



## Comparative Study of Efficacy of Local Injection of Platelet Rich Plasma and Corticosteroid in Patients of Chronic Plantar Fasciitis

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### ABSTRACT

**Introduction:** One of the most prevalent causes of pain in the heels is Plantar Fasciitis, which presents as discomfort in the medial part of the calcaneal tuberosity, where plantar fascia insertions occur. Platelet Rich Plasma (PRP) exhibits potent anti-inflammatory characteristics while having no negative impact on the structure of the plantar fascia. These days, it appears to be a potential treatment for a number of orthopaedic issues, including nonunion, arthritis in the knee, and tendon disorders.

**Aims/objective:** To compare the effects of local injection of platelet-rich plasma and corticosteroid in chronic plantar fasciitis with respect to improvement in pain, functional mobility, and reduction in thickness of plantar fascia.

**Materials and Method:** 35 patients of chronic plantar fasciitis in corticosteroid group received a single local injection of 1 millilitre of methylprednisolone (40 mg/ml) under local anaesthesia, while 35 patients PRP group received a local autologous platelet-rich plasma injection. At the time of local injection (baseline), at the completion of the 3 months, and 6 months of follow-up, the patients were assessed using the visual analog scale (VAS) and the AOFAS score. Plantar fascia thickness was measured at baseline and 6 months.

**Results:** At 3 months of follow-up, patients of chronic plantar fasciitis receiving corticosteroid injection had significantly better improvement but after 6 months, patients receiving PRP therapy had significantly better improvement with respect to AOFAS score and VAS pain score ( $p < 0.05$ ). There was significantly more decrease in plantar fascia thickness in patients receiving PRP injection as compared to corticosteroid group after 6 months ( $p < 0.05$ ).

**Conclusion:** Local injection of PRP is more successful than corticosteroid injections in the long-term improvement in functional mobility and discomfort but corticosteroid was more effective for treating pain immediately.

**Keywords:** Chronic Plantar Fasciitis, Platelet Rich Plasma, Corticosteroid, Pain, Functional Mobility.

### INTRODUCTION

Plantar fasciitis (PF), also known as plantar fasciosis, is a condition in which the plantar fascia degenerates and causes inflammation.<sup>1-3</sup> The primary cause of it is the bio-mechanical strain placed on the plantar fascia.<sup>4</sup> The plantar fascia is a slender, elastic band of fibrous connective tissue that is longitudinally oriented and mostly composed of a dense extracellular matrix of hyaluronan.<sup>5</sup> The novel cell called fasciocytes, which was initially identified in the plantar fascia by Stecco et al. (2018), is responsible for producing hyaluronan, which facilitates the gliding activity within the deep fascia and muscle.<sup>6</sup> Via the heel periosteum, the plantar fascia and Achilles' para-tendon are closely connected. Consequently, any inflammatory or degenerative condition within the Achilles para-tendon might interfere with proper foot mechanics, increasing the overall thickness of the plantar fascia and causing plantar fasciitis.<sup>7</sup>

With an average global occurrence rate of 10%, the plantar fasciitis lowers quality of life.<sup>8-10</sup> It is more prevalent in females than in males because of the disparities in health and way of life between males and females.<sup>11-12</sup> One of the most prevalent causes of pain in the heels is Plantar

Fasciitis, which presents as discomfort in the medial part of the calcaneal tuberosity, where plantar fascia insertions occur. It gets worse when patient take your first morning step, stand for extended periods of time, or get up from a sitting position.<sup>13</sup> In the overall population, heel pain is 3.6 percent to 7% common, and in athletes, it accounts for roughly 8% of cases.<sup>14</sup>

In 80 to 90% of instances, plantar fasciitis resolves in 10 months or less.<sup>15,16</sup> First-line treatments for this condition include non-steroidal anti-inflammatory drugs (NSAIDs), shoe inserts, stretching procedures, and extracorporeal shockwave therapy.<sup>17,18</sup> These treatments have been shown to be successful in as many as ninety per cent of cases, and if non-surgical treatment is unsuccessful, local injection of corticosteroid is typically used.<sup>19,20</sup> Its anti-inflammatory qualities contribute to its effectiveness in preventing plantar fascia degeneration but can also lead to heel fat pad wasting, calcaneal osteomyelitis, injection-related lateral plantar nerve damage, and burning of the overlying skin.<sup>21,22</sup>

