

Treatment of Chronic Lateral Epicondylitis: Platelet Rich Plasma versus Extra-Corporeal Shock Wave Therapy

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Abstract

Background: Several treatment options have been proposed to treat lateral epicondylitis. Both Platelet rich plasma (PRP) and Extra-corporeal Shock Wave Therapy (ESWT) are new treatment modalities for tendinopathy. **Patients and Methods:** Thirty seven patients suffering from chronic lateral epicondylitis (tennis elbow) for at least six months were treated in this study. The patients were divided into two treatment groups, the first group including 20 patients treated by ESWT and the second group including 17 patients treated by local injection of platelet-rich plasma. The results were evaluated using the visual analogue scale and the DASH score. **Results:** In the first group (treated by ESWT), the average follow-up period was 21.55 months. The average VAS improved from 8.2 to 1.95 and the average DASH score improved from 72.25 to 51.7. Moreover, 11 cases were satisfied (55%), 3 cases (15%) were satisfied with reservation and 6 cases (30%) were not satisfied. In the second group (treated by PRP), the average follow-up period was 18.47 months. The average VAS improved from 8.52 to 1.47, the DASH score improved from 72 to 48.23. Concerning patient satisfaction, 13 cases were satisfied (83.33%), 3 cases (10.52%) were satisfied with reservation and 1 case (5.55%) was not satisfied. **Conclusion:** Platelet rich plasma was proved to achieve superior results when compared to ESWT as regards pain relief, improvement of elbow function and patient satisfaction at follow-up.

Keywords

Lateral Epicondylitis; ESWT; PRP; DASH Score

1. Introduction

Tennis elbow is the most common cause of elbow pain in patients attending the orthopedic clinics. It occurs

most commonly in the tendon of extensor carpi radialis brevis [1].

However, other tendons of the extensor bundle such as the extensor digitorum communis (involved in 30% of cases) may be involved [2].

Pathophysiology involves microtears in the tendon leading to hemorrhage, rough granulation tissue formation and later repair [3].

The initial management of tennis elbow is conservative, with the use of rest, activity modification, non-steroidal anti-inflammatory drugs, forearm bracing, physiotherapy and local steroid injections. These measures result in up to 90% of patients being in a transient remission [4] [5].

Even though the different treatment modalities of tennis elbow have been claimed to be effective in treating this condition due to its chronic nature and tendency to recur with resumption of activity, no single modality has been considered [1].

Newer treatment modalities have been tried such as extracorporeal shock wave therapy, iontophoresis and injection of botulism toxin. If conservative treatment fails, the last resort is surgery with the primary objective of pain relief [6]-[8].

Shock wave therapy has been employed in orthopedic and traumatic conditions including calcific tendonitis, tennis elbow, plantar fasciitis, achilles tendonitis, patellar tendonitis fracture non-unions and pseudoarthrosis as well as myositis ossificans and avascular necrosis [9].

The mechanism of action of ESWT is unknown, but it possibly includes direct stimulation of the healing process, neovascularization, disintegration of calcium and neural elements. These may involve alterations of the permeability of cell membranes preventing the development of potentials to transmit painful stimuli, direct suppression on nociceptors and a hyperstimulation mechanism which controls gate control mechanism [10] [11].

Growth factor technologies are increasingly used to enhance healing in musculoskeletal injuries, particularly in sports medicine [12].

Platelet rich plasma contains more concentrated amounts of platelets than does whole blood. Within the platelets are powerful growth factors, including platelet-derived growth factors, transforming growth factor beta, and epidermal growth factor [13].

Moreover, platelet rich plasma (PRP) has shown to be a general stimulator for repair or regeneration [14] [15].

Sonographic assessment proved that platelet rich plasma improves extensor tendon morphology after local injection [16].

Platelet-rich plasma has been shown to reduce pain and symptoms of lateral epicondylitis [2].

2. Material and Methods: (Table 1)

The study included two groups of patients according to the methods of treatment either by ESWT or PRP.

2.1. Inclusion Criteria

1) Pain over the common extensor origin increases with pressure over the lateral epicondyle and with resisted dorsiflexion of the wrist and or middle finger.

