IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 24, Issue 8 Ser. 3 (August. 2025), PP 18-25
www.iosrjournals.org

Evaluation And Efficacy Of Intra-Articular Platelet-Rich Plasma Injection For The Treatment Of Temporomandibular Joint Disorders – An Observational Study

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Abstract:
Background*: Temporomandibular joint disorders (TMDs) are a complex set of conditions affecting the jaw joint and associated structures, often presenting with pain, joint sounds, and limited mandibular movement. Platelet-rich plasma (PRP), rich in growth factors and anti-inflammatory properties, has emerged as a potential therapeutic option for TMD.*
Objective*: To evaluate the efficacy of intra-articular PRP injections for the management of temporomandibular joint disorders.*
Methods: *Ten patients diagnosed with TMD unresponsive to conservative management were enrolled in this observational study. All underwent arthrocentesis followed by PRP injection into the superior joint space. Clinical outcomes, including pain (VAS score), mouth opening, joint sounds, deviation, and tenderness, were assessed pre-operatively, and at 1 week, 1 month, 3 months, and 6 months post-operatively.*
Results: *Statistically significant reductions in pain, joint sounds, deviation, and tenderness were observed over the 6-month period ($p < 0.05$). Mean pain score decreased from 1.90 pre-operatively to 0.10 at 6 months. Mouth opening improved significantly from 39.10 mm to 42.70 mm. No major adverse effects were noted.*
Conclusion: *Intra-articular PRP injections following arthrocentesis appear to be a safe and effective treatment modality for TMD, providing significant symptom relief and functional improvement.*
Key Word: *minimally invasive therapy, arthrocentesis, intra-articular injection, prp, temporomandibular joint disorder*

Date of Submission: 02-08-2025 Date of Acceptance: 12-08-2025

I. Introduction

Temporomandibular joint (TMJ) is one of the most complex and functionally active joints in the body, comprising the temporal bone, mandibular condyle, articular disc, ligaments, and associated musculature [1]. Disorders affecting the TMJ, collectively termed temporomandibular joint disorders (TMDs), include a broad spectrum of conditions such as myofascial pain, internal derangement, arthritis, and degenerative changes [2]. These conditions commonly present with pain in the jaw, face, or temples; restricted mandibular movement; and joint sounds such as clicking, popping, or crepitus during jaw function. Additional signs include deviation or deflection of the mandible during opening or closing, joint locking, and muscle tenderness. The three hallmark features of TMD are pain, limited range of motion, and TMJ sounds, which often interfere with normal jaw function and quality of life [3].

The prevalence of TMD is thought to be greater than 5% of the population. Lipton and colleagues showed that about 6% to 12% of the population experience clinical symptoms of TMD [4].

Pain in TMD is commonly localized to the masseter, preauricular area, and anterior temporalis muscles. It is often dull, poorly localized, and typically unilateral, though it may occasionally present as sharp or throbbing, especially during flare-ups. Patients frequently report exacerbation of pain with stress, jaw clenching, or chewing, while relief is noted with relaxation, warm compresses, or over-the-counter analgesics [5].

Patients with TMD symptoms present over a broad age range; however, there is a peak occurrence between 20 and 40 years of age. TMD symptoms are more prevalent in women than men. In general, the causes of pain symptoms may not be determined by clinical examination alone.

The diagnosis of TMD-related pain is ideally based on a combination of clinical evaluation and diagnostic imaging. While physical examination provides essential information, imaging modalities like computed tomography (CT) and magnetic resonance imaging (MRI) are crucial for assessing TMJ structures. CT is particularly useful for evaluating osseous changes, whereas MRI is preferred for visualizing soft tissues, including disc position, joint effusion, inflammatory changes in the posterior disc attachment, and bone marrow edema. Advanced imaging techniques such as magnetization transfer contrast (MTC), magnetic resonance spectroscopy (MRS), diffusion tensor imaging, and ultrasonography (US) have recently been employed to detect masticatory muscle changes like edema and fibrosis, enhancing the diagnostic accuracy in complex TMD cases [6].

TMD is a multifactorial disorder influenced by muscle overuse, trauma, hormonal factors, and joint degeneration [7]. It can alter the TMJ microenvironment, leading to cartilage breakdown and bone damage. Pain and dysfunction are also linked to increased intra-articular pressure and elevated cytokine levels in the synovial fluid [8].

