

Original Research Article

Efficacy of intralesional corticosteroid versus autologous platelet rich plasma injection in the management of chronic plantar fasciitis

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ABSTRACT

Background: Plantar fasciitis is a common pathological condition affecting the hind foot, and a common cause of heel pain. The present study was taken up to assess the efficacy of intralesional corticosteroid compared to autologous platelet rich plasma injection in the management of chronic plantar fasciitis.

Methods: Patients were randomized into two groups (Group A and Group B) of 30 each. Group-A received Corticosteroid injection while Group-B received PRP injection. Patients were assessed functionally using American Orthopaedic Foot and ankle score (AOFAS), Visual analogue scale (VAS) scores before treatment and on follow-up visit at 6 weeks, 3rd month, and 6th month. Ultrasound of heel for plantar fascia thickness was measured before treatment and follow up visit at 6th month.

Results: A significant decrease in VAS score was observed in the corticosteroid group compared to PRP group at 6 weeks while the VAS score continued to decrease in the PRP group at 3 months and 6 months with an increase in the corticosteroid group at 3 months and 6 months. A significant increase in AOFAS was observed in the Corticosteroid group compared to PRP group at 6 weeks which increased in the PRP group at 3 months and 6 months. However it decreased in the corticosteroid group at 3 months and 6 months. Ultrasonographic evaluation showed improvement in fascial thickness in both the groups, but was better in the PRP group.

Conclusions: To conclude our study shows that corticosteroid is more effective for short term relief and PRP is more effective for long term relief.

Keywords: Plantar fasciitis, Platelet-rich plasma, Corticosteroids

INTRODUCTION

Plantar fasciitis is an important clinical cause of infero medial heel pain in adults which occurs due to overuse injury arising due to multiple factors.^{1,2} There is often inflammation at the origin of the plantar fascia and surrounding perifascial structures, such as the calcaneal periosteum.³⁻⁶ Mechanical overload can eventually lead to chronic inflammation and degenerative changes.⁶ Combination of treatment modalities is usually recommended over any individual treatment option.⁶

Mechanical interventions like foot orthoses, foot taping, footwear, night splints, rest, and walking casts have been thought to reduce the load and stress applied to the inflamed plantar fascia to a tolerable level.^{7,8} Other treatment options include drugs such as non-steroidal anti inflammatory drugs (NSAIDs) to relieve pain and steroid injections.^{9,10} Night splints, low dye taping, heel pads, cups and orthoses have also been used with varying success rates.^{11,12} Extra corporeal shock wave therapy is used in the recent years to treat this disease with life style modifications.¹³ Only 5 to 10% of the people will need

surgical intervention like removal of calcaneal spur, neurectomy and plantar fasciotomy.^{14,15} Among the above mentioned treatments, steroid injection is a popular method of treating the condition but is useful in the short term with disappointing long-term results.¹¹ Potentially disabling complications have also been reported, such as rupture of the plantar fascia, infection, and fat pad atrophy.¹⁶ Platelet rich plasma (PRP) is recently being recommended for treatment of plantar fasciitis. It has been shown to cause early relief from pain and is associated with improved functional activities of the patient compared to the other treatment modalities available.¹⁷ Platelet rich plasma is defined as a volume of the plasma fraction of autologous blood having a platelet concentration above baseline. Injecting an aliquot of concentrated platelet enriched plasma into a localized area introduces platelets into the tissue to stimulate a supra-physiologic release of growth factors. This initiates the regenerative process in degenerative conditions and thereby reduces pain.¹⁸ There are only a few studies which have shown the efficacy of PRP to treat plantar fasciitis when compared to other agents.¹⁹⁻²³ In this study we have tried to compare the efficacy of intralesional corticosteroid vs autologous platelet rich plasma injection in the management of chronic plantar fasciitis.

