Effectiveness of Platelet-Rich Plasma in Chronic Severe Plantar Fasciitis: A Prospective Analysis

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ABSTRACT

Purpose: *Chronic plantar fasciitis is a commonly faced problem and can be challenging to treat. The purpose of the study was to prospectively analyze the effectiveness of platelet-rich plasma (PRP) in patients with chronic plantar fasciitis.*

Methods: *We included 56 patients with unilateral chronic severe plantar fasciitis who underwent a single injection of autologous PRP under ultrasound guidance. The patients were followed up at regular intervals of 3, 6, 12, and 24 months. The results were evaluated with visual analog scale (VAS) and American Orthopedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot scale.*

Results: *The average pretreatment AOFAS score of 56 increased to 96 at 3 months, was 94 at 6 months, and was 92 at 12 months, with a final score of 92 at 24 months. The average pretreatment VAS score of 8.1 decreased to 1.8 at 3 months, was 1.9 at 6 months, and was 2.1 at 12 months, with a final score of 2.0 at 24 months.*

Conclusion: *From our prospective study, we found that a single injection of PRP is a safe and effective method for the treatment of chronic severe recalcitrant cases of plantar fasciitis.*

Keywords: *AOFAS Hindfoot scale; chronic; heel pain; plantar fasciitis; platelet-rich plasma; PRP*

Access this article online	
Quick Response Code:	**Website:** www.innovativepublication.com
	DOI: 10.5958/2395-1362.2015.00043.2

INTRODUCTION

Plantar fasciitis is one of the commonest causes of heel pain, affecting approximately 10% of the general population[1].Repetitive tensile overload of the soft tissue attachments to the plantar aspect of the heel causes pathological changes comparable to those of tendinitis (inflammation) and tendinosis (degeneration). In addition, a relative heel cord contracture, which often worsens during the night because the heel is held in plantar flexion during sleep, accentuates these symptoms because the heel cord attaches to the heel pad [2].

Increasing knowledge of the pathology of plantar fasciitis has led to the widespread application of a several conservative treatments for recalcitrant plantar fasciitis[3], including physiotherapy, plantar fascia-stretching exercises[4], ice packs, night splints, prefabricated and custom-made insert, shoe modification, nonsteroidal anti-inflammatory drugs (NSAIDs), and extracorporeal shock wave therapy (ESWT), when conventional physical therapy is ineffective[5].

Standard treatment for plantar fasciitis is conservative; however, approximately 10% of patients fail to respond[6]. Surgery is eventually recommended but is unsuccessful in 2%–35% of patients[7]. Chronic plantar fasciitis can be frustrating for the patient and treating physician.

Crawford et al.[8] in their review of 11 randomized trials involving 465 participants concluded that there was no evidence for the effectiveness of corticosteroid injections. There was a limited evidence for the effectiveness of low energy ESWT in reducing night pain, resting pain, and pressure pain in the short term (12 weeks). In individuals with chronic pain (longer than 6 months), there was a limited evidence for the effectiveness of dorsiflexion night splints in reducing pain. Furthermore, the effectiveness of these frequently employed treatments in altering the clinical course of plantar heel pain has not been established in comparative studies.[8]

Recently, promising results were reported with the use of platelet-rich plasma (PRP) injections for treating muscle and tendon injuries and degeneration[9-11]. The rationale for using PRP is to increase tendon regenerative abilities with a high content of cytokines and cells in hyper physiologic doses, which should promote cellular chemotaxis, matrix synthesis, and proliferation. It has been demonstrated that the healing fascia is responsive to the local application of growth factors and the fact that platelets secrete growth factors and active metabolites means that their applied use can have a positive influence on damaged tissues with a low healing potential. PRP is a method that provides

several growth factors in a simple, low cost, and minimally invasive way [12].

Hence, we have designed a prospective study to analyze the effectiveness of PRP in chronic severe plantar fasciitis.

