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Functional outcome of autologous platelet rich plasma injection in plantar fasciitis and tennis elbow

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ABSTRACT

Background: Recent developments in cellular and molecular biology have emerged as a potent tool in the management of orthopaedic illnesses and injuries. Upon binding to the target cell receptor, the growth factor from platelets triggers the activation of an intracellular signal transduction system, which results in a biological response that is essential for chemotaxis, cell proliferation, and osteoblastic differentiation. The aim of this study is to determine the efficacy and safety of autologous platelet-rich plasma injection in tennis elbow and plantar fasciitis.

Materials and Methods : We conducted a prospective study with patients who were suffering from plantar fasciitis (n=37) or tennis elbow (n=23) and were given with autologous platelet-rich plasma injection. A short term follow up of all these cases were done at regular intervals for 1, 4, 8, and 12 weeks. The clinical outcomes were analyzed with severity of pain and movements of the pathological part. The functional outcomes were analyzed with VAS and AOFAS scoring for plantar fasciitis and VAS and Mayo's elbow scoring for tennis elbow. All these patients were statistically analyzed by repeated measures ANOVA test.

Results: Our investigation found a statistically significant difference between pre-procedural and post-procedural scores in both the subjective (VAS) and functional (AOFAS and Mayo elbow score) grading systems used in this study. Patients who received an autologous platelet-rich plasma injection experienced a statistically significant ($p < 0.05$) improvement in their ability to combat both of the musculoskeletal illnesses studied.

Conclusion: Autologous platelet-rich plasma acts as a promising efficacious biological therapeutic agent for use in musculoskeletal disorders such as plantar fasciitis and tennis elbow without major complications upon its usage.

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1. Introduction

Recent developments in cellular and molecular biology have resulted in the identification of specific cytokines that mediate cellular activities, and as a result, they have emerged as a potent tool in the management of orthopaedic illnesses and injuries.¹ By concentrating platelets, it is possible to achieve larger amounts of growth factors, which may help to restart the healing process that has been

prematurely stopped.¹ Upon binding to the target cell receptor, the growth factor triggers the activation of an intracellular signal transduction system, which results in a biological response that is essential for chemotaxis, cell proliferation, and osteoblastic differentiation.^{2–4}

Platelet-rich plasma (PRP) is defined as the volume of supernatant-containing plasma with a platelet concentration that is 4 to 6 times higher than usual (10^5 – 10^6).⁵ PRP contains 94 percent of the total number of platelets found in blood.⁶ Potent osteogenic and osteointegrative

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agents are found in platelet-rich plasma (PRP).^{3,6} The bioactive components in platelets are a mixture of pro-angiogenic, anti-angiogenic, and chemotactic factors that undergo degranulation and stimulate cellular proliferation, chondrogenesis, angiogenesis, and the regeneration of damaged tendons and fascia, among other effects.^{3,6}

Chronic plantar fasciitis, caused by overuse of the plantar fascia, is a self-limiting condition.⁷ There are micro rips, collagen breakdown, and scarring in this condition of the ligament's insertion point on the bone, which makes it difficult to move the ligament.^{7,8} Among patients with plantar fasciitis, the most common site of abnormality is near the origin of the central band of plantar aponeurosis, which is located at the medial plantar tubercle of the calcaneus (enthesis of central band of plantar aponeurosis). Patients should walk with an equinus gait to minimise putting pressure on their aching heels when walking.^{8,9}

Tennis elbow is an idiopathic, benign and self-limiting disease, characterized by degeneration of musculotendinous origin at lateral epicondyle which serves as an origin of common extensor muscles of forearm.¹⁰ Nirschl et al emphasized tennis elbow as a mesenchymal syndrome and proved genetic linkage of disease. They proved the affection of tennis elbow with the higher incidence of rheumatoid factor (RA factor) and HLA – B27 positivity.¹¹ Tennis elbow is primarily due to altered biomechanics of elbow joint and increased activity of extensor carpi radialis brevis activity, underuse or stress shielding, compromised blood supply and apoptosis of tenocytes.^{12,13}

The aim of this study is to determine the efficacy and safety of autologous platelet-rich plasma injection in these common orthopedic conditions such as tennis elbow and plantar fasciitis to recommend its routine clinical use.

