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Abbreviations

CBP: Complete Blood Picture; ESR: Erythrocyte Sedimentation Rate; RBS: Random Blood Sugar; AOFAS: American Orthopaedic Foot and Ankle Society; VAS: Visual Analogue Scale; HTI: Heel Tenderness Index; PRP: Platelet Rich Plasma; PF: Plantar Fascitis; Cs: Cortico Steroid

Research Article

Intra-Lesional Platelet Rich Plasma Injection vs Extracorporeal Shockwave Therapy for the Treatment of Chronic Resistant Plantar Fasciitis

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Abstract

Aims and Objectives

a. The objective of this study is to evaluate and compare the role of two novel modalities: Intralesional PRP (Platelet Rich Plasma) injection and Extra Corporeal Shockwave Therapy (ESWT) in pain reduction in patients with chronic resistant plantar fasciitis.

b. With the help of this study, both the treatment modalities are compared and evaluated as to which modality is better than the other to treat recalcitrant plantar fasciitis in order to facilitate to decrease morbidity in chronic resistant cases.

Introduction

Plantar fasciitis is characterized by severe pain in the inferior or the posterior part of the heel, which increases on walking or weight bearing sometimes progress to worst cases often incapacitating, with evidence of a spur in more than half of the cases. Plantar fasciitis is caused due to degeneration and irritation of the plantar fascia at the medial calcaneum and surrounding fascial structures. Plantar fascia itself is very important to maintain the biomechanics of the foot by providing support to the arch of the foot and also plays important role in shock absorption [1]. This condition accounts for about 10% of runner-related injuries and 11% to 15% of all foot symptoms requiring professional medical care. It is thought to occur in about 10% of the general population as well, with 83% of these patients being active working adults between the ages of 25 and 65 years old. It may present bilaterally in a third of the cases. Some literature shows prevalence rates among a population of runners to be as high as 22% [2].

It follows a self-limiting course and almost 90% of the patients can be successfully treated with conservative measures. However, the remaining patients 10% experience a state of recalcitrant painful heel syndrome, which is extremely difficult to treat. The successful management of this condition has been an area of focus since long. Surgery is the last resort for the treatment but even with treatment, the resolution of symptoms may take up to weeks or months. The alternative modalities like Platelet rich plasma injections and extracorporeal shock wave therapies have shown promising results in recent years. The diagnosis of PF is mainly based on the patient's history and clinical examination, and further investigation is rarely needed. In terms of treatment, various methods have also been used in the treatment of PF, including non-steroidal anti-inflammatory drugs (NSAIDs), corticosteroid injections, and non-drug approaches, such as ice packs, shoe inserts, plantar fascia stretching exercises, extracorporeal shock wave therapy, and even surgical treatment [6-8].

It is reported that the symptoms will disappear after nonsurgical treatment in more than 80% of patients [9]. In 10% of patients, symptoms do not improve with conservative measures and further develop into chronic diseases [10]. In general, when these conservative treatments fail, injecting steroids is considered an option [11]. However, steroid injections are often not successful after 1 injection and can thus require multiple injections, which may be associated with potential complications, including plantar fascia rupture and fat pad atrophy [12,13]. Therefore, the study of alternative therapies is important.

A local injection of platelet-rich plasma (PRP) is an emerging therapy for ligament pathologies and recalcitrant tendons, including PF. PRP is prepared from autologous whole blood that contains an increased concentration of autologous platelets. In the clinic, PRP has been widely applied to various tissue injuries, such as osteoarthritis, muscle strain, bone healing, and tendon injury [14-16]. PRP has also been used as an effective treatment modality in sports medicine to rehabilitate disabled muscles [17]. However, all of these approaches have resulted in inconsistent treatment response rates in different clinical trials. Extracorporeal shock wave therapy (ESWT) has been widely used as an alternative treatment option for PF for decades due to its noninvasive nature, fast recovery time, and convenience for daily life of patients [5,6]. The specific mechanisms of ESWT in treating musculoskeletal pain remain unclear; however, multiple studies have shown that it can destroy sensory un-myelinated nerve fibers, and stimulate neovascularization and collagen synthesis in degenerative tissues [7]. Recently, both focused shock wave (FSW) and radial shock wave (RSW) therapies were introduced as treatment options for PF. Extracorporeal shock waves are focused, single pressure pulses of microseconds duration. They have traditionally been used as one of the most effective approaches to the treatment of renal calculi. More recently, ESWT has been used in the treatment of a number of musculoskeletal conditions such as plantar fasciitis, at doses of 10-20% of those used in lithotripsy of renal calculi [9,10]. ESWT was approved by FDA in 2007 for recalcitrant cases of plantar fasciitis in which conventional treatment has not been effective [11].