MATERIAL AND METHODS

A total of 56 patients with 56 painful heels who presented to us between December 2012 and August 2013 were included in our study. All patients had plantar fasciitis for more than 6 months. All patients had undergone at least 4 months of conservative treatment, including ice packs, plantar fascia-stretching exercises, footwear modification like micro-cellular rubber sandals and shoes, silicone insoles, silicone heel-cups, and ultrasound therapy to the heel and night splints. Despite the conservative treatment, all patients had inadequate pain relief or functional outcome and were still experiencing severe pain or limitation of activity.

The present study was approved by the hospital ethics committee and has been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki. All the study participants gave their informed consent before inclusion in the study.

All patients were over 18 years of age (range: 20–56 years), with a mean age of 32.7 years (ranging from 20 years to 56 years). There were 24 males and 32 females. Patients with a known history of generalized inflammatory disorder, such as rheumatoid arthritis, ankylosing spondylitis, psoriatic arthritis; any wound or skin lesion at the plantar aspect of the foot; or previous corticosteroid injection into the painful heel were excluded from the study. Patients with platelet dysfunction conditions and thrombocytopenia are contraindicated for PRP therapy[13] and therefore were excluded.

The diagnosis of plantar fasciitis was confirmed in all patients with an MRI before the injection. All patients underwent a single PRP injection into the plantar fascia under ultrasound guidance. Under strict aseptic precautions, 3 or 4 cc of PRP was injected into the origin of plantar fascia on the medial tubercle of the calcaneus, as described by Cyriax and Cyriax[14]. The origin of the plantar fascia was approached from the medial side of the foot but near the plantar surface. After the injection, all patients were allowed to walk immediately but were advised to avoid weight-bearing sport activities, such as running or jumping, for at least 4 weeks after the injection.

PRP was prepared at the point-of-care by a lab technician who was experienced with the technique. Approximately 30–40 mL of whole blood was removed from the patient depending on the quantity of PRP required and centrifuged. A 3–5 times of baseline concentration of platelets is regarded as a therapeutic dose (baseline platelet concentration of 200 × 103/μL concentrated to 1,000 × 103/μL in PRP)[15]. Using a standard benchtop centrifuge, the first spin was used to remove the RBC layer, and the second spin was used to yield a more concentrated platelet layer. The injections were given immediately after the isolation of PRP.

Patients were followed up at 3, 6, 12, and 24 months. No patients were lost to follow-up. The patients were assessed prior to the treatment and at each of the follow-ups with a visual analog scale (VAS) score. The scale consisted of a rating from 1 to 10, 1 being no pain and 10 being the maximum pain possible. Further, American Orthopedic Foot and Ankle Society (AOFAS) Ankle-Hind foot scale was also used to assess the results. The main emphasis of this system was on pain and functional activities. A normal person would score 100 points [16].

Pain (40 points)	
• None	40
• Mild, occasional	30
• Moderate, daily	20
• Severe, almost always present	0
Function (50 points)	
Activity limitations, support requirement	
• No limitations, no support	10
• No limitation of daily activities, limitation of recreational activities, no support	7
• Limited daily and recreational activities, cane	4
• Severe limitation of daily and recreational activities, walker, crutches, wheelchair, brace	0
Maximum walking distance, blocks	
• Greater than 6	5
• 4–6	4
• 1–3	2
• Less than 1	0
Walking surfaces	
• No difficulty on any surface	5
• Some difficulty on uneven terrain, stairs, inclines, ladders	3
• Severe difficulty on uneven terrain, stairs, inclines, ladders	0
Gait abnormality	
• None, slight	8
• Obvious	4
• Marked	0
Sagittal motion (flexion plus extension)	
• Normal or mild restriction (30° or more)	8
• Moderate restriction (15°–29°)	4
• Severe restriction (less than 150)	0
Hindfoot motion (inversion plus eversion)	
• Normal or mild restriction (75–100% normal)	6
• Moderate restriction (25–74% normal)	3
• Marked restriction (less than 25% normal)	0
Ankle-hindfoot stability (anteroposterior, varus–valgus)	
• Stable	8
• Definitely unstable	0
Alignment (10 points)	
• Good, plantigrade foot, midfoot well aligned	15
• Fair, plantigrade foot, some degree of midfoot malalignment observed, no symptoms	8
• Poor, nonplantigrade foot, severe malalignment, symptoms	0