While a steroid injection might provide temporary respite, a recent analysis found no long-term benefit in comparison to a placebo in follow-ups after six months.<sup>23</sup> Conversely,



Platelet Rich Plasma (PRP) exhibits potent anti-inflammatory characteristics while having no negative impact on the structure of the plantar fascia. High concentrations of growth factors and cytokines with anti-inflammatory properties are present in it; they may help prevent infections, improve wound, bone, and tendon healing, and maybe improve degenerative disorders.<sup>24-27</sup> PRP has therefore been a biological choice for treatment of plantar fasciitis.<sup>27</sup>

In the field of regenerative medicine, treatment using PRP is a relatively new technique.<sup>28</sup> These days, it appears to be a potential treatment for a number of orthopaedic issues, including non union, arthritis in the knee, and tendon disorders.<sup>29</sup> Naturally, its use in managing Achilles tendinopathies has grown.<sup>30</sup> Nonetheless, there is disagreement between orthopaedic surgeons on the PRP's efficacy.<sup>31</sup> Most of the time, the exorbitant cost of commercially accessible PRP kits deters people from using PRP therapy.<sup>32</sup>

By implementing a standardized laboratory infrastructure and PRP preparation methodology in underdeveloped nations, the economic strain on the healthcare system can be reduced, as homemade standard PRP is more dependable and economical than commercially accessible PRP kits [38]. In order to manage plantar fasciitis in India, this study compared the effects of local injection of platelet-rich plasma and corticosteroid in chronic plantar fasciitis with respect to improvement in pain, functional mobility, and reduction in thickness of plantar fascia.

## MATERIALS AND METHODS

This was a comparative, prospective and observational study conducted in patients of chronic plantar fasciitis in Department of Orthopaedics of SKMCH, Muzaffarpur, Bihar (a tertiary care centre of eastern India) from January 2023 to June 2023 after getting approval of institutional ethics committee. Patients of chronic plantar fasciitis fulfilling our eligibility criteria were enrolled in the study after written informed consent under guidelines of declaration of Helsinki and good clinical practice.

**Inclusion Criteria:** Patients of either gender of age between 18 to 65 years of age with diagnosis of plantar fasciitis of duration greater than 6 months with persistent symptoms even after 1 month of conservative therapy were included in the study.

**Exclusion Criteria:** Patients who had received corticosteroid injection within past 3 months or have received any non-steroid anti-inflammatory drug within 1 week before enrolment to the study or with history of foot deformity or with history of foot surgery or with diagnosis of neuropathy or pregnant or lactating women or with any acute illness were excluded from our study.

Considering the result of previous study,<sup>33</sup> minimum sample size required to achieve 85% power with alpha

value of 0.05 was found to be 70 with 35 patients in each group.

Using a straightforward randomization process (web generated random numbers), participants were randomized to one of two treatment groups. Patients in corticosteroid group received a single local injection of 1 millilitre of methylprednisolone (40 mg/ml) under local anaesthesia, while PRP group received a local autologous platelet-rich plasma injection.

**Method of PRP preparation:** 20 ml of blood was extracted from the antecubital vein using a 10-cc syringe and placed into sterile, disposable test tubes coated with anticoagulant while adhering to aseptic procedures. Initially, the test tube was put straight into the centrifuge and the whole blood was centrifuged. "Soft spin" refers to the initial spin, which lasts three minutes at 3000 revolutions per minute. Blood is separated into red blood cell, platelets, buffy coat, and top layer of Platelet Poor Plasma as a result of this. Using a long-bore, sterile micropipette, the upper layer of plasma, containing the platelets and buffy coat, is transferred into a different test tube. This undergoes a second centrifugation process known as the "hard spin," which runs for 15 minutes at 4500 rpm. As a result, platelet rich and platelet poor plasma separate. Using a long bore sterilized micropipette, the platelet poor plasma layer was removed, and approximately 4-5ml of platelet rich plasma was collected and made ready for usage.

