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A prospective study to analyse the efficacy of platelet rich plasma in the treatment of chronic plantar fasciitis

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Abstract
Introduction: Regenerative medicine has been used in the treatment of various Musculo skeletal disorders, chronic tendinopathies and in the field of sports medicine in the recent times. PRP is a biological blood-derived autologous component, rich in numerous growth factors and cytokines that will lead to an enhanced healing of bone and soft tissue at a cellular level.
Materials and Methods: 25 patients with unilateral chronic plantar fasciitis who were not responding to conservative management for 6 weeks were included in this study. The study was done at the Orthopaedics department at RMMCH, Annamalai University, from October 2020 to October 2021. Functional outcome was evaluated using visual analog score [VAS] and Foot and ankle ability measure [FAAM] scores at 0,4,8,12, and 24 weeks. Plantar fascia thickness was measured pre-injection and 6 months post-injection using ultrasound.
Results: Patients had a pre-treatment VAS score of 7.56and FAAM score of 30.04after 6 months follow-up, the score improved to 1.32and 80.88respectively. Pre-treatment Plantar fascia thickness was 5.52mm, 6 months follow-up study showed the thickness of 3.56 mm.
Conclusion: Platelet-rich plasma was found to be more effective in relieving the symptoms, increases the functional outcome in long-term follow-up.

Keywords: PRP, VAS score, FAAM score

Introduction
Plantar fasciitis is the most common cause of extreme pain in the heel region in the adult population. The plantar fascia maintains the medial longitudinal arch of the foot and can absorb dynamic shock during weight-bearing of the foot [2, 3]. Plantar fasciitis is common in athletes, obese individuals, prolonged standing, tight tendo-achilles and improper footwear [2, 3]. The pathological changes are degenerative in nature and histologically, there is collagen necrosis, angio-fibroblastic hyperplasia, chondroid metaplasia and calcification of matrix. PRP has been used in the treatment of chronic tendinopathies, muscle and cartilage injuries in recent times. Patients have complaints of sharp pain, insidious in onset with maximal tenderness along the anteromedial aspect of the calcaneum. Pain is more severe in the morning after the first step from bed and after prolonged sitting or inactivity.
Treatment options include rest, NSAIDS, stretching protocols, foot orthotics, physiotherapy, ESWT, Cortico-steroid, autologous blood, PRP injection has also been included in recent times. Surgical management has been reserved for recalcitrant cases of plantar fasciitis.
It is an autologous blood-derived biological product that has numerous cytokines and growth factors like PDGF, TGF beta, EGF, VEGF, IGF, FGF and CTGF present on the alpha granules [4]. These growth factors have the mitogenic potential for both mesenchymal and osteoblast cells and regulate collagen synthesis, neovascularization and angiogenesis.

Materials and Methods

The study was conducted at the Department of Orthopaedics, RMMCH, Annamalai University, Chidambaram from 2020-2021.25patients with unilateral chronic plantar fasciitis who were not responding to conservative management for 6 weeks were included in this study. Ethical committee clearance was obtained. Informed written consent was obtained from all patients who were willing for the treatment and follow-up. Patients were diagnosed with chronic plantar fasciitis based on their history, radiological evaluation and ultrasonic evaluation of PF thickness.

Inclusion criteria

1. Unilateral heel pain>6weeks.
2. Has taken conservative treatment with oral analgesics, footwear modification and physiotherapy for >4 weeks with no improvement in symptoms.
3. Not undergone any previous local injections in the heel.
4. Willing for follow-up
5. Normotensive and normoglycemic patients

Exclusion criteria

1. Bilateral heel pain
2. Has undergone previous local injections
3. Not willing for follow-up
4. Patients with other medical illness
5. Achilles tendon pathology and foot deformity
6. A patient who has had previous foot surgery

Prp Preparation

Fig 1: PRP preparation

Under strict aseptic precautions, [fig 1] 10 ml of the patient's own venous blood was withdrawn from cubital vein and was collected in pre-sterilized centrifuge vials [17]. The centrifuge vials were loaded with anticoagulant acid citrate dextrose. The blood was then centrifuged in a cooling centrifuge [REMI] at a rate of 3200 rpm for 20 minutes. The blood was then segregated as platelet-poor plasma and platelet-rich plasma. The platelet-poor plasma was discarded and the PRP was collected in a syringe [26].

Ultrasonic Evaluation of Plantar Fascia Thickness

A diagnostic ultrasound machine with a 4 cm wide transducer head and 8 MHz probe was used [22]. The thickness of the plantar fascia was measured at the thickest portion from the base of the medial calcaneal tubercle, where a bright echogenic line was easily visible. Plantar fascia thickness of more than 4mm was considered abnormal [1].