Patient as well as doctor huge dissatisfaction led to a search for an alternative mode of treatment and both ESWT and Autologous PRP injections have shown promising results in recent years [14,15]. Although many studies have shown the efficacy of both these modalities when used individually, no conclusive treatment guidelines are available. There are still so many ongoing studies on these specific modalities for the treatment of plantar fasciitis. So this study was aimed to prospectively evaluate and bring out the comparison between the two treatments modalities in terms of their efficacy and prevent recurrence when used for the treatment of plantar fasciitis.

Review of Literature

Ignoring this so called common heel pain can result in very severe constant recurrent heel pain which hinders even regular activities of the person. They're likely to change the walking or standing posture to avoid the pain, which sometimes might lead to foot, knee, hip or back problems. The longer the person delays the treatment, the less likely they are to improve from conservative management as they continue to overload the ligament so the inflammation keeps developing eventually the other ways of treatment procedures doesn't make a difference. They may require surgical treatment. But recent studies shown significant improvement in these recurrent plantar fasciitis conditions with the use of two very specific treatment modalities which are the Intraregional platelets rich plasma injections and extracorporeal shockwave therapy.

Based on the meta analysis of randomized controlled trials on Platelet-rich plasma as a treatment for plantar fasciitis conducted by Wei-yi Yang, Yan-hong Han, Xue-wei Cao, Jian-ke Pan, Ling-feng Zeng, Jiong-tong Lin and Jun Liu on evaluating the current evidence concerning the efficacy and safety of PRP as a treatment for PF compared with the efficacy and safety of steroid treatments. They conducted this study on 430 people who are suffering from chronic heel pain. The results were monitored and measurements were taken on the visual analogue scale (VAS), Foot and Ankle Disability Index (FADI), American Orthopedic Foot and Ankle Society (AOFAS) scale, and the Roles and Maudsley score (RMS). The statistical analysis was performed with RevMan 5.3.5 software. The outcome of the study was that there is no significant differences in short-term (2-4 weeks) and intermediate-term (4-8 weeks) pain relief. However, they said that PRP had better long-term efficacy in relieving pain (≥24 weeks). In addition, they found no differences in functional improvement between PRP and steroid treatments. Considering the long-term effectiveness of PRP, they recommended the use of PRP as the preferred treatment for plantar fasciitis.

A British Medical Bulletin published an article in 2014 on a systemic review on Platelet-rich plasma injections for chronic plantar by facilitate F Franceschi, R Papalia, E Franceschetti, M Paciotti, N Maffulli, V Denaro, by conducting a study on 256 patients who are clinically diagnosed with plantar fasciitis. Ninety-three patients were male and 163 were female, with a ratio male/female of 0.63. The mean age of the patients involved in all the studies was 45.43 years. Different scores were used to evaluate the outcomes. The most frequently used test was the VAS (Visual analogue scale) score. Roles and Maudsley scores were recorded in three of eight studies. The AOFAS (American Orthopedic Foot and Ankle Society) score were used in two studies. Plantar fascia bands thickness was evaluated by ultrasound in one article.

They compared PRP with different treatment modalities like dextrose prolotherapy, CCS. The randomized controlled trial by Kim and Lee did not find any significant difference comparing PRP and dextrose prolotherapy at 6 months. The controlled study by Aksahin et al. also failed to note the difference between PRP and CS therapy in terms of FFI scores. In other two randomized studies, PRP had a significantly greater efficacy than CS, both after a short-term follow-up of 6 weeks and after a longer period (24 months). They concluded that PRP injection therapy may be of benefit over purely conservative treatment and other injection therapy modalities to treat plantar fasciitis. They said the current evidence is promising but limited, and therefore further high-quality research must be undertaken to both compare PRP versus placebo and better characterize the optimal preparation of PRP, the appropriate recipient, and the timing of the intervention to maximize any benefit it may have.

