

## Evaluation of the results of local injection of corticosteroid versus platelet rich plasma in treatment of plantar fasciitis

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### Abstract

An orthopaedic illness that may be difficult to cure, chronic plantar fasciitis is a prevalent one. In the treatment of chronic instances of plantar fasciitis refractory to typical nonoperative care, autologous platelet-rich plasma (PRP), a concentrated blood component high in growth factors, was compared to steroid injection in this research. Methods: PRP or steroid injections were given to 30 patients with chronic plantar fasciitis who had previously failed to respond to conservative therapy. Roles-Maudsley, Visual Analogue, and American Orthopaedic Foot and Ankle Society (AOFAS) scores were used to evaluate each patient. Pre-treatment, three weeks after injection, and three months afterwards, data was gathered and compared. Results: There was no statistically significant difference between the two groups before injection. All three outcome scores increased considerably from their pretreatment level in both groups, although after 3 months, the scores of the RM, VAS and AOFAS scores in the PRP arm (1.47, 2.20 and 98.00) were significantly better than the Steroid arm (2.80, 4.00 and 71.46) When it comes to relieving the symptoms of persistent plantar fasciitis, PRP is just as effective as steroid injections, but unlike steroids, its impact does not wear off. At three months, PRP outperforms steroid injections in treating chronic recalcitrant instances of plantar fasciitis, making it a better and more long-lasting therapy option. Disabling, intractable plantar fasciitis may benefit from the use of PRP injections as a therapy option.

**Study design:** Cohort study.

**Key words:** Level I, prospective randomized comparative study.

### 1. Introduction

Heel discomfort in adults is most often caused by plantar fasciitis, which is characterised as an overload of the plantar fascia. A progressive start of severe pain along the heel's medial side that worsens as a person takes their first step in the morning or when they begin a new activity and eases as they warm up. [3] Although the origin and pathogenesis are yet unknown, it seems to be similar to Achilles tendinopathy, with microscopic degenerative damage, local disruption of the collagen matrix, and microtears, rather than a failed healing response, as in Achilles tendinopathy. [4] Repeated microtrauma of the plantar fascia at its origin may lead to inflammation and degeneration as a consequence of poor biomechanics and foot abnormalities. Sedentary people and athletes, as well as those who participate in running sports, are more likely to suffer from plantar fasciitis. 3 A higher BMI, decreased ankle dorsiflexion, and weight-bearing tasks performed at work are all potential causes of plantar fasciitis. Rest, heel cups, eccentric stretching exercises and night splints are some of the conservative therapy options that may be used in around 80% of instances. Nonsteroidal anti-inflammatory medicine is also an option. Shockwave therapy and platelet-rich plasma (PRP) injection are further treatment options for people with persistent plantar fasciitis. 7–8 Surgical release of the plantar fascia is seldom performed nowadays, although it may be utilised in the most difficult instances, with outcomes that can be inconsistent. [9]

Because corticosteroids have a powerful anti-inflammatory impact, pain alleviation may be expedited. Fibroblast and substance protein proliferation may both be inhibited by them. [10] Plantar fasciitis may be treated

with corticosteroid injections, although this therapy has been linked to plantar fascia rupture, infection, skin pigmentation change, peripheral nerve injury, muscle damage, and fat pad atrophy, among other things. A natural concentrate of autologous growth factors, PRP, is now widely used in various fields of medicine for its potential to aid tissue regeneration, derived by centrifuging whole blood, has a platelet concentration higher than that of whole blood, and is thought to stimulate the natural healing process through growth factors contained in the platelets, such as Platelet derived growth factor (PDGF), transforming growth factor (TGF). [15]

An autologous platelet-rich plasma (PRP) injection was compared to a cortisone injection in the treatment of chronic instances of plantar fasciitis that had not responded to nonoperative therapy in this prospective randomised research. Three weeks and three months after injection, researchers compared the effectiveness and outcomes of corticosteroid and platelet rich plasma treatment for persistent plantar fasciitis.

