

Original Article

Evaluating the Efficacy of Platelet-Rich Plasma, Hyaluronic Acid, and Botulinum Toxin in the Treatment of Temporomandibular Joint (TMJ) Disorders: A Comparative Cross-Sectional Study

Platelet-Rich Plasma, Hyaluronic Acid, Botulinum Toxin in the Treatment of TMJ Disorders

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ABSTRACT

Objective: This cross-sectional study aimed to compare the efficacy of these three treatments in managing TMJ disorders.

Study Design: A retrospective study

Place and Duration of Study: This study was conducted at the Abbasi Shaheed Hospital, Karachi from January 2023 to June 2024.

Methods: A total of 60 patients diagnosed with TMJ disorders were recruited and divided into three equal groups of 20 patients. Data was collected using a structured questionnaire and clinical examination. The following information was recorded.

Results: The Botox group demonstrated the most significant pain reduction, with a mean VAS score of 2.1 ± 0.9 at 3 months, compared to 4.5 ± 1.3 in the PRP group and 4.3 ± 1.2 in the HA group. The mean MMO increase was also highest in the Botox group (15.3 ± 3.6 mm), compared to 8.7 ± 4.3 mm in both the PRP and HA groups. Quality of life improvements were most notable in the Botox group, with a mean increase of 27.4 ± 9.1 points, significantly higher than the improvements seen in the PRP (17.3 ± 10.2) and HA (15.1 ± 9.8) groups.

Conclusion: PRP, HA, and Botox are effective minimally invasive treatments for TMJ disorders. Botox may offer superior pain relief and functional improvement compared to PRP and HA.

Key Words: Patients, PRP, TMJ, Disorder, Botox, Treatments

Citation of article: Khan M, Ahmed S, Faraz A, Abbasi SK, Khero R, Shirazi N. Evaluating the Efficacy of Platelet-Rich Plasma, Hyaluronic Acid, and Botulinum Toxin in the Treatment of Temporomandibular Joint (TMJ) Disorders: A Comparative Cross-Sectional Study. Med Forum 2024;35(12):59-62.doi:10.60110/medforum.351212.

INTRODUCTION

Temporomandibular joint (TMJ) disorders refer to a diverse group of conditions that affect the temporomandibular joints, muscles of mastication, and surrounding structures, leading to a range of clinical symptoms, including pain, clicking or popping sounds, restricted jaw movement, and headaches. These disorders are typically classified into two categories:

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Received: July, 2024

Accepted: August-September, 2024

Printed: October, 2024

These include disc displacement disorders, osteoarthritis diseases of the joint and myofascial pain syndrome^[1]. Despite etiologic factors ranging from trauma, malocclusion, bruxism, or systemic inflammatory diseases such as rheumatoid arthritis, the precise cause of the condition is not still conclusively understood and most likely polyetiologic^[2]. TMJ disorder treatment starts with conservative therapy, such as – taking medication like NSAIDs or muscle relaxants, receiving physical therapy, wearing a bite splint, or making some changes in behaviour. Among these, platelet-rich plasma, hyaluronic acid, and botulinum toxin have become promising options and/or adjuvants to the classical treatment because they have different mechanisms of action and are less invasive^[3]. PRP is autologous biological remodeling from the patient's blood; platelet concentrate enriched with growth factors. Many of these growth factors like platelet derived growth factor (PDGF), transforming growth factor beta (TGF β) and vascular endothelial growth factor (VEGF) are very active in tissues healing and regeneration^[4]. Reports regarding the utilisation of

PRP in patients with TMJ dysfunction have revealed some positive outcomes with regard to the reduction of the amount of pain, flexibility of the joint and other related outcome functionalities. Nevertheless, the data are still scarce, and larger scale RCTs are required to define the therapeutic schedules such as the number of injections, time intervals and long-term effectiveness^[5]. Hyaluronic acid is a natural component of synovial fluid of joints and the drug effect comes from its ability to lubricate articular surfaces, to act as a shock absorbing agent, and a vehicle for nutrient exchange^[6]. It is used for other joint diseases, including osteoarthritis of the knee; however, its application to TMJ disorders has increased in recent years. In this review of clinical trials of HA for TMJ disorders therapies, pain relief and functional benefit is variable and ranges from moderate to insignificant. These variations of outcomes may be explained by the type of HA employed, the degree of the disorder, or perhaps the population of patients. However, HA still should be considered for treatment of patients with TMJ osteoarthritis or those with degenerative joint changes^[7]. Botox, or botulinum toxin type A, has been researched with a view of its effectiveness on muscle spasm and pain as well as muscular relaxation is via blocking the release of acetylcholine at the neuromuscular junction. Regarding conditions of the TMJ, Botox is applied mainly for the relief of myofascial pain and muscle dysfunction as a cause of bruxism, clenching, or hypertrophy of the temporalis muscle^[8].

