Original Article

Platelet-Rich Plasma in the Treatment of Plantar Fasciitis versus Corticosteroids

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ABSTRACT

Objective: To determine the effect of platelet-rich plasma (PRP) injections versus corticosteroid injections in plantar fasciitis.

Methodology: It was a non-randomized controlled trial done in the Orthopaedic Department of the Sharif Medical City Hospital, Lahore after approval by the institutional ethical committee from February to April 2021. Seventy patients of plantar fasciitis for greater than 6 months who failed to respond to the conservative treatment were included in the study by non-probability convenient sampling technique. The patients were divided into two groups: 35 patients in the standard (Corticosteroid) treatment group and 35 patients in the intervention (Platelet-rich plasma) group. After taking informed written consent, the standard treatment group received the intra-articular corticosteroid injection whereas the intervention group received the intra-articular PRP injection. The patients were assessed for plantar fascia thickness, visual analog scale (VAS), and the American Orthopaedic Foot and Ankle Society (AOFAS) score before treatment, and at 6 weeks, 3 months, and 6 months after treatment.

Results: The plantar fascia thickness decreased from 4.77 to 3.68 mm in the PRP group and from 4.66 to 3.96 mm in the corticosteroid group. The pre-treatment VAS score improved from 8.02±0.857 to 1.37±0.49 at 6 months in the PRP group and from 7.8±0.719 to 2.8±0.759 at 6 months in the corticosteroid group. The pre-treatment AOFAS score was 57.45±4.972 in the PRP group and it increased to 89.82±4.01 at 6 months. In the corticosteroid group, the AOFAS score improved from 57.85±6.329 at baseline to 77.02±4.307 at 6 months. When the pre-treatment VAS score, AOFAS score & plantar fascia thickness were compared with the scores at 6 weeks, 3 months, and 6 months in each group, there was a significant difference in the score and thickness (p-value=0.001).

Conclusion: Both the corticosteroid and PRP treatment modalities lead to improved VAS score, AOFAS score, and plantar fascia thickness but the improvement was statistically significant in the PRP group as compared to the corticosteroid group.

Keywords: *Plantar fasciitis. Platelet-rich plasma. Corticosteroid.*

INTRODUCTION

Plantar fasciitis (PF) is the most common foot problem constituting 11-15% of the foot symptoms in adults.[1] It is characterized by chronic inflammation and the degenerative process of the plantar aponeuroses. About 2 million people are affected by plantar fasciitis in the United States annually and 10% of the individuals develop the disease during their life.[2] It is a self-limiting condition but rehabilitation takes a long time. Chronic pain leads to a significant healthcare burden for patients and affects their quality of life.[3]

The plantar fascia is a thick tendinous sheet on the bottom of the foot and is composed of collagen and elastic fibers. It arises from the medial side of the calcaneus bone. It has a central thick portion and peripheral thin portions.[1] It maintains and stabilizes the medial arch of the foot and absorbs shock.[4] It manifests as heel pain typically occurring in the morning and tenderness on the medial side of the heel.[1] There is a gradual decrease in pain with physical activity. The pain worsens with the dorsiflexion of the toes because it pulls the plantar fascia.[4]

It frequently affects 40 to 60 years old individuals.[5] The predisposing factors of plantar fasciitis are prolonged standing, obesity, female gender, increasing age, high arched foot, leg length discrepancy, uncomfortable shoes, excessive foot pronation, and foot deformities such as pes planus/pes cavus, and a shortened Achilles tendon.[6] The underlying cause of plantar fasciitis is the repeated trauma that causes tears in the plantar fascia, periostitis, and chronic inflammation. In chronic disease, degeneration of the fascia occurs.[7]

The treatment modalities of plantar fasciitis are nonsteroidal anti-inflammatory drugs (NSAIDs), physiotherapy, ice packs, night splints, and corticosteroid injections. Eighty percent of the cases are cured with conservative treatment whereas, in 10% of the patients, the disease fails to respond to conservative treatment and progresses to the chronic stage.[8] Steroid injections are used as the treatment option in patients not responding to conservative management. Multiple steroid injections are required for effective and long-term pain relief but they can cause rupture of fascia and atrophy of the fat pad.[9] Fascial rupture interferes with the foot windlass mechanism and promotes inflammation in the neighboring tissue. Atrophy of the plantar fat pad reduces the subcalcaneal cushioning, making it more susceptible to trauma and pain.[10]

