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Original Research Article

Functional Outcome and Improvement in Pain Following Autologous Platelet Rich Plasma Infiltration in Lateral Epicondylitis Patients

Sandeep Vellarakkat[1], Rijesh Pottangadi[2], M K Ravindran[3]

[1]Assistant Professor, Department of Orthopaedics, Malabar Medical College and Research Centre, Modakkallur, Kozhikode, Kerala.
[2]Professor, Department of Orthopaedics, Malabar Medical College and Research Centre, Modakkallur, Kozhikode, Kerala.
[3]Professor, Department of Orthopaedics, Malabar Medical College and Research Centre, Modakkallur, Kozhikode, Kerala.

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Corresponding author: Dr. Sandeep Vellarakkat
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Abstract

Introduction: Platelet Rich Plasma (PRP) is prepared from autologous human plasma and has higher platelet concentration. Injections of PRP have been found to be effective in treating tendinopathies. Only a few studies focused on using PRP injection in patients with lateral epicondylitis (tennis elbow). Hence functional outcome and improvement in pain following treatment with PRP injection needs to be further studied.

Aim of the Study: To assess the relief of pain and functional outcome after PRP injection in patients with tennis elbow.

Materials: A prospective study on 65 patients diagnosed with tennis elbow, aged between 18 to 65 years with symptoms of pain not relieved with oral analgesics or physiotherapy was conducted. Patients were evaluated using a Patient Rated Tennis Elbow Evaluation (PRTEE) Score and Visual Analogue Pain Scale (VAS) before and after autologous platelet rich plasma infiltration in the tendon.

Results: Among the 65 patients participated the mean age was 37.72±4.10 years. There was statistically significant difference in the pain scores measured by PRTEE score and VAS before and after injection of PRP. Paired t test of both PRTEE score and VAS scores was found to be statistically significant with the difference of means of score at 2 weeks, 4 weeks, 8 weeks and 12 weeks ($p < 0.001$). Repeated measures of ANOVA of PRTEE scores and VAS scores at pre procedure, 2, 4, 8 and 12 weeks also found that there was a significant difference in mean values of PRTEE scores and VAS scores at pre procedure, 2, 4, 8 and 12 weeks and was statistically significant ($p < 0.001$).

Conclusion: In tennis elbow patients, PRP injection can be used an alternative treatment option as it shows an effective reduction in pain and improves functional outcome according to PRTEE Score and VAS Score in the short term.

Keywords: Platelet rich plasma, Lateral epicondylitis, Pain and Functional outcome.

Introduction

Lateral epicondylitis is commonly due to overuse injury and eccentric overload at the origin of the Extensor carpi radialis brevis (ECRB) muscle [1]. It may also involve micro tears of Extensor carpi radialis longus(ECRL) and Extensor carpi ulnaris (ECU). Specific cytokines that mediate cellular activities were identified in the last two decades during cellular and molecular biology experiments, which were found to be potent in treating various diseases of unknown origin of multiple specialties [2]. These factors extracted from the components of blood were found to help recommence the prematurely stopped healing process and as a result, they have emerged as a potent tool in the management of orthopaedic illnesses and injuries [3]. Platelet-rich plasma (PRP) contains Growth factors and mediators like transforming growth factor-1 (TGF-1), platelet-derived growth factor (PDGF), vascular endothelial growth factor (VEGF) and epidermal growth factor (EGF) which promotes healing process when injected to an injury site [4]. Growth factor initiates the activation of intracellular signal transduction system once it is bound to the target cell receptor resulting in a biological response that is necessary for chemotaxis, cell proliferation, and osteoblastic differentiation [5,6]. Platelet rich plasma (PRP) is actually that part of supernatant containing plasma having 4 to 6 time's higher concentration of platelets obtained by controlled centrifugation [7]. Active and powerful osteogenic and osteointegrative agents were found in platelet-rich plasma (PRP).[8] These bioactive agents in platelets were found to be a mixture of proangiogenic, anti-angiogenic, and chemotactic factors which are released after platelet degranulation at the site of injection and stimulate cellular proliferation, chondrogenesis, angiogenesis, and the regeneration of damaged tendons and fascia, among other effects [8]. Many studies have been done to study the role of PRP to treat tendon injuries or tendinopathies [9,10)]. PRP promotes neo-vascularisation, which increases the blood supply and nutrients required for cells to heal injured tissue. PRP injections were found to be effective for treating symptomatic tendinopathy in a recent review and meta-analysis [11]. The procedure requires extraction of patient's venous blood, centrifugation, and injection of plasma into the lateral epicondyle at the maximum point of tenderness. It has been documented that the results have been positive [12]. In many studies the peppering technique has been used for injecting [13,14]. Research on PRP injection in lateral epicondylitis had shown encouraging results, but more research studies are needed to study the effect of PRP on pain improvement and functional outcome. The aim of the study is to assess the improvement in pain and functional outcome after autologous PRP injection in patients with tennis elbow.

