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ORIGINAL RESEARCH

Assessment of functional outcomes for lateral epicondylitis treated with PRP injections in a tertiary care centre- A descriptive study

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ABSTRACT

Background: Lateral epicondylitis, commonly known as tennis elbow, results from repetitive and forceful wrist extension, leading to degeneration of the Extensor Carpi Radialis Brevis tendon. Current treatment methods focus on symptomatic relief, including rest, physiotherapy, NSAIDs, and corticosteroid injections. Platelet Rich Plasma (PRP) injections, containing concentrated healing factors, offer a potential for actual tendon healing rather than mere symptom alleviation. **Methods:** A prospective longitudinal study was conducted on 45 patients with lateral epicondylitis treated with intralesional PRP injections. Patients were evaluated at Dr. Somervell Memorial CSI Medical College from December 1, 2016, to October 31, 2018. Functional outcomes were assessed using Visual Analog Scale (VAS) for pain and qDASH scores. Statistical analysis was performed to determine the success rate of PRP treatment. **Results**: Our study involved participants aged 31-64 years (mean age: 44.9±8.0 years), with more females (53.3%) than males (46.7%) surveyed, and 66.7% reporting right-side affection. Treatment significantly reduced Quick DASH scores from 43.6 (SD = 21.9) to 22.9 (SD = 13.3), a 47.7% decrease ($t = 9.467$, $p < 0.001$), and VAS scores improved from a median of 8 (IQR: 6.5 - 9) to 4 (IQR: 3 - 5) after treatment ($z = 5.742$, $p < 0.001$). Additionally, 80% of patients achieved satisfactory functional outcomes, and 86.7% experienced successful results with PRP treatment, evidenced by ≥25% reduction in VAS scores. **Conclusion**: Intralesional PRP injections offer promising treatment for lateral epicondylitis, with good functional outcomes in most patients. This study highlights PRP's potential for promoting tendon healing, contrasting with traditional symptom-focused methods.

Keywords: lateral epicondylitis; tennis elbow; PRP; VAS; qDASH

INTRODUCTION

Lateral epicondylitis, or tennis elbow, frequently affects individuals who engage in repetitive and forceful wrist extension. This condition typically occurs in the dominant arm and affects men and women equally [1]. It was first described by Runge in 1873 as "writer's cramp," is associated with tenderness in the lateral epicondyle of the humerus and difficulty writing. The condition was later termed "lawn tennis arm" by Morris in The Lancet in 1882, eventually becoming known as lateral epicondylitis or tennis elbow [2]. According to literature, tennis elbow can result from sprain, contusion, local trauma, soft tissue calcification, bursa inflammation, ECRB tear, tendon avulsion, or orbicular ligament displacement on the radial head, and sometimes it is idiopathic [3,4,5]. Boyer and Hastings [6] noted the lack of a distinct pathology, often attributing the condition to work-related activities or idiopathic causes, and criticized the treatment approaches as often involving "witchcraft and pseudoscience." In 1936, Cyriax suggested that the condition typically resolves on its own within eight to twelve months with minimal treatment, primarily by avoiding painful elbow movements [7].

Lateral epicondylitis or tennis elbow is a very common tendinopathy that can cause significant functional impairment. 2018 ICD – 11 FB55.1 describes lateral epicondylitis of the elbow as a common disorder of the upper extremity characterized

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by degenerative changes in the musculotendinous region of lateral epicondyle [8]. Tennis elbow, while commonly associated with tennis players, predominantly affects individuals with active and physically demanding lifestyles such as homemakers, painters, musicians, masons, mechanics, and recreational racquet sports players like badminton or tennis enthusiasts. The prevalence of this condition among regular tennis players ranges from 10% to 50% [9]. Despite its name, tennis elbow frequently occurs in the general population, particularly among those who do not engage in tennis [10].

