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Original Article

Evaluation of Arthrocentesis with and without Platelet Rich Plasma in the Internal Derangement of Temporomandibular Joint

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Abstract *- The 20 patients in this quasi-experimental investigation had internal temporomandibular joint dysfunction. Prior to the procedure, information on the temporomandibular joint sound, the maximum inter-incisor opening of the mouth (MIO), and pain intensity (VAS) were acquired. Patients were checked seven days and three months after the operation to gather outcome information. To find out the procedure's effectiveness, pre- and post-procedural data were compared (PRP). The findings demonstrated that there was no significant difference in VAS scores between the two groups after the seventh day and after the surgery had been completed (p>0.05). After the seventh day of the procedure, the mean MIO in groups A and B were 40.25 ± 4.27 mm and 35.65 ± 5.74 mm, respectively. After three months of treatment, group A's mean MIO was 36.55 ± 4.40 mm, while group B's was 31.95 ± 5.88 mm in group B. Mean MIO was considerably greater in Group A than in Group B after the seventh day and after three months of the operation (p 0.05). TMJ sound was substantially higher in Group B than in Group A after the seventh day of the operation (55.0% versus 0.0). Following the procedure for three months, group B had significantly higher TMJ sound levels than Group A (75.0% vs. 15.0%). It may be said that arthrocentesis combined with platelet-rich plasma increased VAS scores at various follow-ups more than arthrocentesis alone did. 7 days and 3 months following the procedure, arthrocentesis with platelet rich plasma significantly improved the maximum interincisal opening and temporomandibular joint (TMJ) sound compared to arthrocentesis alone or without platelet rich plasma.*

Keywords *- Arthrocentesis, TMD, Temporomandibular joint, VAS score.*

1. Introduction

The temporomandibular joint (TMJ), masticatory muscles, and associated tissues are all affected by temporomandibular joint disorders (TMDs), which are chronic, severe musculoskeletal diseases.[1,2] These diseases, which affect 10–70% of the population on average[3,4], have a negative impact on the patient's quality of life. The most typical TMD is an internal condition brought on by abnormalities in the disc, mandibular condyle, glenoid fossa, and articular eminence. This syndrome is accompanied by synovitis, adhesions, disc displacements, and usually disc perforations.[5,6] The reported prevalence of TMD varies from 3.7% to 12%, and it is said to affect women more often than males.[7,8] In addition, between 44.2% and 55.6% of TMD patients had degenerative disorders and TMJ disc displacement.[9,10]

There is presently no agreement on the best course of action for persons with arthrogenous TMD. The effectiveness of different therapy modalities for the treatment of arthrogenous TMDs has been extensively studied in clinical research. Whether the therapy approach has the most reliable data and predicted results remains a wonder. Only one-on-one trials are compared in a direct meta-analysis. Therefore, only these clinical studies are included in the comparison. Network meta-analysis (NMA) has shown to be a useful method for evaluating the effectiveness of several treatments in a study, in addition to comparing two therapies that have not been explicitly evaluated in head-to-head clinical trials. [11,12]

The primary objectives of TMD treatment are to increase the temporomandibular joint's range of motion and decrease its functional discomfort (TMJ). Surgery options for individuals with refractory internal derangement include

discectomy, disc displacement, and arthrocentesis. Further instances of modern conservative treatments for temporomandibular disorder encompass counseling aimed at modifying behavior, jaw relaxation techniques, consumption of soft foods, analgesic medications, splinting, and physical rehabilitation.[13-16] Platelet-rich plasma (PRP) is produced through the process of centrifugation of a patient's blood sample, which results in the concentration of platelets and growth factors (GFs) that are associated with them. Platelet-rich plasma (PRP) has gained popularity in therapeutic applications due to its potential healing properties, including the recruitment, proliferation, and differentiation of cells and tissue remodeling. Initially used in maxillofacial and plastic surgery during the 1990s, PRP has since been employed in a variety of therapeutic settings.[17-18]