The study based on extracorporeal shock wave therapy is effective in treating chronic plantar fasciitis as a randomized, placebo-controlled trial with ultra-sonographic and subjective outcome assessments by Babak Vahdatpour, Sepideh Sajadieh, Vahid Bateni, Mehdi Karami and Hamidreza Sajjadieh. This randomized, placebo-controlled trial was conducted from Jun 2010 to Jul 2011 on adult patients with a clinical diagnosis of plantar fasciitis referred to the outpatient clinics of Alzahra University Hospital, Isfahan (IRAN). Patients with plantar heel pain for at least three months, who had no satisfactory response to common treatments such as NSAIDs and physiotherapy were included. The sample size was calculated as at least 20 patients in each group. Patients in the intervention group received 2000 focused shock waves and 2000 radial pulses in three sessions (4000 shock waves/session of 0.2 mJ/mm^2) at weekly intervals.

For the placebo group sham treatment was done where standard contact of radial and focus probe with the skin was provided. Ultra sonographic evaluation was carried out before and after the therapy. All assessments (pain and ultra-sonographic evaluation) were repeated three months after completion of the therapy. Along this time, conservative managements including stretching exercise, using NSAIDs, and heel pad were considered in both groups. Regarding the NRS pain scores, no significant difference were observed between the pain scores of the two groups at baseline (P= 0.59), but after three months follow-up, pain scores was significantly lower in the ESWT group than in the placebo group (P= 0.04). They concluded that ESWT can contribute to healing and pain reduction in plantar fasciitis.

A study conducted on Sonoelastographic evaluation of plantar fascia after shock wave therapy for recalcitrant plantar fasciitis which is a 12-month longitudinal follow-up study by Chueh-Hung Wu, Yun-Yi Lin, Wen-Shiang Chen & Tyng-Guey Wang in 2020 was done. This study was done on 31 participants who are around age 20-80 years old with an unilateral heel pain at the insertion of the PF on the medial tubercle of the calcaneus which becomes worse when waking up in the morning or after rest and also pain duration longer than 6 months despite conservative treatments including shoe modification, arch support, medication and physiotherapy. They recorded the pain measurements in visual analogue scale (VAS) of worst heel pain in previous one week >40 on a scale of 100; and B-mode ultrasound (US) examination revealing a thickened (>4 mm) and hypo echoic plantar fasciitis. Piezoson100 (Richard Wolf, Knittlingen, Germany), a piezoelectric-type device, was used by one physiatrist for ESWT. All participants received three sessions of ESWT (3000 shock waves per session of 0.08-0.2 mJ/mm^2) at weekly intervals.

Local anesthesia wasn't applied during treatment. The target of treatment was determined by the self-reported tender area. A sonographic examination was performed only before each session of ESWT to confirm the depth of the PF. The shock waves were applied to the maximum pain sites and to the surrounding area within a 1-cm radius. Each participant was examined in a prone position with 90° of knee flexion in the neutral ankle position. The ultrasound transducer can be hold more steadily in this posture, which is important for obtain high-quality strain sonoelastography images. The entire width of the PF was examined to localize the thickest area. The stiffness color scale used in the sonoelastogram expresses differing degrees of tissue stiffness with corresponding color.

For the Siemens system, the scale indicates the relative stiffness of the examined tissues within the region of interest (ROI) and ranges from red (hardest), yellow (relatively hard), green (intermediate stiffness), blue (relatively soft), to purple (softest). The Outcome measurements and follow-up was measured in VAS of heel pain, PF thickness, and PF elasticity (hue value) were recorded before ESWT, and 1 week, 1 month, 3 months, 6 months, and 12 months after ESWT. Only 22 patients were able to complete the complete 12 month program and they concluded that after ESWT for plantar fasciitis, heel pain intensity decreased gradually, while the PF thickness became thinner at the 12-month follow-up. The PF became softer at 1 week of follow-up and regained stiffness thereafter, finally becoming stiffer than pre-ESWT at 12 months of follow-up.

A comparative study between intralesional platelet rich plasma injection and extracorporeal shockwave therapy for the treatment of plantar fasciitis was done by Naman Goel, Jatin Talwar Person, Sarang Agarwal, Loveneesh G.Krishna , Ashish Rustagi in 2021. They conducted this study on 60 patients with a clinical diagnosis of recalcitrant plantar fasciitis were randomized into 2 groups; PRP Group (n = 30) and ESWT Group (n = 30). In PRP group patients received 3 intraregional injections of PRP and in ESWT group 3 sessions of Extra Corporeal Shockwave Therapy were administered. The Primary outcome measures were Visual Analogue Scale (VAS) score, American Orthopedic Foot and Ankle Society (AOFAS) Ankle-Hind-foot Score, Roles and Maudsley Index and Heel Tenderness Index (HTI). The secondary outcome measures were complications. The patients were followed up for a period of 6 months and evaluated for various scores. At a follow-up duration of 6 months, their results were consistent with the previous studies which have suggested the efficacy of both local PRP injection and ESWT in treating chronic plantar fasciitis.