II. Material And Methods

Study Design

This observational, prospective study was conducted at the Department of Oral and Maxillofacial Surgery, Panineeya Mahavidyalaya Institute of Dental Sciences and Hospital, Hyderabad, India. The study received ethical clearance from the Institutional Ethics Committee (Approval No: PMVIDS&RC/IEC/OMFS/DN/019317). Written informed consent was obtained from all participants.

Sample Size and Study Population

The sample size of 10 patients was determined based on feasibility for this pilot observational study, which aimed to explore preliminary efficacy and safety outcomes of PRP in TMD management. A formal power calculation was not conducted; however, the sample size aligns with previous exploratory studies in this field and was sufficient to detect statistically significant clinical improvements within the cohort.

Inclusion Criteria

Participants aged between 17 and 60 years with a clinical diagnosis of temporomandibular joint (TMJ) disorder were considered for inclusion. Eligibility required limited mouth opening of less than 35 mm and failure to respond to conservative treatments such as non-steroidal anti-inflammatory drugs (NSAIDs), physiotherapy, or splint therapy for at least three months. Only those willing to comply with follow-up protocols and provide informed consent were enrolled.

Exclusion Criteria

Patients with systemic diseases such as rheumatoid arthritis or diabetes mellitus, known platelet function disorders or fibrinogen deficiency, and those currently using anticoagulant medications were excluded. Additional exclusion criteria included a history of TMJ trauma, infection, or surgery; pregnancy or lactation; and any active infection at or near the injection site.

Preoperative Evaluation

All patients underwent a comprehensive clinical examination that included documentation of pain using the Visual Analog Scale (VAS), assessment of joint sounds, mandibular deviation, joint tenderness, and range of motion. Radiographic evaluation was performed using an orthopantomogram (OPG) to exclude dental pathologies, and magnetic resonance imaging (MRI) was used to confirm internal derangement of the temporomandibular joint. Hematological investigations included a complete blood count to ensure normal platelet levels prior to platelet-rich plasma preparation. Prior to enrollment, all patients had completed a course of conservative therapy, which included occlusal splint management using 2 mm thick vacuumformed hard splints worn continuously for four weeks.

PRP Preparation

Five milliliters of venous blood were collected aseptically from the antecubital vein and mixed with 0.4 ml of Citrate Phosphate Dextrose Adenine (CPDA) in a sterile tube. The first centrifugation was performed at 2000 rpm for 15 minutes to separate red blood cells from plasma. The resulting plasma, including the buffy coat, was then centrifuged at 3000 rpm for 10 minutes. The lower fraction (approximately 0.6 ml) containing platelet-rich plasma (PRP) was carefully extracted and used for injection.

Surgical Procedure

All procedures were performed under local anesthesia using 2% lignocaine with 1:80,000 adrenaline. Arthrocentesis was initiated by marking two entry points along the canthotragal line. Two 20-gauge needles were inserted to allow flushing of the superior joint space with 20 ml of sterile normal saline. Once anatomical access was confirmed, 0.6 ml of PRP was injected into the joint space. Patients were instructed to perform gentle mandibular movements immediately post-injection to facilitate intra-articular distribution of PRP and were advised to follow a soft diet for three days.

Postoperative Care and Follow-up

Post-procedure follow-up assessments were conducted at 1 week, 1 month, 3 months, and 6 months. Clinical evaluation at each visit included assessment of pain using the Visual Analog Scale (VAS), interincisal mouth opening, and evaluation for joint sounds, deviation, and tenderness through clinical palpation and auscultation.

Statistical Analysis

Data were analyzed using IBM SPSS version 20.0 (IBM Corp., Armonk, NY). Descriptive statistics were calculated and expressed as mean ± standard deviation (SD). The paired t-test was employed to compare continuous parametric variables, such as interincisal mouth opening and VAS pain scores. For nonparametric ordinal variables like joint sounds and tenderness, the Wilcoxon signed-rank test was applied. A p-value of less than 0.05 was considered statistically significant.

Quality Assurance and Bias Minimization

To ensure uniformity and reduce inter-operator variability, all clinical procedures and follow-up assessments were performed by a single trained oral and maxillofacial surgeon. Standardized instruments and protocols were used throughout the study for measuring clinical parameters such as pain, mouth opening, and joint function. Magnetic resonance imaging (MRI) and platelet-rich plasma (PRP) preparation followed consistent protocols across all cases. Although patients were aware of the procedure, they were blinded to the study hypothesis, which helped reduce expectation-related bias.

