



ISSN (P): 2521-3466
ISSN (E): 2521-3474
© Clinical Orthopaedics
www.orthoresearchjournal.com
2019; 3(3): 100-104
Received: 22-05-2019
Accepted: 24-06-2019

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The role of PRP injection in the management of plantar fasciitis: The analytical prospective study in 60 patients

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DOI: <https://doi.org/10.33545/orthor.2019.v3.i3b.168>

Abstract

Introduction: Plantar fasciitis is the most common overuse injury. Steroid injections are a popular short-term method of treating it. However lack of an inflammatory process histologically in plantar fasciitis questions its mode of action. Recently, promising results were reported with the use of Platelet-rich plasma (PRP) injections for treating muscle and tendon injuries and degeneration. The rationale lies in reversing the blood ratio by decreasing RBCs (less useful in the healing process) to 5%, and increasing platelets to 94% to stimulate recovery. We conducted a study with an aim to assess the efficacy of PRP injections for treating chronic plantar fasciitis.

Materials and Methods: Study was conducted in a private medical college in Andhra Pradesh, including 44 male and 16 females, attending orthopaedics OPD from November 2016 to October 2018, suffering with chronic plantar fasciitis. From each patient 10 cc of whole blood was drawn and PRP was prepared by differential centrifugation and injected locally. They were reviewed at 4 weeks 8 weeks 3 months and 6 months. Injection was repeated if no significant improvement seen at 4th week. The result assessed using Base line Visual Analogue Score (VAS), Foot and Ankle Disability Index (FADI) score.

Results: There was highly significant improvement in the VAS and FADI score on each successive visit, when compared with baseline scores.

Conclusion: PRP injection has a beneficial effect in treatment of plantar fasciitis.

Keywords: Plantar fasciitis, platelet rich plasma (PRP), FADI & VAS scoring

Introduction

Plantar fasciitis is the third most common cause of overuse injury after patella-femoral pain syndrome, and ilio-tibial band friction syndrome (ITBFS). It is a degenerative tissue condition that occurs near the site of origin of the plantar fascia at the medial tuberosity of the calcaneus. Histological findings show no evidence of inflammation; rather, they show myxoid degeneration, micro tears, collagen necrosis, and angio-fibroblastic hyperplasia. These findings suggest a chronic degenerative process, not an acute inflammatory one ^[1]. Steroid injections are a popular method of treating the condition but are useful in the short term and only to a small degree ^[2]. However, the lack of an inflammatory process histologically in plantar fasciitis questions its mode of action and has been associated with rupture of the plantar fascia in 2.4 to 10% of patients as well as attenuation of the plantar fat pad ^[3]. Recently, promising results were reported with the use of platelet-rich plasma (PRP) injections for treating muscle and tendon injuries and degeneration ^[4-6]. The use of autologous PRP was first used in 1987 by Ferrari, *et al.* ^[7]. PRP is a bioactive component of whole blood with platelet concentrations elevated above baseline and containing high levels of various growth factors ^[5]. The rationale for PRP benefit lies in reversing the blood ratio by decreasing red blood cells (RBC) to 5%, which are less useful in the healing process, and increasing platelets to 94% to stimulate recovery ^[8]. An increased awareness of platelets and their role in the healing process has led to the concept of therapeutic applications. There is emerging literature on the beneficial effects of PRP for chronic non-healing tendon injuries including lateral epicondylitis and plantar fasciitis ^[9, 10]. In view of the above said, we conducted a study with an aim to assess the efficacy of PRP injections for treating chronic plantar fasciitis and provide initial clinical assessment of its effectiveness.

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Aim and objective of study

1. To evaluate the efficacy of PRP injection in the treatment of chronic plantar fasciitis in terms of symptom relief using (VAS-Visual Analog Score) and
2. To evaluate the improvement of foot function using FADI (Foot and Ankle Disability Index) over a period of six months.