METHODS

Sixty patients were studied in this randomized controlled study conducted from September 2015 to September 2016 at PES Institute of Medical Sciences & Research, Kuppam. Patients were randomized into two groups (Group A and Group B) of 30 each by computer generated random numbers using the “sealed opaque envelope” technique. All patients were diagnosed as plantar fasciitis by clinical and radiological evaluation i.e. presenting complaint of plantar heel pain longer than 6 weeks, plantar fascia thickness >4 mm at the area of maximal tenderness (ultrasound of heel for plantar fascia thickness), failed conservative management of at least 4 weeks duration. Patients with history of severe anaemia, thrombocytopenia and those not willing to participate were excluded from the study.

Group-A (30 patients) were given Corticosteroid injection, Group-B (30 patients) were given PRP injection. Patients in group A (corticosteroid group) were given 2 ml (80 mg) Depomedrol injected along with 0.5ml of plain 2% xylocaine using 20 G wide bore needle into the point of maximum tenderness. Post injection, patients were asked to take rest for 15 min and then allowed to walk.

PRP preparation and administration

For the preparation of P-PRP, blood was withdrawn from cubital vein with help of BD vacutainer eclipse in three BD vacutainer tubes which is a 2.7 ml tube that contains 0.35 ml of 3.2% sodium citrate, an anticoagulant and volume of approximately 2.35 ml for whole blood. It was

prepared using a 2-spin technique. In the 1st low spin step blood is centrifuged at 1200 rpm for 10 min in a Routine 380 R centrifuge model (Hettich, Zentrifugen). After the formation of three layers (a bottom layer composed of RBC; an upper layer composed of plasma, platelets and some WBCs; and an intermediate layer, or buffy coat, composed mostly of WBCs), the upper layer just above Buffy coat was collected with a 10 ml syringe. This collection was performed carefully to avoid disturbing the bottom layer of RBC and the buffy coat layer. Depending on the centrifugal force of the spin, the collected volume ranged from 0.75 ml to 1.25 ml in each BD vacutainer. Approximately 1 ml of the upper layer of the sample that underwent the first spin step was collected and transferred to one empty tube (approximately 3 ml). The tube is centrifuged again for 10 min at 2400 rpm. The upper half of the plasma volume, platelet poor plasma (PPP), was removed. The remaining volume of PPRP was used for injection. Platelet count was estimated by a pathologist. The PRP is randomly checked for number of platelets by Neubauer’s chamber or auto analyser. Most of the samples had a platelet count more than 1,000,000/ul in 5 ml volume that is 5 times the baseline. After this the PRP is shaken by just turning the tube 2 to 3 times to mix the platelets.

PRP injection technique

The procedure was explained to the patient and consent was obtained. With the patient in supine position, the involved foot was identified. The part was cleaned and prepared with spirit and povidone iodine. The site of maximal tenderness i.e. medial aspect of the foot at the origin of plantar fascia usually was marked using a marker. One ml of 2% plain xylocaine was infiltrated into the skin and subcutaneous tissue. Dry needling, also called peppering, was used to locally “injure” the soft tissue to stimulate the inflammatory response. Concomitant delivery of the PRP then modulates (enhances) the healing response. Each marked point of tenderness is penetrated with a 20-gauge needle until the underlying periosteum is touched. A gristly, crunchy texture is audibly and palpably noted as the needle is advanced. After contacting the periosteum, the needle is gently partially withdrawn then advanced in a fan-like wheel (peppering) the area 7 to 10 times. Next, 1 ml of the PRP is injected as this peppering manoeuvre is continued. This process is then carried out at each marked site.

Post injection care

Post injection, patients were rested for 15 min and then allowed to walk. As PRP effectively induces an inflammatory response, some patients experienced minimal to moderate discomfort following the injection which usually lasts for up to 1 week. They were instructed to ice the injected area if needed for pain control and modify activity as tolerated. We recommended acetaminophen as the optimal analgesic, and avoided use of NSAID’s.

After 48 hours, patients were given a standardized stretching protocol to follow for 2 weeks. A formal strengthening program was initiated after this stretching. Patients were advised to avoid strenuous activities and rest for 2 weeks. No aggressive running or jumping activities were allowed for 2 weeks. At 4 weeks after the procedure, patients were allowed to proceed with normal sporting or recreational activities as tolerated. Any type of foot orthoses was not be allowed.