The condition is primarily caused by repetitive wrist extension and forearm pronation-supination activities. Tobacco use is identified as a risk factor for developing tennis elbow [11]. It most commonly affects middle-aged individuals, with the majority of cases occurring between 35 and 54 years of age, peaking at around 45 years. Typically, the dominant arm is affected, and the incidence is equally distributed between males and females [12]. Tennis elbow is now recognized as a degenerative tendinopathy or tendinosis rather than a tendinitis [13]. Tendinopathy encompasses a spectrum of conditions resulting from chronic overuse of the tendon [14]. Lateral epicondylitis primarily affects the attachment point of the extensor carpi radialis brevis to the lateral epicondyle. In around 30% of instances, the extensor digitorum is also implicated, while the extensor carpi radialislongus (ECRL) and extensor carpi ulnaris (ECU) are seldom affected. [15] The degeneration of the extensor carpi radialis brevis (ECRB) tendon results from repetitive mechanical strain or excessive stress on the lateral elbow. When the tendon's ability to repair itself is surpassed, it leads to microscopic tears and an inadequate healing response.[16]

The clinical presentation of lateral epicondylitis typically includes pain over the lateral elbow, which is exacerbated by activities such as playing tennis, using a screwdriver forcefully, or any action involving wrist extensor contraction [17]. This pain generally decreases with rest. A physical examination reveals marked tenderness just below the lateral epicondyle, with sharp pain occurring during wrist extension combined with radial deviation and pronation. [18] Although the diagnosis is primarily clinical, it can be confirmed using imaging techniques such as X-ray, ultrasound, CT, and MRI.

Treatment options for lateral epicondylitis include the use of analgesics and immobilization, with 90% of cases resolving spontaneously within 6 to 12 months. Other treatments include wearing a tennis elbow brace and modifying work habits. For cases that are persistent or recurrent, surgical interventions such as the Homan’s procedure or Garden’s procedure may be necessary. [19]

Platelet-rich plasma (PRP) is derived from the patient’s own blood and contains a high concentration of platelets, achieved by centrifuging a larger blood sample. These platelets are rich in growth factors such as TGF-β1, PDGF, VEGF, EGF, and IGF-1. The centrifugation process increases these growth factors, which can be applied to an injury to enhance the body’s natural healing mechanisms. [20]

The normal human platelet counts ranges from 150,000 to 450,000 per microliter, but PRP can boost this to up to 1,000,000 per microliter, a three to five-fold increase. [21,22] This higher concentration aids in repairing bone and soft tissue injuries. Numerous studies have explored PRP's effectiveness in treating tendon injuries and tendinopathies. [23-26] PRP's cytokines are crucial in inflammation, cellular proliferation, and tissue remodeling, essential for healing. Additionally, PRP promotes neovascularization, improving blood supply and nutrient delivery to injured tissue. These benefits are particularly useful in chronic tendinopathies. A recent review and meta-analysis confirmed PRP injections' effectiveness in treating symptomatic tendinopathy. [27]

In 2011, Thanasas's research found that PRP injections were more effective at reducing pain than whole blood injections [28].However, differences in PRP systems and application techniques make it challenging to determine PRP's overall efficacy. While recent studies on PRP for tennis elbow are promising, further research is needed. This study aims to assess the functional outcomes of PRP injections in tennis elbow patients.

MATERIALS AND METHODOLOGY

This prospective longitudinal study was conducted at Dr. Somervell Memorial CSI Medical College, Kerala, over 23 months (December 1, 2016, to October 31, 2018), after obtaining institutional research board approval. The study involved treating 45 patients with lateral epicondylitis using intralesional Platelet Rich Plasma, with informed written consent obtained from all participants.

Inclusion criteria for the study involved patients aged 20 to 70 who presented with lateral elbow pain for more than 7 days, along with one or more positive clinical tests: tenderness near the lateral epicondyle, pain with resisted wrist extension, pain when lifting a cup (coffee cup test) or a chair (chair test), pain during the Thompson test (arm and wrist in specific positions with applied pressure), or pain with Cozen’s test (wrist extension against resistance). The study excluded patients younger than 20 or older than 70 years, those presenting with pain for less than 7 days, and those with conditions such as rheumatoid arthritis of the elbow, cervical radiculitis, infections, neoplastic lesions, dermatomyositis, or previous elbow trauma. Patients who had undergone surgery for lateral epicondylitis, received a steroid injection within the past 3 months, or had elbow instability (determined by the varus-valgus instability test) were also excluded.