2. Materials and Methods

Following permission by an ethical commission, we conducted a prospective study with patients who were suffering from plantar fasciitis (n=37) or tennis elbow (n=23) as subjects. We received their written and informed agreement in their native language, which we translated into English. All of the patients were treated to a comprehensive clinical evaluation. Prior to receiving autologous PRP treatment, the duration of the condition and manner of treatments were evaluated. Those with clinically established plantar fasciitis and lateral epicondylitis who had taken anti-inflammatory medication but had not shown improvement for more than three months, as well as those who consented to treatment with PRP according to our protocol, were eligible to participate in the research. Patients with haemoglobin levels below 10 gm/dl and platelet counts below $10^5/L$, patients who had taken NSAIDs within the previous 3 days, patients who had received a corticosteroid injection at the treatment site within the previous month, patients with local infection at the site of the procedure,

HIV, Hepatitis B or C, septicemia, systemic metabolic disorders, and patients who were pregnant or suffering from malignancy were excluded from the study.

2.1. PRP preparation

The patient is placed in the recumbent posture while aseptic precautions are observed, and 20 cc of venous blood is extracted and placed in vials with acid citrate dextrose anticoagulant. Afterwards, it is centrifuged for 10 minutes at 3000 rpm, which is the first of two centrifugations. In the following step, plasma and buffy coat are separated in plain tubes, which are then subjected to a second centrifugation for 10 minutes at an RPM of 5000 for the final separation. The resulting plasma solution contains 2/3 platelet poor plasma and 1/3 platelet rich plasma, with the upper 2/3 of platelet poor plasma and the lower 1/3 of platelet rich plasma. The lower one-third of the solution is taken out of the sterile syringes and injected directly into the diseased area.

2.2. Pre-procedural precautions

The cases are being investigated for the use of NSAIDs 72 hours before to the PRP injection and for the use of steroids 4 weeks prior to the PRP injection. Prior to surgery, the severity of pain is determined by utilising conventional grading standards, which are applied during the pre-operative period.

2.3. PRP injection technique

The pathological location is painted and draped in accordance with aseptic procedures. In order to stimulate the platelets in PRP before injection, calcium chloride is added to PRP in a 1:10 ratio prior to injection. The syringe containing PRP is gently stirred after the calcium chloride has been added to ensure that the calcium chloride and PRP are distributed evenly throughout the syringe. The PRP must be injected into the pathogenic location under ultrasound guidance as soon as the site of greatest tenderness has been identified. There should be no additional delay after this. A sterile dressing and a crepe bandage are put to the injection site to protect it against infection. Individualized home-based elbow and ankle strengthening programmes are provided to the patients.

2.4. Post procedural care

In order to avoid weight bearing for a minimum of 2 weeks, all patients are advised to apply ice packs to the area where the injection was performed following the procedure.

A short term follow up of all these cases were done at regular intervals for 1, 4, 8 and 12 weeks after percutaneous PRP injection and the outcomes were assessed clinically, functionally and statistically. The clinical outcomes were

analyzed with severity of pain and movements of the pathological part. The functional outcomes were analyzed with VAS and AOFAS scoring for plantar fasciitis and VAS and Mayo's elbow scoring for tennis elbow. All these patients were statistically analyzed by repeated measures ANOVA test.

Patients who reported a recurrence of symptoms were provided a second dose of autologous PRP injection three weeks after the first injection if the symptoms had returned. This 3 week break between doses is necessary due to the production of collagen and proliferation of fibroblasts in the diseased site of the disease process during the first treatment cycle.

3. Results

Our study included 60 participants, 34 of whom were males and 26 of whom were girls. The mean age of the patients who took part in our study was 48.48 years, with the youngest patient being 19 years old and the oldest being 79 years old. Everyone (n=60) received a single dose of autologous PRP injection after being assessed and charted out according to the pre-procedural functional grading system. After that, all of the patients are notified that they will need to come back to our department for a follow-up to examine their pain alleviation and functional outcome following the autologous PRP injection.

