

# Ultrasonography-guided Injections of Platelet-rich Plasma in the Management of Internal Derangement of Temporomandibular Joint

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## ABSTRACT

**Objective:** The objective of this study was to assess average improvement in maximal mouth opening, pain at rest, and active mouth opening after platelet-rich plasma (PRP) injections using ultrasonography (USG)-guided platelets rich plasma injection in the management of internal derangement of the joint. **Materials and Methods:** Ten patients with internal derangement of the temporomandibular joint (TMJ) underwent PRP injections guided by the ultrasonography. The extent of maximal mouth opening, pain, and tenderness of the TMJ and the masticatory muscles at rest, motion, and mastication were thoroughly assessed at the beginning of the study and scheduled for next follow-up at 2, 4, 12, and 24 weeks. **Results:** USG-guided platelet-rich plasma injection was significantly effective in improvements of the extent of maximal mouth opening, pain at rest, and on movement. Statistics result demonstrated a significant reduction in the visual analog scale values of pain at rest and on movement. **Conclusion:** USG-guided PRP injection to the upper TMJ space provided improvement in signs and symptoms of patient with internal derangement of the TMJ.

**Keywords:** Internal derangement, Platelet-rich plasma, Superior joint space, Temporomandibular joint, Ultrasonography  
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## INTRODUCTION

Temporomandibular disorders (TMDs) are a progressive condition of the temporomandibular joint (TMJ). Internal derangement of the joint presents as joint sounds, painful movement of the jaws, pain at rest, and reduced mouth opening.<sup>[1]</sup> Internal derangement includes disc displacement with or without reduction, the disc may be displaced anteriorly, posteriorly, or laterally. Anterior displacement being the most common among the rest.<sup>[2]</sup> Most TMDs including internal derangements have an excellent prognosis. If addressed in the initial stages, are usually responsive<sup>[3]</sup> and its progression can be limited by various conservative professional approaches.<sup>[4]</sup> Surgical intervention may be required in patients not responding to the conservative management, significant pain and/or dysfunction, and later stages of internal derangement requiring disc repositioning.<sup>[5]</sup>

Platelet-rich plasma (PRP) is an ultracentrifuge blood product, with a two-fold or more increase in platelet count concentration above the baseline levels or  $>1.1 \times 10^9$ .<sup>[6]</sup> PRP is known to improve cartilage repair due to the growth factors stored in the platelet granules.<sup>[7]</sup> These include PDGF, VEGF, TGF- $\beta$ , FGF, and EGF.<sup>[8,9]</sup> The role of PRP in healing and tissue repair is believed to be based on the modulation of the inflammatory response,<sup>[10]</sup> promotion of local angiogenesis, attraction of fibroblasts, and local stem cells to the site of injury.<sup>[9]</sup>

Ultrasonography (USG) is a widely used imaging technique for various joints of the body, to visualize the articular structure and guide the intra-articular injections; only recently has it gained popularity for guiding injections in the TMJ.<sup>[11]</sup> USG-guided injections in the joint are safe and highly efficacious for the treatment of TMD as they are done under direct vision. At present, there is very limited literature available regarding the targeting of the joint spaces.<sup>[12]</sup> Hence, the lack of a well-established approach for reaching the joint spaces guided by the USG.

Although many studies have demonstrated the therapeutic effects<sup>[13-19]</sup> of PRP in the treatment of TMDs, the accuracy of the

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USG-guided injection in the superior joint space of the TMJ has not been reported in humans. The aim of this study was to assess the efficacy of the USG-guided injection of PRP in the superior joint space of TMJ.

## MATERIALS AND METHODS

A prospective study, with 6 months follow-up period, was designed. It was conducted from October 2017 to December 2019. Ten patients with ten joints were included in the study after being informed about the study and taking their consent. All the patients who were included in the study had internal derangement of the TMJ (anterior disc displacement with reduction), causing functional disability and pain and who had not responded to conservative treatment. History, clinical examination assessment, and diagnosis were done using the (Diagnostic Criteria/TMD) questionnaire.<sup>[20,21]</sup> The pre-operative radiologic assessment of the condylar disc was done using the magnetic resonance imaging (MRI) of the TMJ in both closed and open mouth position [Figure 1].