Materials

A prospective study was conducted between July 2021 and July 2022, at Malabar Medical College Hospital and Research Centre, Calicut, Kerala. An institution Ethics committee clearance from Malabar Medical College Hospital and Research Centre was obtained before commencing the study and the committee approved consent form and proforma were used for the study. 65 patients diagnosed with tennis elbow attending the Department of Orthopaedics were included in the study.

Inclusion Criteria: Patients of all genders were included. Patients aged between 18 and 65 years were included. Patients with symptoms of pain not subsided with oral analgesics or physiotherapy were included. Patients with clinically confirmed diagnosis of Tennis elbow (lateral epicondylitis) and who had taken anti-inflammatory medicines but had no improvement or partial relief for more than three months were included.

Exclusion Criteria: Patients aged below 18 years and above 65 years were excluded. Patients with low haemoglobin concentrations (< 10 Gm%) were excluded. Patients who had taken NSAIDs within 3 days before injection were excluded. Patients who were on oral or injectable (local or systemic) corticosteroids were excluded. Patients who have undergone elbow surgeries, immune-compromised status, bleeding disorders, those on anticoagulants intake, alcohol and smoking habits, mentally challenged persons, were excluded from the study. All patients included were given the choice of joining the study by taking an informed consent. The PRP was prepared from venous whole blood of the patient.

PRP preparation: 20 ml venous blood from the patients was drawn and collected in acid citrate dextrose anticoagulant vials. In its first centrifuge the collected venous blood was centrifuged for 10 minutes at 3000 rpm. A second centrifuge of separated plasma and buffy coat in separate plain tubes at 5000 rpm for final separation was done. Thus, obtained plasma solution contained 2/3 platelet poor plasma at the top and 1/3 platelet rich plasma at the bottom. The lower one-third plasma was drawn in the sterile syringes and used for injecting directly into the diseased area.

PRP injection technique: No local anaesthetic was used prior to the injection of PRP. The site of injection, in this study the lateral epicondyle of elbow area was painted and draped under aseptic conditions in a minor operation theatre. To stimulate the platelets in PRP before injection, calcium chloride was added to PRP in a 1:10 ratio. The syringe containing PRP was gently stirred after adding calcium chloride to make sure that the calcium chloride and PRP are mixed and distributed evenly throughout the syringe. The PRP was injected into the pathogenic location after carefully locating the anatomical site of maximum tenderness. No delay after mixing the calcium chloride was allowed. Sterile dressing and a firm crepe bandage were applied to the site of injection to protect from infection as well as to prevent hematoma. Patients were encouraged to perform home-based elbow strengthening exercises at home till the next visit.

Post procedural care: Patients were advised to avoid lifting weights or heavy objects for 2 weeks. Patients were advised to apply ice packs to the site of injection for two days. Patients were assessed before PRP injection using PRTEE Score and VAS Score and at 2weeks, 4 weeks, 8weeks and 12 weeks after the injection during follow-up period. The data were entered in Microsoft Excel 2013, and results were analysed in Statistical Package for social sciences (SPSS) IBM Corp Ver 20.

Statistical Analysis

The continuous variables were described as mean, standard deviations and qualitative data were described in terms of percentage and frequency. Paired t-test and repeated measures of ANOVA (Analysis of variance) was done to analyse the association between the mean pain scores of both PRTEE and VAS on pre- and post-procedure follow up.