Their Significant results were found only on VAS score for both groups (p-value <0.05). However, both modalities resulted in significant clinical improvement with no complications reported. Based on their results they said that they couldn't comment

as to which of the two modalities is better as both modalities have shown significant improvement in pain among the patients with plantar fasciitis. They said they didn't note any statistically significant differences were reported between the two test groups. They finally concluded that both autologous PRP and ESWT can become extremely useful modalities for management of recalcitrant cases of plantar fasciitis with no known adverse effects.

In one Egyptian study on Platelet rich plasma injection versus extracorporeal shock-wave therapy in treatment of plantar fasciitis by Samar G Soliman1, Alaa A Labeeb1, Eman A Abd Allah1, Tarek F Abd-Ella2, El Zahraa A. Abd-El Hady Hammad was done. This comparative study included 60 patients, comprising 48 female and 12 male patients with plantar fasciitis diagnosed clinically and by ultrasound. The patients were divided into two groups: 30 patients received single local PRP injection and 30 patients received three sessions of ESWT weekly. All patients were assessed using pain visual analog scale (VAS) score, American Orthopedic Foot and Ankle Society (AOFAS) ankle-hind foot scale, and plantar fascia thickness by ultrasound before treatment and at 1 and 3 months after treatment. VAS, AOFAS ankle-hind foot score, and plantar fascia thickness improved significantly in both groups. The AOFAS ankle-hind foot scale shows more improvement in the ESWT group at 1 month after treatment (P= 0.009). Significant improvement in plantar fascia thickness was seen clearly in PRP group at 1 and 3 months after treatment (P < 0.001). VAS and AOFAS ankle-hind foot scale score in patients with calcaneal spur show more improvement in ESWT group at 1 month after treatment (P= 0.019 and P= 0.009, respectively). They concluded that Local PRP injection and ESWT improve pain and function in patients with plantar fasciitis. ESWT showed early improvement if plantar fasciitis is associated with calcaneal spur.

In another study, Chew and coworkers detailed a study that consisted of 54 patients with plantar fasciitis. The three treatment groups included: 19 patients who had PRP and conventional therapy (eccentric stretching, etc.); 19 patients who had ESWT and conventional therapy; and 16 patients who had only conventional therapy. Both the PRP and ESWT cohorts had better VAS and AOFAS scores than the group that only had conventional therapy. However, the authors noted no difference in VAS or AOFAS scores between the ESWT and PRP groups.

In a 2018 study, Augural and colleagues compared VAS scores and the Revised Foot Function Index for patients receiving ESWT, PRP, corticosteroid injection or prolotherapy (injection of dextrose with needling) for the treatment of chronic plantar fasciitis.5 Patients receiving corticosteroid injection showed the best improvement in VAS scores at one month but there was a loss of this improvement noted after one month. Platelet-rich plasma had the best long-term VAS result at 36 months. In a 2019 study comparing PRP to corticosteroid injections for plantar fasciitis, Peer booms and coworkers found that PRP was effective in 84 percent of those studied in comparison to only 55 percent of those treated with corticosteroid injection.

Materials and Methods

Type of Study and Study Design

Comparative, observational and prospective study

Place of study
The study conducted in the department of orthopaedics at a tertiary, teaching hospital attached to our medical college, Chinakakani and at Orthocare clinic, Vijayawada

Duration of study: 02 years(24 months).
Study carried out from the months of September 2020 and September 2022.

Sample size: (n=20)
20 patients underwent treatment for chronic resistant plantar fasciitis.
They were randomized into two groups by randomization method.

Group A: Intra-lesional injections of Platelet Rich Plasma is given to 10 patients of this group.

Group B: Extracorporeal shockwave therapy is given to the other 10 patients of this group.

Selection Criteria

Inclusion criteria:

a. Patients who have failed after undergoing conventional conservative therapies for more than six months of treatment.

b. Patients who are not currently on any other analgesics or conservative therapies

c. Patients with pain in the medial calcaneal tuberosity.

