ORIGINAL ARTICLE

Therapeutic Potential of Platelet-Rich Plasma in the Treatment of Temporomandibular Joint Disorders

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Abstract

Background: Temporomandibular joint disorders (TMDs) is a widespread disease which is characterized by pain, dysfunction and low quality of life. The non-surgical procedures that are used traditionally alleviate the symptoms, but did not include degeneration of the joint in most cases. Platelet-rich plasma (PRP) can be an opportunity to make a better intervention compared to the established method.

Objective: To compare the efficacy of PRP injection versus conventional therapies in terms of pain relief and improvement of jaw performance in patients with TMDs.

Material and Methods: This non-randomized comparative study were carried out at Oral and Maxillofacial Surgery department of Lady Reading Hospital, Peshawar from 01-03-2025 to 30-11-2025 involving two groups (30 patients in each), one having intra-articular PRP injections and the other having standard conservative management. Patients were including consecutively in the study. The measurement of pain was done using the Visual Analogue Scale (VAS) and functional outcomes were measured in terms of maximal mouth opening and lateral jaw excursion. The SPSS-27 was used to analyze the data with $p<0.05$ considered significant.

Results: Baseline demographic and clinical characteristics were comparable between two groups (all $p>0.05$). At 12 weeks, the PRP group showed significantly lower pain scores than the conventional therapy group (2.1±1.0 vs. 4.3±1.4; $p<0.001$), greater maximal mouth opening (41.2±3.8 vs. 36.5±4.2 mm; $p<0.001$), and greater lateral jaw excursion (9.5±1.3 vs. 7.8±1.6 mm; $p<0.001$). PRP also resulted in higher rates of reduction in joint sounds (80.0% vs. 50.0%; $p=0.010$), functional improvement (86.7% vs. 60.0%; $p=0.020$), and patient satisfaction (90.0% vs. 60.0%; $p=0.003$). The incidence of complications was comparable between the groups (10.0% vs. 6.7%; $p=0.640$).

Conclusion: PRP therapy is more effective than conventional conservative treatments for TMDs, improving pain, function, and patient satisfaction, making it a promising non-surgical option.

Keywords: *Temporomandibular joint disorders, PRP, conservative treatment, pain, jaw function.*

Introduction

Temporomandibular joint disorders (TMD) involve the jaw joints and other body structures that lead to internal derangement of joint space, changes in bones and degenerative pathologies. Pain, joint noise, limited range of movement, impaired jaw function, deviation or deflection on mouth opening/closing or open locking are common signs and symptoms of TMDs, and the most prevalent age group is those between 18 and 60 years (44.8% prevalence). TMD is most commonly found in women (9 to 56%) especially those with malocclusion, children (as young as 7-12 years) have TMD. [1-3]

The treatment of Temporomandibular joint (TMJ) dysfunction comprises various therapies ranging between conservative treatments and more complex ones. Platelet-rich plasma (PRP) has attracted attention in recent years as an effective treatment method because of its capacity to stimulate healing and tissue regeneration. PRP is a product of the own blood of a patient and is rich with growth factors that aid in repairing the joints. PRP has demonstrated more potential in pain reduction and TMJ functional improvement than other forms of traditional treatment like corticosteroid injections. [4,5] Non-surgical interventions such as nonsteroidal anti-inflammatory drugs (NSAIDs), physical therapy and oral splints may offer relief to some degree but fail to mitigate the actual problem. [6,7] Some studies have demonstrated that PRP injection can be used to manage long-term pain and enhance the quality of life of patients with a significant effect when compared to corticosteroids and hyaluronic acid. [8,9] In a meta-analysis study, Tsai et al. (2025) revealed that PRP had significant effects in alleviating TMJ pain as VAS scores dropped to 2.1 ± 1.0 at eight weeks, compared to the minimal improvement in the placebo group (6.5 ± 1.1 to 5.7 ± 1.3). PRP also enhanced the jaw function, which is increased to 38.2 + 2.5mm to 43.5 + 3.1mm in maximal mouth opening and 12.3 + 1.5mm to 14.9 + 2.0mm in lateral excursion and overall quality of life, but the placebo group had insignificant improvements. Complications were minor with 6.3% discomfort, 3.1% swelling, and 1.6% headaches in PRP group and no severe complications. The paper provides evidence to prove that PRP is a safe and effective intervention in TMJ pain and dysfunction management. [10] A different study established in the majority of patients (70%) an overall reduction in pain of more than 50 percent following a single PRP injection. [11] Although several international studies and systematic reviews have demonstrated the potential benefits of PRP in reducing pain and improving jaw function among patients with TMDs, evidence comparing PRP with conventional conservative therapy remains limited, particularly in low- and middle-income countries. In Pakistan, published data on the clinical effectiveness of PRP for TMD management are scarce despite the increasing burden of TMD and the growing use of regenerative therapies in clinical practice. Differences in patient characteristics, healthcare resources, and treatment practices may limit the generalizability of findings from other populations. Therefore, this study aimed to compare the effectiveness