PRP contains many growth factors with potent analgesic, anti-inflammatory, and regenerative properties that enhance functional results.[19-20] No earlier studies in this field have been conducted in Bangladesh, as far as I know. The goal of the present investigation was to determine if platelet-rich plasma and arthrocentesis had a beneficial synergistic impact on the treatment of temporomandibular joint internal derangement. Theoretically, PRP offers benefits and has been shown to be beneficial in treating articular diseases, but there is little data on how well it treats temporomandibular joint internal derangement. This research was carried out at the Department of Oral and Maxillofacial Surgery and the Department of Radiology and Imaging of Bangabandhu Sheikh Mujib Medical University to evaluate the efficacy of PRP in treating this ailment (TMJ internal derangement).

2. Materials and Methods

A quasi-experimental research was carried out at the Department of Oral and Maxillofacial Surgery at Bangabandhu Sheikh Mujib Medical University in Shahbagh, Dhaka, from September 1, 2021, to August 31, 2022, in collaboration with the Radiology and Imaging division. A total of 40 patients with internal temporomandibular joint illness received treatment. The same surgeon performed each operation. The antiseptic solution was used to clean and prep the preauricular area.

The canthotragal line (CTL) is being indicated. The second point was located 10 mm anterior to the midtragus, whereas the first point was located 20 mm in front of the CTL and 2 mm below. The biggest mouth opening was achieved by placing a mouth splint on the occlusal surface of the molar teeth. An auriculotemporal nerve block was performed before administering 100 cc of Ringer's lactate solution and two 18-gauge needles through the relevant areas for joint lavage. Following arthrocentesis, one millilitre of PRP was injected into the joint area (group A).

The previously specified areas were used for the standard arthrocentesis in the control group (Group B). After the first day, analgesics (aceclofenac 100 mg and acetaminophen 500 mg) were supplied as required. A soft diet was advised for the whole week. A ten-point visual analogue scale (VAS), the maximum mouth opening, and digital callipers were used to evaluate discomfort and record the presence or absence of TMJ sound. Three months following the baseline measurement, these indicators were analysed.

Microsoft Excel was used to input the data for the statistical analysis, and IBM SPSS statistics for Windows (version 23.0) was used to analyse it. The Chi-square test was used for variables that could be categorised. Using the unpaired t-test for continuous variables, the data were compared. A 0.05 p-value was required for statistical significance. The lateral canthus and tragus centre are joined to form a line. The initial puncture site is marked on a line 10 millimetres in front of the tragus' midline (in a) and is situated 2 millimetres perpendicularly below (in b). The second puncture places for the outflow needle are 20 mm in front of the tragus point and 10 mm below the line (c).

3. Results

In this study, group A's mean age was 36.95 ± 11.40 years, while group B's was 37.80 ± 9.12 years. Males made up 8 (40%) of group A's population and 7 (35%) of group B's. In groups, A and B, females made up 12 (60.0%) and 13 (65.0%), respectively. 11 (55.0%) of those in group A and 7 (35.0%) of those in group B showed bilateral participation. In groups A and B, respectively, there were 2 (10.1%) and 4 (20.0%) instances of right involvement. In group A, there were 7 (35%) and 9 (45%) on the left. Age, sex, region of involvement, and disease duration did not significantly differ between the two groups (Table 1).

Pre-procedure, the majority of patients in both groups—11 (55.0%) in group A and 15 (75.0%) in group B—experienced moderate pain. Seven days after the surgery, 14 people in Group B and 17 people in Group A reported having no pain. In groups A and B, mild pain was experienced by 3 (15%) and 6 (30%) people, respectively. 13 (65.0%) in group A and 12 (60.0%) in group B reported no pain following the surgery after three months. The difference between the two groups was not statistically significant ($p>0.05$). VAS score on the seventh day following the treatment revealed that 17 patients were pain-free; however, after three months, 4 patients experienced pain recurrence because these 4 patients did not adhere to the required recommendations (Table 2).