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Patients were scheduled for weekly follow-up appointments, with functional outcomes assessed three weeks after PRP injection. Pain was evaluated using the Visual Analogue Scale (VAS), where patients marked their pain level on a line. A 33% reduction in pain indicated meaningful improvement. The Quick Disabilities of the Arm, Shoulder, and Hand (qDASH) score, with an 8-point change, distinguished between improved and stable patients. Visual Analog Scale method involves a linear scale where the endpoints represent the most minimal and most severe levels of pain. Patients are instructed to indicate their pain level by marking a point along this line. The distance between the mark and the "no pain at all" endpoint determines the extent of the patient's pain. The qDASH scoring system is a concise version of the DASH outcome measure, comprising two sections: disability/symptoms and optional high-performance activities. With 11 items scored on a scale of 1-5, including tasks like opening jars and carrying bags, it assesses the impact of arm, shoulder, or hand issues on daily life. At least 10 of these items must be completed for scoring. The score, ranging from 0 to 100, reflects the degree of disability, calculated by averaging responses, subtracting 1, and multiplying by 25. A change exceeding 8 points indicates significant improvement, useful for discerning treatment effectiveness. Successful treatment is defined as a 25% reduction in pain and total DASH scores without further intervention within three weeks' post-injection compared to pre-injection scores.

Statistical analysis

Quantitative variables were expressed as mean, standard deviation, median, and interquartile range. Qualitative variables were expressed as frequency and proportion. Pre-test post-test comparisons of quantitative data were analyzed by Paired t-test or Wilcoxon Signed Rank test according to the nature of the data. Associations between qualitative variables were analyzed by chi-square test. A p-value <0.05 was considered statistically significant. Data analysis was performed using SPSS version 16.0.

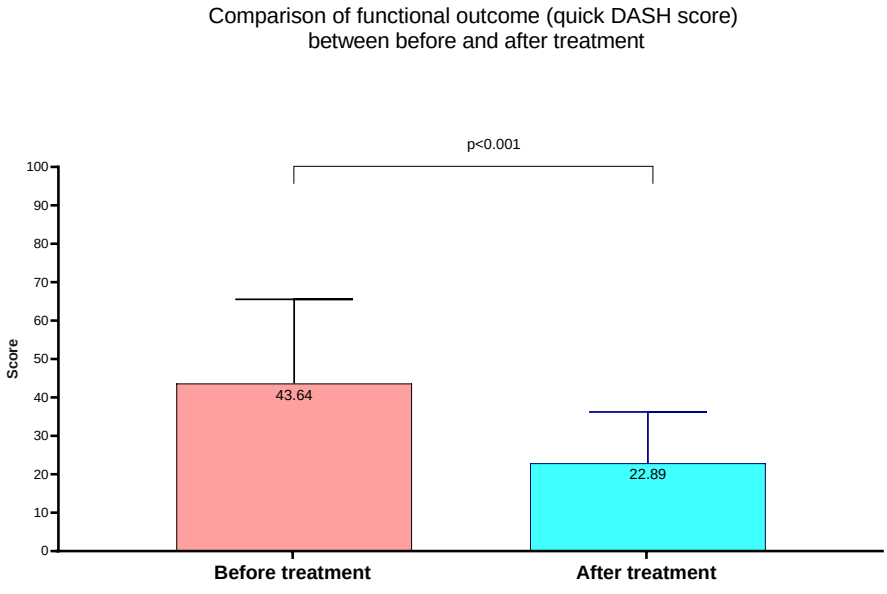
RESULTS

In our studyage ranges from 31-64 years and average age of the participants were 44.9± 8.0 years. More females (53.3%) than males (46.7%) were surveyed. Most participants (66.7%) were affected on the right side; 33.3% on the left. There was no significant age difference between males and females (p = 0.600). There was no significant difference in affected side between males and females (p = 0.526) as well.