Following a thorough cleaning, betadine coating, surgical spirit, and sterile dressing, the patients in each group received the appropriate injections (corticosteroids or PRP). The injection was administered at the heel's most painful area while the patient was in a supine position with their leg externally rotated.

**Outcome Variables:** At the time of local injection (baseline), at the completion of the 3 months, and 6 months of follow-up, the patients were assessed using the visual analog scale (VAS) and the AOFAS score. Plantar fascia thickness was measured at baseline and 6 months.

The AOFAS (American Orthopaedic Foot & Ankle Society) score incorporated the objective ratings assessed by the orthopaedic surgeon after performing a physical checkup of the patients with the subjective pain and functional mobility scores provided by the patients. Sagittal movement, hindfoot movement, ankle-hindfoot stability, and ankle-hindfoot alignment were used to evaluate them. Nine items altogether, divided down into three sub-scales (pain, function, and alignment), made up the AOFAS. A score of 100 points represents the absence of any symptoms or limitations.<sup>34</sup>

The VAS was a horizontal line of 10 centimeters, with ends designating pain levels from zero to 10, where zero meant "no pain at all" and 10 meant "worst pain".<sup>35</sup> A qualified radiologist used high-resolution ultrasound to measure the thickness of the PF. If the thickness of the PF was more



than 4 mm, the cut-off value for confirming PF was applied.<sup>36</sup>

**Statistical Analysis**

Data collected from patients of chronic plantar fasciitis were presented in tabular form using Microsoft Excel 365 and transferred to graph pad version 8.3 for further statistical analysis. Baseline demographic and clinical data such as age, sex, side of lesion were expressed as frequency and compared between two groups using chi-square test of fisher’s exact test. Outcome parameters such as AOFAS score, VAS score, and thickness of plantar fascia were expressed in mean ± SD and compared between two groups using unpaired t-test.

**RESULTS**

**Table 1:** Comparison of baseline demographic and clinical characteristics between PRP and corticosteroid group

Variables	Number of Patients in PRP Group (%) n = 35	Number of Patients in Corticosteroid Group (%) n=35	P-Value
Age Group			
18-30	11	13	0.88*
31-50	16	15	
51-65	8	7	
Gender			
Male	5	6	>0.99**
Female	30	29	
Side of Plantar Fasciitis			
Left	17	16	>0.99**
Right	18	19	
Presence of Calcaneum Spurs			
Yes	14	12	0.80**
No	21	23	

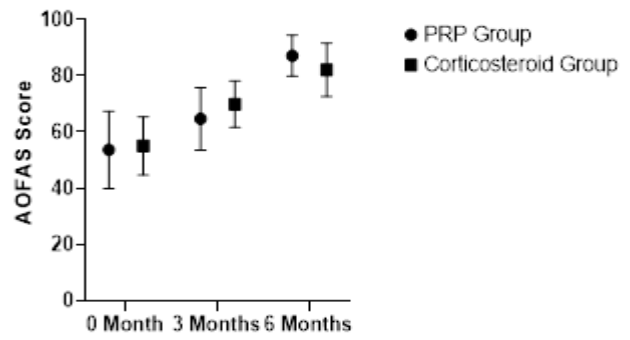
\*Chi-square test: No statistically significant difference

\*\*Fisher’s exact test: No statistically significant difference

Most of the patients of chronic plantar fasciitis belonged to 31 to 50 years of age group and most of them were females. There was slightly higher frequency of cases with right sided plantar fasciitis and with no calcaneum spurs. Both groups were similar with respect to age, sex, side of lesion and presence of calcaneum spurs (p<0.05).