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The treatment modality that activates the healing process rather than inhibiting inflammation is now considered the most efficacious option. Platelet-rich plasma (PRP) is recognized for inducing tissue healing and cell growth. It contains a high concentration of platelets and growth factors which will increase the regeneration capacity of the local tendons and muscles in plantar fasciitis.[4] Ultrasound is a famous, inexpensive, and radiation-free radiological technique for the diagnosis of many musculoskeletal conditions. In addition, it also helps in assessing the prognosis after the PRP injection. Platelet-rich plasma is a safe and effective alternative as compared to steroids.[11]

Plantar fasciitis is a very common degenerative disease which affects the hindfoot. Its successful treatment is a great challenge for clinicians. Despite the availability of several treatment modalities, the chronic pain associated with the disease is a major cause of morbidity and affects the quality of life of the patients. Platelet-rich plasma (PRP) has been introduced as a popular, safe, effective, and revolutionary intervention for the treatment of various musculoskeletal diseases including plantar fasciitis. This study was planned to determine the effectiveness of PRP injections in patients with plantar fasciitis who fail to respond to the conservative treatment and compare it with steroid injections. It will help us to use PRP injections in the future for the treatment of plantar fasciitis.

METHODOLOGY

It was a non-randomized controlled trial done in the Orthopaedic Department of the Sharif Medical City Hospital, Lahore. After approval by the institutional ethical committee (Letter No. SMDC/SMRC/153-20, 20-01-2021), the study was conducted from February to April 2021. Seventy patients with plantar fasciitis for greater than 6 months who failed to respond to the conservative treatment were included in the study by non-probability convenient sampling technique. The patients with a history of surgery, recent steroid injection within 6 months and plantar fascia rupture on ultrasound, severe anemia, thrombocytopenia, bleeding disorder, impalpable pedal pulse, and neuropathy were excluded from the study. The patients were divided into two groups: 35 patients in the standard treatment group and 35 patients in the intervention group. After taking informed written consent, the standard treatment group received the intra-articular corticosteroid injection whereas the intervention group received the intra-articular PRP injection. Using the aseptic technique, the standard treatment group was given a corticosteroid injection containing 80 mg methylprednisolone with 1 ml of lignocaine into the medial calcaneal tubercle. Under aseptic conditions, 20 ml venous blood of the patient was taken and mixed with 3 ml of citrate phosphate dextrose solution. Equal amounts of the sample were put into 4 vacutainers and then centrifuged for 7 minutes at 3500 revolutions per minute (rpm). The supernatant layer containing the buffy coat was discarded. The sample obtained was put into 2 vacutainers and then centrifuged for 5 minutes at 3000 rpm. The buffy coat was separated making PRP. The PRP was injected into the medial calcaneal tubercle of the intervention group. The follow-up duration was 6 weeks, 3 months, and 6 months. The patients were prescribed NSAIDs, ice packs, and physiotherapy. Patients were assessed before treatment and at each follow-up for plantar fascia thickness determined by ultrasonography, visual analog scale (VAS), and the American Orthopaedic Foot and Ankle Society (AOFAS) score. The visual analog scale quantifies the intensity of pain. It has a score from 0 to 10 (Figure 1).