Materials and Methods

This Analytical prospective study was conducted in the department of orthopaedics in a private medical college in Andhra Pradesh, including 44 males and 16 females, attending the orthopaedics OPD from Nov 2016 to Oct 2018, suffering with chronic plantar fasciitis satisfying the inclusion criteria as follows-

Inclusion Criteria

1. Patients aged ≥ 18 years,
2. Patients who experienced heel pain felt maximally over the plantar aspect for six months.
3. Patients with/without radiographic evidence of calcaneal spur.
4. Patients with chronic plantar fasciitis who failed to respond to conservative management

Exclusion Criteria

1. Patients having systemic diseases like Diabetes, ankylosing spondylitis, Reiter syndrome, rheumatoid arthritis, gout or psoriatic arthritis.
2. Had underwent Physical/occupational therapies within 4 weeks.
3. Any wound or skin lesion at the plantar aspect of the foot.
4. History of severe infection, malignancy, bleeding disorder, previous surgery.
5. Corticosteroid injection into the heel, including Achilles tendon.
6. Nerve-related symptoms such as radiculopathy, tarsal tunnel syndrome, foot and ankle osteoarthritis.

Method of PRP Preparation

After obtaining Institutional Ethical committee approval, all eligible patients satisfying the inclusion criteria were enrolled and informed written consent was taken. From each patient for preparing PRP, Under strict aseptic precautions, 10cc of whole blood will be drawn by vene-puncture into vacutainers with ACD-A as an anticoagulant. The whole blood is initially centrifuged by differential centrifugation. The first spin is called “soft spin” at 3000 rpm for 3 minutes. This causes separation of the blood into RBC, buffy coat and platelets and top platelet poor plasma. The upper layer of plasma including the platelets and buffy coat is drawn into another syringe using a three way connector. This is subjected to the second centrifugation called “hard spin” at 4500 rpm for 15 minutes. This causes separation of the platelets and platelet poor plasma. From this, the supernatant platelet poor plasma was discarded and the platelets re-suspended in appropriate volume of either plasma or normal saline.

Since an acidic anticoagulant (Anticoagulant Citrate Dextrose Solution – Solution A [ACD-A]) was added during the collection of venous blood, collected PRP was buffered by adding 8.4% sodium bicarbonate solution in a ratio 0.05 ml of sodium bicarbonate to 1 ml of PRP, to increase the pH to normal physiological levels, just before injection. No activating agent was added to the PRP before administration. The time taken to prepare PRP was about 30 minutes.

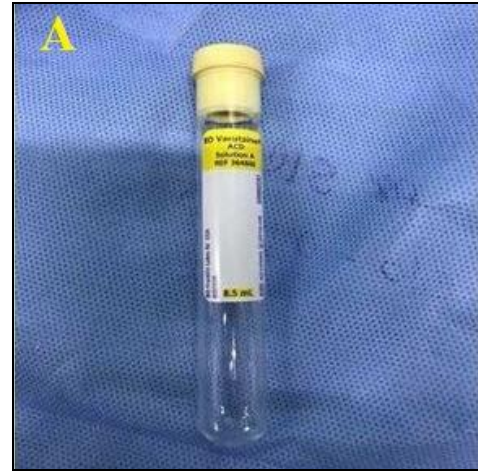


Fig 1: Vacutainer



Fig 2: Three layers of RBC, buffy coat with platelets, and PPP

Injection Technique

1. After prepping with povidone-iodine and using local Xylocaine a single injection of 2 ml of the extracted PRP is injected into the affected area, at the origin of the plantar fascia on the medial tubercle of the calcaneus, as described by Cyriax and Cyriax [20], approached from the medial side of the foot but near the plantar surface.
2. Post injection analgesic tablets were used in the group for a maximum period of one week and ice packs were allowed for post-injection pain.



Fig 3: Technique of injecting PRP

Post-Injection Protocol

1. After injection, all patients were allowed to immediately walk but were advised to avoid weight-bearing sport activities, such as running or jumping, for at least four weeks after the injection.

