The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 3, Issue 4, 2025

EVALUATION OF PAIN REGRESSION WITH INTRA-ARTICULAR PLATELET-RICH PLASMA INJECTION IN PATIENTS WITH TEMPOROMANDIBULAR JOINT DYSFUNCTION SYNDROME

Dr. Noor Ul Ain[*1], Dr. Beenish Pervaiz[2], Dr Haseeb Uddin[3], Major Dr Shehroz Khan[4], Dr Jamal Ahmed[5], Prof Dr Muhammad Umar Farooq[6]

[1,2,3,5](BDS) FCPS Resident (Oral & Maxillofacial Surgery) Pakistan Institute of Medical Science, SZABMU, Islamabad
[4](MBBS) AFPGMI
[6](BDS, MDS) Professor & Chairman of Oral & Maxillofacial Surgery Department, Pakistan Institute of Medical Science, SZABMU, Islamabad.

[*1]noor.13@iideas.edu.pk, [2]benishp94@gmail.com, [3]haseebhumzvi@gmail.com, [4]shehrozniazi2970@gmail.com, [6]surgeonu@gmail.com

DOI: https://doi.org/10.5281/zenodo.15307871

Keywords
Pain, Temporomandibular joint dysfunction, Platelet-rich plasma, Intra-Articular

Article History
Received on 22 March 2025
Accepted on 22 April 2025
Published on 30 April 2025

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Corresponding Author: *
Dr. Noor Ul Ain

Abstract

Objective: *Evaluation of mean pain and mean mouth opening before and after intraarticular injection of platelet-rich plasma in patients presenting with temporomandibular joint dysfunction.*

Introduction: *Temporomandibular joint dysfunction syndrome (TMDs) is found in 40–60% of the community. It is more common in female population, and primarily affect people in 20-40 years of age.*

Methodology: *A quasi-experimental study was conducted at PIMS Islamabad from June 2023 to July 2024 using consecutive sampling. Patients with temporomandibular joint dysfunction having age range in between 18 to 60 years were included. Pregnancy, history of recent steroid injections, infections, significant joint injury and previous surgeries were among the exclusion criteria. PRP was equipped using double spin technique followed by injection on affected joint area. Pain and mouth opening was documented at preintervention, 30mints after single injection of PRP, 1st, 2nd and 6th week on follow up.*

Results: *The study of 50 participants (68% female) presented a marked decline in pain, with VAS scores reducing from 6.42±1.46 pre-intervention to 1.02±0.38 by week six, and mouth opening improving from 19.66±3.65 mm to 35.58±2.52 mm. These changes were statistically significant (p = 0.000), reflecting substantial pain respite and functional regaining over the six-week period.*

Conclusion: *Significant improvement in mouth opening and decrease in VAS discomfort levels over a six-week period demonstrated the high efficacy of intra-articular platelet-rich plasma (PRP) injection in temporomandibular joint dysfunction syndrome patients.*

