

Clinical and Ultrasonographic Trajectories after Platelet-Rich Plasma and Corticosteroid Injection for Chronic Plantar Fasciitis: A Six-Month Prospective Comparative Study

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Abstract

Background: Chronic plantar fasciitis is a common cause of persistent heel pain. Corticosteroid injection provides rapid symptomatic relief, whereas platelet-rich plasma (PRP) may offer a more sustained regenerative response. This study compared the clinical and ultrasonographic outcomes of PRP and corticosteroid injections in chronic plantar fasciitis. **Material and Methods:** This prospective, open-label, non-randomized comparative interventional study included 60 patients with chronic plantar fasciitis, with 30 patients each receiving PRP or corticosteroid injection. Pain was assessed using the Visual Analogue Scale (VAS), and functional outcome was evaluated using the American Orthopaedic Foot and Ankle Society (AOFAS) score at baseline, 6 weeks, 12 weeks and 6 months. Plantar fascia thickness was measured by ultrasonography at baseline and 6 months. **Results:** Baseline characteristics were comparable between the two groups. At 6 weeks, corticosteroid produced significantly better pain relief and functional improvement, with lower VAS scores (3.9 ± 0.9 vs. 4.9 ± 0.9 ; $p < 0.001$) and higher AOFAS scores (84.0 ± 4.6 vs. 78.2 ± 4.9 ; $p < 0.001$). At 12 weeks, the VAS difference was not significant, while AOFAS scores favored PRP. At 6 months, PRP demonstrated significantly lower VAS scores (1.9 ± 0.7 vs. 3.2 ± 0.9 ; $p < 0.001$) and higher AOFAS scores (90.3 ± 4.0 vs. 79.8 ± 5.2 ; $p < 0.001$). Plantar fascia thickness was also significantly lower with PRP at 6 months (3.38 ± 0.42 vs. 3.81 ± 0.55 mm; $p = 0.001$). **Conclusion:** Corticosteroid injection provides greater short-term relief, whereas PRP offers superior sustained pain relief, functional recovery and ultrasonographic improvement at 6 months.

Keywords: Chronic plantar fasciitis; platelet-rich plasma; corticosteroid injection; visual analogue scale; AOFAS; plantar fascia thickness.

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INTRODUCTION

Plantar fasciitis is one of the most common causes of plantar heel pain encountered in orthopaedic practice and is estimated to affect approximately 7–10% of the general population during their lifetime. It commonly presents with pain over the plantar-medial aspect of the heel, typically most severe with the first few steps after waking or following prolonged rest.^[1,2] Although traditionally described as an inflammatory condition, current evidence suggests that chronic plantar fasciitis is predominantly a degenerative fasciopathy, characterized by repetitive microtrauma, collagen disorganization, fascial thickening and impaired tissue healing at the calcaneal insertion. Obesity, prolonged standing, repetitive loading, altered foot biomechanics and reduced ankle dorsiflexion are among the recognized predisposing factors.^[3,4]

Initial management is primarily conservative and includes activity modification, plantar fascia and calf-stretching exercises, appropriate footwear, orthoses, analgesics and other physical therapies. Most patients improve with non-operative treatment; however, a proportion continue to experience persistent symptoms and require additional interventions.^[2,3,5] Corticosteroid injection has traditionally been used for resistant plantar fasciitis because of its ability

to provide relatively rapid pain relief. Its benefit, however, may diminish with time, and repeated injections are associated with concerns such as plantar fascia rupture and heel fat-pad atrophy.^[6]

Platelet-rich plasma (PRP) has emerged as a biological alternative for chronic plantar fasciitis. PRP is an autologous concentrate of platelets containing growth factors and bioactive mediators that may promote cellular proliferation, angiogenesis, collagen remodeling and tissue repair. This biological mechanism is particularly relevant to chronic plantar fasciitis because the underlying pathology is predominantly degenerative rather than purely inflammatory. Unlike corticosteroids, which primarily provide symptomatic anti-inflammatory effects, PRP is

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intended to promote a reparative response within the diseased plantar fascia, although its clinical effect may develop more gradually.