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of PRP injections with conventional conservative treatment in patients with TMDs treated at a tertiary care hospital in Pakistan, thereby providing locally relevant evidence to support clinical decision-making.

Material and Methods:

It was a prospective non-randomized comparative study conducted at the Department of Oral and Maxillofacial Surgery, Lady Reading Hospital, Peshawar between March 2025 and November 2025 after getting permission of Hospital IRB committee with reference number: 494/LRH/MTI; dated 16 march 2025. Written informed consent was obtained from all participants prior to enrollment. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

The sample size was firstly worked out in OpenEpi software, depending on the average of the reduction in the TMJ pain after 8 weeks in PRP treated patients (VAS = 2.1 ± 1.0) versus conventional therapy treated patients (VAS = 5.7 ± 1.3), [10] assuming a 99% confidence interval, 95% study power, and 0.75 correlation coefficient. The estimated minimum sample size was 8 participants (4 per group).

Although the minimum required sample size calculated using OpenEpi was eight participants (four per group), this estimate was based on a large expected treatment effect reported in the reference study. To improve the precision of treatment effect estimates, enhance statistical power, increase the reliability of the findings, and improve the generalizability of the results, a total of 60 participants (30 in each group) were prospectively enrolled before study commencement. The recruited participants were selected in the outpatient department, using non-probability consecutive sampling.

The inclusion criteria were patients of either gender, aged ≥18 years, clinically diagnosed with temporomandibular joint dysfunction at least 3 months, limited mouth opening (<40 mm), and the presence of radiographic evidence of involvement of the temporomandibular joint were included. The exclusion criteria included the presence of systemic illnesses like diabetes mellitus, immunosuppression or bleeding disorders, history of TMJ surgery, taking anticoagulant drugs or pregnancy and lactation.

The study recruited the participants after clarifying the aims of the study, the methods, risks, and benefits, and the freedom to discontinue the study at any point without compromising on normal care. During the study, confidentiality of the participants was observed. Age, gender, residence, occupation, education level, socioeconomic status, smoking history, comorbidities and family history of TMJ dysfunction were captured on a structured proforma as baseline demographic data. The clinical features of dysfunction of TMJ including the duration of symptoms, severity of pain, maximum mouth opening (MMO), lateral jaw movements, and sounds of the joints (click, pop, or crepitus) and functional limitations in chewing/speaking were recorded prior to treatment.

Participants were allocated to the PRP or conventional therapy group according to the treatment decision made during routine clinical practice by the treating oral and maxillofacial surgeon after clinical assessment and discussion with the patient. As this was a prospective non-randomized comparative study, treatment allocation was not randomized or concealed. Randomization was not performed because the study was designed as a prospective comparative study reflecting routine clinical practice. Treatment allocation was based on the treating surgeon's clinical judgment and patient preference after discussion of the available treatment options, rather than by random assignment.

PRP Group (Patients underwent intra-articular injections of PRP injections made of autologous blood in an aseptic environment. The dosage (one to three injections) was decided according to patient response after the initial treatment and the discretion of the physician.

Standard Therapy Group (Patients received conventional conservative management) consisting of oral diclofenac sodium 50 mg twice daily for 10 days, together with a a structured physical therapy program consisting of TMJ mobilization exercises, gentle stretching exercises, controlled mouth-opening exercises, and lateral mandibular movement exercises. Patients were instructed to perform the exercises three times daily for 12 weeks. During the first visit, all exercises were demonstrated and supervised by a trained physiotherapist. Follow-up visits were scheduled every two weeks to reinforce the exercise protocol and assess adherence. Patient compliance was evaluated through self-reported adherence at each follow-up visit.