INTRODUCTION

Temporomandibular joint dysfunction syndrome (TMDs) is present in 40–60% of the community. It is more common in female population, and primarily affect people in 20-40 years of age.[1]When opening the mouth, TMDs result in a restricted extent of mandibular movement, deviation, or deflection. There are also sounds of clicking or crepitus, as well as joint discomfort. Trauma, bruxism, clenching, occlusal discrepencies, and orthodontic therapy are some of the etiological variables that lead to TMDs. These factors cause the temporomandibular joint's muscular apparatus to sustain repeated microtrauma, which causes joint bleeding, effusion, and lubrication loss.[1-2] Medications, Occlusal splints of various designs, physical and psychological rehabilitation are all used as treatment modalities for temporomandibular joint dysfunction syndrome. In medicine,Orthopedic and rheumatology illnesses characterized by pain, fibrous adhesions and joint capsule as well as bony and cartilaginous inflammation are effectively treated by Intra-articular injectable medication.[3-4] Currently, intra-articular injection of hyaluronic acid, steroids and platelet rich plasma are used in management of TMDs.[5] Among all the injectable therapies PRP is getting more acceptance. Even though concentrates of PRP were created in 1970s, their medicinal application was only made possible by subsequent technological advancements, particularly in medical instrumentation.[6] PRP has lately been deemed as an ortho biological adjuvant intervention. It repairs intraarticular hyaluronic acid, boost glycosaminoglycan chondrocyte production and counterbalances joint angiogenesis. It supplies a matrix for stem cells relocation. Scientific studies have suggested that PRP activates cell proliferation and the synthesis of cartilage matrix by chondrocytes and bone marrow-derived mesenchymal stromal cells. It also enhances the synthesis of hyaluronic acid by synoviocytes.[5,7] A study by Ismael et al. reported that intra-articular platelet-rich plasma (PRP) injections significantly increased mouth opening and decreased discomfort intensity in individuals with temporomandibular joint dysfunction. Comparing preoperative measurements with those obtained six months after treatment revealed these improvements.[8]According to Chandra L et al[9]., intra-articular PRP injection significantly decreased pain intensity and amplified maximum interincisal opening in 52 patients with refractory temporomandibular joint dysfunction syndrome. Comparing preoperative and six-month post-treatment data, patients reported a notable decrease in pain and an increase in mouth opening. However the previous text on the use of PRP in the management of articular impairments in orthopedics, its application in TMDs is quite uncharted in our population. Hence, we are conducting the study using PRP in management of patients with TMDs reporting to our center. This research may assist general dentist in treating patients with less intervention by using PRP in temporomandibular joint, resulting in better treatment option and financial management plans.

Material and methods:

After the approval from the ethical review board of Shaheed Zulfiqar Ali Bhutto Medical University (No.F.1-1/2015/ERB/SZABMU/940) a Quasi-experimental study with non-probability, consecutive sampling was conducted in the oral and maxillofacial surgery (OMFS) department of Pakistan institute of medical science (PIMS) Islamabad from June 2023 to may 2024. The WHO sample size calculator was used to evaluate the study's sample size based on predetermined statistical characteristics. The expected population mean was 1.614, whereas the test value of the population mean was set at 8.142. A 90% test power, a 5% significance threshold, and a population standard deviation of 1.378 were employed. The estimated sample size was 50 based on these values. It was designed to assess the results both before and after the PRP injection.[10] Male and female patients with age range of 18-60 presented with temporomandibular joint dysfunction were included and patients presented with history of previous surgery, central disc perforation, advanced arthrofibrosis, PRP contraindications such as Platelet functional disorders, fibrinogen deficiency, and anticoagulation treatment) and thrombocytopenia, malignant diseases of head and neck, non-odontogenic infection on involved side, and recent use of injections of sodium hyaluronate or corticosteroids. Additionally, pregnant and lactating women were considered as exclusion criteria for this study from the outpatient department