3.1. Plantar fasciitis

Patients with plantar fasciitis were treated with autologous platelet-rich plasma (PRP) injections in 37 cases, with 22 males (59.45 percent) and 15 females (40.54 percent) receiving the treatment. The mean age of patients with plantar fasciitis is 55.43 years, with a minimum age of 26 years and a maximum age of 79 years in the plantar fasciitis entity. A total of 31 patients (83.78 percent) experienced pain relief after receiving the first dose of autologous PRP, and 4 patients (10.8 percent) experienced pain relief after receiving the second dose of injection. Two patients (5.42 percent) presented with recalcitrant disease and were advised to seek surgical intervention. During the pre-operative period, the mean VAS and AOFAS scores were 8.88 and 46.71 respectively, while the mean post-operative 3rd month VAS and AOFAS scores were 3.54 and 86.27 respectively during the post-operative period. Both pain alleviation and functional improvement ($p < 0.001$) were observed to be statistically significant improvements ($p < 0.001$).

3.2. Tennis elbow

Twelve male patients (52.17 percent) and eleven female patients (47.82 percent) were treated with autologous platelet-rich plasma (PRP) injections out of a total of 23 instances of tennis elbow. Patients with tennis elbow have

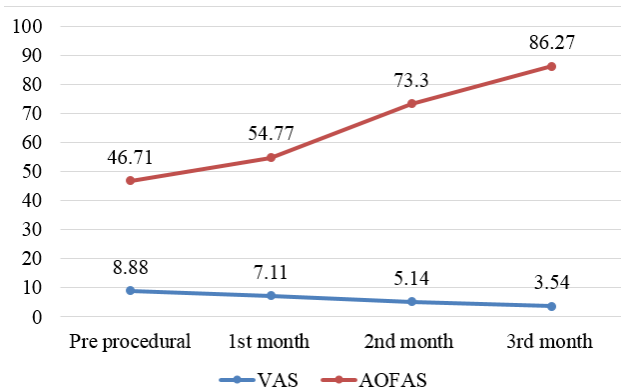


Fig. 1: Functional outcome of PRP in Plantar fasciitis

a mean age of 43.78 years, with a minimum age of 19 years and a maximum age of 77 years. Tennis elbow is a common condition. A total of 19 patients (82.6 percent) experienced pain relief after receiving the first dose of autologous PRP, and 2 patients (8.7 percent) experienced pain relief after receiving the second dose of injection. Two patients presented with recalcitrant disease and were advised to seek surgical intervention. The mean VAS and Mayo's elbow scores before the procedure were 8.84 and 42.20, respectively, while the mean VAS and Mayo's elbow scores after the procedure were 3.56 and 83.85, respectively. Both pain alleviation and functional improvement ($p < 0.001$) were observed to be statistically significant improvements ($p < 0.001$).

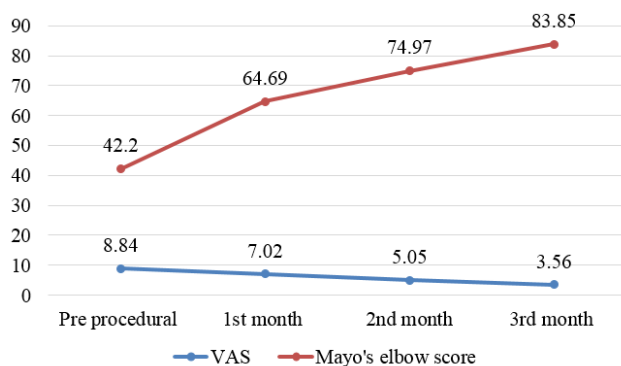


Fig. 2: Functional outcome of PRP in tennis elbow

Out of 60 cases, 50 patients (83.33 percent) reported pain relief after receiving one dose of autologous PRP injection at the end of the first month of follow-up, and 6 patients (10 percent) reported pain relief after receiving a second dose of injection administered three weeks after the first dose. After three months of receiving the first dose, four patients (6.66 percent) reported with recalcitrant illness. Our investigation found a statistically significant difference between pre-procedural and post-procedural scores in both the subjective

Table 1: Number of PRP doses and cure rates

Disease	Total	No of patients cured with 1 st dose of autologous PRP (at 4 weeks)	No of patients cured with 2 nd dose of autologous PRP	No of patients with recalcitrant disease (at 12 weeks)
Plantar fasciitis	37	31	4	2
Tennis elbow	23	19	2	2
Total cases	60	50	6	4

Table 2: Functional outcome analysis at varied time points

Disorder	Scoring	Pre procedure	Repeated measures ANOVA test (p value)		
			1 st month	2 nd month	3 rd month
Plantar fasciitis (n=37)	VAS	0.527	0.045	0.001	<0.001
	AOFAS	0.671	0.091	0.006	<0.001
Tennis elbow (n=23)	VAS	0.415	0.021	0.003	<0.001
	Mayo's elbow score	0.087	0.056	0.026	<0.001

(VAS) and functional (AOFAS and Mayo elbow score) grading systems used in this study. Patients who received an autologous platelet-rich plasma injection experienced a statistically significant ($p < 0.05$) improvement in their ability to combat both of the musculoskeletal illnesses studied.