III. Result

A total of 10 patients (2 males and 8 females), aged between 17 and 54 years (mean age: 34.3 ± 14.47 years), were included in the study. All patients completed follow-up assessments at 1 week, 1 month, 3 months, and 6 months postoperatively [Table 1].

Time	Clicking Sound Mean ± SD	Pain Score Mean ± SD	Mouth Opening (mm) Mean ± SD	Deviation n (%)	Joint Tenderness n (%)
Preoperative	1.20 ± 1.033	1.90 ± 0.738	39.10 ± 6.082	6 (60.0%)	8 (80.0%)
1 week	1.10 ± 0.994 (p = 0.317)	1.20 ± 0.632 (p = 0.008*)	40.10 ± 5.174 (p = 0.168)	6 (60.0%) (p = 1.000)	1 (10.0%) (p = 0.008*)
4 weeks	0.60 ± 0.516 (p = 0.014*)	0.50 ± 0.527 (p = 0.006*)	41.90 ± 3.510 (p = 0.034*)	2 (20.0%) (p = 0.046*)	0 (0.0%) (p = 0.005*)
3 months	0.40 ± 0.516 (p = 0.023*)	0.20 ± 0.422 (p = 0.006*)	42.30 ± 2.406 (p = 0.045*)	0 (0.0%) (p = 0.014*)	0 (0.0%) (p = 0.005*)
6 months	0.30 ± 0.483 (p = 0.024*)	0.10 ± 0.316 (p = 0.005*)	42.70 ± 2.111 (p = 0.040*)	0 (0.0%) (p = 0.014*)	0 (0.0%) (p = 0.005*)

TABLE 1: Clinical Outcomes Over Time Following Treatment (n = 10)

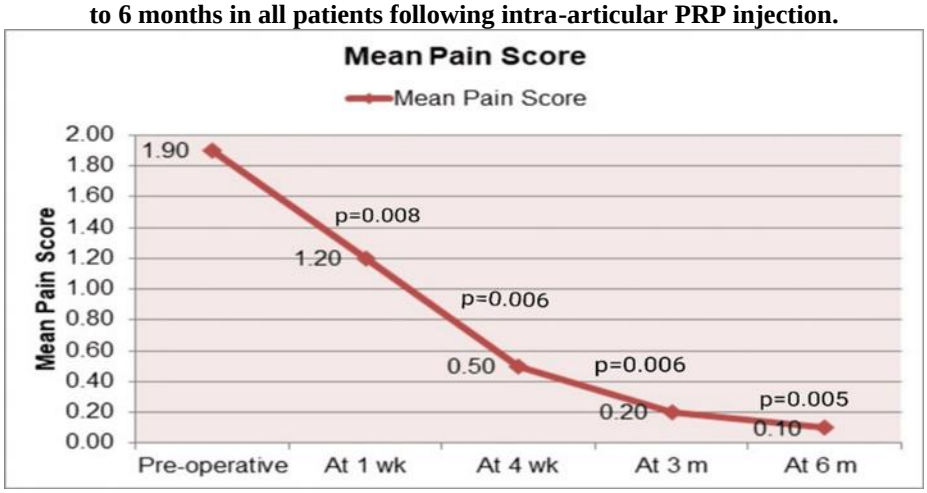
P values indicate comparison with pre-operative values. Statistically significant values are marked with an asterisk (* $p < 0.05$).

Pain Reduction (Visual Analogue Scale)

The most immediate and consistent finding was the statistically significant reduction in TMJ-related pain, observed from the first week post-treatment and continuing progressively throughout the six-month followup. The mean pain score declined from 1.90 ± 0.738 preoperatively to 0.10 ± 0.316 at six months ($p = 0.005$).

At 1 week, the pain score dropped to 1.20 ± 0.632 (p = 0.008), and further reductions were observed at 1 month (0.50 ± 0.527, p = 0.006), 3 months (0.20 ± 0.422, p = 0.006), and 6 months (0.10 ± 0.316, p = 0.005). These findings highlight PRP's anti-inflammatory effect and support its sustained analgesic action (Figure 1).