### 2. Patients and methods

Patients presented to Benha university hospital outpatient clinic with intractable plantar fasciitis, which had not responded to cushioned insoles, a full course of eccentric stretching exercises and physiotherapy were included in the study. All patients had symptoms for at least 3 months. The patients were randomised into one of the two treatment arms. All patients were assessed with the Roles–Maudsley (RM) Score, Visual Analogue Score (VAS) and the American Orthopaedic Foot and Ankle Society (AOFAS). Data was collected prospectively on the cohort, pre-treatment, at 3 weeks and 3 months post

injection. Complications of the procedure were also documented.

**Inclusion Criteria:**

- Patients diagnosed with plantar fasciitis.
- Failure of conservative treatment (stretching exercises, nonsteroidal anti-inflammatory drugs, and heel pads) for at least 3 months.
- Patient should be able to understand the informed consent.
- Visual analog scale pain higher than 5 (on a 10-point visual analog scale).

**Exclusion Criteria:**

- Any previous local injection treatment for heel pain
- Any history of surgery for heel pain
- Associated pathology involving the lower limb such as - history of tarsal tunnel syndrome - effusion of the ankle indicating an intra-articular disease - old healed calcaneal fracture - Achilles tendinopathy - any deformity of foot and ankle, including pes planus or pes cavus.
- Patients with systemic disorder like diabetes mellitus, rheumatoid arthritis, hematological disease, or gout.
- Pregnancy.

**The baseline characteristics (parameters) of each group included:**

Age, sex, weight, body mass index (BMI) and the duration of foot pain were recorded and had taken in consideration and their effects on the results of the study.

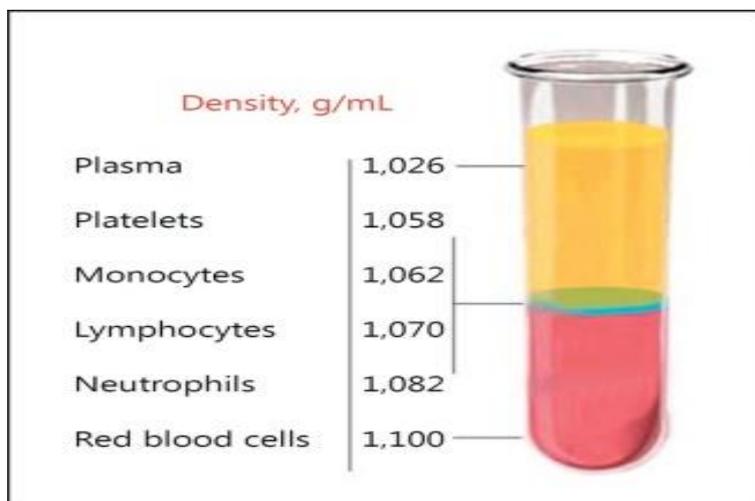
Informed consents obtained for all patients.

Corticosteroid injection procedure:

Under aseptic precautions, patients were injected with 2 mL of 40 mg methylprednisolone with 2 mL of 2% prilocaine (metilprednizalone) into the tender spot and then dressed with an occlusive dressing. The patient was then mobilised.

**PRP Preparation and application:**

PRP was obtained under aseptic precautions with the use of GPS III system; Gravitational Platelet Separation, (Biomet Biologics, Warsaw, IN) using an 18- gauge needle. Twenty-seven millilitres (ml) of blood was withdrawn from the patient and added to 3ml of sodium citrate (anticoagulant). This was placed in the centrifuge machine and spun for 15 min at 3200 revolutions per minute. The plasma portion of the centrifuged mixture was discarded. Since the anticoagulant introduced to the whole blood used to produce the platelet concentrate is acidic, the PRP portion harvested is buffered with 8.4% sodium bicarbonate, to increase the Ph to normal physiological levels. From the initial 27 ml blood harvest, around 2.5-3 mls of buffered PRP was obtained.



