Original Article

Arthrocentesis, Dextrose Prolotherapy and combination of both protocols in the management of Temporomandibular joint internal derangement " A Clinical Study "

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ABSTRACT

Aim: The purpose of this study is to evaluate and compare the clinical results of arthrocentesis, dextrose prolotherapy and combination of both protocols in the management of Temporomandibular joint internal derangement.

Materials and Methods: Thirty patients suffering from Temporomandibular joint Disorders (TMD) including pain and limited mouth opening were included in this study. The patients were divided randomly into three equal groups. Arthrocentesis was carried out for the patients in group I, prolotherapy was carried out for the patients in group II and arthrocentesis followed by injection of dextrose was performed for the patients in group III.

Results: Pair-wise comparisons concerning pain scores revealed that there was no statistically significant difference between Group I and Group II but both showed statistically significantly higher pain score than Group III. Pair-wise comparisons between groups concerning maximal mouth opening revealed that Group III showed the statistically significantly highest mean maximum mouth opening. Group I showed statistically significantly lower mean value. Group II showed the statistically significantly lowest mean maximum mouth opening.

Conclusion: Arthrocentesis followed by dextrose injection resulted in better clinical outcomes concerning pain and Maximum Mouth Opening (MMO) when compared to arthrocentesis alone or prolotherapy alone. It is a safe and simple procedure. Our findings suggests the need for further studies to asses this treatment protocol radiographically with a longer follow up time period.

Key Words: Arthrocentesis, Prolotherapy, Dextrose, Temporomandibular joint

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INTRODUCTION

Temporomandibular joint disorders (TMD) is a common disease that affects up to 15% of adults and can interfere with normal life activities due to pain, clicking and limited mouth opening. [1, 2, 3]

Management of TMD usually starts with conservative methods including analgesics, muscle relaxants, soft diet, hot fomentations and occlusal splints. [4] Simple and minimally invasive surgical procedures such as arthrocentesis or prolotherapy should be considered if the symptoms persist after conservative management. [5, 6]

Arthrocentesis is a minimally invasive surgical procedure that results in breaking up the joint adhesions and washing away the inflammatory mediators and necrotic tissues from the joint. [7]

Significant decrease of interleukins and tumor necrosis factor alpha was found in the synovial fluid of the temporomandibular joint following arthrocentesis. [8]

Prolotherapy of the TMJ is based on injection of an irritant solution which stimulates the tissues to proliferate and promotes healing. Several solutions have been used among them is hypertonic dextrose. [9] This solution is widely available, inexpensive and safe to be used to initiate an inflammatory reaction promoting tissue proliferation and healing. [10, 11]

Although arthrocentesis and prolotherapy proved success in relieving joint symptoms, there still a controversy regarding which minimally invasive surgical modality is the most effective. [12, 13] This study was conducted to compare the clinical outcomes of three different techniques for the management of internal derangement of the temporomandibular joint including arthrocentesis, prolotherapy and combination of both.

MATERIALS AND METHODS

Thirty patients suffering from TMD with pain and limited mouth opening were included in this study. Inclusion criteria were adult patients with an age range between 20 and 60 years old with chronic unilateral TMJ pain persisting for at least 3 months and indicated by a score of 7 and above according to the Visual analogue scale of pain. Patients with limited mouth opening less than 40 mm were included in the study. Magnetic resonance Imaging was performed preoperatively for all the patients and those represented with anterior disc displacement were included in the study. Patients with previous TMJ surgeries, rheumatoid disease, ankylosis, tumors, condylar fractures, coagulation disorders, pregnancy or lactation and those patients with

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previous TMJ injections were excluded from the study.

All the patients were managed conservatively in terms of physiotherapy, non-steroidal anti-inflammatory drugs, muscle relaxants and splints. Patients with persistent symptoms after conservative treatment were included in the study.

The patients were divided randomly into three equal groups. Arthrocentesis was carried out for the patients in Group I, prolotherapy was carried out for the patients in Group II and arthrocentesis followed by injection of dextrose was carried out for the patients in Group III.

Group I :

A straight line was drawn from the outer canthus of the eye till the middle of the tragus of the ear. The first point (Point A) of entrance was marked at 10 mm anterior to the tragus and 2 mm below the line and the second point of entrance was marked at 20 mm anterior to the tragus and 10 mm below the same line (Point B) (Figure 1) .