Results

Totally 65 patients with clinical diagnosis of Lateral Epicondylitis attending the Department of Orthopaedics of Malabar Medical College Hospital and Research Centre, Kozhikode, Kerala were analyzed for final outcome after PRP injection at fixed time intervals. The mean age of the participants was 37.72±4.10.There were 35 (53.8%) males and 30 (46.2%) females. In 43 (66.2%) patients the right elbow was involved and in 22(33.8%) patients left elbow was involved. The mean value of pain score at various follow-up points including before injection of PRP was tabulated in Table 1 and 2.

Table 1: Distribution of the study participants according to the PRTEE score (n=65).

Descriptive statistics	PRTEE Pre-procedure	PRTEE 2weeks	PRTEE 4weeks	PRTEE 8weeks	PRTEE 12weeks
Mean	74.446	67.423	37.438	21	04.331
Std. deviation	05.86	05.728	04.809	04.7162	05.265
Median	73	68	37.5	21	3

Table 2: Distribution of the study participants according to the VAS score (n=65).

Descriptive statistics	VAS Pre-procedure	VAS 2weeks	VAS 4weeks	VAS 8weeks	VAS 12weeks
Mean	82.69	60.71	41.38	24.28	4.72
Std. deviation	8.7	10.446	8.029	6.304	6.084
Median	80	65	40	25	0

Comparison of mean scores between PRTEE Pre-procedure with PRTEE scores 2, 4, 8 and 12 weeks was done using paired t test. It was found that there was statistical significance in the difference of means of PRTEE score at 2 weeks, 4 weeks, 8 weeks and 12 weeks ($p < 0.001$). There was significant positive correlation with the PRTEE scores at 2nd week and 12th week after the procedure. (Table 3)

Table 3: Comparison between PRTEE score before & after the procedure (n=65)

Observations	Correlation	t value	p- value
PRTEE Pre-procedure Vs PRTEE 2weeks	0.399	8.914	<0.001
PRTEE Pre-procedure Vs PRTEE 4weeks	0.082	41.046	<0.001
PRTEE Pre-procedure Vs PRTEE 8weeks	-0.050	55.927	<0.001
PRTEE Pre-procedure Vs PRTEE 12weeks	0.345	88.513	<0.001

Comparison of mean scores between VAS Pre-procedure with VAS scores 2, 4, 8 and 12 weeks was done using paired t test. It was found that there is statistical significance in the difference of means of VAS score at 2 weeks, 4 weeks, 8 weeks and 12 weeks ($p < 0.001$). There was significant positive correlation with the VAS scores at 4th week and 12th week after the procedure. (Table 4)

Table 4: Comparison between VAS score before & after the procedure (n=65)

Observations	Correlation	t value	p- value
VAS Pre-procedure Vs VAS 2weeks	0.100	13.732	<0.001
VAS Pre-procedure Vs VAS 4weeks	0.251	32.496	<0.001
VAS Pre-procedure Vs VAS 8weeks	0.138	47.031	<0.001
VAS Pre-procedure Vs VAS 12weeks	0.333	71.449	<0.001

Repeated measures of ANOVA (Analysis of variance) was used to test the statistical significance in mean values of PRTEE scores and VAS scores at pre procedure, 2, 4, 8 and 12 weeks. It was found that there was a significant difference in mean values of PRTEE scores and VAS scores at pre procedure, 2, 4, 8 and 12 weeks ($p < 0.001$). (Table 5 and6)

Table 5: Comparison of PRTEE scores at Pre-procedure, 2, 4, 8, 12 weeks (n=65).

PRTEE Scores	N	Mean	SD	p value
PRTEE Pre-procedure	65	74.446	5.86	<0.001
PRTEE 2wk	65	67.423	5.728	
PRTEE 4wk	65	37.438	4.809	
PRTEE 8wk	65	21	4.716	
PRTEE 12wk	65	4.331	5.265	

Table 6: Comparison of VAS scores at Pre-procedure, 2, 4, 8, 12 weeks(n=65).

VAS Scores	N	Mean	SD	p value
VAS pre-procedure	65	82.69	8.7	<0.001
VAS 2wk	65	60.71	10.446	
VAS 4wk	65	41.38	8.029	
VAS 8wk	65	24.28	6.304	
VAS 12wk	65	4.72	6.084	

Figure 1 and 2 showed that there was progressive decrease in the mean PRTEE score and mean VAS score calculated at pre procedure, 2weeks, 4weeks, 8weeks and 12weeks, showing progressive improvement during the follow up period.