Treatment significantly improved Quick DASH scores, reducing the mean score from 43.6 (SD = 21.9) before treatment to 22.9 (SD = 13.3) after treatment. This is an average reduction of 20.8 points (SD = 14.7), a 47.7% decrease. The paired t-test indicates a highly significant improvement (t = 9.467, p < 0.001). (table 1)

Table 1: Comparison of Functional outcome using qDASH score

	N	Quick DASH score		Paired difference		Percentage reduction	Paired *t* test	
		mean	SD	mean	SD		t	p
Before treatment	45	43.6	21.9	20.8	14.7	80.1	9.467	<0.001
After treatment	45	22.9	13.3					



Graph 1: Comparison of functional outcome

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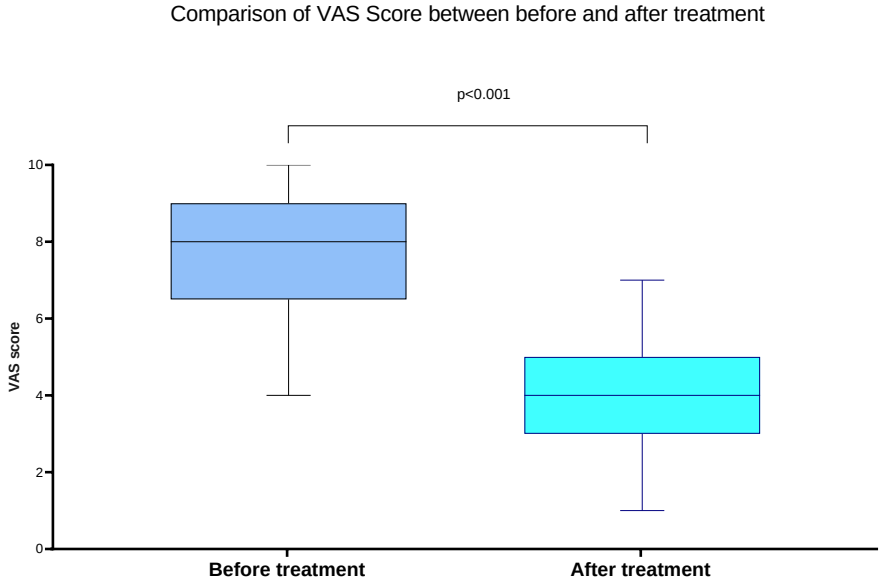
Before treatment, the median VAS score was 8 (IQR: 6.5 - 9), significantly higher than after treatment, where the median decreased to 4 (IQR: 3 - 5). The Wilcoxon signed-rank test showed a significant improvement ($z = 5.742$, $p < 0.001$). (Graph 2)

Table 2: Comparison of VAS score

	N	VAS score		Wilcoxon signed Rank test	
		Median	IQR	z	p
Before treatment	45	8	6.5 - 9	5.742	<0.001
After treatment	45	4	3 - 5		