2) Duration of symptoms for at least 6 months.

3) Pain ranking at least 5 on a 10-point scale.

Table 1. Pre-treatment data of both groups.

	ESWT	PRP	P value
Age (years)	26 - 53 (37.3)	23 - 57 (36.76)	0.807007
Sex (Male/Female)	15/5	13/4	-
Pre-treatment period (months)	6 - 36 (17.95)	6 - 36 (17.88)	0.853325
Pre-treatment VAS	6 - 9 (8.2)	7 - 9 (8.52)	0.110115
Pre-treatment DASH score	60 - 88 (72.25)	60 - 88 (72)	0.306979

2.2. Exclusion Criteria

- 1) Active inflammatory disease.
- 2) Concurrent pain in the cervical spine or ipsilateral shoulder due to other cause.
- 3) Coagulation disorders.
- 4) Previous treatment with steroids for the last 3 months.

The method of treatment was discussed with the patient before the start of treatment. The ESWT technique depends upon application of 3 sessions of ESWT without anesthesia with one week interval between each session whereas PRP method depend withdrawal of patient's own blood, centrifugation and injection into the affected tendon. So, the choice of the method of treatment was based on patient's choice after discussing the two techniques with the patient.

The first group included 20 patients treated by ESWT 15 males and 5 females, all cases were unilateral, the age of the patients ranged between 26 to 53 years with an average of 37.3 years. The pre-treatment period ranged between 6 months and 35 months with an average of 17.95 months. The pre-treatment VAS scale ranged between 6 to 9 points with an average of 8.2 and the pre-treatment DASH score ranged between 60 to 88 with an average of 72.25.

The second group included 17 patients treated by PRP injection 13 males and 4 females, all cases were unilateral, the age of the patients ranged between 23 to 57 years with an average of 36.76 years. The pre-treatment period ranged between 6 months and 36 months with an average of 17.88 months. The patients were evaluated pre-operatively using the Visual Analogue Scale (VAS) and the Disabilities of the Arm, Shoulder and Hand (DASH) score. The pre-treatment VAS scale ranged between 7 to 9 points with an average of 8.52 and the pre-treatment DASH score ranged between 60 to 88 with an average of 73.

The patient is seen after treatment in the first day, after 1 week, one month and then every three months for evaluation of pain and elbow function.

2.3. Technique of ESWT

Every patient is given three sessions of ESWT at weekly intervals. A total of 2000 shock waves (at 0.07 to 0.09 mJ/mm²) were administered at each session under ultrasound guide and without anesthesia.

2.4. Technique of PRP

The procedure is performed in the outpatient surgery centre.

- 1) First, between 45 - 60 ml of patients own blood is withdrawn.
- 2) This amount is centrifuged and the platelet rich plasma portion is collected in a syringe.
- 3) While the centrifuge process is going on, local anesthetic is injected after skin preparation of the area of the tendon.
- 4) Then, the PRP is injected into the tendon using 22-g needle by peppering technique.

2.5. Post-Injection Protocol

The patient is kept in supine position without moving for 15 minutes. Patients are sent home with instructions to limit the use of the arm for 24 hours and given paracetamol or codeine for pain but not given NSAIDs.

After 24 hours, patients were given a standardized stretching protocol for 2 weeks. A formal strengthening program is then initiated. At 4 weeks after the procedure, patients were allowed to proceed with normal sporting or recreational activities as tolerated.

3. Statistical Analysis

The SPSS (version 11.5, SPSS Inc, Chicago, IL, USA) was used. Chi square test were used to compare the results between the two groups. The Kruskal-Wallis test was applied to compare VAS score changes before and after treatment. The difference in the VAS at the early results and at follow up was estimated using the Wilcoxon signed ranks test. Concerning the demographic data including the age ($P = 0.807007$), pre-treatment period ($P = 0.853325$), VAS ($P = 0.110115$) and DASH score ($P = 0.30697$), consequently, there was no significant difference.