**Fig. (1)** After centrifugation, the blood components (red blood cells, leukocytes, and platelets) are separated from the plasma due to their different densities. The platelets have the lowest density. Adapted from Dohan Ehrenfest et al.[16]

Steroid and PRP were both injected under aseptic technique in theatre, directly into the area of maximal tenderness at the heel from the medial aspect, via a peppering technique (single skin entry, partially withdrawing the needle, redirecting and making multiple penetrations to the fascia), patients were sitting relaxed on examination bed with their affected foot was put in front of them on the lateral side.



Fig. (2) PRP injected under aseptic circumstance.

**Post procedure Protocol:**

Immediately after injection, the patients were kept in a sitting position without moving the foot and observed for 10 minutes. They were discharged if comfortable. They were advised to apply ice on the injected area for swelling and pain control and to avoid high-impact activities for a week. All the patients were taught stretching exercises for the plantar fascia and Achilles tendon. Patients were allowed to take paracetamol for pain after the injection.

**Outcome evaluation:**

Follow up required at 3 weeks and again at 3 months following injection to the evaluated patient. At each visit, we documented subjective and objective assessment using Roles-Maudsley (RM) Scale, Visual Analog Scale (VAS) and American Orthopedic Foot and Ankle Society (AOFAS) Scale.

RM scale shows the following levels: excellent (no pain, patient satisfied with the treatment outcome, and unlimited walking without pain), good (symptoms substantially decreased, patient satisfied with the treatment outcome, and ability to walk without pain for >1 h), fair (symptoms somewhat decreased, pain at a more

tolerable level than before treatment, and patient slightly satisfied with the treatment outcome), or poor (symptoms identical or worse and patient not satisfied with the treatment outcome with pain-limiting activity).

In VAS scale, while 0 reflected the total absence of symptoms, 10 indicated the worst imaginable pain or stiffness.

The two treatment groups compared for differences in age, height, weight gender composition (sex) and pre-treatment measures of pain and function.

**Statistical analysis:**

Data were coded and entered using the statistical package for the Social Sciences (SPSS) version 26 (IBM Corp., Armonk, NY, USA). Data was summarized using mean, standard deviation, median, minimum and maximum in quantitative data and using frequency (count) and relative frequency (percentage) for categorical data. Comparisons between quantitative variables were done using the non-parametric Mann-Whitney test.<sup>17</sup> For comparing categorical data, Chi square test was performed. Exact test was used instead when the expected frequency is less than 5.<sup>18</sup> Correlations between quantitative variables were done using Spearman correlation coefficient.<sup>19</sup>

P-values less than 0.05 were considered as statistically significant.

**3. Results**

The age range of patients in the study was 29 to 66 years, the age and sex distribution of the subjects of this study are shown in Table (1).

Table (1) Age and sex distribution of the groups.

Characteristics	Steroid (15)	PRP (15)
Age (mean)	49.07 (SD 9.48)	43.47 (SD 11.55)

Table (2) Count and percentage of sex with affected side.

		steroid		PRP		P value
		Count	%	Count	%	
Gender	male	6	40.0%	7	46.7%	0.464
	female	9	60.0%	8	53.3%	
Affected side	right	8	53.3%	7	46.7%	0.715
	left	7	46.7%	8	53.3%	

In the steroid arm, the male to female ratio was 6:9. In the PRP arm, the male to female ratio was 7:8. 15 injections were performed on the right heel and 15 on the left side as well. There was no statistical difference in the patient demographics (age, gender composition) between the two treatment groups as shown in table 2.

As shown in Table 3, there is highly significant difference in both groups for all post-operative outcome minimum 1.00 and maximum 2.00, after three months the mean was 2.80±0.41 with minimum 2.00 and maximum 3.00.