Graph 2: Comparison of VAS score

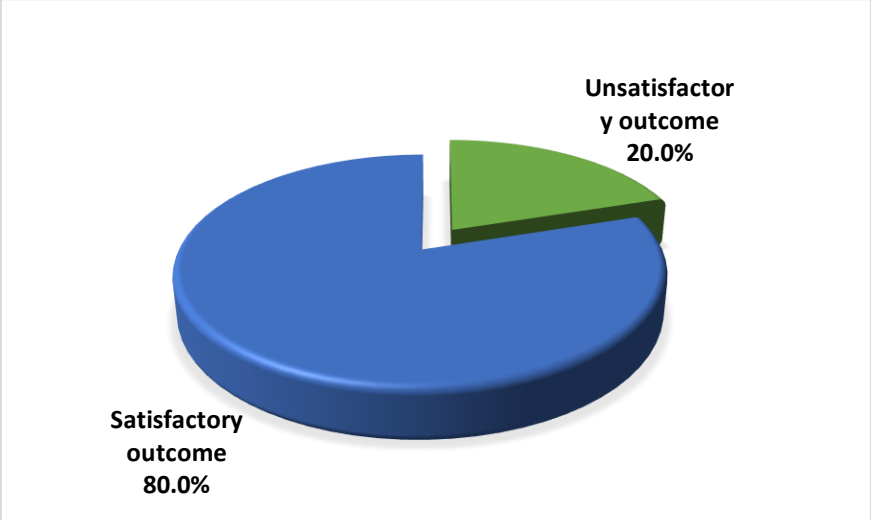


Figure 1: Change in functional outcome after treatment

80% of the patients had a satisfactory functional outcome as determined by the qDASHscores. (figure 1), The treatment using PRP was successful in 86.7 % of patients as evidenced by the ≥25% reduction in VAS scores.

DISCUSSION

Lateral epicondylitis, commonly known as tennis elbow, is a prevalent condition in our population, particularly among masons, mechanics, and homemakers due to their repetitive wrist extension activities. Treatment typically includes avoiding aggravating activities, using NSAIDs, undergoing physiotherapy, bracing, and receiving intralesional steroid injections. Corticosteroid injections were once regarded as the gold standard for treating tennis elbow[29]. However, their efficacy has become controversial. These injections are beneficial primarily for short-term pain relief in acute cases but tend to show poor results in long-term follow-ups [30]. In a meta-analysis, Smidt et al. found that the intermediate and long-term effects of steroid

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injections are not significantly different from those of placebo injections, other non-operative treatments, or injections with local anesthetic [31].

In our investigation, tennis elbow exhibited an equal distribution between sexes, with 53.3% females and 46.7% males, aligning with findings from Jiwani et al.'s [32] study. The dominant arm was more commonly affected, with 66.7% experiencing symptoms on the right side and 33.3% on the left. A significant proportion of patients, 42.2%, fell within the 31-40 age bracket, followed by 33% in the 41-50 age range. Hence, nearly 75% of patients were within the active age range of 30 to 50, consistent with findings by Jiwani et al. The mean age of affected individuals was also reported in studies by Dunn et al. [33] and Haahr and Andersen. [34].

Our study is a prospective longitudinal study of 45 patients with lateral epicondylitis treated with intralesional PRP injections, evaluated at three-week intervals, showing 80% and 86.7% good functional outcomes based on qDASH and VAS scores, respectively.whereas study by Alsaki et al [35] was a retrospective analysis of 55 patients with chronic medial or lateral epicondylitis treated with either PRP or continued physiotherapy (PT) and pain medication, demonstrating significantly better results for the PRP group over a longer follow-up period (up to 36 months) using PRTEE, VAS, and DASH scores. Unlike the present study, this study also compared the need for surgical intervention, finding fewer surgeries in the PRP group. Both studies indicate PRP's effectiveness, but Alaskisstudy provides a longer follow-up and comparison with other treatments, reinforcing PRP's advantages.

Similarly, Peerbooms et al. [36] and Gosens et al. [37] conducted the initial large-scale randomized controlled trials (RCTs) with one- and two-year follow-ups, respectively, comparing PRP against corticosteroid injections for chronic lateral epicondylitis, with findings favoring PRP. Following this, Mishra et al. [38] conducted a larger multicenter RCT involving chronic lateral epicondylitis patients, comparing PRP against active controls. They concluded that PRP showed superiority, suggesting its use as the ultimate treatment option before considering surgery.

In a randomized controlled trial with 60 patients, by Anwar et al [39] compared PRP to corticosteroid injections and evaluated outcomes over six months, showing PRP provided better pain relief and functional improvement than steroids. Like our research, this study underscores PRP's superiority, offering a direct comparison with corticosteroids over an extended follow-up period. Similarly, Jiwani et al. [32] demonstrated that local autologous PRP injections effectively manage lateral epicondylitis (tennis elbow) in patients unresponsive to conservative treatments. However, functional improvement in their study was assessed using the patient-rated tennis elbow evaluation (PRTEE) score.