MR was done using the 1.5 Tesla Siemens Magnetom Avanto of bore size 60 cm and magnet length 160 cm. The head and neck coil 20 cm was used for imaging of the TMJ.

Patients with pathologies of the TMJ, systemic condition, or medically compromised status were not included in the study. Patients' demographics, Wilke's stage of internal derangement, previous treatment, pain, joint sounds, and mouth opening were recorded before the initiation of the treatment, and all the subsequent follow-up visits.

The pain was evaluated on a visual analog scale (VAS) from 0 to 10, the mouth opening was recorded in millimeters. The presence or absence of joint sounds was recorded. All assessments were done by the same clinician on days 1, 2, 4, 12, and 24 weeks after the injections.

PRP was prepared in the same center by the same clinician. 20 cm<sup>3</sup> of venous blood was withdrawn using a 24 gauge syringe from antecubital fossa of each patient and citrated blood samples were fractionated using centrifugation (REMI-8C centrifuge) at 1500 rpm for 15 min. Then, the plasma from the first harvest was fractionated using centrifugation at 3000 rpm for 10 min. Handling of all blood products was done under sterile conditions. 1 ml of PRP was prepared to be injected in each affected joint with the 24 gauge syringe.

For the USG-guided injection, real-time assessment of the superior joint space was done using the linear probe of Toshiba Ciplio XG of 12 MHz frequency, and 1 ml PRP injected after accurate assessment of the joint space [Figure 2a and b].

Soft diet was advised to the patient for 3 days. Anti-inflammatory drugs were not advised to avoid the analgesic effect of medication while documentation in the subsequent days.

SPSS 20.0 for windows (SPSS Inc. Chicago, IL) was used for statistical analysis. Mouth opening was compared using the paired *t* test. Pain at rest and on mandibular movement was assessed using Kruskal–Wallis Test and compared using the Chi-square test. The level of significance was set at 0.05 for all statistical tests.

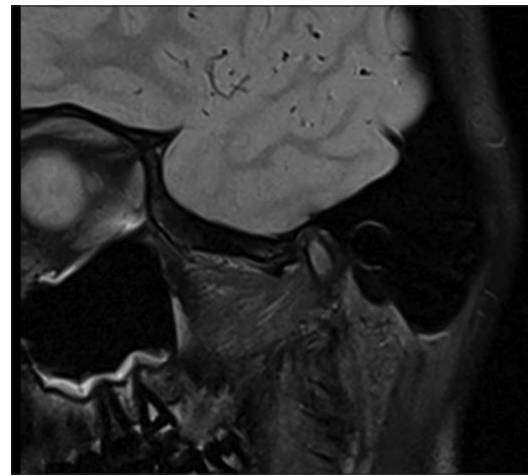
## RESULTS

USG-guided PRP injections were performed in ten patients, who showed significant improvement as can be observed in the graph. The significant improvements were not immediately noticeable after the first follow-up with the treatment but were visible and maintained during the subsequent follow-up clinical assessments after 2 weeks, 1 month, 3 months, and 6 months. In the case of maximal mouth opening, pre-operative opening was  $33 \pm 2.49$  which after 6 months increased to  $41.4 \pm 0.69$  [Figure 3].