**Table 2:** Comparison of AOFAS score between PRP and corticosteroid group

Time	AOFAS Score in mean ± SD		P-Value (Unpaired t-test)
	PRP Group n = 35	Corticosteroid Group n=35	
Baseline	53.64 ± 13.76	55.03 ± 10.36	0.63
3 Months	64.69 ± 11.13	69.87 ± 8.29	0.03
6 Months	87.15 ± 7.34	82.12 ± 9.49	0.02



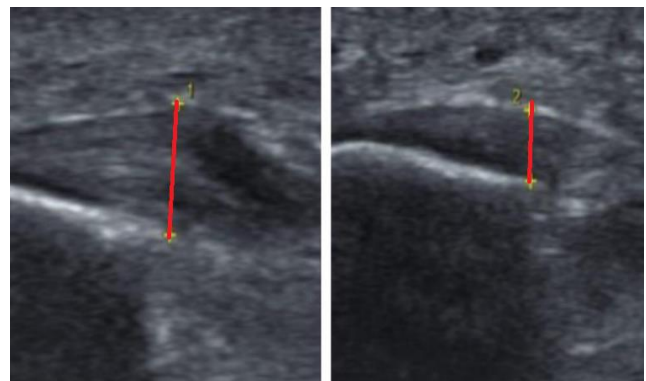
**Figure 1:** Comparison AOFAS Score between Two Groups

At baseline both groups were similar with respect to AOFAS score with no statistically significant difference (p>0.05). At 3 months of follow-up, patients of chronic plantar fasciitis receiving corticosteroid injection had significantly better improvement but after 6 months, patients receiving PRP therapy had significantly better improvement with respect to AOFAS score (p <0.05).

**Table 3:** Comparison of VAS score between PRP and corticosteroid group

Time	VAS Score in mean ± SD		P-Value (Unpaired t-test)
	PRP Group n = 35	Corticosteroid Group n=35	
Baseline	5.33 ± 1.23	4.98 ± 1.04	0.20
3 Months	4.32 ± 0.95	3.25 ± 0.83	<0.0001
6 Months	2.08 ± 1.02	2.82 ± 0.91	0.002

Patients receiving corticosteroid therapy had significantly better pain control after 3 months but after 6 months, patients receiving PRP injection had significantly better pain control than corticosteroid group (p<0.05).



**Figure 3:** Estimation of Plantar Fascia Thickness by Ultrasonography

**Table 4:** Comparison of Plantar Fascia Thickness between PRP and corticosteroid group

Time	Plantar Fascia Thickness (mm) in mean ± SD		P-Value (Unpaired t-test)
	PRP Group n = 35	Corticosteroid Group n=35	
Baseline	5.61 ± 0.89	5.72 ± 0.92	0.61
6 Months	3.64 ± 0.78	4.63 ± 0.97	<0.0001

There was significantly more decrease in plantar fascia thickness in patients receiving PRP injection as compared to corticosteroid group after 6 months ( $p < 0.05$ ).

## DISCUSSION

The purpose of the study was to evaluate the effectiveness of PRP and steroid injections in the management of plantar fasciitis. In three months, this study demonstrates that corticosteroids performed better than PRP; however, after six months, PRP produced a greater improvement in AOFAS score and reduced severe pain more than corticosteroids.

At 3 months, the patients' health was shown to be greater in the corticosteroid group when it came to pain and functional mobility; nevertheless, the PRP group experienced longer-lasting pain alleviation and greater physical function at 6 months. These results align with those of previous research.<sup>37, 38</sup> In contrast to PRP, which improves more slowly but has a longer-lasting impact, steroid injections reduced symptoms more quickly, according to systematic reviews.<sup>39,40</sup>

PRP is superior to corticosteroid injection for chronic pain relief in plantar fasciitis, according to Yang et al.'s 2017 study.<sup>41</sup> However, there was no discernible significant difference between the short and intermediate term benefits. The fact that PRP contains growth factors and numerous other molecules with biologically restorative qualities for healing helps shed light on this.<sup>42</sup>