of OMFS. After explaining purpose and procedure informed written consent was taken. The basic demographic data of the patients i.e age, gender, duration of disease, laterality (left, right, or both) visual analog pain scale, and maximum mouth opening were collected through structured proforma. As verified by various studies and the American Association of Blood Banks technical manual a double spin method give good concentration of palates was utilized for the preparation of PRP. Platelet rich plasma (PRP) was prepared by a sample of 10ml of blood gathered from every patient in 10 ml vacuum tubes having 1 ml of 10% sodium citrate(anti-coagulant). The tubes were centrifuged at 1200rpm for 10 minutes at room temperature, allowing the separation of three constituents of blood such as red blood cells, white blood cells with platelets and plasma. Then plasma was taken in to another 10ml tube and centrifuged again for 5 minutes. The upper plasma layer was discarded and lower layer which is rich in platelets was termed as PRP.[11] Patient were seated at a 45degree incline position for a basic technique for joint to be managed. Under aseptic conditions, a line was drawn from lateral canthus to the most posterior and central point of tragus. The posterior point of entry is positioned along the cantho-tragal line 10 mm from the middle of tragus and 2 mm below the cantho-tragal line. This is the estimated area of maximum concavity of glenoid fossa. The point of entry was placed 10 mm furthermost along the cantho-tragal line and 2 mm below it. The auriculotemporal nerve block was given in joint cavityfollowed by an injection approximately 0.5ml of prepared PRP in the superior joint space.[12] The patients were sitting on a dental chair upright at a 90° angle in order to determine maximum mouth opening (MMO). The patients were told to open their mouths as wide as they could until they could no longer open them any wider. Next, a measurement was made and recorded in millimetres of the separation between the incisal edges of the upper and lower central incisor teeth.[13] In the population of Pakistan, the range of maximum mouth opening among men and women is usually in the range of 35–45 mm and 30–40mm.[14] On the other hand Visual Analog Scale (VAS),[15] an appropriate tool for measuring musculoskeletal pain was used to evaluate the degree of discomfort before and after 30 mints of PRP application in temporomandibular joint (TMJ) area. Patients were asked to assess the severity of their TMJ pain using the VAS on the 10cm measuring scale, which goes from 0cm (no pain), 1-3cm (mild pain), 4-6cm (moderate pain), 7-9cm (severe 10cm (worst possible pain). This evaluation technique aids in determining how well PRP injections help to reduce TMJ pain and gradually improve symptoms.[16] All the procedure was done by a single team under standard operating procedures. The patients were reassessed at 1st, 2nd and 6th week after single PRP injection on the affected area of TMJ.

Results:

The study included 50 participants, with 68% females and 32% males. The most frequently painful side of TMJ was the right (60%), which was followed by the left side (34%), and bilateral involvement (6%). Initially, 58% reported severe pain and 42% moderate pain. Post-intervention, pain levels gradually decreased, with 94% experiencing only mild pain and 6% reporting no pain by the 3rd and 6th weeks. No participants reported severe or worst pain in the later stages as shown in table No I.

Table No I. Descriptive statics showing the frequency and percentages of Qualitative variables.

Variable		Frequency	Percentage	Total
Gender	Male	16	32.0%	
	Female	34	68.0%	
	Total	**50**	**100.0%**	
Side Of TMJ Involved	Left	17	34.0%	
	Right	30	60.0%	
	Bilateral	3	6.0%	
	Total	**50**	**100.%0**	
	No Pain	0	0.0%	

VAS Pain Category Preintervention	Mild Pain	0	0.0%
	Moderate Pain	21	42.0
	Severe Pain	29	58.0
	Worst Possible Pain	0	0.0%
	Total	**50**	**100.0%**
VAS Pain Category Immediate Postintervention	No Pain	0	0.0%
	Mild Pain	3	6.0%
	Moderate Pain	28	56.0%
	Severe Pain	19	38.0%
	Worst Possible Pain	0	0.0%
	Total	**50**	**100.0%**
VAS Pain Category After 1st Week Postintervention	No Pain	0	0.0%
	Mild Pain	32	64.%0
	Moderate Pain	18	36.0%
	Severe Pain	0	0.0%
	Worst Possible Pain	0	0.0%
	Total	**50**	**100.0%**
VAS Pain Category After 2nd Week Postintervention	No Pain	3	6.0%
	Mild Pain	47	94.0%
	Moderate Pain	0	0.0%
	Severe Pain	0	0.0%
	Worst Possible Pain	0	0.0%
	Total	**50**	**100.0%**
VAS Pain Category After 6th Week Postintervention	No Pain	3	6.0%
	Mild Pain	47	94.0%
	Moderate Pain	0	0.0%
	Severe Pain	0	0.0%
	Worst Possible Pain	0	0.0%
	Total	**50**	**100.0%**

Table II reveals that mean age of participants was 29.02±7.81 years, with an average TMJ pain duration of 23.26±15.53 months. VAS pain scores significantly decreased from 6.42±1.46 pre-intervention to 1.02±0.38 by the sixth week. Correspondingly, mouth opening improved from 19.66±3.65 mm to 35.58±2.52 mm, indicating substantial pain relief and functional recovery over time.

Table No II. Descriptive statistics with mean and standard deviation of age, TMJ pain Duration, VAS pain score and clinical mouth opening.