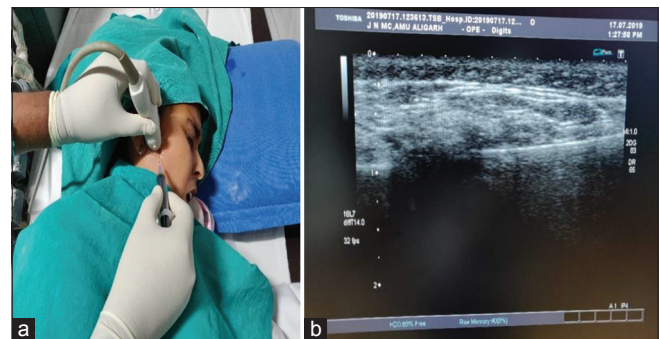
Similarly, preoperative pain at rest pre-operative was  $8.8 \pm 0.64$  which decreased to a minimum of  $1 \pm 0.77$ . Subsequent pain assessments after 3 months and 6 months slightly higher pain scores indicating the need of repeated injection [Figure 4]. Similarly, pre-operative pain during mandibular motion was  $9 \pm 0.54$  which reduced to  $2.2 \pm 0.64$  after 2 weeks, and slightly increased again  $3.8 \pm 2.99$ . Even though it increased slightly, it still remains significantly lower than pre-operative pain scores [Figure 5].

No significant complications were observed. There was no facial nerve damage or injury to parotid gland in any of the cases. Patients experienced temporary swelling and soreness over the TMJ for the first 1–3 days following the procedures. The patient's age varied from 18 to 62 years.

All ten patients in this group were treated with one dose of 1 ml of intra articular PRP injection. Mean mouth opening improved.



**Figure 1:** Pre-operative magnetic resonance imaging of the right temporomandibular joint of the patient, with the disc in anteriorly displaced position (white arrow) and thickened retrodiscal tissue on the condylar head (Red arrow)



**Figure 2:** (a) Platelet-rich plasma injection in the superior joint space of the right temporomandibular joint guided by the ultrasonography (USG), (b) intraoperative USG shows 24 G needle in the right superior joint space

Improvement in mean pain of jaw at rest and on movement was statistically significant for as long as 6 months. Table 1 shows that the technique showed significant improvement in mouth opening, mean pain at rest and on mandibular motion.

## DISCUSSION

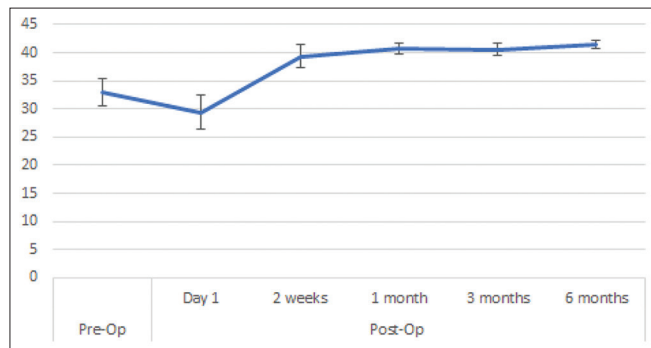
TMDs are a painful condition as the patient might experience pain even at rest. Hanci *et al.*<sup>[17]</sup> and Kiliç *et al.*<sup>[22]</sup> evaluated pain outcomes and compared them in PRP and arthrocentesis. Their results were similar to our findings which suggest PRP as a healing and regenerative material in improving pain at rest. Both the groups in our study showed improved pain status due to the healing properties of PRP.

In our study, the patients were symptom free for more than 6 months suggesting high accuracy in the deposition of the PRP in superior joint space of the TMJ. This may be attributable to the accuracy of reaching the joint space. To the best of our knowledge, the comparison of both these techniques *in vitro* in humans is not available in English literature, although comparison of PRP with other therapeutic agents such as hyaluronic acid and arthrocentesis are found.<sup>[13-18]</sup>

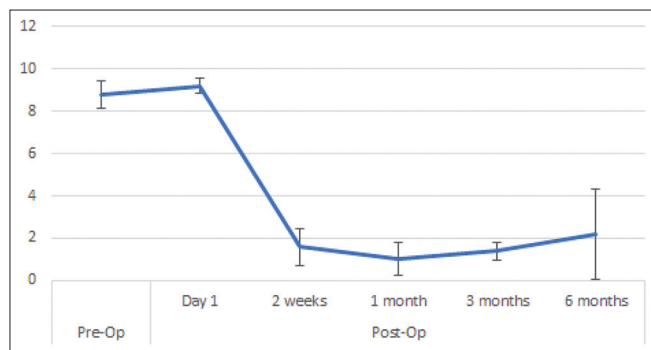
**Table 1:** Comparison of mean mouth opening and pain scores at rest and motion