After 10 minutes of PRP injection, approximately 70 percent of the growth factors are released in an hour. The platelets continue to synthesis and produce growth factors for an additional 8 days until they die. After injection, full activity takes between six and eight weeks.<sup>43</sup> This characteristic is absent in corticosteroid, which also disrupt the immunological and proinflammatory cascade, which has a brief duration.<sup>40, 44</sup> According to Ang et al. (2019), corticosteroids can reduce acute pain in lateral epicondylitis patients, but they do not provide chronic pain relief. This could be because of the corticosteroid short half-life.<sup>31</sup> It could be the cause of why patients who receive local corticosteroids recover quickly. As a result, individuals resume their harmful activities without receiving the necessary therapy, which raises the risk of recurrence.<sup>21, 31</sup>

In addition to this, we now understand that plantar fasciitis is caused by a degenerative process as opposed to an inflammatory one.<sup>45</sup> Histologically, PF has a minor fascia tear that heals into normal fascia as well as surrounding tissue through angio-fibroblastic hyperplastic tissues. It is feasible when pro and anti-inflammatory cytokines and interleukins, like TNF- $\alpha$ , IL 4, 8, 13, interferon- $\alpha$  are present in PRP.<sup>41</sup> Similar to this, PRP supplies the many growth factors that plantar fasciitis lacks because of its high vascularity and low cellularity.<sup>46</sup>

The results of this study demonstrated that the plantar fascia thickness in both the PRP and corticosteroid groups

was similar at baseline ( $5.61 \pm 0.89$  mm versus  $5.72 \pm 0.92$  mm), confirming the presence of plantar fasciitis. A value of greater than 4 millimetres for plantar fascia thickness is suggestive of plantar fasciitis.<sup>36</sup> Our research revealed a statistically and clinically significant decrease in plantar fascia thickness in the group receiving PRP after six months compared to the corticosteroid group.

According to Kalia et al., 2021, corticosteroid injection considerably lessens plantar fascia thickness at 1 and 3 months compared to PRP, but there was no change at six months.<sup>47</sup> According to McMillan et al. (2012), steroid injections can minimize aberrant plantar fascia thickening for a maximum of 3 months.<sup>14</sup> Within 6 months of follow-up, data show a 35.45% decrease in plantar fascia thickness in the PRP group and a 29.16% decrease in the corticosteroid group.<sup>46</sup>

It has not been thoroughly investigated how the corticosteroid and PRP injections reduce the thickness of the plantar fascia. Nonetheless, it is justified by the fact that the inflammatory episode is linked to the thickening of the plantar fascia, and that corticosteroids and PRP both have anti-inflammatory effects and can lessen inflammation.<sup>5, 20</sup> Nevertheless, PRP may be preferable to corticosteroid injection due to its regenerative qualities, which corticosteroids lack and are therefore transient.<sup>20</sup> PRP may therefore control the deterioration of the plantar fascia. As a matter of fact, plantar fasciitis is not primarily an inflammatory illness, but rather a degenerative condition.<sup>48</sup> Steroids have little effect on healing; they just momentarily lessen discomfort. After six months, PRP's effects last longer than those of corticosteroids.<sup>37</sup>

This research has certain restrictions. Because this study was carried out in a tertiary care hospital, the results of our intervention may be impacted by the fact that the majority of the patients had previous treatment from another facility. Furthermore, the majority of plantar fasciitis patients chose conservative care over injectable therapy, which prevented the bigger sample size from being able to generalize the results in a large population. Similarly, because there were no confounding factors related to the plantar fasciitis, the multivariate analysis could not have been used.

## CONCLUSION

According to the study's findings, local injections of platelet rich plasma and corticosteroid can both relieve symptoms in patients with chronic plantar fasciitis. Local injection of PRP is more successful than corticosteroid injections in the long-term improvement in functional mobility and discomfort but corticosteroid was more effective for treating pain immediately. More extensive multi-centre trials with a follow-up period of longer than six months are necessary to produce strong data comparing the effectiveness of PRP to corticosteroid injection for the management of chronic plantar fasciitis.



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