Articaine 4% with epinephrine 1:100000 was injected through the entrance points before starting arthrocentesis. The patients were asked to open their mouth widely while protruding the mandible. An 18-gauge needle was inserted into the posterior entrance point in the superior joint space and 5ml of lactated Ringer's solution was injected into the joint before inserting the second needle. This was performed to distend the superior joint space and release the joint adhesions. Following this, the second needle was inserted through the anterior entrance point allowing the lactated Ringer's solution to flow freely through the superior joint space. 400 ml of Ringer's lactate solution was injected simultaneously from both needles. During the injection procedure the patients were asked to open, close, protrude and perform lateral excursions of the mandible to facilitate the lysis of any adhesions.

Group II :

A straight line was drawn on the patients face from the outer canthus of the eye till the middle of the tragus of the ear. A point was marked 10 mm anterior to the tragus and 10 mm inferior and perpendicular to the canthotragal line (Figure 2) .

Prolotherapy was started after achieving auriculotemporal nerve block. A 30 gauge needle was inserted through the marked point and directed towards the condylar neck to a depth of 25 mm followed by a single injection of 2 ml of 25% dextrose solution.

Group III :

Arthrocentesis was performed as in group A and at the end of the procedure the anterior needle was removed and 2 ml of 25% dextrose solution was injected through the posterior needle .

Follow up was carried out at 1 week, 1 month and 3 months postoperatively in terms of :

- Pain with various mandibular movements utilizing the Visual Analogue Scale (VAS) where score 0 indicates no pain and score 10 indicates worst pain ever.

- Maximum Mouth Opening (MMO) by measuring the distance in mm between the incisal edges of the upper and lower central incisors.

Figure (1) : Showing the first (A) and second (B) points of entrance .

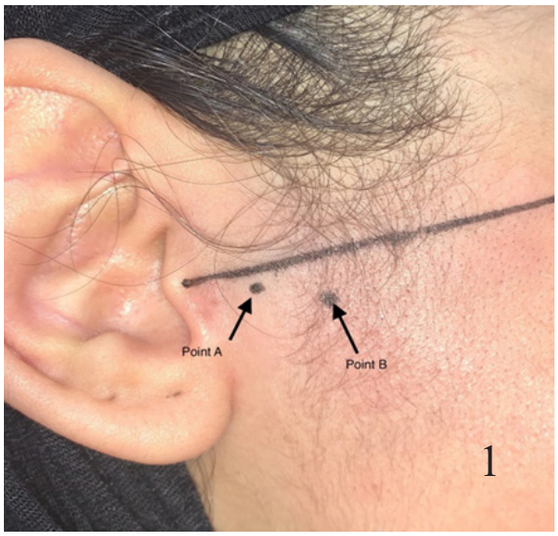
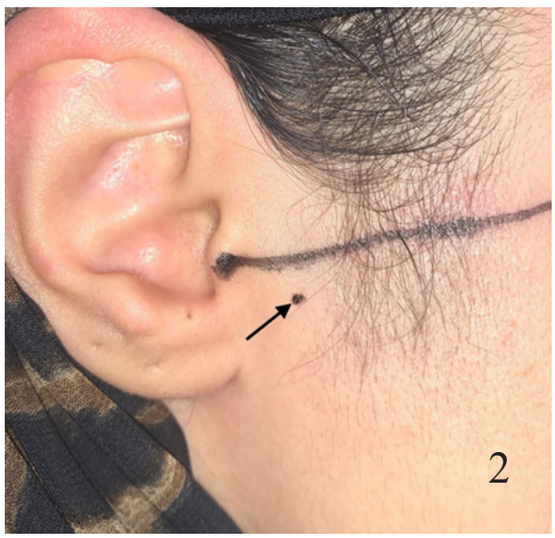


Figure (2) : Showing the marked points of entrance for injection of dextrose solution .



Statistical Analysis

Numerical data were explored for normality by checking the distribution of data and using tests of normality (Kolmogorov-Smirnov and Shapiro-Wilk tests). Maximum Mouth Opening data showed normal (parametric) distribution while pain scores showed non-normal (non-parametric) distribution. Parametric data were presented as mean, standard deviation (SD) and 95% Confidence Interval (95% CI) values. Non-parametric data were presented as median and range values.