	Pre-operative	Post-operative				
		Day 1	2 weeks	1 month	3 months	6 months
Maximum Mouth Opening	33±2.49	29.4±3.10	39.4±2.07	40.8±1.00	40.6±1.16	41.4±0.69
Pain intensity at rest (VAS)	8.8±0.64	9.2±0.34	1.6±0.88	1±0.77	1.4±0.42	2.2±2.13
Pain intensity on mandibular motion (VAS)	9±0.54	9.6±0.42	2.2±0.64	4±2.23	4±2.92	3.8±2.99

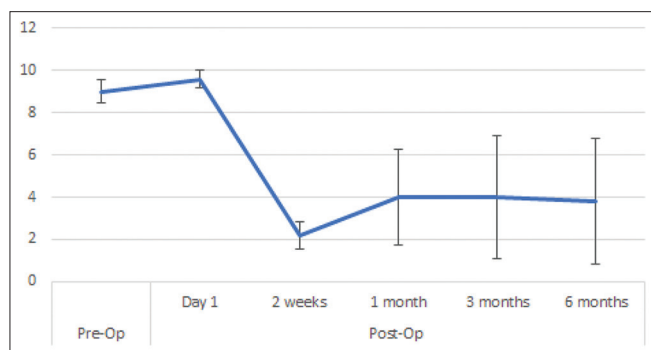
VAS: Visual analog scale



**Figure 3:** Maximum mouth opening



**Figure 4:** Pain at rest



**Figure 5:** Pain at motion

Cha *et al.*<sup>[23]</sup> did a comparative study between the blind technique and USG-guided technique, by injecting a dye in both upper and lower joint spaces of TMJs in cadavers. On dissection, they found superior accuracy in USG-guided technique in reaching the joint space as compared to the blind technique. The difference of the duration of the therapeutic effect of PRP in both the groups in our study can be attributed to the difference in the accuracy of deposition of PRP.

Four patients were above 50 years of age and showed only 2 weeks of painless period. While rest of the patients in this group, who were all within 30 years of range remained asymptomatic for longer duration. This suggests the role of age-dependent healing capacity of the body required for the alleviation of pain and resolution of symptoms.

Clicking was not the primary complaint of any of the patients in this study. Clicking seems to be unrelated to the resolution of inflammation and discal repair, as the cause of clicking is the anteriorly displaced disc. Pre-operative and post-operative MR imaging showed no change in the position of the disc, thus no change in the frequency and intensity of clicking.

Pain and discomfort were associated with the PRP injection. The pain was observed during the injection procedures and in the next few days (during the acute inflammatory phase). This complication can be minimized by application of local anesthetic before the introduction of the PRP. Analgesics and topical ice application can be used for management of the pain and discomfort associated with then PRP injection. NSAIDs should be avoided because of its negative effect on the function of the PRP.<sup>[24]</sup>

Comparative assessment of pre-operative and post-operative images of the anteriorly displaced disc on MRI showed no change in the disc position or shape. No patient had disc perforation. Inflammatory status of the joint space could not be assessed on the images.

In our opinion, symptomatic relief of PRP in patients with internal derangement of TMJ may be due to the inflammatory modulating capability of the PRP by removing pain inducers and providing a microenvironment conducive for discal retrodiscal tissue repair. Due to constraints of time for a long-term follow-up, further effects of second injections could not be observed in our study but similar to the study by Al-Delayme *et al.*,<sup>[21]</sup> we felt the need for the second injections.

## CONCLUSION

This study showed the efficacy of USG-guided PRP injection in TMJ. It was also found that intra-articular PRP injection is therapeutic in alleviating pain, increase in mouth opening and improving clicking to some extent, in patients with anterior disc displacement of the joint.

The technique was also found to be more in alleviating the symptoms of the TMD. For more uniform results, the age of the patients should be taken into account and a larger sample size should be studied.

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