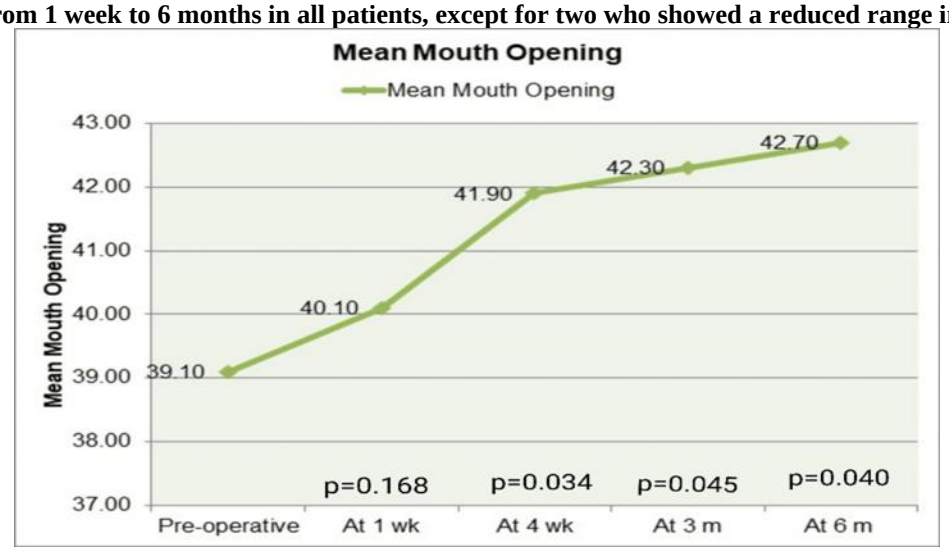
FIGURE 1: Graph showing a statistically significant decrease in pain (VAS score, p < 0.05) from 1 week to 6 months in all patients following intra-articular PRP injection.



Mouth Opening (Interincisal Distance)

A steady and statistically significant increase in mouth opening was observed. The mean interincisal distance improved from 39.10 ± 6.08 mm preoperatively to 42.70 ± 2.11 mm at six months (p = 0.040). Although no significant change was observed at 1 week (p = 0.168), improvements became significant by the first month (p = 0.034), continued at 3 months (p = 0.045), and were maintained at 6 months (p = 0.040) (Figure 2).

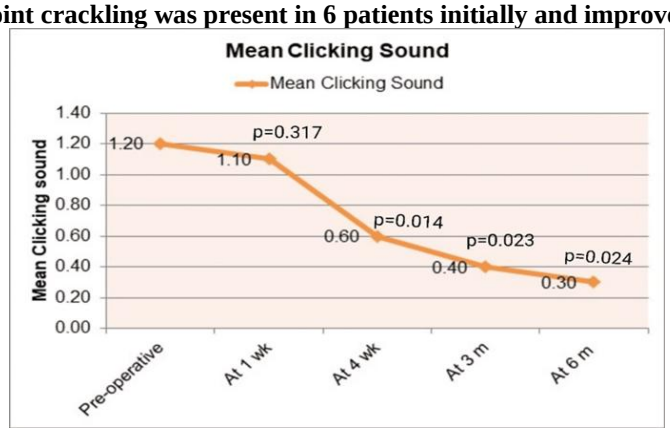
FIGURE 2: Graph showing a statistically significant increase in mouth opening (interincisal distance, p < 0.05) from 1 week to 6 months in all patients, except for two who showed a reduced range initially.



Joint Sounds (Clicking)

A reduction in clicking sounds was observed in most patients. The mean score declined from 1.20 ± 1.033 to 0.30 ± 0.483 at 6 months (p = 0.024). Statistically significant improvements were noted at 4 weeks (p = 0.014), 3 months (p = 0.023), and 6 months (p = 0.024). Although some patients continued to exhibit minimal joint sounds, overall improvement was marked (Figure 3).

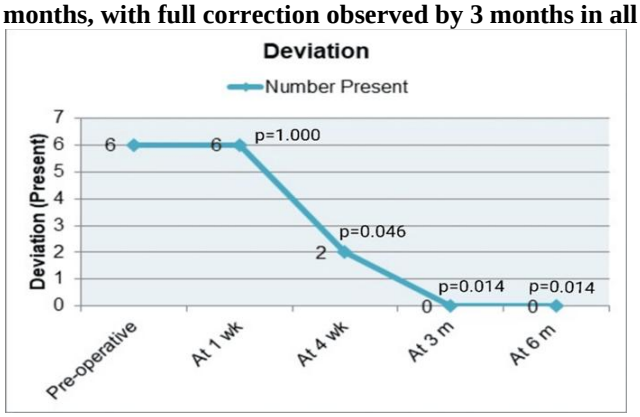
FIGURE 3: Graph showing a statistically significant decrease in clicking sound (p < 0.05) from 1 week to 6 months. Joint crackling was present in 6 patients initially and improved over time.