PRP was prepared from autologous venous blood collected under aseptic conditions using the department's standardized prol;'tocol. Blood was processed by centrifugation to obtain platelet-rich plasma suitable for intra-articular administration. PRP was injected into the affected temporomandibular joint under strict aseptic precautions by an experienced oral and maxillofacial surgeon familiar with TMJ injection techniques. The injection was administered into the superior joint space using standard anatomical landmarks. Patients were observed for immediate post-procedure complications and were advised regarding post-injection care. Depending on the clinical response, patients received one to three PRP injections during the study period.

Pain intensity was assessed using the Visual Analogue Scale (VAS). Maximal mouth opening and lateral jaw excursion were measured in millimeters using a calibrated digital caliper. All clinical outcome measurements were performed by the same trained oral and maxillofacial surgeon at baseline and at the 12-week follow-up using standardized assessment procedures to minimize inter-observer variability. Clinical examination and patient-reported outcomes were used to assess joint sounds and functional limitations. Post-treatment side effects like injection site pain, swelling or infection were noted. Owing to the nature of the interventions and the non-randomized study design, outcome assessment was not blinded, as the assessor was aware of the treatment allocation.

Analysis of data was conducted through IBM SPSS Statistics version 25. The quantitative variables like age, MMO, lateral excursions, and VAS scores, were first checked for the normality. The Shapiro–Wilk test demonstrated that continuous variables, including VAS score, maximal mouth opening, and lateral jaw excursion, were approximately normally distributed (all $p > 0.05$); therefore, parametric tests were applied. Frequencies and percentages were used to summarize categorical variables such as gender, smoking status, education, occupation, joint sounds, and complications related to the treatment. The independent samples t-test was used to compare the treatment results between the two groups based on the data distribution. The age and gender stratification was done and post-stratification it was subjected to the chi-square test or Fisher exact test. A p-value of 0.05 was taken as a statistically significant. Baseline demographic and clinical characteristics were compared between the two treatment groups to assess comparability before outcome analysis.

Results

The study enrolled 60 patients of equal groups (PRP and

conventional therapy) of 30 each. . The PRP and conventional therapy groups were comparable with respect to age distribution, gender, and residence, with no statistically significant differences in baseline demographic characteristics ($p > 0.05$), indicating good baseline comparability between the groups (table 1). Baseline clinical characteristics were comparable between the PRP and conventional therapy groups, with no statistically significant differences in symptom duration, bilateral pain, pain on jaw movement, joint sounds, limited mouth opening, previous TMJ treatment history, baseline pain intensity (VAS), or maximal mouth opening (all $p > 0.05$). These findings indicate similar clinical status at baseline between the two groups (table 2). At the 12-week follow-up, the PRP group demonstrated significantly better clinical outcomes than the conventional therapy group. Pain intensity was significantly lower (2.1 ± 1.0 vs. 4.3 ± 1.4; MD = −2.20, 95% CI: −2.83 to −1.57; Cohen's $d = 1.81$; $p < 0.001$), while maximal mouth opening (41.2 ± 3.8 mm vs. 36.5 ± 4.2 mm; MD = 4.70, 95% CI: 2.63–6.77; Cohen's $d = 1.17$; $p < 0.001$) and lateral jaw excursion (9.5 ± 1.3 mm vs. 7.8 ± 1.6 mm; MD = 1.70, 95% CI: 0.95–2.45; Cohen's $d = 1.17$; $p < 0.001$) were significantly greater in the PRP group. Reduction in joint sounds (80.0% vs. 50.0%; RR = 1.60, 95% CI: 1.07–2.39; $p = 0.010$), functional improvement (86.7% vs. 60.0%; RR = 1.44, 95% CI: 1.04–2.00; $p = 0.020$), and patient satisfaction (90.0% vs. 60.0%; RR = 1.50, 95% CI: 1.09–2.06; $p = 0.003$) were significantly higher among patients receiving PRP. Although complications were slightly more frequent in the PRP group (10.0% vs. 6.7%; RR = 1.50, 95% CI: 0.27–8.34), the difference was not statistically significant ($p = 0.64$), indicating comparable safety between the two treatment approaches (table 3). Among patients in the PRP group, the majority (60.0%) received two PRP injections, while 20.0% received one injection and 20.0% received three injections (table 4)**Discussion**