4. Results: (Tables 2-4)

In the first group (treated by ESWT), all cases were unilateral and all patients were available for follow up. The follow up period ranged between 8 months and 40 months with an average of 21.55 months. The average VAS improved from 8.2 to 1.95 with a mean improvement of 6.25 ($P = 0.0001$) and the average DASH score improved from 72.25 to 51.7 with a mean improvement of 20.55 ($P = 0.0001$). Concerning patient satisfaction, 11 cases were satisfied (55%), 3 cases (15%) were satisfied with reservation and 6 cases (30%) were not satisfied. The success rate was 70%.

In the second group (treated by PRP), all cases were unilateral, The follow up period ranged between 7 months and 33 months with an average of 18.47 months. The average VAS improved from 8.52 to 1.47 with a mean improvement of 7.05 ($P = 0.0001$), the DASH score improved from 72 to 48.23 with a mean improvement of 23.77 ($P = 0.0001$). Concerning patient satisfaction, 13 cases were satisfied (83.33%), 3 cases (10.52%) were satisfied with reservation and 1 case (5.55%) was not satisfied. The success rate was 93.85%.

There were no reported complications in either group either early or at late follow up.

In the post-treatment results of the ESWT group, the mean change in the VAS was 6.25 ($P = 0.0001$) and the mean change in the DASH score was 20.55 ($P = 0.0001$). In the PRP group, the mean change in the VAS was 7.05 ($P = 0.001$) and the mean change in the DASH score was 23.77 ($P = 0.001$).

Regarding the difference in the results between the two groups, the mean improvement in the in the VAS in the ESWT group was 6.25 and in the PRP group was 7.05 (P value = 0.05) and in the DASH score, the mean improvement in the ESWT group was 20.55 and in the PRP group was 23.77 (P value = 0.05). Accordingly, there was a significant difference in the results of both groups in favor of the PRP group.

Outcome and the success rate, the PRP group achieved much better results than the ESWT group *i.e.* 93.85% versus 70% respectively ($P = 0.001$).

Successful results were defined as reduction of as much as 25% of VAS and DASH score in either group at late follow up. Consequently, the PRP group achieved more success as compared to ESWT group ($P < 0.001$).

5. Discussion

Elbow epicondylar tendinosis is a common problem with many available treatments. Quick cessation of symptoms is important and is economically advantageous. If neither rest nor simple treatment provides a satisfactory

Table 2. Post-treatment results of the whole study.

	ESWT	PRP	<i>P</i> value
Average follow up period (months)	21.55	18.47	0.376395
Average Post-treatment VAS	1 - 4 (1.95)	1 - 3 (1.47)	0.02
Average Post-treatment DASH score	46 - 58 (51.7)	40 - 54 (48.23)	0.01

Table 3. Results of the whole study.

	ESWT	PRP
Satisfied	11(55%)	13 (83.33%)
Satisfied with reservation	3 (15%)	3 (10.52%)
Not satisfied	6(30%)	1 (5.5%)

Table 4. Mean changes in DASH score and VAS.

	ESWT	PRP	<i>P</i> value
Mean improvement in VAS	6.25	7.05	0.05
Mean improvement in VAS DASH score	20.55	23.77	0.01

remedy, a patient may pursue other treatment options [13].

Non-operative management will result in successful resolution of symptoms in 90% of patients [2].

Rompe *et al.*, (1996) [17] have described the use of low-dose ESWT in patients with chronic tennis elbow. There was a significant reduction in pain and increase in grip strength in the group which received shock wave therapy (3000 impulses of 0.08 MJ/mm²).

Haake *et al.*, (2002) [18] in a double blind controlled study involved 270 patients with tennis elbow received either ESWT (2000 shocks at 0.07 to 0.09 mJ/mm²) or placebo at weekly intervals for three weeks, no difference was noted between the two groups.

Pettrone and McCall (2005) [19] found significant improvement after full dose of ESWT at 3 months ranged between 33% to 70% and at 6 months ranged between 55% to 79%.

Staples *et al.*, (2008) [20] conducted a double-blind randomized controlled trial on 68 patients to determine whether ultrasound-guided ESWT reduced pain and improved function in patients with lateral epicondylitis. Patients received 3 ESWT treatments or 3 treatments at a subtherapeutic dose given at weekly intervals. There were significant improvements in almost all outcome measures for both groups over the 6 months follow up. There was little evidence to support the use of ESWT at a therapeutic or subtherapeutic dose for the treatment of lateral epicondylitis.