Variable	Minimum	Maximum	Mean± SD
Age	21	55	29.02±7.81
TMJ Pain Duration	2	48	23.26±15.53
VAS Pain score preintervention	4	8	6.42±1.46
VAS Pain score immediate postintervention	2	8	5.80±1.60
VAS Pain score after 1st week postintervention	1	6	3.24±1.35
VAS Pain score after 2nd week postintervention	0	3	1.30±0.71
VAS Pain score after 6th week postintervention	0	2	1.02±0.38
Mouth Opening preintervention	14	26	19.66±3.65

Mouth Opening immediate postintervention	18	36	26.26±4.59
Mouth Opening after 1st week postintervention	25	37	31.14±3.38
Mouth Opening after 2nd week postintervention	30	40	34.60±2.61
Mouth Opening after 6th week postintervention	31	40	35.58±2.52

Paired sample t-test analysis showed statistically marked enhancement in both pain intensity and mouth opening across all time points (p = 0.000). VAS pain scores decreased significantly from pre-intervention to immediate post-intervention and continued to decline over the 1st, 2nd, and 6th weeks. Similarly, clinical mouth opening increased significantly from pre-intervention measurements through to the 6th week, indicating effective pain relief and functional improvement following the intervention.

Table No 3. Paired Sample t test between the quantitative variables.

Variable	Mean±Std	P-value	Significant status
VAS Pain score preintervention - VAS pain score immediately postintervention	0.620±0.923	0.000	Paired sample t test is Significant
VAS Pain score preintervention- VAS Pain score after 1st week postintervention	3.18±1.19	0.000	Paired sample t test is Significant
VAS Pain score preintervention - VAS Pain score after 2nd week postintervention	5.12±1.41	0.000	Paired sample t test is Significant
VAS Pain score preintervention - VAS Pain score after 6th week postintervention	4.78±1.37	0.000	Paired sample t test is Significant
Mouth Opening Preintervention- Mouth opening Immediate Postintervention	-6.60±5.16	0.000	Paired sample t test is Significant
Mouth Opening Preintervention- Mouth opening after 1st week Postintervention	-11.48±4.24	0.000	Paired sample t test is Significant
Mouth Opening Preintervention- Mouth opening after 2nd week Postintervention	-14.94±3.13	0.000	Paired sample t test is Significant
Mouth Opening Preintervention- Mouth opening after 6th week Postintervention	-15.92±3.43	0.000	Paired sample t test is Significant

Discussion:

A concentrated autologous blood product high in platelets and physiologically active compounds, platelet-rich plasma (PRP) has encouraging promise for use in regenerative treatments.[17] By encouraging chondrocyte proliferation, increasing the formation of cartilage matrix, and inhibiting inflammatory mediators, PRP may help with tissue regeneration in terms of temporomandibular joint disorders (TMPDs). PRP therapy may help reduce symptoms by addressing the underlying inflammatory processes, as inflammation leads to advancement and acceleration of TMPDs.[18] Our study's results, which showed notable improvements in mouth opening (from 19.66 mm to 35.58 mm) and pain (VAS score from 6.42 to 1.02) over the six weeks after intra-articular PRP injections for temporomandibular joint dysfunction (TMD), are in line with recent research showing PRP's effectiveness in TMJ disorders.[19] In patients with TMJ osteoarthritis, Liu et al. found that PRP injections produced more immediate improvements in mouth opening and pain reduction than hyaluronic acid (HA), underscoring PRP's superior anti-inflammatory and regenerative properties which in favour of our findings.[20] . Similarly, a 2024 systematic review supported our findings of early and long-lasting functional recovery by finding moderate-quality

evidence that PRP significantly reduces pain and maximal mouth opening (MMO).[21]

Our results also align with findings by Mathpati S et al.[22] who documented notable pain reduction and enhanced jaw function in young adults with TMD following PRP treatment, emphasizing PRP's role in modulating inflammatory cytokines and promoting tissue healing. The progressive reduction in pain scores and concurrent improvement in mouth opening in our cohort mirror the typical clinical trajectory reported in these studies, where PRP's growth factors stimulate chondrocyte activity and extracellular matrix synthesis, accelerating joint repair and reducing inflammation.[17]