Mandibular Deviation

Preoperatively, 60% of patients (6/10) demonstrated mandibular deviation during mouth opening. This reduced to 20% (2/10) at one month (p = 0.046) and was completely resolved in all patients by three months (p = 0.014), with this correction persisting through six months (Figure 4).

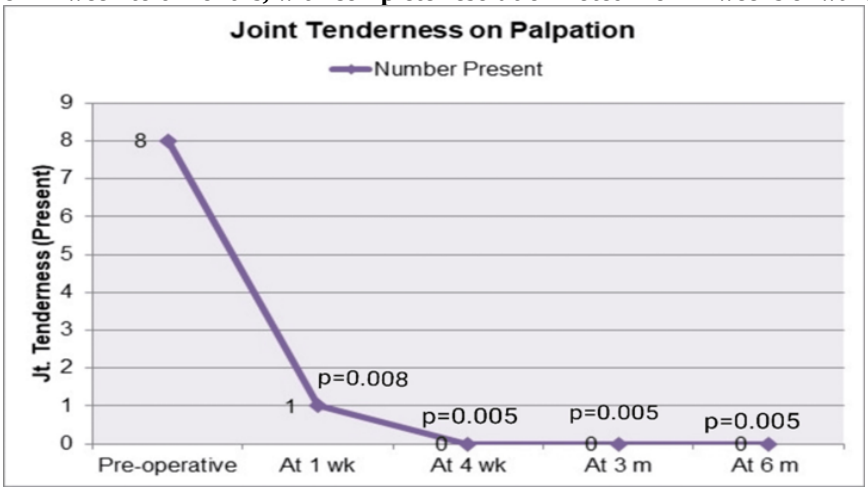
FIGURE 4: Graph showing a statistically significant reduction in mandibular deviation (p < 0.05) from 1 week to 6 months, with full correction observed by 3 months in all patients.



Joint Tenderness

Tenderness on palpation, a clinical indicator of joint inflammation, was reported in 80% of patients preoperatively. It decreased to 10% at 1 week (p = 0.008), and complete resolution was noted from 4 weeks onward (p = 0.005), with no recurrence throughout follow-up (Figure 5).

FIGURE 5: Graph showing a statistically significant decrease in joint tenderness on palpation (p < 0.05) from 1 week to 6 months, with complete resolution noted from 4 weeks onward.



Safety and Tolerability

The procedure was well-tolerated by all participants, with no major adverse events recorded. Minor side effects, such as mild swelling and localized discomfort at the injection site, were reported in a few patients during the first postoperative week; these resolved spontaneously without the need for intervention. No cases of infection, fibrosis, joint restriction, or systemic complications were observed during the study period. These findings support the favorable safety profile of PRP therapy, attributed to its autologous nature and minimally invasive method of administration.

Age-Related Observations

An informal trend observed during the study suggested that younger patients experienced more rapid and pronounced clinical improvements compared to older participants. This difference may be attributed to the superior tissue regenerative capacity typically seen in younger individuals, whereas older patients may have more advanced degenerative changes that limit the full potential of biological repair. These observations underscore the importance of considering patient age and associated tissue quality when selecting candidates and setting expectations for PRP therapy in temporomandibular joint disorders.

IV. Discussion

Temporomandibular disorders (TMDs) are a group of multifactorial, musculoskeletal and joint-related conditions that affect the TMJ, associated musculature, and surrounding structures. These disorders often present with pain, joint noises (clicking or crepitus), limited mandibular movement, and deviations in function. If left untreated, TMDs may progress, resulting in chronic pain, internal joint derangement, and irreversible structural damage due to persistent inflammation and cytokine-mediated joint degradation [5].

The initial management of TMD typically involves conservative approaches such as occlusal splints, analgesics, physiotherapy, and behavior modification. However, when these modalities fail to provide adequate relief, minimally invasive procedures such as arthrocentesis and intra-articular injections are recommended. Arthrocentesis has been well-documented as an effective treatment modality to relieve pain and improve mandibular mobility by removing inflammatory cytokines and reducing intra-articular pressure [9-11].

In recent years, platelet-rich plasma (PRP) has emerged as a promising biological therapy in the management of musculoskeletal disorders, including TMDs. PRP is rich in autologous growth factors such as platelet-derived growth factor (PDGF), transforming growth factor-beta (TGF-β), insulin-like growth factor (IGF), and basic fibroblast growth factor (bFGF), which contribute to tissue repair and modulation of inflammation [12,13]. These bioactive components stimulate chondrocyte proliferation, enhance extracellular matrix formation, and promote angiogenesis, thereby accelerating healing within the TMJ.