Method

Patients with a clinical diagnosis of recalcitrant plantar fasciitis are required to get tested for

A. Complete blood picture(CBP)

B. Erythrocyte sedimentation rate(ESR)

C. Random blood sugar (RBS)

D. C-reactive protein level.

Only the patients with normal levels of the above mentioned tests are selected. 20 such patients are selected and randomized into two groups each group consisting of 10 patients;

- In group A (PRP): 2 Intralesional injections of Platelet rich plasma are administered, 2 weeks apart (maximum of 2 injections). PRP is to stimulate the natural healing cascade and tissue regeneration by a "supra-physiologic" release of platelet derived factors directly at the site of injection [11].
- In group B (ESWT): 3 sessions of extracorporeal shockwave therapy per week and a maximum of 9 sessions are given. Each session for about 5-7 minutes. Air compressed shockwaves cause mechanical tissue disruption, the repair of which is the theoretical basis for the neovascularization process and subsequent pain relief following ESWT [11].

The primary outcomes are measured in the Visual Analogue Scale (VAS) score given by American Orthopedic Foot and Ankle Society.

a. The patients were called to follow up

b. No other analgesics for pain reduction are given and used.

Instruments Used

i. For the analysis VAS score i.e. Visual Analogue Scale score given by American Orthopedic Foot and Ankle society is used. It is pre-designed, pre-validated, subjective measure for acute and chronic pain. It consists of a 10cm line that represents a continuum between "no pain" and "worst pain". Scores are recorded by marking a handwritten mark on the line. And also American Orthopedic Foot and Ankle Society (AOFAS) Ankle-Hind-foot Score is used.

ii. Extracorporeal shockwave therapy machine

iii. Centrifuge machine

iv. PRP extraction kit

Interventions

I. Intralesional platelet rich plasma injections- 2 doses each 2 weeks apart

II. Extracorporeal shockwave therapy- 3 sessions per week for a maximum of 9 sessions. Each session lasting for 5-7 mins.

Statistical Tool

The data collected summarized in the form of table and graphs of both the groups differently and relevant tests of significance like Chi square test was done. The summarized data was compared as to see which treatment modality has better efficacy for the pain reduction in chronic resistant plantar fasciitis (Figure 1, Tables 1-7).

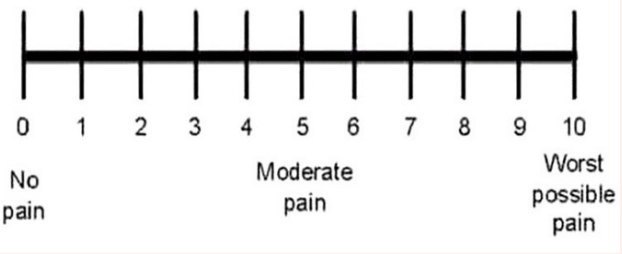


Figure 1: VAS - visual analogue scale.

Table 1: AOFAS -ANKLE Hind Foot scale.

Category	Criteria	Points
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, can	4
	Severe limitation of daily and recreational activities walker, crutches wheelchair, brace	0
Maximum walking distance, blocks	4-6	4
	1-3	2
	Less than I	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 15°)	0
Hind foot 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-hind foot stability (anteroposterior, Varus- valgus)	Stable	8
	Definitely unstable	0

Table 2: Comparison of baseline variables between the study groups. The data were presented in median.

Range	PRP (n=10)	ESWT (n=10)	P value
Age in years	27(55-28)	19(55-39)	0.032
BMI in kg/m^2	25.6(46.9-21.3)	13.4(40.4-26.6)	0.335
Disease duration	3(6-3)	3(8-5)	0.02
VAS score	6(9-3)	6(8-2)	0.04
AOFAS AHF scale	33(78-45)	33(88-52)	0.214

Table 3: Comparison between baseline parameters in first and second follow up.

VAS score	N values	Baseline	First followup	Second followup	P value
PRP	10	6(9-3)	6(8-2)	3(5-2)	<0.0001
ESWT	10	6(9-3)	5(8-3)	2(5-3)	<0.0001

AOFAS AHF Score	N Values	Baseline	First follow up	Second followup	P value
PRP	10	40(80-42)	28(84-56)	12(88-76)	<0.0001
ESWT	10	38(79-40)	34(86-52)	18(88-70)	<0.0001

All groups were significantly different from each other by pair wise comparison. The data were presented in median. PR: platelet-rich plasma; VAS: visual analogue scale; AHF scale.