The American Orthopaedic Foot and Ankle Society

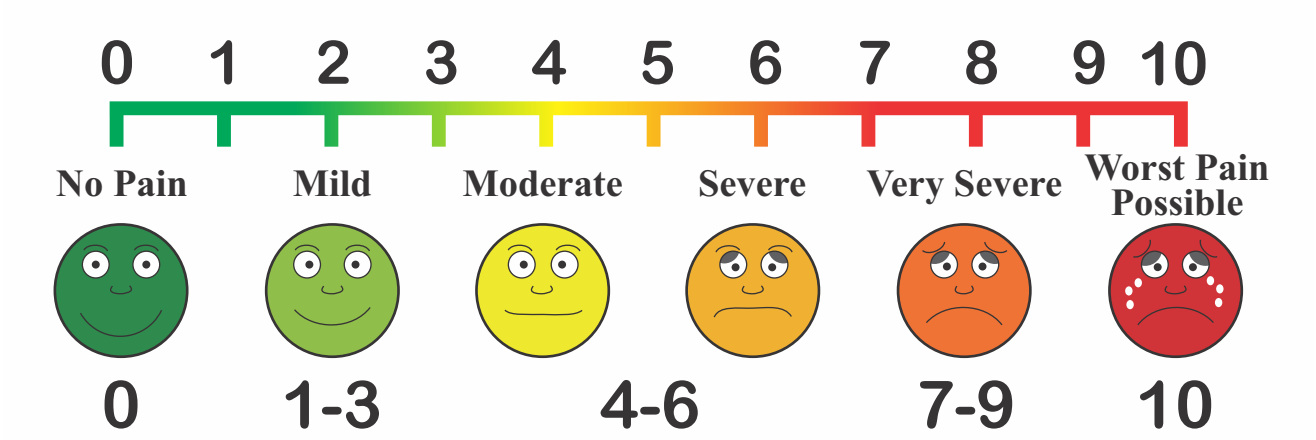

Figure 1: Visual Analog Scale

(AOFAS) score determines the outcome in patients with hindfoot diseases or injuries. It has 3 subscales of pain, function, and alignment. The pain has the highest score of 40. Function and alignment have the highest score of 40 and 10, respectively. The maximum score is 100 showing no symptoms or malfunctioning.[12]

STATISTICAL ANALYSIS

The data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 25. The quantitative variables such as age, plantar fascia thickness, VAS score, and AOFAS score were expressed using mean and standard deviation. The qualitative variables such as gender were represented by frequency and percentage. Paired t-test was applied to compare the plantar fascia thickness, VAS, and AOFAS score at baseline, 6 weeks, 3 months, and 6 months. The plantar fascia thickness, VAS, and AOFAS scores in the two groups were compared by independent t-test. The significant p-value was taken as ≤ 0.05.

RESULTS

Patients had a mean age of 44.97±4.712 years in the PRP group and 45.08±4.761 years in the corticosteroid group. In the PRP group, 19(54.3%) patients were females and 16(45.7%) patients were males. Twenty two (62.9%) patients were females and 13(37.1%) patients were males in the corticosteroid group. The difference in the age, BMI, and duration of disease between the two groups was insignificant. The demographic features of the two treatment groups are shown in Table 1.

When the pre-treatment VAS score was compared with the score at 6 weeks, 3 months, and 6 months in each group, there was a significant difference in the score with the p-value of 0.001. Similarly, there was a significant difference between the pre-treatment AOFAS score & plantar fascia thickness and the score & plantar fascia thickness at 6 weeks, 3 months, and 6 months in each group (p-value=0.001) (Table 2).

The difference in the pre-treatment VAS score was statistically insignificant between the PRP and the

Table 1: Comparison of Demographic Features and Outcomes between the Intervention and Standard Treatment Group Using Independent t-test

Parameters	PRP Group	Corticosteroid Treatment Group	p-value
Age (Years)	44.97±4.712	45.08±4.761	0.920
BMI (kg/m^2)	32±4.036	31.57± 3.301	0.628
Duration of Disease (Months)	23.25±9.159	20.314 ±7.218	0.140
Pre-treatment VAS Score	8.02±0.857	7.8±0.719	0.231
VAS Score at 6 weeks	5.82±0.663	6.05±0.639	0.147
VAS Score at 3 months	4.02±0.513	4.77±0.546	0.001*
VAS Score at 6 months	1.37±0.49	2.8±0.759	0.001*
Pre-treatment AOFAS Score	57.45±4.972	57.85±6.329	0.770
VAS Score at 6 weeks	68.57±4.852	64.22±5.461	0.001*
VAS Score at 3 months	78.25±4.06	70.31±5.251	0.001*
VAS Score at 6 months	89.82±4.01	77.02±4.307	0.001*
Pre-treatment Plantar Fascia Thickness (mm)	4.77±0.189	4.66±0.181	0.015
Plantar Fascia Thickness (mm) at 6 weeks	4.35±0.231	4.40±0.166	0.377
Plantar Fascia Thickness (mm) at 3 months	3.98±0.262	4.14±0.124	0.002*
Plantar Fascia Thickness (mm) at 6 months	3.68±0.341	3.96±0.100	0.001*

**Significant p-value*

Table 2: Comparison of Pre-treatment and After Treatment Outcomes in Each Group Using Paired t-test