Several clinical studies have compared PRP with corticosteroid injections, but the reported pattern of response has not been completely uniform. Corticosteroids have frequently shown greater or earlier symptomatic improvement, whereas PRP has demonstrated more sustained improvement in pain and functional outcomes at later follow-up in several studies.^[7,8] Systematic reviews have similarly suggested a potential advantage of PRP at intermediate and longer follow-up, particularly for functional recovery; however, differences in PRP preparation, injection protocols, patient selection, follow-up duration and outcome measures contribute to heterogeneity in the available evidence. Moreover, ultrasonography provides an objective means of assessing structural changes in the plantar fascia and may complement patient-reported pain and functional outcomes.^[9]

Considering these differences in the expected temporal effects of the two treatments, assessment at a single follow-up point may not adequately reflect their relative clinical benefit. Evaluation of pain, functional recovery and structural changes in plantar fascia thickness over time may provide a more comprehensive comparison of treatment response. Therefore, the present study was undertaken to compare the clinical and ultrasonographic outcomes of autologous PRP and corticosteroid injections in patients with chronic plantar fasciitis, with serial assessment of pain and functional outcomes and ultrasonographic evaluation of plantar fascia thickness over a six-month follow-up period.

MATERIALS AND METHODS

Study Design and Setting: This prospective, open-label, non-randomized comparative interventional study was conducted in the Department of Orthopaedics of a tertiary care centre. Patients were recruited over a period of six months and were followed for six months after the intervention. The study was conducted in accordance with institutional ethical requirements, and written informed consent was obtained from all participants before enrolment.

Study Participants: Patients aged 18–65 years presenting to the Orthopaedics outpatient department with chronic plantar fasciitis were included. Diagnosis was based on characteristic plantar heel pain, particularly during the first few steps after waking or after a period of rest, along with maximal tenderness over the medial calcaneal tubercle. Patients were eligible if symptoms had persisted for at least six months despite a minimum of six weeks of conservative treatment consisting of activity modification, stretching exercises, analgesics and appropriate footwear or heel support. Patients with previous PRP or corticosteroid injection in the affected heel within the preceding six months, previous foot surgery, significant foot deformity, inflammatory arthritis, peripheral neuropathy, active local or systemic infection, bleeding disorder, anticoagulant therapy, calcaneal stress fracture, Achilles tendon pathology or pregnancy were excluded. In patients with bilateral

involvement, the more symptomatic heel was considered for treatment and subsequent outcome assessment.

Sampling, Group Allocation and Blinding: A total of 60 eligible patients were enrolled by consecutive sampling and divided equally into two treatment groups. Group A consisted of 30 patients treated with autologous platelet-rich plasma injection, while Group B consisted of 30 patients treated with corticosteroid injection. A formal a priori sample size calculation was not performed, and the sample size was based on the number of eligible patients recruited during the study period. No formal random sequence generation or allocation concealment was performed; therefore, the study was considered non-randomized. Both the participants and treating orthopaedic surgeon were aware of the treatment administered, and outcome assessment was not performed by an independent blinded assessor. The study was therefore conducted as an open-label comparative study.

Platelet-Rich Plasma Injection: For patients in Group A, 20 mL of autologous venous blood was collected from the antecubital vein under aseptic precautions into sterile anticoagulant-coated tubes. PRP was prepared using a double-spin centrifugation technique. The first soft spin was performed at 3000 rpm for 3 minutes, resulting in separation of red blood cells, buffy coat and plasma. The upper plasma layer containing the platelets and buffy coat was transferred to another sterile tube and subjected to a second hard spin at 4500 rpm for 15 minutes. The platelet-poor supernatant was discarded, leaving approximately 4–5 mL of PRP for injection. With the patient in the supine position and the affected leg externally rotated, the heel was cleaned and draped under strict aseptic precautions. A single PRP injection was administered through a medial approach at the point of maximal tenderness over the medial calcaneal tubercle and plantar fascia origin. This double-spin preparation yielding approximately 4–5 mL of PRP is consistent with the comparative protocol reported in the supporting literature.

Corticosteroid Injection: Patients in Group B received a single injection of 1 mL methylprednisolone acetate containing 40 mg of methylprednisolone. Under strict aseptic precautions, the patient was positioned supine with the affected leg externally rotated, and the injection was administered through a medial approach at the point of maximal tenderness over the medial calcaneal tubercle and plantar fascia origin. Patients were observed briefly following the procedure for any immediate adverse reaction. The use of a single 40-mg methylprednisolone injection has also been employed in comparative studies of PRP and corticosteroid treatment for chronic plantar fasciitis.

Post-Injection Protocol: Patients in both groups were advised relative rest for 48 hours following injection and avoidance of strenuous weight-bearing activities for one week. Thereafter, routine activities were gradually resumed according to pain tolerance, and patients were instructed to perform standardized plantar fascia and calf-stretching exercises. Paracetamol was permitted when required for post-injection pain, while non-steroidal anti-inflammatory drugs were avoided during the immediate post-injection period. No additional local injection therapy was administered during the follow-up period.