Moreover, the rapid pain relief observed immediately and within the first two weeks post-injection in our study corresponds with the early-phase benefits described by Liu et al.[23] who noted significant symptom improvement within one month of PRP therapy. This contrasts with HA treatments, which often show more gradual or less sustained effects. The lower re-injection rates and longer-lasting pain relief reported in orthopaedic PRP studies further emphasize the potential durability of PRP's therapeutic benefits.[24]

A sequential review by Haddad C et al.[25] documented that PRP injections significantly improve mandibular range of movement and reduce pain severity up to 12 months post-treatment, often outperforming other procedures such as hyaluronic acid (HA) injections or saline controls. Our study's short-term results align with these findings, showing rapid pain relief and functional recovery within six weeks. In a similar vein, PRP injections dramatically reduced pain in patients with TMJ osteoarthritis when compared to placebo and HA, according to a randomized controlled experiment by Lun LS et al.[26] The mean differences in VAS scores were roughly 2.8 points at six months and 3.3 points at twelve months. The significant pain reduction we saw, despite our shorter follow-up, highlights PRP's strong analgesic effects.

The biochemical processes that underlie PRP's effectiveness are widely known. Growth factors like vascular endothelial growth factor (VEGF), transforming growth factor-beta (TGF-β), and platelet-derived growth factor (PDGF) are abundant in PRP and aid in tissue healing, inflammatory regulation, and chondrocyte proliferation. These effects, which enhance joint homeostasis and decrease inflammatory mediators that cause symptoms of TMJ dysfunction, perhaps help explain the noted improvements in pain and mouth opening.[27]

Our study concentrated on PRP injections alone, while other studies have utilized PRP in conjunction with arthrocentesis to improve results. PRP alone may be adequate for efficient symptom management, according to a recent study by Hegab AF et al.[28] that examined arthrocentesis plus PRP versus PRP alone and showed no discernible difference in pain or function improvement between groups. Because it encourages a less invasive approach, which lowers procedure risks and patient pain, this is clinically useful.

In spite of these promising results, our study's constraints include a comparatively short follow-up time and lack of a control group, which limits conclusions about long-term efficacy and relative effectiveness. Larger sample sizes and longer follow-up are necessary for future randomized controlled studies in order to determine the best dosage, frequency of injections, and standardized treatment regimens. Furthermore, investigating PRP's effects in various patient subgroups and TMD severity levels would improve generalizability.

Conclusion:

The substantial effectiveness of intra-articular platelet-rich plasma (PRP) injection in patients with temporomandibular joint dysfunction syndrome was established by significant improvements in mouth opening and reductions in VAS pain levels over a six-week period. These results suggest that PRP is a beneficial and minimally invasive treatment option for TMJ dysfunction, especially for patients who don't respond to standard treatments. Physicians are urged to investigate PRP injections as part of the management approach for TMJ disorders, even if future research should focus on long-term outcomes and comparisons with other treatment methods to further confirm its efficacy and optimal utilization.

Limitations of the study:

The study's six-week follow-up period and limited sample size might make it difficult to determine how PRP treatment will affect participants in the long run. Without a control group, it is challenging to

conclusively attribute improved mouth opening and pain reduction to the intervention alone. Additionally, a relatively homogeneous patient sample and subjective pain assessments may affect the data' generalizability. Future studies must use bigger, controlled sample sizes and lengthened follow-up to verify this survey.

Funding source:
The authors have not settled any financial assistance for this study.

ETHICAL APPROVAL:
The Ethical approval was sought out from the Ethical Review Board (IRB) of Shaheed Zulfiqar Ali Bhutto Medical University (No.F.1-1/2015/ERB/SZABMU/940).

PATIENTS' CONSENT:
Eligible patients were briefed about the study's purpose and methodology before providing their written consent. Those who agreed to participate in the study by signing consent forms were taken as participant.

COMPETING INTEREST:
The authors acknowledged no dispute of interest.

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