Table 1: Demographic Characteristics of Participants

[1]Independent sample t test, [2]Chi-square test was used, p-value<0.05 is significant

Characteristics		PRP Group	Conventional Group	P-value
Age (years), Mean ± SD		34.8 ± 8.6	35.6 ± 8.9	0.726[2]
Age group (years) – (n,%)	18–30	12 (40.0)	10 (33.3)	0.720[1]
	31–40	11 (36.7)	13 (43.3)	
	41–50	7 (23.3)	7 (23.3)	
Gender – (n,%)	Male	14 (46.7)	13 (43.3)	0.791[1]
	Female	16 (53.3)	17 (56.7)	
Residence – (n,%)	Urban	19 (63.3)	21 (70.0)	0.572[1]
	Rural	11 (36.7)	9 (30.0)	

This study examined the effectiveness of PRP versus traditional therapy in TMD patients. There was a notable reduction in the intensity of pain, the sound of the joints, increase in jaw movement, and patient satisfaction within the PRP group, which also is consistent with the results of literature. The level of pain had greatly reduced in PRP group and the mean VAS scores had dropped to 2.1 after 12 weeks as compared to 4.3 in conventional group. This is compared with the findings of the study by Harba et al. who found the same level of decrease in pain among patients who underwent PRP with VAS scores going down to 2.3 after three months of follow-up. [12] Similarly, Lin et al. carried out a meta-analysis study and found that PRP injections were better than traditional conservative therapy in reducing the pain score of TMD patients. [13] The com-

Table 2: Baseline Clinical Characteristics

[1]Independent sample t test, [2]Chi-square test was used, p-value<0.05 is significant

Variable	PRP Group	Conventional Group	P-value
Duration of TMD > 6 months – (n,%)	21 (70.0)	19 (63.3)	0.581[2]
Bilateral pain – (n,%)	16 (53.3)	14 (46.7)	0.610[2]
Pain triggered by jaw movement–	28 (93.3)	27 (90.0)	0.642[2]
Joint sounds present – (n,%)	25 (83.3)	23 (76.7)	0.515[2]
Limited mouth opening– (n,%)	20 (66.7)	21 (70.0)	0.780[2]
Previous TMJ treatment history– (n,%)	23 (76.7)	24 (80.0)	0.752[2]
Baseline VAS pain score- Mean±SD	7.6 ± 1.2	7.5 ± 1.1	0.694[1]
Baseline MMO (mm) – Mean±SD	32.5 ± 5.1	33.0 ± 5.4	0.723[1]

Table 3: Post-Treatment Outcomes at Week 12

[1]Independent sample t test, [2]Chi-square test was used, p-value<0.05 is significant

Outcome	PRP Group (n=30)	Conventional Group (n=30)	Mean/ Risk Difference	95% CI	Effect Size	P-value
Pain score (VAS), Mean ± SD	2.1 ±1.0	4.3 ±1.4	MD = −2.20	−2.83 - −1.57	Cohen's d = 1.81	<0.001[1]
Maximal mouth opening (mm), Mean ± SD	41.2 ±3.8	36.5 ±4.2	MD = 4.70	2.63 - 6.77	Cohen's d = 1.17	<0.001[1]
Lateral jaw excursion (mm), Mean ± SD	9.5 ±1.3	7.8 ±1.6	MD = 1.70	0.95 - 2.45	Cohen's d = 1.17	<0.001[1]
Reduction in joint sounds, n (%)	24 (80.0)	15 (50.0)	RR = 1.60	1.07 - 2.39	OR = 4.00	0.010[2]
Functional improvement, n (%)	26 (86.7)	18 (60.0)	RR = 1.44	1.04 – 2.00	OR = 4.33	0.020[2]
Any complications, n (%)	3 (10.0)	2 (6.7)	RR = 1.50	0.27 – 8.34	OR = 1.56	0.640[2]
Patient satisfaction, n (%)	27 (90.0)	18 (60.0)	RR = 1.50	1.09 – 2.06	OR = 6.00	0.003[2]

Table 4: Summary of PRP Injections (PRP Group Only, n = 30)

**The number of PRP injections varied according to patients' clinical response and symptom improvement during follow-up, with a maximum of three injections permitted under the study protocol.*

Number of PRP injections	Participants, n (%)
1 injection	6 (20.0)
2 injections	18 (60.0)
3.Injections	6(20.0)

bined analysis they performed proved that PRP has a statistically significant effect on pain reduction as compared to placebo and hyaluronic acid.