In group A, the mean maximum inter-incisal opening (MIO) measured 30.5± 6.51 mm, while in group B, it was 28.85 ± 6.14 mm. After the seventh day of the operation, the mean MIO in groups A and B were 40.25 ± 4.27 mm and 35.65 ± 5.74 mm, respectively. After three months of the operation, the mean MIO in group A was 36.55± 4.40 mm, while in group B it was 31.95 ± 5.88 mm. Mean MIO was

considerably greater in Group A than in Group B after the seventh day and after three months after the operation (p 0.05) (Table 3).

Preoperative temporomandibular joint (TMJ) sound was nearly the same in the two groups, with group A (90% in this case) and group B (17 (85% in this case). TMJ sound was significantly higher in group B (55.0% vs 0.0) after a 7-day procedure than in group A. Following the procedure for three months, group B had significantly higher TMJ sound than Group A (75.0% vs. 15.0%) (Table 4).

Table 1. Demographic characteristics of the study patients (N=40)

Parameters	Group A (n=20)	Group B (n=20)	P value
Age years, Mean±SD	36.95±11.40	37.80±9.12	0.796^{ns}
Sex			
Male	8(40.0%)	7(35.0%)	0.500^{ns}
Female	12(60.0%)	13(65.0 %)	
Site of involvement			
Right	2(10.0%)	4(20.0%)	
Left	7(35.0%)	9(45.0%)	0.405^{ns}
Bilateral	11(55.0%)	7(35.0%)	
Duration of disease (months), Mean ± SD	15.80±13.85	14.55±11.48	0.758^{ns}

Group A: Arthrocentesis with platelet rich plasma
Group B: Arthrocentesis without platelet rich plasma
ns=not significant; P value reached from unpaired t-test and Chi-square test

Table 2. Distribution of the study patient by VAS score at different follow up (N=40)

VAS score	Group A (n=20)		Group B (n=20)		p-value
	n	%	n	%	
Pre-procedure					
Moderate pain	11	55.0	15	75.0	0.410^{ns}
Severe pain	9	45.0	5	25.0	
After 7th day of the procedure					
No pain	17	85.0	14	70.0	0.256^{ns}
Mild pain	3	15.0	6	30.0	
After 3 months of the procedure					
No pain	13	65.0	12	60.0	0.744^{ns}
Mild pain	7	35.0	8	40.0	

s=significant; ns=not significant; p-value reached from Chi-square test

Table 3. Distribution of the study patient by maximum inter-incisal opening (MIO) at different follow up (N=40)

MIO	Group A (n=20)		Group B (n=20)		P value
	n	%	n	%	
Pre-procedure					
<35 mm	14	70.0	16	80.0	
35-50 mm	6	30.0	4	20.0	
Mean±SD	30.5±6.51		28.85±6.14		0.489^{ns}
After 7th day of the procedure					
<35 mm	2	10.0	11	55.0	
35-50 mm	18	90.0	9	45.0	
Mean±SD	40.25±4.27		35.65±5.74		0.009^{s}
After 3 months of the procedure					
<35 mm	6	30.0	15	75.0	
35-50 mm	14	70.0	5	25.0	
Mean±SD	36.55±4.40		31.95±5.88		0.008^{s}

s=significant; ns=not significant; p-value reached from unpaired t-test

Table 4. Distribution of the study patient by temporomandibular joint (TMJ) sounds at different follow up (N=40)

TMJ sound	Group A (n=20)		Group B (n=20)		P value
	n	%	n	%	
Pre-procedure					
Present	18	90.0	17	85.0	0.633^{ns}
Absent	2	10.0	3	15.0	
After 7 days of the procedure					
Present	0	0.0	11	55.0	0.001^{s}
Absent	20	100	9	45.0	
After 3 months of the procedure					
Present	3	15.0	15	75.0	0.001^{s}
Absent	17	85.0	5	25.0	

s=significant; ns=not significant; p-value reached from Chi-square test

4. Discussion

The present investigation revealed that the average age of participants in Group A was 36.95 ± 11.40 years, while that of Group B was 37.80 ± 9.12. There was no statistically significant difference observed between the two groups, as indicated by a p-value greater than 0.05. Singh et al.[21] conducted a study on 24 patients with internal derangement and reported comparable results. The research group consisted of 12 participants with an average age of 34.75 years, while the control group comprised 12 participants with an average age of 36.41 years. The authors of the study, Hanc et al.[22,] reported that the mean age of the study group was 27.21 ± 3.4 years (PRP), while the control group's mean age (arthrocentesis) was 25.4 ± 1.7 years. Moreover, no significant distinction was observed between the two cohorts.