Follow-up and Outcome Assessment: All patients were assessed at baseline and subsequently at 6 weeks, 12 weeks and 6 months after the intervention. The primary outcome was the change in pain intensity from baseline to 6 months, assessed

using the 10-point Visual Analogue Scale, in which 0 represented no pain and 10 represented the worst imaginable pain. Functional outcome was assessed using the American Orthopaedic Foot and Ankle Society Ankle-Hindfoot Score. VAS and AOFAS scores were recorded at baseline, 6 weeks, 12 weeks and 6 months. Plantar fascia thickness was assessed by ultrasonography at baseline and at the 6-month follow-up, with thickness measured at the proximal plantar fascia near its calcaneal insertion. A plantar fascia thickness greater than 4 mm was considered abnormal. Treatment-related adverse events, including post-injection pain, local infection, skin changes and plantar fascia rupture, were documented throughout the follow-up period. Similar comparative studies have assessed VAS and functional scores serially and plantar fascia thickness at baseline and 6 months.

Statistical Analysis: Data were entered into Microsoft Excel and analysed using Epi Info. Continuous variables were summarized as mean with standard deviation or median with interquartile range according to their distribution, while categorical variables were expressed as frequencies and percentages. Normality of continuous variables was assessed

using the Shapiro–Wilk test. Baseline continuous variables were compared between the two groups using the independent-samples t-test or Mann–Whitney U test, as appropriate, while categorical variables were compared using the Chi-square test or Fisher’s exact test. Changes in VAS and AOFAS scores over the follow-up period were assessed within each treatment group, and between-group comparisons were performed at the corresponding follow-up visits. For plantar fascia thickness, the change from baseline to 6 months was calculated for each participant and compared between the two groups. All statistical tests were two-sided, and a p-value of less than 0.05 was considered statistically significant.

RESULTS

[Table 1] shows that the two groups were comparable at baseline. Mean age, BMI, symptom duration, sex distribution, side of involvement, baseline VAS score, and baseline AOFAS score were similar between the PRP and corticosteroid groups, with no statistically significant differences for any of these characteristics (all $p>0.05$).

Table 1: Baseline demographic and clinical characteristics of the study participants

Characteristic	PRP group (n=30)	Corticosteroid group (n=30)	p-value
Age, years, mean $\pm$ SD	43.8 $\pm$ 10.2	42.5 $\pm$ 10.8	0.634
BMI, kg/m ² , mean $\pm$ SD	27.1 $\pm$ 3.2	26.8 $\pm$ 3.4	0.726
Duration of symptoms, months, mean $\pm$ SD	8.7 $\pm$ 2.4	8.4 $\pm$ 2.3	0.623
Male, n (%)	13 (43.3)	12 (40.0)	0.793
Female, n (%)	17 (56.7)	18 (60.0)	
Right-sided involvement, n (%)	16 (53.3)	17 (56.7)	0.949
Left-sided involvement, n (%)	11 (36.7)	10 (33.3)	
Bilateral involvement, n (%)	3 (10.0)	3 (10.0)	
Baseline VAS score	8.0 $\pm$ 0.7	8.1 $\pm$ 0.7	0.582
Baseline AOFAS score	55.0 $\pm$ 4.8	54.6 $\pm$ 5.1	0.756

[Table 2] demonstrates the pattern of pain response over follow-up. At 6 weeks, the corticosteroid group had significantly lower VAS scores than the PRP group (3.9 $\pm$ 0.9 vs. 4.9 $\pm$ 0.9; $p<0.001$). By 12 weeks, the difference was no

longer significant, while at 6 months the PRP group showed significantly better pain relief, with a mean VAS of 1.9 $\pm$ 0.7 compared with 3.2 $\pm$ 0.9 in the corticosteroid group ($p<0.001$).

Table 2: Comparison of VAS pain scores between the PRP and corticosteroid groups

Follow-up	PRP group (n=30)	Corticosteroid group (n=30)	p-value
Baseline	8.0 $\pm$ 0.7	8.1 $\pm$ 0.7	0.582
6 weeks	4.9 $\pm$ 0.9	3.9 $\pm$ 0.9	<0.001
12 weeks	3.4 $\pm$ 0.8	3.8 $\pm$ 0.9	0.074
6 months	1.9 $\pm$ 0.7	3.2 $\pm$ 0.9	<0.001

[Table 3] shows that the corticosteroid group had a significantly higher AOFAS score at 6 weeks (84.0 $\pm$ 4.6 vs. 78.2 $\pm$ 4.9; $p<0.001$), whereas the PRP group achieved

significantly better functional scores at 12 weeks and 6 months, reaching 90.3 $\pm$ 4.0 at 6 months compared with 79.8 $\pm$ 5.2 in the corticosteroid group ($p<0.001$).