Many articles have studied the use of PRP in treatment of lateral epicondylitis in the past few years.

Mishra and Pavelko (2006) [13] treated 140 patients with chronic lateral epicondylitis by injection of platelet-rich plasma and at final follow up (mean 25.6 months; range 12 - 38 months) they reported 93% reduction in pain compared with before treatment.

Hechtman *et al.*, (2011) [21] in a similar study using PRP, treated 31 patients with epicondylitis not responding to conservative treatment for 6 months. Two cases elected surgery 1 month post-injection and 29 cases continued follow up. The overall success rate was 90% (28 of 31 elbows). Patient satisfaction improved from 5.1 ± 2.5 at 1 month to 9.1 ± 1.9 at last follow up.

Peerbooms *et al.*, (2010) [14] compared the results of two groups of patients suffering from lateral epicondylitis. The first group ($n = 51$) treated by PRP injection and the second group ($n = 49$) treated by corticosteroid injection. The results showed 73% success rate in the PRP group compared to 51% success rate in the corticosteroid group after 1 year follow up.

Thanasas *et al.* (2011) [22] treated two groups of patients with lateral epicondylitis the first group included 14 patients treated by PRP injection and the second group included 14 patients treated by injection of autologous blood and concluded that PRP treatment is superior to autologous blood concerning short term results but no statistically significant difference in the elbow function at follow up.

Creaney *et al.*, (2011) [12] compared the results of two groups of patients suffering from lateral epicondylitis. The first group ($n = 80$) treated by PRP injection and the second group ($n = 70$) treated by autologous blood injection. The results showed 66% success rate in the PRP group compared to 72% success rate in the autologous blood injection group after 6 months follow up.

Gosens *et al.*, (2011) [23] compared the results of two groups of patients with chronic lateral epicondylitis. The first group ($n = 51$) treated by leukocyte-enriched PRP injection and the second group ($n = 49$) treated by corticosteroid injection. Both groups significantly improved across the time. After 2 years follow up, the DASH scores of the corticosteroid group returned to baseline levels while those of PRP group significantly improved.

Chaudhury *et al.*, (2012) [16] treated 6 patients who had a baseline ultrasound confirming tendinosis of the common extensor tendon. Patients received 3 ml PRP under sonographic control. Five patients were available for follow up and they gained improvement of tendon morphology rather than tendon vascularity at 6 months follow up.

We did not find in the literature any available study comparing the results of ESWT with those of PRP in treating lateral epicondylitis. In the current study, the results showed that both ESWT and PRP can be used for treatment of such a condition. However, PRP group of patients achieved better results and more patient satisfaction. In the PRP group, the overall success rate was 93.85% (16 of 17 elbows) whereas in the ESWT group it was 80% (16 out of 20 elbows). The recorded levels of patient satisfaction were much higher in the PRP group. The assessment of our results was based totally on the subjective and clinical data during the pre-treatment and post-treatment periods. May be it will be more reliable to use ultrasonographic measurement of the thickness and vascularity of the common extensor tendon at the start of treatment and at late follow up.

6. Conclusion

Lateral epicondylitis or tennis elbow can be treated effectively with non-surgical methods of treatment. Both ESWT and PRP can be successfully used for treatment of tennis elbow. However, PRP is more effective concerning pain relief and improvement of elbow function. PRP is a promising technique for treatment of tendinopathy.

7. Strengths and Limitations of This Work

The proposed techniques provide a new scale of conservative treatment for chronic tennis elbow without the need for surgery and with promising early results. The limitations in our study were small size of the study groups as well as short period of follow up, and longer periods of follow up as well as larger sizes of study are need.

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List of Abbreviations

ESWT: Extra Corporeal Shock Wave Therapy;

PRP: Platelet Rich Plasma;

VAS: Visual Analogue Scale;

DASH Score: The Disabilities of the Arm, Shoulder and Hand (DASH) Score.