The mean VAS in patients before treatment was 5.00±0.80 with minimum 4.00 and maximum 6.00, while

The mean AOFAS in patients before treatment was 66.59±3.91 with minimum 55.00 and maximum 70.00, while three weeks after treatment the mean was 82.5±6.39 with minimum 72.00 and maximum 90.00 , but after three months the mean was 71.46±4.32 with minimum 68.00 and maximum 80.00, (Table-3).

**PRP group:**

The mean **RM** scale in patients before treatment was 4.00±0.00 with minimum 3.00 and maximum 4.00, while three weeks after treatment the mean was 3.00±0.00 with minimum 2.00 and maximum 3.00, but after three months the mean was 1.47±0.52 with minimum 1.00 and maximum 2.00 .

measures (RM,VAS and AOFAS), with much better improvement in the PRP group as compared to the steroid group (Fig. 3A and B).

**Steroid group:**

The mean RM scale in patients before treatment was 3.00, with minimum 2.00 and maximum 3.00, while three weeks after treatment the mean was 1.33±0.49 with

three weeks after treatment the mean was 1.87±0.83 with minimum 1.00 and maximum 3.00, after three months the mean was 4.00±0.32 with minimum 2.00 and maximum 5.00.

The mean **VAS** in patients before treatment was 6.00±0.76 with minimum 5.00 and maximum 7.00, while three weeks after treatment the mean was 6.87±0.92 with minimum 5.00 and maximum 7.00, but after three months the mean was 2.20±0.77 with minimum 1.00 and maximum 3.00 .

The mean **AOFAS** in patients before treatment was 59.80±3.40 with minimum 50.00 and maximum 70.00, while three weeks after treatment the mean was 74.51±5.12 with minimum 60.00 and maximum 80.00, but after three months the mean was 98.00±7.85 with minimum 90.00 and maximum 100.00,(Table-3).

**Table (3)** Mean, standard deviation, median, minimum and maximum of pre and post treatment, RM scale, VAS and AOFAS pre and post treatment.

	Groups										P value
	steroid					PRP					
	Mean	SD	Median	Minimum	Maximum	Mean	SD	Median	Minimum	Maximum	
<b>pre-RM</b>	3.00	0.00	3.00	2.00	3.00	4.00	0.00	4.00	3.00	4.00	1.000
<b>pre-VAS</b>	5.00	0.80	6.00	4.00	6.00	6.00	0.76	7.00	5.00	7.00	0.367
<b>pre-AOFAS</b>	66.59	3.91	60.00	55.00	70.00	59.80	3.40	50.00	50.00	70.00	0.074
<b>post(3w)-RM</b>	1.33	0.49	1.00	1.00	2.00	3.00	0.00	3.00	2.00	3.00	< 0.001
<b>post(3w)-VAS</b>	1.87	0.83	2.00	1.00	3.00	6.87	0.92	7.00	5.00	7.00	< 0.001
<b>post(3w)-AOFAS</b>	82.53	6.39	80.00	72.00	90.00	74.51	5.12	70.00	60.00	80.00	< 0.001
<b>post(3m)-RM</b>	2.80	0.41	3.00	2.00	3.00	1.47	0.52	1.00	1.00	2.00	< 0.001
<b>post(3m)-VAS</b>	4.00	0.32	3.00	2.00	5.00	2.20	0.77	2.00	1.00	3.00	< 0.001
<b>post(3m)-AOFAS</b>	71.46	4.23	70.00	68.00	80.00	98.00	7.85	90.00	90.00	100.00	< 0.001

**Abbreviations:** RM, Roles-Maudsely scale; VAS, Visual Analog scale; AOFAS, American Orthopedic Foot and Ankle Scale.

The mean preinjection RM score was 3.00 ± 0.00 in steroid and 4.00 ± 0.00 in PRP group, difference was not significant (P = 1.000). Postinjection, there was a downward trend in the values of the RM and VAS scores in both groups on subsequent follow-ups. With the available numbers, this decrease in RM and VAS scores at each follow-up was statistically significant compared to the preinjection score.

