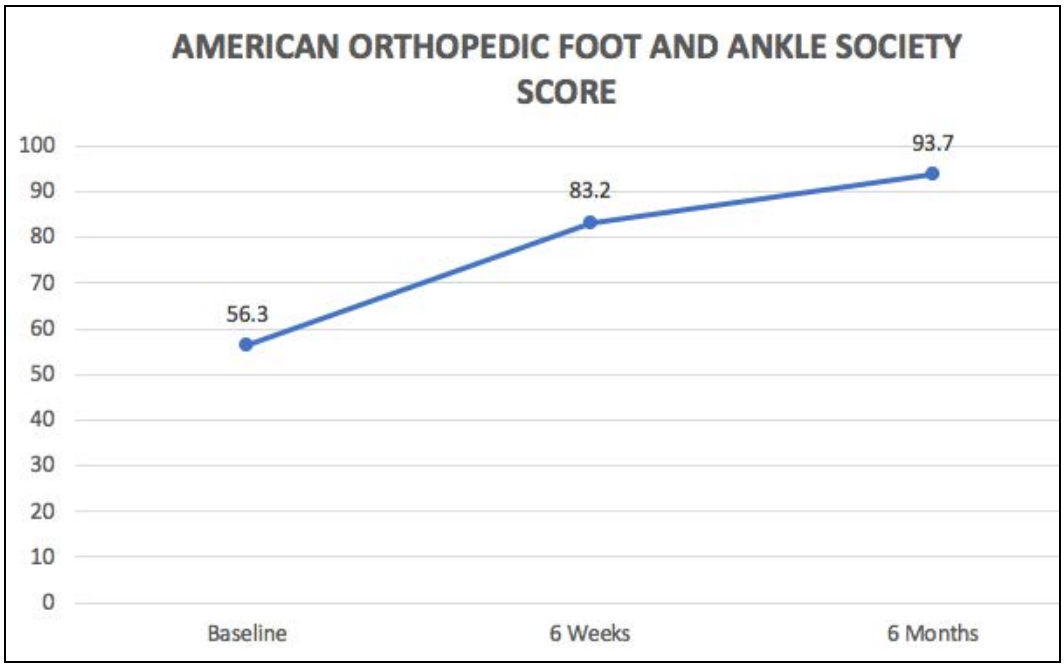

Fig2: AOFAS Score: Baseline, 6 weeks and 6 months

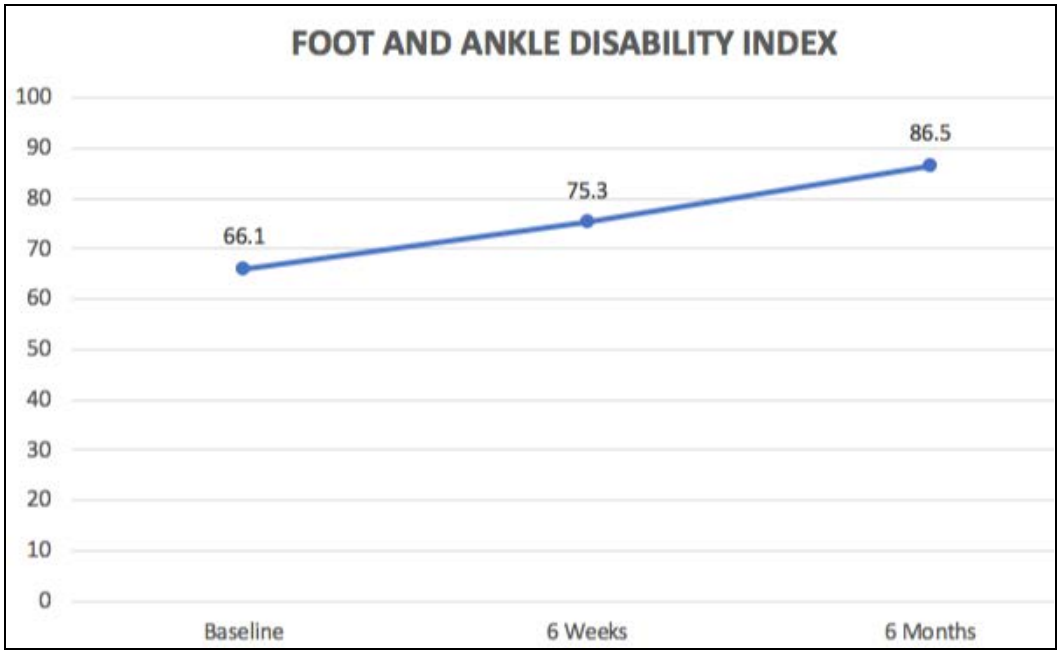

Fig 3: FADI Score: Baseline, 6 weeks and 6 months

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