The present study reports that the mean age of participants in Group A was 36.95 ± 11.40 years, whereas the mean age of participants in Group B was 37.80 ± 9.12 years. The difference between the two groups was found to be not statistically significant, with a p-value greater than 0.05. In their study, Singh and colleagues21 reported a comparable finding involving 24 patients diagnosed with internal derangement. The research cohort consisted of 12 individuals with a mean age of 34.75 ± 10.83 years, while the control group comprised 12 participants with a mean age of 36.41 ± 15.15 years. According to Hanc et al.[22,] the mean age of the control group who underwent arthrocentesis was 25.4 ± 1.7 years, while the mean age of the study group who received PRP was 27.2 ± 13.4 years. Furthermore, no statistically significant distinction was observed between the two cohorts.

The present investigation revealed that at the three-month follow-up, a total of 13 (65.0%) participants in Group A and 12 (60.0%) participants in Group B reported the absence of discomfort. The statistical analysis did not reveal a significant difference between the two groups, as the p-value was greater than 0.05. As per the VAS score, it was observed that 17 patients reported being free of pain after a week of undergoing the therapy. However, after a period of three months, it was found that 4 patients experienced pain again. This could be attributed to the fact that these patients did not adhere to the prescribed instructions. Marzook et al.[23] reported that the median discomfort level in the first group was 8, whereas, in the second group, it was 7.5. At the three-month mark, the median values for pain intensity were recorded as 0 for both groups. No significant statistical difference was observed between the two groups regarding the preoperative or evaluation period VAS ratings of TMJ discomfort.

The results of this investigation indicate that at the three-month follow-up, a total of 13 (65.0%) participants from Group A and 12 (60.0%) participants from Group B reported the absence of discomfort. The statistical analysis did not reveal a significant difference between the two groups, as indicated by a p-value greater than 0.05. As per the VAS score, it was observed that 17 patients reported being free of pain seven days post-therapy. However, after a period of three months, four patients reported experiencing pain once again. This could be attributed to these four patients failing to comply with the prescribed instructions. Marzook et al.[23] reported that the median level of discomfort in the first group was 8, whereas, in the second group, it was 7.5. At the three-month mark, the median values for pain intensity were recorded as 0 for both groups. No statistically significant difference was observed between the two groups regarding the preoperative or evaluation period VAS ratings of TMJ discomfort.

Singh and colleagues [21] reported no significant difference between the groups at baseline (p>0.501), thus enabling comparison. After conducting a 1-month and 3-month follow-up, the statistical analysis yielded p-values of 0.483 and 0.164, respectively. These results indicate no significant difference in the pain ratings between the groups at the two-time points. According to Ghoneim et al.[24,] the preoperative pain score median for the control group was 8.0, whereas, for the study group, it was 6.0. The median pain scores of the control and study groups were 3.0 and 0.0, respectively, six months post-surgery.

The study findings indicate a statistically significant difference ($P < 0.05$) between the baseline VAS score and all other scores in both groups before surgery and during the follow-up intervals. This finding is inconsistent with the research hypothesis, given that the follow-up period extended up to 6 months. Hanc et al.[22] reported statistically significant differences ($p < 0.05$) in pain levels, as measured by the visual analogue scale (VAS), between pre- and post-injection. The largest discrepancy was observed between the pre-injection mean value of 6.69 ± 2.21 and the mean value of 0.07 ± 0.27 at six months post-injection, with a statistically significant p-value of 0.01.