Outcome	Mean±SD	Difference	p-value
PRP Group			
Pre-treatment VAS Score	8.02±0.857	2.20±0.472	0.0019*
VAS Score at 6 weeks	5.82±0.663		
Pre-treatment VAS Score	8.02±0.857	4±0.641	0.001*
VAS Score at 3 months	4.02±0.513		
Pre-treatment VAS Score	8.02±0.857	6.65±0.905	0.001*
VAS Score at 6 months	1.37±0.49		
Pre-treatment AOFAS Score	57.45±4.972	-11.11±2.586	0.001*
AOFAS Score at 6 weeks	68.57±4.852		
Pre-treatment AOFAS Score	57.45±4.972	-20.8±2.826	0.001*
AOFAS Score at 3 months	78.25±4.06		
Pre-treatment AOFAS Score	57.45±4.972	-32.37±4.066	0.001*
AOFAS Score at 6 months	89.82±4.01		
Pre-treatment Plantar Fascia Thickness (mm)	4.77±0.189	0.417±0.188	0.001*
Plantar Fascia Thickness (mm) at 6 weeks	4.35±0.231		
Pre-treatment Plantar Fascia Thickness (mm)	4.77±0.189	0.788±0.258	0.001*
Plantar Fascia Thickness (mm) at 3 months	3.98±0.262		
Pre-treatment Plantar Fascia Thickness (mm)	4.77±0.189	1.08±0.335	0.001*
Plantar Fascia Thickness (mm) at 6 months	3.68±0.341		
Corticosteroid Treatment Group			
Pre-treatment VAS Score	7.8±0.719	1.74±0.443	0.001*
VAS Score at 6 weeks	6.05±0.639		
Pre-treatment VAS Score	7.8±0.719	3.02±0.617	0.001*
VAS Score at 3 months	4.77±0.546		
Pre-treatment VAS Score	7.8±0.719	5±0.970	0.001*
VAS Score at 6 months	2.8±0.759		
Pre-treatment AOFAS Score	57.85±6.329	-6.37±1.516	0.001*
AOFAS Score at 6 weeks	64.22±5.461		
Pre-treatment AOFAS Score	57.85±6.329	-12.45±2.512	0.001*
AOFAS Score at 3 months	70.31±5.251		
Pre-treatment AOFAS Score	57.85±6.329	-19.17±3.442	0.001*
AOFAS Score at 6 months	77.02±4.307		
Pre-treatment Plantar Fascia Thickness (mm)	4.66±0.181	0.262±0.103	0.001*
Plantar Fascia Thickness (mm) at 6 weeks	4.40±0.166		
Pre-treatment Plantar Fascia Thickness (mm)	4.66±0.181	0.514±0.153	0.001*
Plantar Fascia Thickness (mm) at 3 months	4.14±0.124		
Pre-treatment Plantar Fascia Thickness (mm)	4.66±0.181	0.702±0.159	0.001*
Plantar Fascia Thickness (mm) at 6 months	3.96±0.100		

**Significant p-value*

corticosteroid group (p-value=0.231). The VAS score was also statistically insignificant between the two groups at 6 weeks (p-value=0.147). There was a significant reduction in the VAS score in the PRP group than the corticosteroid group at 3 months and 6 months (p-value=0.001). The pre-treatment AOFAS score was statistically insignificant between the two groups with a p-value of 0.77. But the score improved greatly with the PRP injection than the corticosteroid injection. The results were statistically significant at 6 weeks, 3 months, and 6 months. The pre-treatment plantar fascia thickness was statistically different between the two treatment groups (p-value=0.015). The mean difference in the plantar fascia thickness was insignificant between the two groups at 6 weeks (p-value=0.377) but was significant at 3 months and 6 months with the p-value of 0.002 and 0.001, respectively (Table 1).

DISCUSSION

Plantar fasciitis is a frequent cause of heel pain encountered in Orthopedics.[13] There is a lack of awareness about the various treatment options of plantar fasciitis among the patients.[14] Corticosteroids are a very popular treatment modality for plantar fasciitis. But PRP injections have also shown promising results in plantar fasciitis patients. Platelet-rich plasma contains growth factors that promote the healing and regeneration of plantar fascia.[15]

In our study, the mean age of the patients was 44.97±4.712 years in the PRP group and 45.08±4.761 years in the corticosteroid group. Similarly in a study by Baz et al., patients had a mean age of 46.5 years.[1] The mean age was 40 years in the PRP group and 42 years in the control group.[5] In contrast, another study reported the mean age as 30.72±7.42 years and 33.92±8.61 years in the PRP and corticosteroid groups, respectively.[8] In our study, most of the study subjects were females; 19(54.3%) in the PRP group and 22(62.9%) in the corticosteroid group. In another study, the male:female ratio was 8:17 in the PRP group and 12:13 in the corticosteroid group, showing female predominance similar to our study.[8] In contrast, a study showed that 54.5% of the patients were males and 45.45% of patients were females.[1]