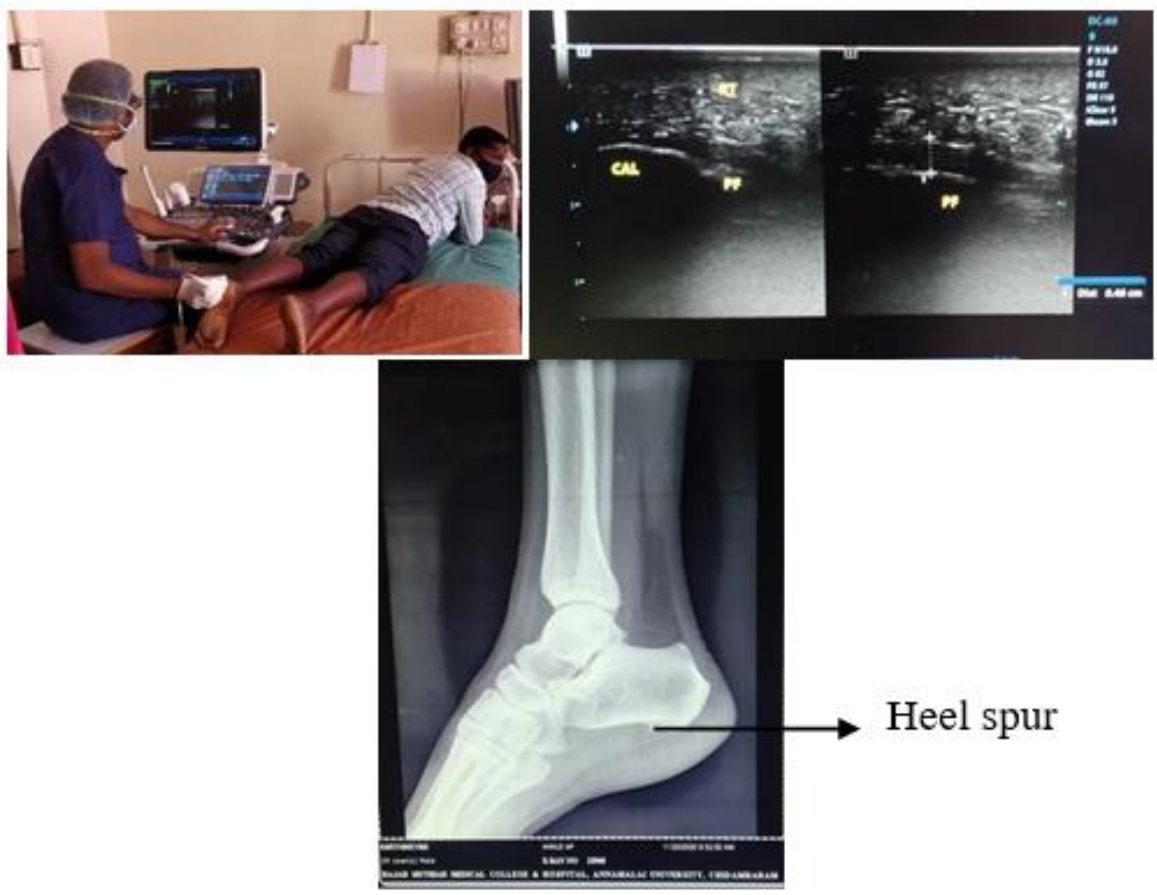


Fig 2: Ultrasonic Evaluation of Plantar Fascia Thickness

Injection Protocol: The procedure was done on an OPD basis under strict aseptic precautions [16, 18]. Patient in the supine position, the site of maximal tenderness over the medial calcaneal tubercle was identified. [Fig 3] 2cc of 2 ml lidocaine was injected into the skin before PRP application. A 'peppering' technique ie., spreading in a clockwise manner was used to achieve a more expansile zone of delivery over the plantar fascia [a single portal and 4 to5 passes through the fascia itself] [19]

Fig 3: Injection Protocol

Post Injection Protocol

The patients were monitored for 60 minutes after injection for any adverse reactions. Advised to limit their use of the feet and use of NSAIDS for 48 hrs. After 48 hrs, patients were given foot stretching protocols to follow for 3 weeks. At 4 weeks, patients were allowed to proceed with sporting or recreational activities. Any type of foot orthoses was not advised [11].

Assessment of Outcome

Patient outcome was assessed using the VAS score based on the pain scale and FAAM [FOOT AND ANKLE ABILITY MEASURE] for assessment of pain and functional outcome.

Results

Vas Score

The baseline VAS score was 8.50 in the PRP group, 12 weeks follow-up VAS score was 3.60. After 24 weeks, the final score in the PRP group was 1.6 [Graph - 1 and Table - 1] [24].