METHODS

A retrospective study was conducted at Abbasi Shaheed Hospital, Karachi, Pakistan from January 2023 to June 2024. A total of 60 patients, diagnosed with TMJ disorders based on clinical and radiological findings, were recruited for the study. These patients were randomly divided into three equal groups of 20 each.

Inclusion Criteria:

- Aged between 18 and 65 years.
- Diagnosed with TMJ disorders confirmed by a qualified dental or medical professional.
- Reported pain intensity of at least 4 on a 10-point Visual Analogue Scale (VAS), indicating moderate to severe pain.

Exclusion Criteria:

- Pregnancy or lactation.
- History of bleeding disorders, such as hemophilia or other clotting abnormalities.
- Previous treatment with PRP, HA, or Botox for TMJ disorders within the past 6 months.
- Known allergy to any of the study medications (PRP, HA, or Botox).

Data Collection: Data was collected through a combination of structured questionnaires, clinical examinations, and follow-up visits. Demographic data,

including age, sex, and occupation, were recorded to ensure that the groups were comparable at baseline. Furthermore, to ensure the accuracy of the obtained results, the chronic conditions of each patient were checked to establish the possible impact on final outcome of the study. The course and severity of the TMJ dysfunction were recorded; in particular, the pain intensity was assessed with the help of Visual Analogue Scale (VAS). To assess their pain, patients were required to give the pain an intensity score of either zero, meaning no pain, or 10, meaning severe pain. MMO was also measured in clinical assessments because it is an important parameter of joint function. Clinical assessments also involved assessment of joint sound which is commonly manifested in terms of cracking or crepitation in relation to TMJ disorders.

Treatment Protocols

- **PRP Group:** Patients in this group received a single intra-articular injection of PRP into the affected TMJ. The PRP was prepared by drawing the patient's blood, centrifuging it to concentrate platelets, and then injecting the product directly into the joint space.
- **HA Group:** Patients received a single intra-articular injection of hyaluronic acid into the affected TMJ. HA is a viscosupplement that aims to restore synovial fluid viscosity and reduce inflammation and pain within the joint.
- **Botox Group:** Patients in this group received a single intramuscular injection of botulinum toxin (Botox) into the masseter muscles, which are frequently implicated in TMJ pain and dysfunction. Botox works by reducing muscle hyperactivity, potentially alleviating pain and improving joint function.

Statistical Analysis:

Data were analyzed using SPSS v25. Comparisons between the three treatment groups were made using one-way analysis of variance (ANOVA) for continuous variables (e.g., pain reduction, mouth opening). The chi-square test was used for categorical variables. A p-value of < 0.05 was considered statistically significant.

RESULTS

Data were collected from 60 patients. The average age of participants was similar, with the PRP group having a mean age of 35.2 years, the HA group at 34.6 years, and the Botox group at 36.1 years. Gender distribution was also consistent, with 70% of participants in each group being female. Regarding comorbidities, hypertension was the most common condition, affecting 20% of patients in the PRP group, 15% in the HA group, and 25% in the Botox group.

At baseline, the mean VAS score was similar across groups: PRP (7.8 ± 1.1), HA (7.6 ± 1.2), and Botox (7.9 ± 1.0). After 3 months, the Botox group exhibited a significant reduction in pain, with a mean VAS score of

2.1 ± 0.9, compared to 4.5 ± 1.3 for the PRP group and 4.3 ± 1.2 for the HA group. The VAS reduction was also greatest in the Botox group (5.8 ± 1.1), significantly outperforming both PRP and HA (3.3 ± 1.2 and 3.3 ± 1.1, respectively). The p-value (< 0.01) indicates that the pain reduction in the Botox group was statistically significant compared to both PRP and HA.

Table No. 1: Demographic Characteristics of Participants

Characteristic	PRP Group (n=20)	HA Group (n=20)	Botox Group (n=20)
Average Age (years)	35.2±7.8	34.6±6.5	36.1±8.3
Gender (Female, %)	70%	70%	70%
Comorbidities (%)	20% (hypertension)	15% (hypertension)	25% (hypertension)

Table No. 2: Baseline and 3-Month Follow-Up VAS Pain Scores

Group	Baseline VAS Score (Mean ± SD)	VAS Score at 3 Months (Mean ± SD)	VAS Reduction (Mean ± SD)
PRP	7.8±1.1	4.5±1.3	3.3±1.2
HA	7.6±1.2	4.3±1.2	3.3±1.1
Botox	7.9±1.0	2.1±0.9	5.8±1.1
p-value	-	< 0.01 (Botox vs PRP, HA)	-