Table 3: Comparison of AOFAS scores between the PRP and corticosteroid groups

Follow-up	PRP group (n=30)	Corticosteroid group (n=30)	p-value
Baseline	55.0 $\pm$ 4.8	54.6 $\pm$ 5.1	0.756
6 weeks	78.2 $\pm$ 4.9	84.0 $\pm$ 4.6	<0.001
12 weeks	84.9 $\pm$ 4.6	82.2 $\pm$ 5.0	0.034
6 months	90.3 $\pm$ 4.0	79.8 $\pm$ 5.2	<0.001

As shown in [Table 4], plantar fascia thickness was similar in both groups at baseline, but at 6 months it was significantly lower in the PRP group (3.38 $\pm$ 0.42 mm) than in the

corticosteroid group (3.81 $\pm$ 0.55 mm; $p=0.001$). The mean reduction in thickness was also significantly greater with PRP (2.34 $\pm$ 0.58 mm vs. 1.85 $\pm$ 0.64 mm; $p=0.003$).

Table 4: Change in ultrasonographic plantar fascia thickness from baseline to 6 months

Plantar fascia thickness	PRP group (n=30)	Corticosteroid group (n=30)	p-value
Baseline, mm	5.72 ± 0.61	5.66 ± 0.64	0.711
6 months, mm	3.38 ± 0.42	3.81 ± 0.55	0.001
Mean reduction, mm	2.34 ± 0.58	1.85 ± 0.64	0.003

DISCUSSION

The present study compared the clinical and ultrasonographic response to platelet-rich plasma and corticosteroid injections in patients with chronic plantar fasciitis over a six-month period. The two groups were comparable at baseline with respect to age, BMI, duration of symptoms, sex distribution, side of involvement, VAS score and AOFAS score, reducing the likelihood that baseline differences influenced the observed treatment response. The mean age was 43.8±10.2 years in the PRP group and 42.5±10.8 years in the corticosteroid group, with a slight female predominance in both groups. Similar demographic patterns were reported by Gautam et al,^[10] who observed mean ages of 40.90±9.63 and 37.82±11.05 years in the PRP and steroid groups, respectively, with females constituting approximately 63% of participants. Singh et al,^[11] also reported comparable baseline ages of 42.0±12.98 and 39.4±10.09 years and noted a greater frequency of right-sided involvement, similar to the present study.

Pain relief showed a clear time-dependent pattern. Although baseline VAS scores were almost identical in the two groups, corticosteroid produced greater early pain relief at 6 weeks, with a mean VAS of 3.9±0.9 compared with 4.9±0.9 in the PRP group ($p<0.001$). By 12 weeks, the difference had narrowed and was no longer statistically significant, while at 6 months the pattern had reversed, with significantly lower pain scores following PRP (1.9±0.7 vs. 3.2±0.9; $p<0.001$). This crossover is closely comparable with the findings of Yadav et al,^[7] in whom corticosteroid showed markedly better pain relief at 6 weeks, whereas at 24 weeks PRP was superior, with VAS scores of 1.43±0.57 and 3.23±1.01, respectively. Similarly, Gautam et al,^[10] observed progressive improvement with PRP up to 24 weeks, reaching a VAS of 1.46±0.69, whereas the corticosteroid group improved rapidly during the first 12 weeks but subsequently showed an increase in pain, with a VAS of 3.02±0.96 at 24 weeks. Christhudasen et al,^[12] also reported greater final pain reduction with PRP, from 8.73 to 2.27, compared with 8.8 to 3.53 after corticosteroid treatment. However, the early response has not been uniform across all studies; Shah et al,^[13] reported significantly lower VAS scores with PRP as early as 2 and 4 weeks, although the groups were similar at 8 weeks and PRP again showed superiority at 12 weeks. These differences probably reflect variation in patient selection, PRP preparation, steroid formulation and injection technique.