At 3 weeks postinjection AOFAS scale showed better improvement on the steroid group than the PRP group, but after three months follow up, AOFAS scale of the PRP group was better improved than steroid.

Thus, both PRP and steroid are effective in the early treatment of plantar fasciitis, with significant difference in outcome at 3 weeks and 3 months post injection, but the PRP group had clearly advantageous scores compared to the steroid group. There was no tendon rupture or skin infection complication in either group.

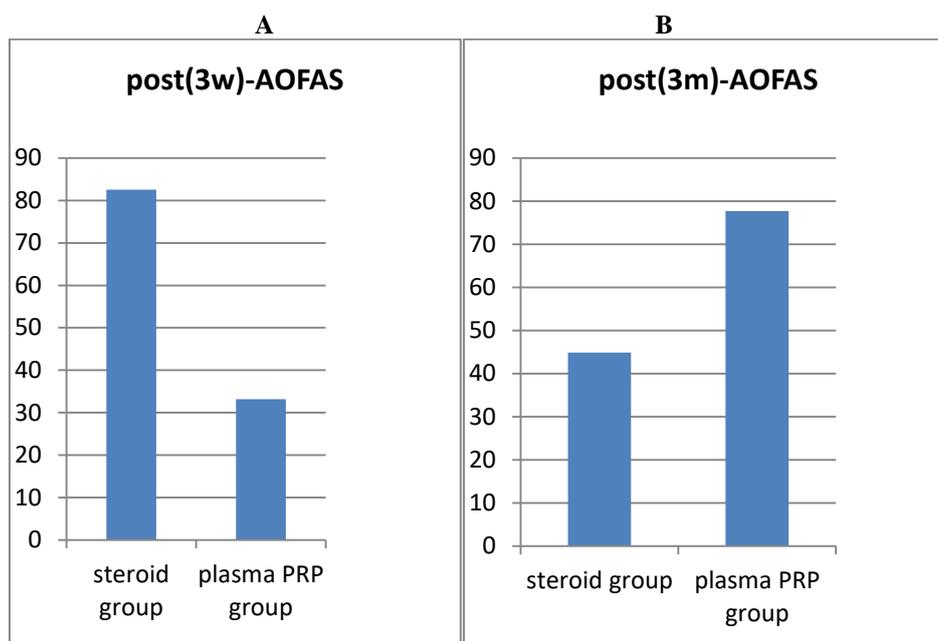


Fig. (3) AOFAS scale at 3 weeks and 3 months postinjection.

#### 4. Discussion

A common cause of chronic plantar heel pain (CPHP) in adults is plantar fasciitis. It is estimated that more than a million people seek therapy for this illness each year. [2] Micro rips and degenerative injuries seem to be comparable to Achilles tendinopathy in their microscopic degeneration and local disruption of the collagen matrix rather than a failed healing response. Biomechanical abuse from standing or jogging for extended periods of time is thought to cause plantar fasciitis by causing micro rips at the calcaneal entheses. Plantar fasciitis may be diagnosed using a patient's medical history and physical exam. Getting out of bed in the morning might cause heel pain for most people. When being examined by a doctor, individuals may walk with their affected foot in an equestrian stance to avoid placing weight on the painful impact point. The typical plantar calcaneal region will provide a sharp, cutting sensation when palpated by the patient. [20]

The proximal plantar fascia might be bothered by inactive first toe/lower leg dorsiflexion. If history and physical examination findings are inconsistent with plantar fasciitis, other possible causes of heel pain should be investigated. [20]

There are a variety of non-invasive treatment options for plantar fasciitis, including lifestyle adjustments, orthotics, stretching, and NSAIDs. [21]