- They all were advised to stay in OPD after injection until pain was considered tolerable and were observed to detect possible side effects.
- They were reviewed at 4 weeks, 8 weeks, 3 months and 6 months.
- A second injection was given if no significant improvement was seen at 4th week.
- The clinical assessment was done using Baseline Visual Analogue Score (VAS), and Foot and Ankle Disability Index (FADI) score.

Results and Analysis

AGE distribution in present study

The least age in present study is 18 years and the maximum age is 55 years, the mean age is 37.33 +/- 7.48, the most common age group is 31-40 years. (TABLE 1)

Table 1: Age Distribution

Age (YRS)	Frequency	Percentage (%)
<20	2	3
21-30	7	12
31-40	32	53
41-50	16	27
51-60	3	5
61-70	0	0
Total	60	100

Table 4: Occupation

Occupation	Frequency	Percentage
Electrician	1	2
Clerk	1	2
Driver	2	3
Farmer	20	32
Housewife	8	13
Police Constable	3	5
Shop Keeper	13	22
Tailor	1	2
Student	1	2
Teacher	10	17
Total	60	100

Body Mass Index in present study

The mean BMI in the present group is 23.87 +/- 3.17. Overall, 37% of the participants have BMI more than 25. (TABLE 5)

Table 5: BMI

BMI	Frequency	Percentage (%)
20-25	38	63.3
26-30	22	36.7
Total	60	100

VAS - at various intervals

To know whether there was any difference in the score on subsequent visits, paired t-test was applied between various groups. (Table 6)

Table 6: VAS - At Various Intervals

VAS-At presentation	VAS-1st follow up	VAS - 2nd follow up	VAS - 3rd follow up	VAS - 4th follow up
7.07	4.53	4.23	4.05	3.62

The mean Visual Analog score was 7.07 +/- 1.82 at the time of presentation, which was reduced to 4.53 +/- 1.44 in the first

Sex Distribution

Among 60 patients 44 (76.7%) were males and 16 (23.3%) were females. In the present study, overall males appeared to be more affected with plantar fasciitis (TABLE 2)

Table 2: Sex Distribution

Group	Frequency	Percentage (%)
Male	44	76.7
Female	16	23.3
Total	60	100

The Side involved

Right side is most commonly involved 52%, followed by left side (35%) and both sides in 13%. (TABLE 3)

Table 3: Side Involved

Side	Frequency	Percentage (%)
Right	31	52
Left	21	35
Bilateral	8	13
Total	60	100

Occupation Of various Patients in Present Study

The most common occupation involved was farmers (32%) followed by shop keepers (22%) and then teachers (17%). (Table 4)

follow-up, to 4.23 +/- 0.79 in the 2nd follow-up, to 4.05 +/- 1.13 in the 3rd follow-up, and further reduced to 3.62 +/- 0.98 in the last follow-up at 6th month. Compared to baseline, all post-injection follow-ups had significant reduction in the mean Visual Analog Scores. There was highly significant improvement in the VAS score, on each successive visit, when compared with the base line VAS score. (Table 7)

Table 7: Paired Sample t-test of VAS - At various intervals

	Paired Sample t-test			
	Pair	T	df	Sig. (p-value)
Pair 1	VAS at Presentation- VAS at first follow-up	8.47	59	<0.0001
Pair 2	VAS at Presentation - VAS at 2nd follow-up	10.49	59	<0.0001
Pair 3	VAS at Presentation - VAS at 3rd follow-up	10.94	59	<0.0001
Pair 4	VAS at Presentation - VAS at 4th follow-up	13.02	59	<0.0001

Foot Ankle Disability Index (FADI)

The mean Foot Ankle Disability Index which was 37.12 +/- 6.27 at the time of presentation, was improved to 73.57 +/- 8.68 in the first follow-up, and further improved to 75.25 +/- 9.22 in the 2nd follow-up. The FADI improved further to 77.53 +/- 9.98 in the 3rd follow-up and at the last follow-up at 6 months the mean