A retrospective study by Boden et al. [40] compared PRP injections with Tenex for treating golfer's and tennis elbow, finding clinical and statistical improvements in visual analog pain scale levels, Quick Disabilities of the Arm, Shoulder, and Hand scores, and EuroQol-5D scores in both groups, with no significant difference between the treatments. Similarly, a study by Paramannathan et al. [41] on tennis elbow patients found that PRP injections effectively reduced pain according to VAS and MAYO scores. Younger patients, in particular, showed greater pain reduction with PRP treatment, aligning with our study's findings.

Our study results are consistent with Saurabh et al. [42], who concluded that PRP is an effective treatment for stubborn tennis elbow. PRP enhances the healing potential of the hypovascular tendon by releasing high concentrations of growth factors, with improvements documented both subjectively through elbow score improvements and objectively via better tendon morphology on sonography. Conversely, Bashir et al. [43] found that the corticosteroid group showed early improvement, while the PRP group began to show improvement after about 7 to 10 days.

The study has several limitations, including being conducted at a single hospital, which may limit the generalizability of its findings. The follow-up period of three weeks is relatively short, potentially missing long-term outcomes and recurrences. Additionally, the sample size of 45 patients is small, which may not adequately represent the broader population. Furthermore, the lack of a control group receiving standard treatments makes it difficult to attribute improvements solely to PRP injections, and potential biases in patient selection and outcome assessment may affect the results. To improve the study, future research should include multiple centers to enhance generalizability and a larger sample size to better represent the population. Extending the follow-up period would help capture long-term outcomes and potential recurrences. Additionally, incorporating a control group receiving standard treatments would provide a clearer comparison to assess the true efficacy of PRP injections.

CONCLUSION

The findings from our 3-week follow-up study on 45 patients with tennis elbow treated with intralesional PRP injections are promising. Both qDASH and VAS scores indicate significant improvements in functional outcomes and pain relief, with success rates ranging from 80% to 89%. These results suggest that intralesional PRP injections offer a reliable treatment option for lateral epicondylitis, potentially promoting actual tendon healing rather than just symptomatic relief. Overall, our study underscores the efficacy and potential of PRP injections in improving functional outcomes and relieving pain in patients with tennis elbow.