Table 4: Comparison in the improvement after the treatment.

	PRP	ESWT	P value
VAS score change	3(5-2)	2(5-3	0.135
AOFAS AHF scale	12(88-76)	18(88-70)	0.023

The data were presented in median.

Table 5: The data recorded on VAS scale on the 3,6,12 and 24 months during the treatment of plantar fasciitis with Intralesional platelet rich plasma proteins.

Study participants (n)	Initial VAS score	3m Rx	6m Rx	12 Rx	24m Rx
1	4	4	4	3	2
2	5	5	4	4	2
3	8	7	7	5	4
4	7	6	6	4	2
5	3	3	3	5	2
6	4	4	4	3	3
7	5	5	5	4	3
8	6	6	6	3	2
9	7	6	5	3	2
10	9	8	7	4	3

Table 6: The data recorded on VAS scale on the 3,6,12 and 24 months during the treatment of plantar fasciitis with extra corporeal shockwave therapy.

Study participants (n=10)	Initial VAS score	3m Rx	6m Rx	12mRx	24m Rx
1	9	8	7	5	3
2	6	6	5	4	2
3	7	6	5	4	2
4	5	4	4	3	3
5	3	3	3	2	2
6	4	4	4	3	2
7	5	4	4	3	2
8	4	4	3	3	3
9	6	5	3	2	2
10	8	7	5	3	2

Table 7: Mean data comparison of both PRP and ESWT over 3,6,12 and 24 months of treatment for plantar fasciitis.

Treatment	3m Rx	6m Rx	12m Rx	24m Rx
PRP	5(8-3)	3(7-4)	3(6-3)	2(4-2)
ESWT	5(8-3)	4(7-3)	3(5-2)	1(3-2)

The data is in the form of mean values

Ethical Considerations

Informed written consent was obtained from all the prospective eligible study subjects before data collection and those patients who are unwilling to participate were excluded from the study.

Implications

With the help of this study, both the treatment modalities are compared and evaluated as to which modality is better than the other to treat recalcitrant plantar fasciitis in order to make a way to decrease morbidity in chronic resistant cases.

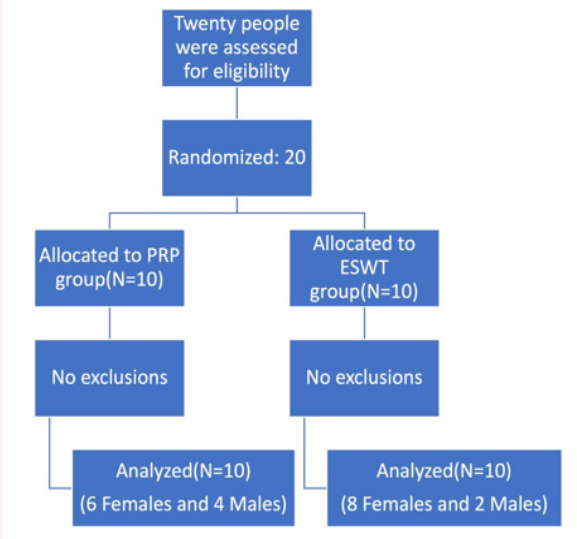
Observations

The study population was calculated using statistical formulas and according to sample size calculation, we considered 10 patients in each group. A total number of 20 patients with plantar fasciitis were entered based on inclusion. We made a note that written informed consent was taken from all patients. All patients were examined by an expert orthopedic surgeon. Patients were randomly divided into 2 groups using SPSS software. The patients in the first group were assigned to PRP injection method and the second group of patients was assigned to ESWT technique.

The pain of patients was measured using visual analogue scale (VAS) before interventions. This scale is a validated, subjective measure for acute and chronic pain. Scores are recorded by making a handwritten mark on a 10 cm line and also is scored from 0 (meaning "no pain") to 10 ("worst pain") [18]. Pain was considered as our primary research indicator while treatment time and age were secondary research indicators.