FADI was 78.28 +/- 10.55. Compared to baseline, all post-injection follow-ups had significant improvement in the mean FADI Scores. (Table 8)

Table 8: FADI - At various Intervals

FADI -At presentation	FADI - 1 st follow up	FADI - 2 nd follow up	FADI- 3 rd follow up	FADI -4 th follow up
37.12	73.57	75.25	77.53	78.28

There was highly significant improvement in the FADI score, on each successive visit, when compared with the base line FADI score. (Table 9)

Table 9: Paired Sample t test for FADI

	Paired samples t-test			
	Pair	T	df	Sig (p-value)
Pair 1	FADI at presentation- FADI first visit	29.3	59	<0.0001
Pair 2	FADI at Presentation - FADI 2nd visit	25.11	59	<0.0001
Pair 3	FADI at Presentation - FADI 3rd visit	25.70	59	<0.0001
Pair 4	FADI at Presentation - FADI 4th visit	27.25	59	<0.0001

Discussion

Plantar fasciitis is an acute or chronic pain in the inferior heel at the attachment of the medial band of the plantar fascia to the medial calcaneal tubercle [11], also called as plantar enthesopathy, and sub-calcaneal pain syndrome [12]. Chronic plantar fasciitis was defined as characteristic symptoms lasting longer than 6 months [4].

Histological findings showing no evidence of inflammation; rather, showing myxoid degeneration, micro tears, collagen necrosis, and angio-fibroblastic hyperplasia, suggest a chronic degenerative process, not an acute inflammatory one [4]. Corticosteroid injections are considered as the treatment of choice for chronic plantar fasciitis. However, the lack of an inflammatory process histologically in these patients questions its mode of action and has been associated with rupture of the plantar fascia in 2.4 to 10% of patients as well as attenuation of the plantar fat pad [4].

One of the emerging therapeutic modalities is the use of platelet rich plasma for chronic plantar fasciitis having the advantage of being autologous and concentrated that are rich in growth factor proteins that promote the healing process. This study was done to find the efficacy of the PRP in the treatment of plantar fasciitis.

We compared our study with mainly following studies and found our results comparable to them.

1. Rajan Sarad *et al.* (2014) [15]
2. Jeroen C *et al.* (2015) [13]
3. Gyneshwar tank *et al.* (2017) [16]
4. Raeissadat *et al.* (2014) [19]

Age Distribution -The least age in the present study is 18 years and the maximum age is 55 years, the mean in the group is 37.43 +/- 7.48. The most common group is 31-40 years (53%). This is comparable to a study by Rajan Sarad *et al.* [15] (2014) majority of patients (152) falling between age group of 31-50 years. In a study by Jeroen C *et al.* [13] (2015) in 58 patients, the mean age

was 48.7 years old (SD ± 10.3). In another study by Gyneshwar tank *et al.* [16] (2017) the mean patient age was 40.90 ± 9.362 years, with minimum age of 24 and maximum age of 57 years.

Sex distribution: Jeroen C *et al.* [13] (2015) studied 58 patients, of which 45 (73.8%) were women. Rajan Sarad *et al.* [15] (2014) study showed that male to female ratio was 112:88. Raeissadat [19] (2014), study in 20 patients with chronic plantar fasciitis, involved 5 males and 15 females, whereas in present study males appeared to be affected more with plantar fasciitis.

Side in present study: Right side was most commonly involved 52%, while the bilateral involvement is 13%, Rajan Sarad [15] (2014) showed that Bilateral plantar fasciitis was found in 25% patients. Jeroen C *et al.* [13] (2015) studied a total of 61 feet in 58 patients, the right side was treated in 26 patients (42.6%). Raeissadat [19] (2014), study in 20 patients with chronic plantar fasciitis, involved 11 with right side, and 9 left side.