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REFERENCES

1. Gautam V, Verma S, Batra S, Bhatnagar N, Arora S. Platelet-rich plasma versus corticosteroid injection for recalcitrant lateral epicondylitis: clinical and ultrasonographic evaluation. J Orthop Surg. 2015;23(1):5.
2. Saccomanni B. Corticosteroid injection for tennis elbow or lateral epicondylitis: a review of the literature. Curr Rev Musculoskelet Med. 2010 ;3(1–4):38–40.
3. Hohl M. Epicondylitis-tennis elbow. ClinOrthop. 1961; 19:232-9.
4. Meherin C. Tennis elbow. Am J Surg. 1950; 80:622-5.
5. Ilfeld FW, Field SM. Treatment of tennis elbow. Use of a special brace. JAMA. 1966 ;195(2):67-70.
6. Boyer MI, Hastings H. Lateral tennis elbow: "Is there any science out there?" J Shoulder Elbow Surg. 1999;8(5):481-91.
7. Mellor S. Treatment of tennis elbow: the evidence. BMJ. 2003 ;327(7410):330.
8. ICD-11 - Mortality and Morbidity Statistics [Internet]. [cited 2018 Oct 7]. Available from: https://icd.who.int/browse11/l-m/en#/http://id.who.int/icd/entity/1254324785
9. Elbow tendinopathy: tennis elbow - Clinics in Sports Medicine [Internet]. [cited 2018 Oct 7]. Available from: https://www.sportsmed.theclinics.com/article/S0278-5919(03)00051-6/abstract.
10. Calfee RP, Patel A, DaSilva MF, Akelman E. Management of lateral epicondylitis: current concepts. J Am AcadOrthop Surg. 2008 ;16(1):19-29.
11. Shiri R, Viikari-Juntura E, Varonen H, Heliövaara M. Prevalence and determinants of lateral and medial epicondylitis: a population study. Am J Epidemiol. 2006 Dec 1;164(11):1065-74.
12. Hamilton PG. The prevalence of humeral epicondylitis: a survey in general practice. J R Coll Gen Pract. 1986 Oct;36(291):464-5.
13. De Smedt T, de Jong A, Van Leemput W, Lieven D, Van Glabbeek F. Lateral epicondylitis in tennis: update on aetiology, biomechanics and treatment. Br J Sports Med. 2007 Nov;41(11):816-9.
14. Bhabra G, Wang A, Ebert JR, Edwards P, Zheng M, Zheng MH. Lateral elbow tendinopathy: development of a pathophysiology-based treatment algorithm. Orthop J Sports Med. 2016 Nov 1;4(11):2325967116670635.
15. Elbow tendinopathy: tennis elbow - Clinics in Sports Medicine [Internet]. [cited 2018 Oct 7]. Available from: https://www.sportsmed.theclinics.com/article/S0278-5919(03)00051-6/abstract
16. Kraushaar BS, Nirschl RP. Current concepts review - tendinosis of the elbow (tennis elbow). Clinical features and findings of histological, immunohistochemical, and electron microscopy studies. J Bone Joint Surg Am. 1999 ;81(2):259-78.
17. Cutts S, Gangoo S, Modi N, Pasapula C. Tennis elbow: A clinical review article. J Orthop. 2019; 17:203-7.
18. Flatt AE. Tennis elbow. Proc (BaylUniv Med Cent). 2008; 21:400-2. doi: 10.1080/08998280.2008.11928437.
19. Zeisig E, Fahlstrom M, Ohberg L, Alfredson H. A 2-year sonographic follow-up after intratendinous injection therapy in patients with lateral epicondylitis. Br J Sports Med. 2008;42(4):267-71.
20. Boswell SG, Cole BJ, Sundman EA, Karas V, Fortier LA. Platelet-rich plasma: a milieu of bioactive factors. Arthroscopy. 2012; 28:429-39. 4o
21. Marx RE. Platelet-rich plasma (PRP): what is PRP and what is not PRP? Implant Dent. 2001; 10:225-8.
22. Foster TE, Puskas BL, Mandelbaum BR, Gerhardt MB, Rodeo SA. Platelet-rich plasma: from basic science to clinical applications. Am J Sports Med. 2009; 37:2259-72.
23. Boesen AP, Hansen R, Boesen MI, Malliaras P, Langberg H. Effect of high-volume injection, platelet-rich plasma, and sham treatment in chronic midportion Achilles tendinopathy: a randomized double-blinded prospective study. Am J Sports Med. 2017; 45:2034-43.
24. Mishra AK, Skrepnik NV, Edwards SG, et al. Efficacy of platelet-rich plasma for chronic tennis elbow: a double-blind, prospective, multicenter, randomized controlled trial of 230 patients. Am J Sports Med. 2014; 42:463-71.
25. Behera P, Dhillon M, Aggarwal S, Marwaha N, Prakash M. Leukocyte-poor platelet-rich plasma versus bupivacaine for recalcitrant lateral epicondylartendinopathy. J OrthopSurg (Hong Kong). 2015; 23:6-10.
26. Gautam VK, Verma S, Batra S, Bhatnagar N, Arora S. Platelet-rich plasma versus corticosteroid injection for recalcitrant lateral epicondylitis: clinical and ultrasonographic evaluation. J OrthopSurg (Hong Kong). 2015; 23:1-5.
27. Miller LE, Parrish WR, Roides B, Bhattacharyya S. Efficacy of platelet-rich plasma injections for symptomatic tendinopathy: systematic review and meta-analysis of randomised injection-controlled trials. BMJ Open Sport Exerc Med. 2017.6 ;3(1):1-11.
28. Thanasas C, Papadimitriou G, Charalambidis C, Paraskevopoulos I, Papanikolaou A. Platelet-rich plasma versus autologous whole blood for the treatment of chronic lateral elbow epicondylitis: a randomized controlled clinical trial. Am J Sports Med. 2011; 39:2130-4.
29. Tonk G, Kumar A, Gupta A. Platelet rich plasma versus laser therapy in lateral epicondylitis of elbow. Indian J Orthop. 2014;48(4):390-3.
30. Bisset L, Beller E, Jull G, Brooks P, Darnell R, Vicenzino B. Corticosteroid injections, physiotherapy, or a wait-and-see policy for lateral epicondylitis: a randomised controlled trial. Lancet. 2006 Feb 18;367(9518):1459-62.
31. Smidt N, Assendelft WJ, van der Windt DA, Hay EM, Buchbinder R, Bouter LM. Corticosteroid injections for lateral epicondylitis: a systematic review. Pain. 2002 ;96(1-2):23-40.
32. Jiwani R, Mehta S, Kadam A. Functional outcome of tennis elbow (lateral epicondylitis) treated by local injection of platelet rich plasma. Asian J Pharm Clin Res. 2022;15(10):90-3.
33. Dunn JH, Kim JJ, Davis L, Nirschl RP. Ten-to 14-year follow-up of the Nirschl surgical technique for lateral epicondylitis. Am J Sports Med. 2008; 36:261-6.