The average duration of the disease was 23 months in the PRP group and 20 months in the control group in our study. Deghady et al. reported the disease duration of 9 months and 12 months in the PRP and control group, respectively.[5] The follow-up duration was 6 months in our study. Similarly, the follow-up period was 6 months in another study.[12] Whereas the follow-up durations of 4 months and 3 months have been documented in other studies.[1,8]

Our results showed that the plantar fascia thickness decreased from 4.77 to 3.68 mm in the PRP group and 4.66 to 3.96 mm in the corticosteroid group. Another study reported that the thickness of the plantar fascia reduced from 4.9 to 4 mm in the PRP group and 4.8 to 4.3 mm in the control group.[5] A study conducted in Egypt found decreased plantar fascia thickness from 6.04 to 4.93 mm after PRP injection.[1]

In our study, the pre-treatment VAS score was 8.02±0.857 and it improved to 5.82±0.663 at 6 weeks, 4.02±0.513 at 3 months, and 1.37±0.49 at 6 months in the PRP group. In the corticosteroid group, the pre-treatment VAS score improved from 7.8±0.719 to 6.05±0.639 at 6 weeks, 4.77±0.546 at 3 months, and 2.8±0.759 at 6 months. In a study by Mahindra et al., the VAS score improved from 7.44±1.04 at baseline to 3.76±1.53 at 3 weeks and 2.52±1.71 in the PRP group, and from 7.72±1.17 at baseline to 2.84±1.46 at 3 weeks and 3.64±1.62 at 3 months in the corticosteroid group.[8] There was an improvement in the VAS score from 9 to 4 in the PRP group and 9 to 7 in the control group in a study by Deghady et al.[5] Shetty et al. reported that the VAS score improved from 7.16 to 3.92 at 6 weeks and 2.92 at 6 months in the corticosteroid group. In contrast, in the PRP group, the VAS score improved from 7.74 to 4.48 at 6 weeks and 1.6 at 6 months.[12] In another study, the visual analog scale (VAS) score improved from 8.14 to 2.59 at follow-up after PRP injection.[1]

In our study, the pre-treatment AOFAS score was 57.45±4.972 in the PRP group and it increased to 68.57±4.852 at 6 weeks, 78.25±4.06 at 3 months, and 89.82±4.01 at 6 months. In the corticosteroid group, the AOFAS score improved from 57.85±6.329 at baseline to 64.22±5.461 at 6 weeks, 70.31±5.251 at 3 months, and 77.02±4.307 at 6 months. Another study reported that the AOFAS score increased from 51.56±11.10 at baseline to 83.92±12.12 at 3 weeks and 88.24±8.76 at 3 months in the PRP group and from 55.72±11.79 at baseline to 86.6±6.77 at 3 weeks and 81.32±6.39 at 3 months.[10] A study conducted by Shetty et al., showed that the AOFAS score increased from 67.08 to 86.88 at 6 weeks and 88.32 at 6 months in the corticosteroid group. In the PRP group, the AOFAS score increased from 67.08 to 89.32 at 6 weeks and 93.04 in the 6 months.[12]

Our results show that there was a statistically significant improvement in the outcomes in the PRP group than in the corticosteroid group. A study reported that the improvement in the VAS and AOFAS score was statistically significant in the PRP group as compared to the corticosteroid group.[12] In a study by Mahindra et al., the difference in the VAS and AOFAS score was insignificant at 3 weeks. But there was a statistically significant improvement in the AOFAS score at 3 months in the PRP group but not in the VAS score.[8]

A study conducted in India showed that PRP injection is a more effective treatment modality for patients with chronic plantar fasciitis as compared to corticosteroid injection.[16]

A systematic review concluded that PRP injection had no better curative response as compared to corticosteroid injection in a well-designed double-blind clinical trial.[17]

In another study, the effectiveness of PRP and corticosteroid injections were compared in patients with chronic plantar fasciitis. They reported that the PRP injection is a safe, long-lasting, and efficient treatment option as compared to the corticosteroid injections.[18]

CONCLUSION

Both the corticosteroid and PRP treatment modalities lead to improved VAS score, AOFAS score, and plantar fascia thickness but the improvement was statistically significant in the PRP group as compared to the corticosteroid group.

RECOMMENDATIONS

- Platelet-rich plasma injections should be used routinely in treating patients with plantar fasciitis non responsive to conservative management.

LIMITATIONS

- Future research should be conducted on a larger number of patients with plantar fasciitis from multiple institutions.
- A double-blinded, randomized controlled trial should be conducted to further validate the results of this study.

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