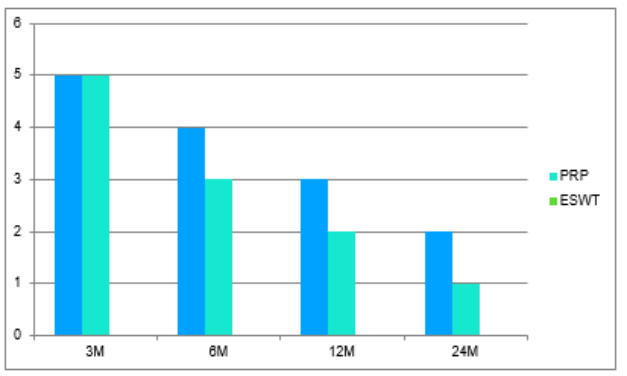
The first group that received PRP treatments consisted of 6 females and 4 males and the second group consisted of 8 females and 2 males. We showed no significant differences between the two groups regarding age (P= 0.032) and BMI (P= 0.335). Analysis of past medical histories of patients also showed no significant differences between the two groups. Initial VAS scores of patients were also analyzed. These data indicated no significant differences between the pains of patients before interventions (P= 0.413). Pain evaluations at 3,6,12 &24 months after interventions showed significantly reduced VAS scores in both groups after interventions. We should also note that there is no significant difference in pain both in the PRP group and ESWT group.

Results



Flowchart: Flowchart regarding the randomization of the study.

On comparing the demographic data in both groups, there was no significant differences in age, BMI involved. The pre-intervention characteristics such as duration of illness and duration of medical treatment received also did not show any significant differences between the 2 groups (Table 3). There were two pain and functional scores utilized for assessment of the patients. The scores in the treatment interventions were compared with the baseline scores and the trend studied in both the groups did not show any significant differences. The mean data of the groups are depicted in the below charts. Both the treatment modalities shows slightly similar results in the treatment of recalcitrant chronic plantar fasciitis (Flow chart & Graph).



Graph: The following two graphs showing the comparison of data from Table 8. The X-axis contains the treatment course over 3,6,12 and 24 months whereas the Y-axis contains the mean values of the data.

Discussion

Plantar fasciitis is the most common issue bringing patients into the opd. While the term plantar fasciitis implies an inflammatory condition, there is much evidence that this heel pain disorder stems from degenerative changes in the fascia and change within the abductor digit minima muscle. Especially when plantar fasciitis continues for many months, experts largely agree that this condition is certainly not an inflammatory issue [19]. Early treatments include modalities such as stretching, physical therapy, non-steroidal anti-inflammatory medications, corticosteroid injections, shoe changes and orthotics that are often utilized simultaneously or in combination. These modalities resolve the issue for the majority of our patients. For example, steroid injections can provide temporary pain relief; however, repeated injections may cause atrophy of the heel pad and even plantar fascia rupture [19]. Surgical interventions, on the other hand, can alter the biomechanics of the foot [20] and prolonged the healing process.

The rationale of the use of PRP is based on the growth factors stored in the alpha granules of platelets. Those factors, such as TGF-β (transforming growth factor beta), VEGF (vascular endothelial growth factor) and PDGF (platelet-derived growth factor), stimulate tissue regeneration from mesenchymal cells, acting on both cell replication and differentiation. The tissue microenvironment determines phenotypic differentiation. Furthermore, platelets activated by thrombin release additional cytokines able to promote tendon cell proliferation [20].

During ESWT, the amount of energy and the frequency of application influence the biological effect on the target tissue. The administration of sound waves creates vibration, which transmits through the tissue and causes local injury. There is a subsequent increase of blood flow and migration of growth factors to the area of treatment. There may be fragmentation with increased pressure in areas of calcium deposition, induction of an inflammatory response leading to an inflammatory-mediated healing process and neovascularization with increased blood flow to the treated site. Multiple studies of ESWT demonstrate destruction of sensory unmyelinated nerve fibers, neovascularization and the creation of collagen within degenerated tissue [21]. There is also the belief that the nerve hyper stimulation may inhibit pain perception [22].

Conclusion

The current evidence is promising but limited, and therefore further high-quality research must be undertaken to both compare PRP versus Extracorporeal shock wave therapy. At a follow-up duration of 24 months, our results were consistent comparing with the previous studies which have suggested the efficacy of both local PRP injection and ESWT in treating chronic recurrent plantar fasciitis. Significant results were

found only on VAS score for both groups (p-value <0.05). However, both the treatment modalities resulted in significant clinical improvement with no complications reported. Based on our results we cannot comment as to which of the two modalities is better as both treatment modalities have shown very little difference and sometimes none as to conclude which treatment modality is better than the other.

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