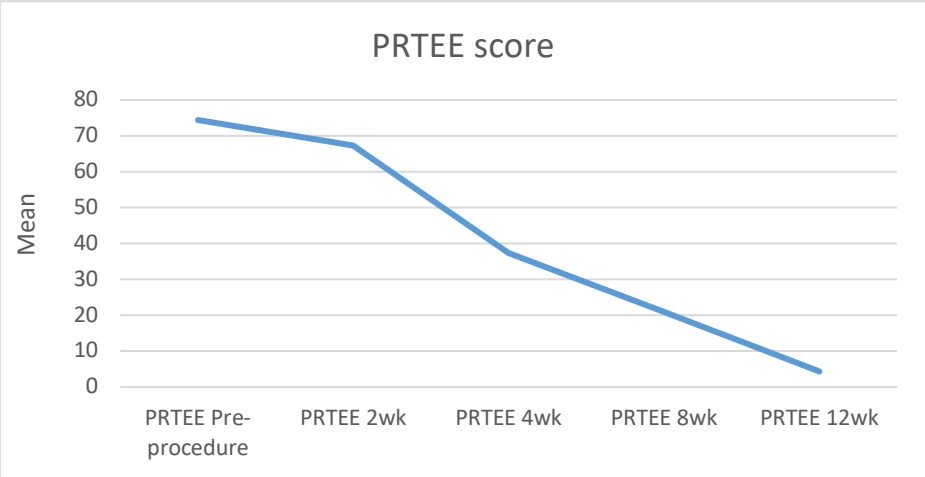

Figure 1: PRTEE score mean

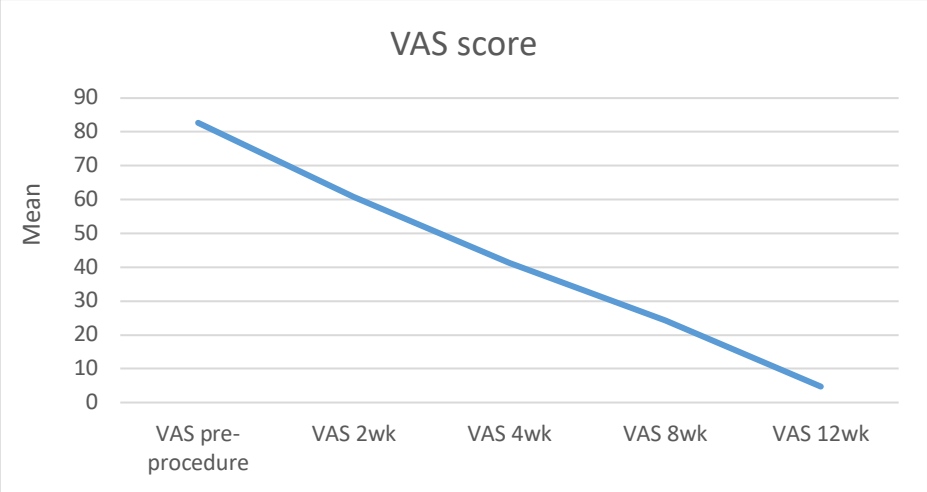

Figure 2: VAS score mean

Discussion

The present study was a prospective study to analyze the final outcome of PRP injections in Lateral Epicondylitis patients. Lateral Epicondylitis is caused by overuse and repeated micro-trauma to the bone tendon junctions [15]. Many physicians use the term "overuse syndrome" to define the condition as an unpleasant pain resulting due to affection of the tendons caused by repetitive strain, overuse, ageing, degeneration, or poor biomechanics [16,17]. It also affects the mobility and quality of life to bring down the capacity to use the joint in day to day