Table No. 3: Maximum Mouth Opening (MMO) at Baseline and 3-Month Follow-Up

Group	Baseline MMO (Mean ± SD) mm	MMO at 3 Months (Mean ± SD) mm	MMO Increase (Mean ± SD) mm
PRP	35.4±8.2	44.1±6.1	8.7±4.3
HA	34.7±7.9	43.4±5.8	8.7±4.1
Botox	33.9±8.5	49.2±5.5	15.3±3.6
p-value	-	< 0.01 (Botox vs PRP, HA)	-

At baseline, the mean MMO was similar across the groups: PRP (35.4 ± 8.2 mm), HA (34.7 ± 7.9 mm), and Botox (33.9 ± 8.5 mm). After 3 months, the Botox group had the largest mean MMO at 49.2 ± 5.5 mm, representing a significant increase of 15.3 ± 3.6 mm. In comparison, the PRP and HA groups both showed an increase of 8.7 ± 4.3 mm and 8.7 ± 4.1 mm,

respectively, reaching a mean MMO of 44.1 ± 6.1 mm and 43.4 ± 5.8 mm.

At baseline, the quality of life scores were similar for all groups: PRP (45.2 ± 12.6), HA (46.3 ± 11.5), and Botox (46.9 ± 13.2). After 3 months, the Botox group showed a substantial improvement, with a post-treatment QoL score of 74.3 ± 6.9, reflecting a mean improvement of 27.4 ± 9.1. In comparison, the PRP group improved by 17.3 ± 10.2 points (62.5 ± 9.3), and the HA group improved by 15.1 ± 9.8 points (61.4 ± 8.1).

Table No. 4: Quality of Life Improvement at Baseline and 3-Month Follow-Up

Group	Baseline Quality of Life Score (Mean ± SD)	Post-Treatment Quality of Life Score (Mean ± SD)	Improvement in Quality of Life (Mean ± SD)
PRP	45.2±12.6	62.5±9.3	17.3±10.2
HA	46.3±11.5	61.4±8.1	15.1±9.8
Botox	46.9±13.2	74.3±6.9	27.4±9.1
p-value	-	< 0.001 (Botox vs PRP, HA)	-

DISCUSSION

The results of this study suggest that all three treatments—platelet-rich plasma (PRP), hyaluronic acid (HA), and botulinum toxin (Botox)—can effectively reduce pain, improve joint function, and enhance the quality of life in patients with temporomandibular joint (TMJ) disorders. However, Botox demonstrated superior efficacy in all measured outcomes, including pain relief, improvement in joint function, and overall quality of life^[9-12]. The most significant outcome of the present research is that a greater degree of pain reduction is a recognizable feature of the Botox group compared to the PRP and HA groups. In total, all three groups demonstrated a decrease in pain intensity using VAS and comparing with the baseline, the decrease was more prominent in the Botox group than in the PRP and HA groups. This would agree with the known usage of Botox for addressing muscle related pain have^[13]. Botox gives a lasting solution to TMJ because it curtails the production of acetylcholine at neuromuscular junctions and therefore reduces muscle contractions that cause pain. However, PRP and HA, as potent anti-inflammatory agents that enhance the lubricating capacity of the joint, lack the musculoskeletal approach of stem cells. Comparing with the other treatments, the much higher efficacy in pain relief underlines the utility of muscle specific treatment approach in TMJ disorder^[14]. Regarding the improvement of joints dysfunction all three groups showed significant improvement with particular emphasis on mouth opening. Nevertheless, Botox showed the significant improvement of MMO compared to control groups, with the increase of 15.3 mm, compared to 8.7 mm in

both PRP and HA groups^[15]. The increase in MMO demonstrates the reasons why Botox is effective on the masseter and temporalis muscles which in TMJ disorders, restricts jaw mobility. Even though, PRP and HA helped in improving the lubrication of the joint and elimination of inflammation in the TMJ, they were not much helpful in dealing with the muscle driven pathology concerning the limitation of mouth opening^[16]. Consequently, the study indicate that Botox may be more effective in patient with TMJ discomfort caused by muscular contraction or spasm, while PRP and HA may benefit patients with joint related discomfort due to degeneration or inflammation. The benefits in terms of the quality of life were revealed in all of the treatment groups with Botox revealing the most pronounced positive effect^[17].

CONCLUSION

It is concluded that all three treatments—platelet-rich plasma (PRP), hyaluronic acid (HA), and botulinum toxin (Botox)—are effective in managing temporomandibular joint (TMJ) disorders, with significant improvements in pain, joint function, and quality of life. However, Botox demonstrated superior efficacy in reducing pain intensity, enhancing joint mobility, and improving quality of life.

Author’s Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Madiha Khan, Sufyan Ahmed
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Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

Conflict of Interest: The study has no conflict of interest to declare by any author.

Source of Funding: None

Ethical Approval: No.ASH/074-9017-2022 Dated 18.12.2022

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