Pain at the injection site was observed in 22 patients (36.6 percent), edoema was observed in 7 patients (11.66 percent), and recurrence of symptoms was observed in 4 patients (6.66 percent). There were no further adverse effects reported by the patients who took part in the research. All four of the recalcitrant cases are advised to undergo surgical intervention.

4. Discussion

Plantar fasciitis and tennis elbow are caused by overuse and repetitive microtrauma to the bone tendon junction, as well as the fascia and sheaths that cover the musculotendinous units in the foot.¹⁸ In the medical community, overuse syndrome is defined as the unpleasant diseases that affect the tendons that are caused by repetitive strain, overuse, ageing, degeneration, or poor biomechanics.^{19,20} These musculoskeletal problems reduce the overall quality of life by producing pain and hindering mobility, reducing the capacity to conduct everyday activities, and interfering with an active lifestyle, among other things.^{19,21}

The following are the many treatment options for plantar fasciitis and tennis elbow:

1. Using the PRICE model – Protection, Rest, Ice application, Compression and Elevation – as well as the POLICE model – Protection, Optimal Loading, Ice application, Compression and Elevation.
2. In addition to the use of analgesics and muscle relaxants, local steroid infiltration (40 mg of triamcinolone) into the afflicted tendon sheath,

as well as local sodium hyaluronate injection (viscosupplement).

3. Physical therapy - Ultrasonic therapy and soft tissue massage of the damaged joints, a home-based exercise programme.
4. Orthotics such as braces and splints, which limit micromotion at the injured area.
5. Biological therapy in the form of cryotherapy at temperatures between -110 and -140 degrees Celsius, autologous platelet rich plasma (PRP) injection, homologous platelet lysate (HPL) injection, autologous tenocytes injection, autologous blood injections and tissue bioengineering with mesenchymal stem cells and silk scaffolds are all being investigated.
6. Surgical management in the form of open or arthroscopic release of fibrosis of the tendon sheath that covers the tendons.

It is now recognised as a biological modality for treating musculoskeletal disorders due to the advantages of increased bioactive micromolecules at the injured or diseased site, as well as its ability to provide a scaffold or provisional matrix for the healing process, as well as its ability to eliminate the risk of disease transmission.²² Platelet-rich plasma (PRP) has a high margin of therapeutic efficacy and safety when compared to other therapies.

In this article, we discussed the use of autologous platelet rich plasma injections for the treatment of planar fasciitis and tennis elbow, respectively. Our study found that functional improvement occurred in 50 patients (83.33 percent) after receiving the first dose of autologous PRP injection and in 6 patients (10 percent) after receiving the second dose of autologous PRP injection after an interval of 3 weeks from the first dose, with statistically significant results (p value < 0.001) being presented with the results.

Table 3: Complications

Disease	Pain	Swelling	Recurrence
Plantar fasciitis	14	4	2
Tennis elbow	8	3	2
Total no. of cases	22	7	4

Table 4: Comparison of results of present study with other studies

Study	No of cases	Scoring system	Duration	Cure rate
Mishra et al. ¹⁴	n = 15	VAS	6 months	81.00%
Peerbooms et al. ¹⁵	n = 51	VAS	6 months	73.00%
Creaney et al. ¹⁶	n = 80	VAS	6 months	77.02%
Barret et al. ¹⁷	n = 9	VAS	12 months	77.80%
Current study	n = 60	VAS, AOFAS & Mayo's elbow score	3 months	82.00%

Our study has certain limitations. We did not standardize the platelet count in the prepared autologous PRP used among the included patients. The concentrate of growth factors injected were also not quantified which could be a variable attributable to the difference in the results among the patients. We had a short duration of follow-up which needs to be lengthened further to explore into its long term efficacy.

5. Conclusion

Autologous platelet rich plasma acts as a promising efficacious biological therapeutic agent for use in musculoskeletal disorders such as plantar fasciitis and tennis elbow without major complications upon its usage.

6. Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

7. Source of Funding

None.

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