Faam Score

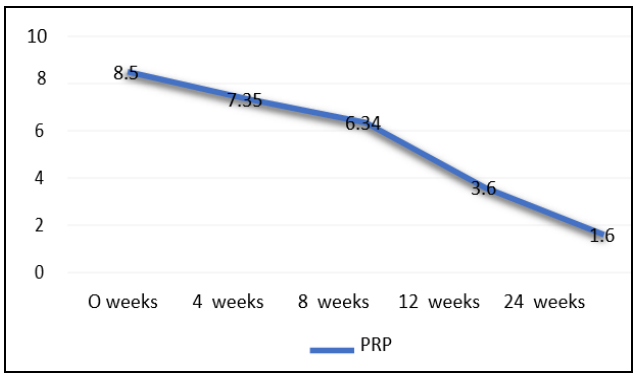
The baseline FAAM score was 30.08 in PRP group, 12 weeks follow-up score was 70.96. After 24 weeks, the final score in the PRP group was 82.86 [Graph - 2 and Table - 2]

Ultrasonic Evaluation of Plantar Fascia Thickness

In the PRP group, the mean plantar fascia thickness before injection was 5.52 mm. After 24 weeks, the mean thickness was 3.56mm. There was a reduction in plantar fascia thickness in all patients [21-23].

Table 1: VAS score comparison

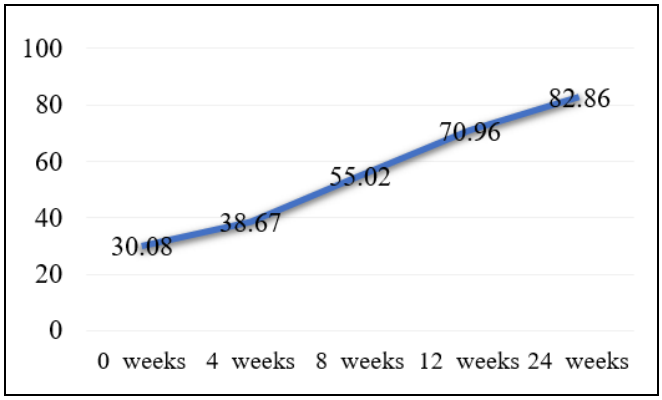
Group statistics	Mean	Standard error mean	P-value
0 weeks	8.50	0.361	<0.001
4 weeks	7.35	0.221	<0.001
8 weeks	6.34	0.157	<0.001
12 weeks	3.60	0.146	<0.001
24 weeks	1.60	0.012	<0.001



Graph 1: Vas Score Comparision

Table 2: FAAM comparison

Group statistics	Mean	Standard error mean	P-value
0 Weeks	30.08	1.086	<0.001
4 Weeks	38.67	1.136	<0.001
8 Weeks	55.02	1.264	<0.001
12 Weeks	70.96	1.221	<0.001
24 Weeks	82.86	1.252	<0.001



Graph 2: Faam Comparison

Discussion

Plantar fasciitis is the most common cause for heel pain and it is difficult to treat. In recent times, PRP has gained popularity in the treatment of various musculoskeletal disorders and in the field of sports medicine [2-4]. PRP has numerous growth factors and cytokines that is released from the alpha granules of the platelets, which is responsible for the healing response in the plantar fascia injury zone [5-7]. It also releases fibroblasts and macrophages that heals the damaged collagen fibers. The release of enzymes from the cytokines and inhibition of COX-2 [cyclo-oxygenase-2] initiates an early anti-inflammatory response after PRP injection.

Mark W. Scio, Joost c Peerboms *et al.* [19] did studies on the 'peppering' technique for the application of PRP injection, which was found to be effective, so we followed the same method. Both ultrasound and MRI help in measuring the thickness of plantar fascia. In our study, we used ultrasonic evaluation because it is cost-effective and well tolerated by the patients.

Matthew V. Smith, Sandra Klein *et al.* [20] studied FAAM score as the effective tool to analyze the functional outcome of the patient. It is sensitive to overall health status and comorbidities. Ragab EM *et al.* [27] did studies on 25 patients with plantar fasciitis treated with PRP. The results include 22 patients with subjective improvement and 15 patients had better functional outcomes. The average pre-injection VAS score was 9.1. Post injection VAS score was 1.6 [*p* value<0.001] USG showed significant changes in the thickness of the plantar fascia as well as signal intensity in the region of PRP injection.

Wilson *et al.* [28] concluded that PRP is a safe therapeutic option that has reduced heel pain in patients with chronic plantar fasciitis who dint respond to conservative management.

Aksahin *et al.* [25] did a comparative study on corticosteroid vs PRP injection for the treatment of plantar fasciitis. 60 patients divided into 2 groups were included in this study and declared no significant difference between both groups after 3 weeks and 6 months follow up.

In our study, the baseline VAS score was 7.56 and after 24 weeks follow up the score drastically reduced to 1.32. Baseline FAAM score was 30.04 and 24 weeks follow-up

score increased to 80.88. Both scores were based on the subjective analysis and it was found to be statistically significant at all stages. The long-term up follow-up was found to be satisfactory with significant improvement in VAS and FAAM score. The baseline mean plantar fascia thickness was 5.52mm and after 24 weeks follow up the thickness reduced to 3.56mm

PRP is found to be durable, cost-effective because of the tissue regeneration properties, collagen upregulation and neovascularization of the injured plantar fascia that gives long-term effects.

Conclusion

Chronic plantar fasciitis is a difficult condition to treat. Platelet-rich plasma was found to be more effective in relieving the symptoms, increases the functional outcome in long-term follow-up with no side effects.

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