DOI: 10.69605/ijlbpr_13.6.10

34. Haahr JP, Andersen JH. Physical and psychosocial risk factors for lateral epicondylitis: A population based case-referent study. Occup Environ Med. 2003; 60:322-9.
35. Annaniemi JA, Pere J, Giordano S. Platelet-Rich Plasma Injections Decrease the Need for Any Surgical Procedure for Chronic Epicondylitis versus Conservative Treatment-A Comparative Study with Long-Term Follow-Up. J Clin Med. 2022 ;12(1):102.
36. Peerbooms JC, Sluimer J, Bruijn DJ, Gosens T. Positive effect of an autologous platelet concentrate in lateral epicondylitis in double-blind randomized controlled trial: Platelet-rich plasma versus corticosteroid injection with a 1-year follow-up. Am J Sports Med. 2010; 38:255-262.
37. Gosens T, Peerbooms JC, Van Laar W, Oudsten BLD. Ongoing positive effect of platelet-rich plasma versus corticosteroid injection lateral epicondylitis: A double-blind randomized controlled trial with 2-year follow-up. Am J Sports Med. 2011; 39:1200-1208.
38. Mishra AK, Skrepnik NV, Edwards SG, Jones GL, Sampson S, Vermillion DA, Ramsey ML, Karli DC, Rettig AC. Efficacy of platelet-rich plasma for chronic tennis elbow: A double-blind, prospective, multicenter, randomized controlled trial of 230 patients. Am J Sports Med. 2014; 42:463-471.
39. Anwar A, Verma S, Agarwal AC, Choudhary R, Garg AK. A better functional outcome with platelet rich plasma compared with local steroid injection in tennis elbow. IP Int J OrthopRheumatol. 2021;7(1):24-8.
40. Boden AL, Scott MT, Dalwadi PP, Mautner K, Mason RA, Gottschalk MB. Platelet-rich plasma versus Tenex in the treatment of medial and lateral epicondylitis. J Shoulder Elbow Surg. 2019; 28:112-9.
41. Paramanantham M, Seenappa H, Venkataraman S, Shanthappa AH. Functional Outcome of Platelet-Rich Plasma (PRP) Intra-lesional Injection for Tennis Elbow - A Prospective Cohort Study. Cureus. 2022 ;14(3).
42. Saurabh J, Rajeev K, Laxman B, Ga. Treatment of lateral epicondylitis with autologous platelet rich plasma injection. Int J Orthop Sci. 2018;4(2):437-41.
43. Bashir SI, Lone F, Rameez R. Injection of platelet rich plasma versus corticosteroid injection in the treatment of tennis elbow: A prospective randomized comparative study. Int J Orthop Sci. 2020;6(1):1164-1167.