Patients assessed functionally using American Orthopaedic Foot and ankle score (AOFAS), Visual analogue scale (VAS) scores and radio logically by Ultrasound of the heel for plantar fascia thickness.^{23,24} The AOFAS, VAS scores recorded before treatment and on follow-up visit at 6 weeks, 3rd month, and 6th month. Ultrasound of heel for plantar fascia thickness measured before treatment and follow up visit at 6th month.

Statistical analysis

Data was coded and entered into Microsoft excel data sheet and analysis was done by using SPSS 11 software. Data is expressed as mean±standard deviation for continuous variables and as frequency (number [%]) for categorical variables. All statistical analysis were performed using Microsoft excel spreadsheets (Microsoft, Redmond, WA USA). Independent samples T test was used to compare the mean difference between two groups, paired samples T test was used to compare the mean difference between paired data. Karl Pearson’s correlation analysis was used to determine the relationships between two continuous variables of interest. All statistical analysis will be performed using Microsoft excel spreadsheets (Microsoft, Redmond, WA USA) and Statistical package for social sciences for windows version 11.0 (SPSS Inc., Chicago IL, USA). A ‘p’ value <0.05 will be considered as statistically significant.

RESULTS

One patient from the PRP group discontinued at the end of the 6 months while two patients discontinued from the corticosteroid group. As shown in Table 1, female patients were more in both the groups [n=15 (51.72%) in

Group A and n=16 (57.14%) in Group B]. In the study it was observed that among PRP group right heel was involved in 48%, while left heel involvement was seen in 52% of the study subjects. In the steroid group, right heel was involved in 54% while left heel involvement was seen in 46%.

Table 1: Baseline characteristics of the study population.

	PRP group	Corticosteroid group
Number of patients	29	28
Age	40.27±8.03	39.35 ±12.52
Females n,%	15 (51.72)	16 (57.14)
Right heel n,%	14 (48.28)	15 (53.57)
Left heel n,%	15 (51.72)	13 (46.43)
Baseline VAS score	7.137	7.214
Baseline AOFAS	54±4.117	55.63±4.34
Plantar fascia thicknesses, mm	5.73	5.60

AOFAS = American Orthopaedic Foot and ankle score; PRP= Platelet rich plasma; VAS= Visual analogue scale.

Table 2: Visual analogue score in the groups studied.

	PRP group (n=29)	Corticosteroid group (n=28)
Pre treatment	7.137	7.214
6 weeks	2.62	1.928
3 months	1.931	2.89
6 months	1.413	3.785

PRP= Platelet rich plasma; VAS= Visual analogue scale.

As shown in Table 2 and 3, a significant decrease in VAS was observed in the corticosteroid injection group at 6 weeks compared to the PRP group (p=0.007). However, at the end of 3 months, the VAS increased in Corticosteroid group) and further decreased in PRP group (p=0.001) (Figure 1). A significant reduction in the VAS was observed in the PRP group at the end of 6 months, compared to the corticosteroid group (3.78) (p=0.001). This shows that corticosteroid is more effective for short term relief and PRP is more effective for long term relief.

Table 3: Pain severity in the groups studied.

VAS	Pre treatment		6th week		3rd month		6th month	
	Steroid (%)	PRP (%)	Steroid (%)	PRP (%)	Steroid (%)	PRP (%)	Steroid (%)	PRP (%)
No pain (VAS-0)	0	0	0	0	0	0	5 (17.24)	0
Mild pain (VAS-1,2,3)	0	0	14 (48.28)	23 (82.14)	24 (82.76)	10 (35.71)	20 (68.97)	6 (21.43)
Moderate pain (VAS- 4,5,6)	10 (34.48)	6 (21.43)	15 (51.72)	5 (17.86)	5 (17.29)	18 (64.29)	4 (13.79)	22 (78.57)
Severe pain (VAS- 7,8,9)	19 (65.52)	22 (78.57)	0	0	0	0	0	0
Worst pain (VAS- 10)	0	0	0	0	0	0	0	0
P value	0.273		0.007		0.001		0.001	

PRP= Platelet rich plasma; VAS= Visual analogue scale.

Table 4: AOFAS score in the groups studied.