For parametric data, repeated measures ANOVA test was used to compare between mean maximum mouth opening measurements in the three groups as well as to study the changes by time within each group. Bonferroni's post-hoc test was used for pair-wise comparisons when ANOVA test is significant. For non-parametric data, Kruskal-Wallis test was used to compare between the three groups. Friedman's test was used to study the changes by time within each group. Dunn's test was used for pair-wise comparisons when Kruskal-Wallis or Friedman's tests revealed significant differences. The significance level was set at $P \leq 0.05$. Statistical analysis was performed with IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.

RESULTS

Thirty patients (18 females and 12 males) with a mean age of 27.4 (±6.6) years were included in this study. Group I included 60% females and 40% males, Group II included 50% females and 50% males and group III included 70 % females and 30% males.

Pain (VAS) scores :

There was no statistically significant difference between pain scores in the three groups preoperatively (P-value = 0.645, Effect size = 0.032). After one week, there was a statistically significant difference between the groups (P-value <0.001, Effect size = 0.55). Pair-wise comparisons revealed that Group I showed the statistically significantly highest pain score. Group II showed statistically significantly lower pain score. Group III showed the statistically significantly lowest pain score. After one as well as three months, there was a statistically significant difference between the groups (P-value = 0.001, Effect size = 0.456) and (P-value = 0.007, Effect size = 0.322), respectively. Pair-wise comparisons revealed that there was no statistically significant difference between Group I and Group II; both showed statistically significantly higher pain score than Group III.

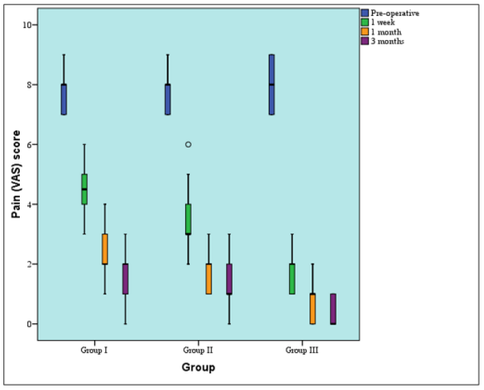
As regards the changes by time in Group I, there was a statistically significant change in pain scores by time (P-value <0.001, Effect size = 0.955). Pair-wise comparisons between the time periods revealed that there was a statistically significant decrease in median pain scores after one week as well as from one week to one month. From one to three months, there was no statistically significant change in median pain scores. In Groups II and III, there was a statistically significant change in pain scores by time (P-value <0.001, Effect size = 0.9) and (P-value <0.001, Effect size = 0.907), respectively. Pair-wise comparisons between the time periods revealed that there was a statistically significant decrease in median pain scores after one week, from one week to one month as well as from one to three months (Table 1) (Figure 3) .

Table (1) : Descriptive statistics and results of Kruskal-Wallis test for comparison between pain scores in the three groups and Friedman's test for the changes by time within each group

Time	Group I (n = 10)		Group II (n = 10)		Group III (n = 10)		P-value	Effect size (Eta squared)
	Median	Range	Median	Range	Median	Range		
Pre-operative	8 D	7 – 9	8 D	7 – 9	8 D	7 – 9	0.645	0.032
1 week	4.5 AE	3 – 6	3 BE	2 – 6	2 CE	1 – 3	<0.001*	0.55
1 month	2 AF	1 – 4	2 AF	1 – 3	1 BF	0 – 2	0.001*	0.456
	2 AF	0 – 3	1 AG	0 – 3	0 BG	0 – 1	0.007*	0.322
P-value	<0.001*		<0.001*		<0.001*			
Effect size (w)	0.955		0.9		0.907			

*: Significant at $P \leq 0.05$,
A,B,C superscripts in the same row indicate significant difference between groups,
D,E,F,G superscripts in the same column indicate statistically significant changes by time .

Figure (3) : Box plot representing median and range values for pain scores in the three groups (Circle represents outlier) .