activities [18]. In the present study, the mean age of the participants was 37.72±4.10. There were 35 (53.8%) males and 30 (46.2%) females. In 43 (66.2%) patients the right elbow was involved and in 22(33.8%) patients left elbow was involved. The choices of treatment available in the literature for Tennis elbow are: 1. PRICE model: Protection, Rest, Ice application, Compression and Elevation. 2. POLICE model: Protection, Optimal Loading, Ice application, Compression and Elevation. 3. Analgesics and muscle relaxants, local steroid infiltration (40 mg of triamcinolone) into the afflicted tendon sheath, as well as local sodium hyaluronate injection. 4. Physical therapy: Ultrasonic therapy and soft tissue massage of the damaged joints, a home-based exercise programme. 5. Orthotics such as braces and splints, which limit micro-motion at the injured area. 6. 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. 7. Surgical treatment used is in the form of open or arthroscopic release of fibrosis of the tendon sheath that covers the tendons. The present study was based on the biological modality for treating musculoskeletal disorders due to the advantages of increased bioactive micro-molecules at the injured or diseased site, as well as its ability to provide a scaffold or provisional matrix for the healing process [19]. Platelet-rich plasma (PRP) has a high margin of therapeutic efficacy and safety when compared to other therapies. The present study showed a statistically significant association in the pain scores measured by PRTEE score and VAS scores before & after the injection of PRP. Paired t test of both PRTEE score and VAS score found that there was statistical significance in the difference of means of score at 2 weeks, 4 weeks, 8 weeks and 12 weeks ($p < 0.001$). There was significant positive correlation with the PRTEE scores and VAS scores during follow up. Repeated measures of ANOVA of PRTEE scores and VAS scores at pre procedure, 2, 4, 8 and 12 weeks also found that there was a significant difference in mean values of PRTEE scores and VAS scores at pre procedure, 2, 4, 8 and 12 weeks ($p < 0.001$). There was progressive improvement in PRTEE score and VAS score calculated at timely interval showing improvement in pain and functional outcome following PRP injection. Watts *et al.,* [20] in their study compared functional and pain scores in PRP treated and open surgical release groups. They found that there were no differences in functional improvements but greater improvements in PRTEE pain scores at 12 months were seen after open surgical release. Another study by Paramanantham *et al*., [21] showed that there was statistical significance in the difference of means of pain score obtained using both VAS and MAYO score at 12 weeks and 24 weeks and that there is high significant positive correlation of age with the pain scores at 12th week and 24th week after the procedure. A study conducted by Yerlikaya *et al*.,[22] in 2017, among 90 patients with lateral epicondylitis, with the aim of comparing the effects of leukocyte-rich and leukocyte-poor PRP on pain and functionality, concluded that there were no significant differences in VAS, PRTEE, grip and pinch measures, extensor tendon thickness, or cortical derangement across groups ($p > 0.05$). Gautam *et al*., [23] compared the clinical and ultrasonographic changes in the morphology and vascularity of the common extensor tendon after injecting platelet-rich plasma (PRP) or corticosteroid for recalcitrant lateral epicondylitis. The VAS for pain, DASH score, Oxford Elbow Score, modified Mayo score, and hand grip strength all improved significantly from pre-injection to the 6-month follow-up in the PRP and corticosteroid groups. However, in the corticosteroid group, the scores generally

peaked at 3 months and then deteriorated slightly at 6 months indicating recurrence of symptoms. Hence PRP appeared to enable biological healing of the lesion, whereas corticosteroid appeared to provide short-term, symptomatic relief but resulted in tendon degeneration [4]. There are many varieties of PRP devices available but no definite opinion about which PRP device would give better PRP preparation in respect to its components.[24, 25] Such diverse PRP preparations available would make the assessment of efficacy and evidence of PRPs also difficult as to which component factor was playing its role [25-28]. PRP basically stimulates healing by initiating or inducing a temporary inflammatory process at the site followed by positive immune-modulatory changes on tenocytes [29,30].

Conclusions

In this short-term prospective study of tennis elbow patients, PRP injections at the point of maximum tenderness on lateral epicondyle gave effective relief of pain and improved functional outcome as per PRTEE scores, VAS scores recorded and analyzed. Autologous platelet rich plasma (PRP) acts as a biological therapeutic agent for usage in musculoskeletal disorders such as tennis elbow without major complications. Thus, PRP injections can be used as a safe treatment alternative to other standard regimens already available and in those patients who do not prefer surgery.

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