AOFAS score	PRP Group (n=29)	Corticosteroid group (n=28)	P value
Pre treatment	54±4.117	55.63±4.34	0.9442
6 Weeks	79.3±2.36	86.06±2.69	0.0155
3 Months	85.72± 2.36	78.57 ±1.91	0.001
6 Months	90.03 ±3.37	74.67±3.69	0.001

PRP= Platelet rich plasma; AOFAS = American Orthopaedic Foot and ankle score

Table 5: Plantar fascia thickness at various intervals in the groups studied.

Average plantar fascia thicknesses in each group		
	PRP group (n=29)	Corticosteroid group (n=28)
Pretreatment (mm)	5.73	5.60
6 Months (mm)	3.35	3.75
% reduction fascia thickness	41.54	33.04

PRP= Platelet rich plasma.

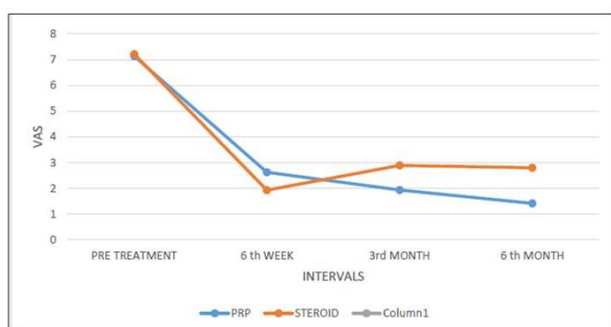


Figure 1: Mean VAS scores in the groups studied.

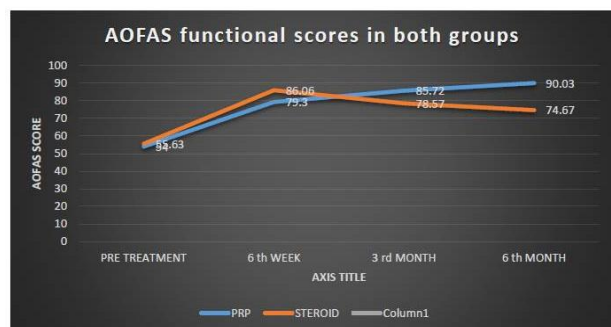


Figure 2: Mean AOFAS scores in the groups studied.

As shown in Table 4, a significant increase in AOFAS was found in the Corticosteroid group as compared to PRP group at 6 weeks ($p < 0.001$). At the end of 3 months, the AOFAS decreased in corticosteroid group and further increased in PRP group ($p = 0.001$). At the end of 6 months, a significant increase in AOFAS was observed in the PRP group compared to Corticosteroid group ($p = 0.001$) (Figure 2). This shows that Corticosteroid is more effective for short term relief and PRP is more effective for long term relief.

As shown in Table 5, ultrasonographic evaluation showed that both the groups had similar baseline plantar fascia thickness prior to injection. After 6 months of injection, the PRP group had a significant reduction in the thickness of plantar fascia compared to corticosteroid group ($p < 0.001$).

DISCUSSION

The present study aimed to compare the efficacy of intralesional corticosteroid vs autologous platelet rich plasma injection in the management of chronic plantar fasciitis; a very common musculo skeletal problem encountered in orthopaedic day today practice. Plantar fasciitis accounts for 11 to 15% of all foot problems in adults and peaks between 40 to 60 years. The patients in our study had a mean of 40 years (range: 27-51 years). Other studies have reported a mean age between 38 to 46 years.^{22,25-27} Females were more frequently affected (52% in PRP group and 57% in the corticosteroid group) in our study. Though gender differences have not been shown in patients with planter fasciitis, a recent study observed a slight male preponderance (57.5%) contrary to our finding.²² Various studies have reported the use of PRP in the treatment of plantar fasciitis and have also compared the effectiveness of PRP and Corticosteroid injections.^{20,21,28}

Initially thought to be an inflammatory disease, plantar fasciitis is now known to occur due to multiple etiologies including anatomical, biochemical and environmental factors.¹ Often a combination of factors are involved. The term fasciosis has been recommended owing to the chronicity of the disease and the evidence of degeneration rather than inflammation.^{29,30} The treatment modalities also vary owing to the different etiologic factors. Conservative approaches¹⁰ such as NSAIDs, low dye taping, heel pads, cups, orthoses, soft soled shoes and night splints, take few weeks to months for the healing.²

However, most of them have limited scientific evidence of their efficacy.