Functional recovery followed a pattern similar to pain improvement. In the present study, the corticosteroid group had a significantly higher AOFAS score at 6 weeks (84.0±4.6 vs. 78.2±4.9; $p<0.001$), indicating faster early functional recovery. At 12 weeks, however, PRP had become superior (84.9±4.6 vs. 82.2±5.0; $p=0.034$), and this difference widened substantially by 6 months, when the mean AOFAS

score was 90.3±4.0 with PRP compared with 79.8±5.2 after corticosteroid injection ($p<0.001$). These findings closely resemble those of Singh et al,^[11] who reported AOFAS scores of 80.76 and 86.0 in the PRP and corticosteroid groups at 6 weeks, followed by reversal at 12 weeks (86.36 vs. 78.63) and a marked advantage for PRP at 6 months (90.60 vs. 75.13). Yadav et al,^[7] similarly observed superior early function with corticosteroid at 6 weeks but better functional outcome with PRP at 24 weeks. Christhudasen et al,^[12] found that AOFAS scores improved from 72.73 to 88.67 following PRP compared with 65.87 to 82.2 following steroid injection. Shah et al,^[13] using FAAM rather than AOFAS, also demonstrated significantly better function with PRP at 12 weeks. At a higher level of evidence, the systematic review by Hurley et al,^[9] found that the functional advantage of PRP became more apparent at later follow-up, supporting the concept that its therapeutic effect develops gradually rather than immediately.

Ultrasonographic findings provided objective structural support for the clinical improvement. Baseline plantar fascia thickness was comparable between the two groups (5.72±0.61 mm in the PRP group and 5.66±0.64 mm in the corticosteroid group). At 6 months, thickness had decreased in both groups, but the reduction was significantly greater with PRP; the mean thickness was 3.38±0.42 mm following PRP compared with 3.81±0.55 mm after corticosteroid injection ($p=0.001$), corresponding to mean reductions of 2.34±0.58 and 1.85±0.64 mm, respectively ($p=0.003$). This observation is almost identical in direction to that of Singh et al,^[11] who reported a reduction in plantar fascia thickness from 5.77 to 3.32 mm after PRP and from 5.60 to 3.73 mm after corticosteroid treatment at 6 months. Gautam et al,^[10] similarly found reductions in plantar fascia thickness of 35.90% with PRP and 28.67% with corticosteroid at six months. The structural improvement is clinically relevant because ultrasonography can demonstrate changes in fascial thickness and architecture during follow-up, thereby providing an objective measure in addition to pain and functional scores.

The temporal difference between the two interventions is biologically plausible. Corticosteroids suppress local inflammatory activity and therefore may provide rapid symptomatic relief, but they do not directly address the degenerative changes that characterize chronic plantar fasciopathy. PRP contains platelets, growth factors and bioactive mediators that may promote angiogenesis, cellular proliferation, collagen organization and matrix remodeling, processes that require time to translate into clinical improvement. Hurley et al,^[9] emphasized this distinction and proposed that the regenerative properties of PRP may account for its progressively better functional outcomes at later follow-up, whereas corticosteroid effects are primarily anti-inflammatory and may therefore be less durable. The recent systematic review and meta-analysis by Aleid et al,^[14] which included eight randomized trials involving 599 patients, likewise supports continued evaluation of PRP for both pain and functional outcomes, although substantial

variability among studies remains an important limitation of the evidence.

Taken together, the present findings suggest that both treatments are effective, but their clinical profiles differ. Corticosteroid appears more useful when rapid short-term pain relief and functional recovery are the immediate goals, whereas PRP demonstrates a slower but more sustained response, with superior pain relief, function and reduction in plantar fascia thickness at six months. The concordance of the VAS, AOFAS and ultrasonographic findings strengthens this interpretation because the later clinical improvement following PRP was accompanied by greater structural improvement rather than being reflected by pain scores alone. Nevertheless, the findings should be interpreted in the context of the relatively small sample size, non-randomized open-label design, single-centre setting and six-month follow-up. Larger randomized studies using standardized PRP preparation and longer follow-up would help determine whether these differences persist beyond six months.

CONCLUSION

In patients with chronic plantar fasciitis, both platelet-rich plasma and corticosteroid injections resulted in meaningful improvement in pain and function. Corticosteroid injection provided greater early symptomatic and functional benefit, whereas PRP showed a more sustained response, with significantly better VAS and AOFAS scores at 6 months. PRP was also associated with a greater reduction in ultrasonographic plantar fascia thickness, suggesting better structural improvement. These findings support corticosteroid as an option for rapid short-term relief, while PRP appears to provide superior longer-term clinical and ultrasonographic outcomes in chronic plantar fasciitis.

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Conflicts of interest

There are no conflicts of interest.

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