In terms of improvement in mouth opening, PRP group in our study had improved in 32.5 mm to 41.2 mm which was higher than the conventional group which was 36.5 mm. This can be compared to those of Sharma et al. who reported an average increase of 8.5 mm in maximal mouth opening after PRP treatment in their systematic review of randomized controlled trials. [14] The researchers of Derwich et al. also reported that the patients receiving PRP made substantially better improvements in the mandibular mobility than those receiving either hyaluronic acid or conventional conservative treatment. [15]

There was an indication of 9.5 mm average improvement in lateral jaw excursion in PRP group as compared to 7.8 mm in the control group. These results are in line with those of Işik et al., who had reported the evidence of better lateral jaw movements in PRP-treated patients, which added to their increased ability to masticate and increase the quality of life. [16] Their randomized controlled trial highlighted the role of PRP in enhancing other functional parameters other than pain relief. Thus, in our study 80 percent of patients in the PRP group reported a reduction in joint noises like clicking and popping joints, as opposed to half of those in the conventional group. These findings are consistent with the results of Chung et al., who established that 76% of PRP-treated TMD individuals had improvement or complete elimination of joint sounds when compared to 45% of the treatment arms in the conservative treatment group. [11] It is believed that the mechanism depends on the anti-inflammatory and cartilage-repair effects of PRP associated with maintenance of joint homeostasis and inner derangement.

Our study reported a significant difference of 86.7% of PRP-treated patients reported functional improvement of daily activities, including chewing, speaking and yawning, compared with 60% in the conventional group. The study of Sikora et al. also supports these findings as the authors observed that PRP therapy was associated with significant functional outcomes and was more accepted by patients because it was faster to present symptoms and fewer complications. [17]

The PRP group showed a significant level of patient satisfaction (90%) as opposed to 60% in the conventional group. Işik et al. also expressed high levels of satisfaction (88) in the PRP group, which is credited to a decrease in pain, function improvement, and minimal side effects. [16]

Finally, we have found that the majority of patients in PRP group (60%) needed two injections, which is consistent with the standard procedure in various clinical trials. As an illustration, Sharma et al. pointed out that the vast majority of researches involved 1-3 PRP injections in a 4-6 week course and still had the best results. [14]

This study has several limitations. First, the non-randomized design introduces the possibility of selection bias and residual confounding, despite comparable baseline demographic and clinical characteristics between the study groups. Because no multivariable adjustment or propensity score analysis was performed, the influence of unmeasured confounders cannot be excluded. Second, the absence of blinding of outcome assessors may have introduced observer bias. Third, the study was conducted at a single tertiary care center with a relatively small sample size, which may limit the generalizability of the findings. Fourth, the follow-up period of 12 weeks was relatively short and did not permit assessment of the long-term durability of PRP treatment effects. Finally, the number of PRP injections varied according to patients' clinical response, which may have contributed to variability in treatment outcomes.

Future multicenter randomized controlled trials with larger sample sizes, blinded outcome assessment, standardized PRP preparation and injection protocols, longer follow-up, and appropriate multivariable or propensity score adjustment are warranted to confirm these findings and determine the optimal dosing schedule and long-term efficacy of PRP therapy for temporomandibular joint dysfunction.

Conclusion

The results show that platelet-rich plasma therapy is a safe and more effective treatment modality than conventional conservative management for temporomandibular joint dysfunction. There was a significant reduction in pain, improvement in mandibular function, reduction in joint sounds, and patient satisfaction with PRP therapy compared to conventional conservative management over a period of 12 weeks, with minimal side effects. These findings suggest that PRP therapy has therapeutic potential as an adjunct or alternative treatment modality to conventional conservative management for TMDs in patients who have not responded to conventional management.

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Author Contributions

1. **Adil Yousaf**: Conception, design.
2. **Tahirullah Khan**: Supervision, funding, materials.
3. **Gulalai Khan:** Data collection and/or processing.
4. **Gulfam Ali:** Analysis and/or interpretation, literature review.
5. **Muhammad Nauman Khan:** Writing, critical review.