Figure 1: American Orthopedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot scale

RESULTS

The mean duration of symptoms from the time of onset of symptoms to the time of enrollment in the study was 7.9 months (range: 6.4–10.5 months).The mean pre-treatment VAS score was 8.1 (range: 7.2–9.6). The mean pre-treatment AOFAS score was 56 (range: 40–88). Post-treatment, 40 (71%) of the 56 patients experienced pain at the injection site and VAS score transiently increased to an average of 8.4, which required treatment with ice packs and paracetamol, and the pain eventually subsided, usually at an average of approximately 4 days.The mean pre-treatment VAS score, which was 8.1, decreased to a mean of 1.8 (range: 1.1–2.7) at 3 months follow-up, to a mean of 1.9 (range: 1.2–3.0) at 6 months follow-up, to a mean of 2.1 (range: 1.2–3.1) at 12 months follow-up, and to a mean of 2.0 (range: 1.2–2.9) at the final follow-up at 24 months.

From the average pre-treatment score of 56, the AOFAS score increased to a mean of 96 (range: 84–98) at 3 months follow-up, a mean of 94 at 6 months follow-up (range: 86–96), a mean of 92 at 12 months follow-up (range: 82–96), and remained at a mean of 92 (range: 82–98) at 24 months follow-up. Furthermore, we did not face any systemic or local complications at any point of time in the study.

DISCUSSION

The therapeutic use of PRP is an autologous biotechnology that relies on the local delivery of a various growth factors and cytokines with the aim of enhancing tissue healing[17]. Understanding both tendon healing and PRP therapies is an area of research that is critically important in developing optimal formulations and protocols to achieve the intended therapeutic effects [17].

In a study by Martinelliet al.[18], they advocated three injections into the plantar fascia in three subsequent weeks for chronic severe plantar fasciitis. However, in our study, we categorically found that a single injection of PRP is effective. Patients may be advised to avoid the use of NSAIDs 2 weeks pre- and post-PRP procedure so as not to inhibit the inflammatory response of the growth factors[19].

Corticosteroid injection and iontophoresis are popular modes of treatment in plantar faciitis. In a prospective randomized study, Lee et al.[20]compared autologous blood injection with corticosteroid injection. Sixty-four patients were randomly allocated to either the autologous blood or corticosteroid treatment group. They concluded that although intralesional autologous blood injection was efficacious in lowering pain and tenderness in chronic plantar fasciitis, corticosteroid was more superior in terms of speed and probably the extent of improvement.

However, while steroid injection and iontophoresis can significantly improve foot pain in plantar fasciitis, several complications were noted, including plantar fascial rupture, plantar fat pad atrophy, lateral plantar nerve injury secondary to injection, and calcaneal osteomyelitis, and in iontophoresis, burning of the underlying skin. Fascial rupture and fat pad atrophy are particularly serious complications because they can lead to intractable complications. Fascial rupture interrupts the intrinsic windlass mechanism of the foot and can promote further inflammation in the surrounding tissue, thus promoting pain. In addition, plantar fat pad atrophy diminishes subcalcaneal cushioning, leading the plantar fascia to further insult and hence more pain [21].Barrett et al. [22] applied a single injection of PRP in a pilot study of 9 patients and reported 78% symptom resolution at a short-term follow-up of 2 months. Our study had a significantly longer follow-up period.

The results in our study indicate that both in the short term and in the long term, there was a significant reduction in pain and improvement in the functional outcome in patients with chronic plantar fasciitis after a single injection of PRP.

CONCLUSION

From our prospective study, we found a single injection of PRP to be a safe and effective method for treatment of chronic severe recalcitrant cases of plantar fasciitis. It significantly improves the pain and functional outcome in patients with chronic plantar fasciitis and is not associated with any major complications.

CONFLICTS OF INTEREST

This manuscript has not been published or presented elsewhere in part or in its entirety and is not under consideration by another journal. All authors have approved the manuscript and agree with submission to your esteemed journal. The authors affirm that there are no potential or existing conflicts of interest that would influence our interpretation of the data in this paper.

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