Corticosteroids are recommended owing to their strong anti-inflammatory effect. Corticosteroids act through inhibition of fibroblast proliferation and ground substance protein expression fasciitis.³¹ PRP being rich in platelets provide a higher concentration of the bioactive growth factors reported to promote healing. Many growth and differentiation factors are released from the alpha granules, which are the storage units found in platelets. In vivo and in vitro researches also suggest that PRP induces over expression of additional endogenous growth factors beyond what is contained within the platelet concentrate. The potential benefits of PRP are thought to rely on intrinsic properties and interplay between the concentrated growth factors. Some of these important growth factors include platelet derived endothelium growth factors, transforming growth factors- β , vascular endothelium growth factors, fibroblast growth factors, epidermal growth factor and insulin like growth factor-1. Complex interaction of these growth and differentiation factors, along with adhesive protein factors such as fibronectin and vitronectin are what is responsible for the healing response, promoting the long regenerative process of chemotaxis, cell proliferation, removal of tissue debris, angiogenesis, extracellular matrix formation, osteoid production and collagen synthesis. The needle induced bleeding during injection provides the clotting factor thrombin needed to activate platelets. Thus PRP accelerate the physiological process of healing.³²

On subjective assessment of the treatment modalities using VAS score, we found that corticosteroid is more effective for short term relief and PRP is more effective for long term relief as evidenced by a significant decrease in VAS score ($p < 0.001$) in the corticosteroid group (1.92) as compared to PRP group (2.62) at 6 weeks while the VAS score continued to decrease in the PRP group at 3 months (1.93) and 6 months (1.41) and increased in the corticosteroid group at 3 months (2.89) and 6 months (3.78). This is in agreement with an earlier study reported.²¹ VAS score to be significantly reduced in both PRP and corticosteroid groups at one month, but at 3 months following treatment it increased in Corticosteroid group and remained constant in PRP group till 6 months. Other studies have reported superior results of PRP over corticosteroid therapy.^{13,33} A recent study has reported both the therapies to be equally effective.²² Others also have reported equal efficacy for both PRP and corticosteroid therapy.^{25,26}

Functional assessment in terms of the AOFAS score also showed that corticosteroid is more effective for short term relief and PRP is more effective for long term relief as evidenced by a significant increase in AOFAS in the Corticosteroid group compared to PRP group at 6 weeks ($p < 0.001$) which increased in the PRP group at 3 months (85.72) and still further increased at 6 months (90.03). However it decreased in the corticosteroid group at 3

months (78.57) and 6 months (74.67). Previous studies have reported improvement or no change on follow-up. Jain et al have reported an improvement in both the groups but the change was not statistically significant between the groups. However the duration of follow-up was for a longer time; 2 years in one study.³³

Ultrasonographic evaluation is commonly employed for to assess the thickness of the plantar fascia and is of diagnostic significance.³⁴ The thickness improved in both the groups. However, PRP group showed a better improvement in the thickness of the plantar fascia compared to the corticosteroid group in our study. However, Jain et al observed plantar fascia thickness to be reduced more quickly in patients who received corticosteroid injection compared to those who received a PRP injection at 3 months.²³ The decrease was however comparable at 6 months follow-up. We have assessed the plantar fascia thickness at baseline and at 6 months. Other studies have shown effectiveness of both the treatment modalities in decreasing the plantar fascia thickness.^{35,36}

To conclude, our study shows that PRP injection is more effective treatment for long term relief of chronic heel pain. Thus, PRP could be a biological option for a common orthopaedic and recalcitrant orthopaedic problem like heel pain/plantar fasciitis.

Limitation

The small sample size and the shorter duration of follow-up of the study are the important limitations. Also, variability of platelet concentration from patient to patient is another limitation. The findings need to be confirmed in larger prospective studies with a longer duration of follow-up.

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