The statistical analysis of pain intensity was examined by Hasan et al.[25.] Throughout the duration of the 30-day and 180-day intervals, there existed no statistically noteworthy dissimilarity in the severity of pain between the two cohorts ($p > 0.05$). Nabil et al. [26] reported a reduction in VAS scores of the affected joints in both groups over time. The results indicate that there was no significant statistical difference in pain intensity between the two groups during the interstitial periods, with a p-value greater than 0.05.

The study revealed that the pre-procedural mean maximum interincisal opening (MIO) for group A was 30.5 ± 6.51 mm, while for group B it was 28.85 ± 6.14 mm. At the seven-day mark, the average MIO for group A was 40.25 ± 4.27 mm, while group B's average was 35.65 ± 5.76 mm. After a three-month treatment period, the mean MIO in group A was found to be 36.55 ± 4.40 mm, while group B exhibited a mean MIO of 31.95 ± 5.90 mm. The statistical analysis revealed that the average MIO in group A was significantly greater than in group B following a treatment period of 7 days and 3 months ($p < 0.05$).

As per the findings of Ghoneim et al.[24], the mean preoperative maximum incisal opening (MIO) values were 31.48 ± 8.52 mm and 36.15 ± 7.26 mm for the study and control groups, respectively. At the six-month mark, the mean MIO values of the study group were 50.20 ± 4.63 mm, while the control group's mean MIO values were 43.75 ± 5.35 mm. The MIO evaluation identified a statistically significant difference ($p < 0.05$) between the two groups during the assessment intervals. The statistical analysis revealed a significant increase ($P < 0.05$) in the mean MIO levels within each group from the baseline.

The authors Hanc et al.[22] reported that the average maximum interincisal opening (MIO) measurements were 32 mm before injection and 39 mm after injection. The alterations in MIO before and after injection were found to be statistically significant (p=0.01) at the six-month mark. As per the findings of Marzook et al.[23], the average preoperative MIO measurements were 37.75 mm and 37.00 mm for the first and second groups, respectively. After a period of three months, the initial group exhibited a mean MIO reading of 50.50 mm, while the second group displayed a mean MIO reading of 51.00 mm. The results of the study intervals indicated that there was no statistically significant difference between the two groups in terms of pre-and post-operative MIO tests. Singh et al.[21] reported no statistically significant difference between the groups at the outset (p=0.098), thus enabling comparison. The obtained p-values of 0.34, 0.496, and 0.28 for the respective time points of 1-month, 3-month, and 6-month follow-up indicate no significant difference in mouth opening between the groups.

Nabil et al.[26] reported a gradual increase in the maximal painless mouth opening of all patients over a period of six months, with the highest point being reached at the end of the sixth month. There was no significant difference in mouth opening between the two groups during the follow-up intervals, as indicated by a p-value greater than 0.05. In the present study, it was found that the pre-procedural temporomandibular joint (TMJ) sound was comparable between the two groups, with 18 participants (90%) in group A and 17 participants (85%) in group B exhibiting similar results. Following a 7-day treatment period, it was observed that 55.0% of participants in group B exhibited significantly higher levels of temporomandibular joint (TMJ) noise in comparison to the absence of such noise in group A, which comprised 0.0% of the participants. After a period of three months of therapy, it was observed that the TMJ sound of Group B was significantly inferior to that of Group A. Singh et al.[21] reported that there were no significant differences between the groups at baseline, one month, three months, and six months of follow-up (p = 0.68, 0.628, 0.68, and 1, respectively). Cochran's intergroup analysis revealed a significant decrease in TMJ sounds for both groups at various follow-up points (p = 0.004 for group I and p = 0.005 for group II). In the study conducted by Hanc et al.[22], it was found that out of the twelve TMJ joints that were evaluated initially, pathologic sounds were detected. However, after a period of six months, only two of these joints were found to have such sounds, and this difference was statistically significant ($p < 0.05$).

5. Conclusion

Arthrocentesis with platelet-rich plasma improved the VAS score more than Arthrocentesis alone at various follow-ups, according to observation and study data. The maximum interincisal opening and temporomandibular joint (TMJ) sound was significantly better in arthrocentesis with platelet rich plasma than in arthrocentesis alone or without platelet rich plasma 7 days and 3 months after the treatment.

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