The findings from our study are consistent with previous research supporting the beneficial role of PRP in managing TMJ-related symptoms. A significant reduction in pain scores was observed from the first week onward, with near-complete resolution by six months. This trend aligns with the work of Pihut et al., who demonstrated that intra-articular PRP injections lead to a marked decrease in pain and functional limitation in patients with TMD [14]. Similarly, Hanci et al. reported that PRP was superior to arthrocentesis alone in improving clinical outcomes, particularly in patients with disc displacement with reduction [13].

Moreover, Comert Kiliç et al. in a randomized clinical trial, showed that the combination of PRP with arthrocentesis significantly improved outcomes compared to arthrocentesis alone in TMJ osteoarthritis patients [11]. Our study's results - particularly the improvements in mouth opening and reduction in joint tenderness - corroborate these findings and further suggest a synergistic benefit when PRP is used in conjunction with arthrocentesis.

Interestingly, the elimination of mandibular deviation in all patients by the third month underscores the possible contribution of PRP not only in symptomatic relief but also in functional and biomechanical restoration of the joint. However, the incomplete resolution of clicking sounds in a few patients may reflect the mechanical complexity of disc-condyle relationships, which may not be fully corrected through biological repair alone.

The safety profile observed in our study - with only minor, self-limiting adverse effects such as transient swelling or soreness - also mirrors findings from previous reports that highlight PRP's excellent biocompatibility and low risk of immune reaction due to its autologous nature [14,15].

Another interesting observation was the faster and more pronounced response in younger patients, likely attributable to better baseline tissue quality and regenerative capacity. This age-related trend is also mentioned in broader PRP literature, where outcomes are often moderated by host factors such as age, metabolic status, and disease chronicity.

While the study contributes positively to the growing body of evidence on PRP for TMD, some limitations must be acknowledged. The small sample size (n=10), absence of a control group, and short-to-intermediate follow-up period limit the generalizability of our findings. Additionally, variability in PRP

preparation protocols across studies makes direct comparison difficult and highlights the need for standardization in PRP composition and injection protocols [13,16].

Clinical Implications and Future Directions

The results of this study support the clinical utility of PRP as an adjunctive modality in TMD treatment. Its combined anti-inflammatory, analgesic, and regenerative actions provide a multifaceted approach to joint healing. Future randomized controlled trials with larger cohorts and standardized PRP protocols are essential to establish optimal indications, dosage, and long-term efficacy. Comparative studies between PRP and other intra-articular agents like hyaluronic acid or corticosteroids would also clarify its relative benefits.

V. Conclusion

This observational study demonstrates that intra-articular platelet-rich plasma (PRP) injections, when combined with arthrocentesis, are a safe and effective minimally invasive treatment for temporomandibular joint disorders (TMDs) unresponsive to conservative management. Statistically significant reductions in pain, joint sounds, deviation, and tenderness, along with improved mouth opening, were observed over a 6month follow-up period.

The regenerative and anti-inflammatory properties of PRP - owing to its rich concentration of growth factors - appear to play a crucial role in modulating the joint environment, enhancing tissue healing, and improving function. The use of autologous PRP also ensures biocompatibility and minimizes risks of hypersensitivity or infection.

Although the sample size was limited, the clinical outcomes suggest that PRP has substantial potential as an adjuvant therapy for TMDs. Further large-scale, randomized controlled studies are recommended to confirm these findings and establish standardized treatment protocols.

Additional Information

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Panineeya mahavidhyala institute of dental sciences and research centre issued approval PMVIDS&RC/IEC/OMFS/DN/0193-17. The research titled "Evaluation and Efficacy of IntraArticular Platelet-Rich Plasma Injection for the Treatment of Temporomandibular Joint Disorders – An Observational Study" was reviewed and approved by the Institutional Ethics Committee of Panineeya Mahavidyalaya Institute of Dental Sciences and Research Centre. The approval was granted under the reference number PMVIDS & RC/ IEC/ OMFS/ DN/ 0193-17. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Animal subjects: All authors have confirmed that this study did not involve animal subjects or tissue.

Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following:

Payment/services info: All authors have declared that no financial support was received from any organization for the submitted work**.**

Financial relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

Other relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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