Occupation: Rajan Sarad *et al.* [15] (2014) study involved of Police constables 18, Farmers 46, Teachers 22, Shopkeepers 80, Housewives 23 and Laborers 11. In present study, the most common occupation involved were farmers 32% followed by shop keepers 22% and teachers 17%. All had standing for long hours.

Body mass index: In the present study, the mean BMI was 23.87 +/- 3.17, overall 37% were overweight. Taş Serkan. *et al.* [17] (2017) who evaluated the effects of body mass index on mechanical properties of the plantar fascia and Ozdemir, Huseyin, *et al.* [18] (2005) who did sonographic evaluation of plantar fasciitis and relation to body mass index had a similar opinion. Jeroen C *et al.* [13] (2015) studied a total of 61 feet in 58 patients, in whom, the body Mass Index (BMI) of the patients was between 20 and 40, with a mean of 29.1 (SD ±04.5).

Comparison of VAS Scores: Martin *et al.* [4] (2013) in a study on 23 patients, found that the mean VAS score improved from 7 to 4, which was similar to the present study i.e improvement of VAS from 7.07 to 3.62. In a study conducted by Mukesh Tiwari *et al.* [14] (2013) the cortisone group had a pre- treatment mean VAS score of 8.5, which initially improved to 1.1 at 12 weeks post treatment to 4.9 at 26 weeks, and then continuously increased to near baseline levels of 8.4 at 52 weeks. In contrast, the PRP group started with an average pre- treatment 8.6 score decreased to 3.4 at 12 weeks, remained declining to 1.2 at 26 weeks and 0.3 at 52 weeks. In another study by Gyneshwar tank *et al.* [16] (2017) within group comparison in PRP group, the results are statistically significant (p = <0.05). The mean VAS score decreased from baseline continuously at 4, 8, 12, and up to 24 weeks. The VAS score is statistically significant in comparison with baseline at all durations. The mean VAS score at the initial visit was 8.44, which was reduced to 1.46 at the end of 6 months. Raeissadat [19]. (2014), in a study in 20 patients with chronic plantar fasciitis, found that the mean VAS score at the time of presentation which was 7.2, reduced to 2.7 with a single injection of 2ml PRP.

Table 11: Comparison of Vas Scores in various Studies

Study	Sample size	VAS at presentation	VAS at last follow up
Present study	60	7.07	3.62
Martin <i>et al.</i> 2013 ^[4]	23	7	4
Martinelli <i>et al.</i> 2013	14	7.1	1.9
Ragab <i>et al.</i> 2012	25	9.1	1.6
Kumar v <i>et al.</i> 2013	44	7.7	4.2
Gyneswar tank <i>et al.</i> 2017 ^[16]	30	8.4	1.4
Tiwari <i>et al.</i> 2013 ^[14]	64	8.6	1.2
Raeissadat <i>et al.</i> 2014 ^[19]	20	7.2	2.7

There is a significant difference in the VAS scores $p < 0.001$ from the time of presentation to the last follow up, The mean Visual Analog score was 7.07 at the time of presentation, which was reduced in the subsequent followups to 3.62. Compared to baseline, all post-injection follow-ups had significant reduction in the mean Visual Analog Scores There is significant difference $p < 0.001$ in the FADI score, from the time of presentation to the last follow up. Compared to baseline, there was a significant improvement in FADI in each visit.

Conclusion

We concluded that

1. Plantar fasciitis has a predilection to those who use lower limb for a long time in the form of standing or walking
2. The pain is the most common complaint and this is effectively controlled with Platelet-rich plasma injection
3. PRP injection has a beneficial effect on pain in patients with plantar fasciitis as evidenced by improvement in Visual Analog Scores and Foot and Ankle Disability Index.
4. However, as the study is carried out in a tertiary care hospital and the followup was only for six months maximum, the demography cannot be considered and long-term population based study should be carried out.

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