Other treatment options for people with persistent plantar fasciitis who have tried and failed earlier methods include injections of local corticosteroids, PRP injections, and shockwave treatment. Plantar fascia surgery is no longer routinely performed, although it is kept in reserve for the most difficult patients, with outcomes that vary widely. It is thought that platelet-derived growth factor, transforming growth factor beta, fibroblast growth factor, and insulin-

like growth factor stimulate the natural healing process through cytokines and growth factors contained in the platelets, such as platelet derived growth factor and transforming growth factor beta. [15]

Patients with lateral epicondylitis (Tennis elbow) who had previously failed non-operative treatment were studied in 2010 by Peerbooms et al. and found that PRP injections were superior to steroid injections in terms of pain relief. A single injection of concentrated PRP improved pain and function more than a steroid injection, according to the results of this research. [22] Patients who received steroid injections for chronic plantar fasciitis improved faster and probably to a greater extent, but PRP significantly reduced pain levels and increased tenderness thresholds over the six-month follow-up period, according to Lee and colleagues [23] He concluded that the use of PRP in these difficult situations appears far more efficacious than the traditional treatment of corticosteroid injection and appears safer than surgical alternatives in patients with severe chronic plantar fasciitis who had previously failed to respond to traditional non operative management techniques. [24] P. Soraganvi et al. in 2019 found that VAS and AOFAS scores improved following a single injection in both the PRP and steroid injection groups, but that the steroid group's improvement in pain and AOFAS score was greater at the first follow-up visit, six weeks later, than the PRP group. The VAS and AOFAS scores in the PRP group continued to increase over the course of three months, and at the conclusion of six months, the PRP group demonstrated a statistically significant improvement over the steroid group. [25] In only 60 patients, Shetty et al. compared the short-term (3-month) outcomes of steroid vs. PRP treatments (30 in each arm). Compared to steroid injections, PRP results were much superior. At three months, the AOFAS, VAS, and Foot

and Ankle Disability Index scores in the PRP group were all significantly higher. However, their conclusions were preliminary, and no data was provided beyond the three-month mark. [26]

Among patients with plantar fasciitis, another research by M. Wafi et al. found that, when compared to steroid injection, PRP injection resulted in a lower pain level after three and six months of follow up.

[27] PRP and steroid treatments for plantar fasciitis were shown to be equally effective and beneficial in several trials done by E. Akşahin et al. and K. Jain et al. [28, 29]

Patients with chronic plantar fasciitis who had steroid injections at the first three week follow-up exhibited lower RM scale and VAS ratings, as well as higher AOFAS scores, than those who received PRP treatment. Second follow-up results showed that the steroid group's clinical scores soon declined, while the PRP group's scores continued to improve, giving them superior scores at RM, VAS, and AOFAS scales than the steroid group (mean values of 1.47, 0.52, and 0.73, respectively).

No injection-related side effects were seen in any of the individuals who took part in the research, which included steroid and PRP therapy.

We attempted to match and connect the outcomes within each group with various characteristics based on the patient data provided in this research. After three months, we found that patients who had been in pain for a long time had lower AOFAS scores than those who had been in pain for a shorter period of time.

For severe planter fasciitis, we found that steroid injections relieved pain quickly, but the symptoms regressed after a few months, which made PRP injection preferable in terms of long-term effects.

The research was hindered by a small sample size and a short amount of time during which patients were monitored. One restriction was that there was no control group to show us how the illness progressed naturally. We didn't know how effective it was on people with diabetes, gout, or rheumatoid arthritis because of the exclusion criteria.

## 5. Conclusion

When it comes to relieving the symptoms of plantar fasciitis, PRP is just as effective as steroids, but unlike steroids, its impact doesn't wear off with time. As a therapy for plantar fasciitis, PRP injection is superior than cortisone injection in terms of effectiveness and durability, hence it is regarded safe and an ideal alternative to steroid injection in cases when conservative measures have failed.

## Conflict of interest statement

All the authors declare that there are no conflicts of interest regarding this article and no source of funding has been received.

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