Maximum Mouth Opening (MMO) :

Pre-operatively, there was no statistically significant difference between maximum mouth opening in the three groups (P-value = 0.905, Effect size = 0.007). After one week, one month as well as three months, there was a statistically significant difference between groups (P-value <0.001, Effect size = 0.639), (P-value <0.001, Effect size = 0.781) and (P-value <0.001, Effect size = 0.762), respectively. Pair-wise comparisons between groups revealed that Group III showed the statistically significantly highest mean maximum mouth opening. Group I showed statistically significantly lower mean value. Group II showed the statistically significantly lowest mean maximum mouth opening.

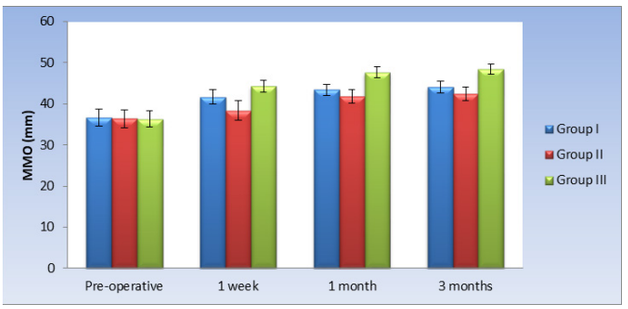
As regards the changes by time in all groups, there was a statistically significant change in maximum mouth opening by time (P-value <0.001, Effect size = 0.802), (P-value <0.001, Effect size = 0.717) and (P-value <0.001, Effect size = 0.919), respectively. Pair-wise comparisons between the time periods revealed that there was a statistically significant increase in maximum mouth opening after one week, from one week to one month as well as from one month to three months (Table 2) (Figure 4).

Table (2) : Descriptive statistics and results of repeated measures ANOVA test for comparison between maximum mouth opening (mm) in the three groups as well as the changes by time within each group

Time	Group I (n = 10)	Group II (n = 10)	Group III (n = 10)	P-value	Effect size (Eta squared)
Pre-operative Mean (SD) 95% CI	36.7 (2.1) ^{G} 35.4 – 38	36.4 (2.2) ^{G} 35.1 – 37.7	36.3 (1.9) ^{G} 35 – 37.6	0.905	0.007
1 week Mean (SD) 95% CI	41.7 (1.8) ^{BF} 40.5 – 42.9	38.4 (2.4) ^{CF} 37.2 – 39.6	44.3 (1.5) ^{AF} 43.1 – 45.5	<0.001*	0.639
1 month Mean (SD) 95% CI	43.4 (1.3) ^{BE} 42.5 – 44.3	41.8 (1.6) ^{CE} 40.9 – 42.7	47.7 (1.3) ^{AE} 46.8 – 48.6	<0.001*	0.781
3 months Mean (SD) 95% CI	44.1 (1.5) ^{BD} 43.1 – 45.1	42.4 (1.7) ^{CD} 41.4 – 43.4	48.4 (1.2) ^{AD} 47.4 – 49.4	<0.001*	0.762
P-value (Changes by time)	<0.001*	<0.001*	<0.001*		
Effect size (Partial Eta Squared)	0.802	0.717	0.919		

*: Significant at P ≤ 0.05,
A,B,C superscripts in the same row indicate significant difference between groups,
D,E,F,G superscripts in the same column indicate statistically significant changes by time

Figure (4) : Bar chart representing mean and standard deviation values for maximum mouth opening measurements in the three groups



DISCUSSION

In this study, all the patients were suffering from moderate to severe pain with limited mouth opening pre-operatively. However, there was a significant decrease in pain and an increase in the Maximum Mouth Opening (MMO) at the end of the follow up period in the three groups.

In Group I, there was a statistically significant decrease in pain scores and increase in MMO at the end of the follow up period. This is in agreement with the studies performed by Kim et al [14] , Alpaslan et al [15] and Polat et al [16] who reported a significant decrease in pain scores and increase in MMO after performing arthrocentesis. The authors attributed their results to the effects of fluid pressure in breaking up joint adhesions as well as washing away the inflammatory mediators.

In group II, there was a statistically significant decrease in pain scores and increase in MMO after 3 months of follow up period. This coincides with the studies of Zhou et al [10], Ungor et al [17], Majumdar et al [18] and Cömert et al [19] who reported favorable outcomes concerning a subjective decrease in joint pain and increase in MMO following dextrose injection. The mechanism of action of dextrose injection is unclear, however, Yoshii et al [20] and Oh et al [21] suggested a multifactorial effect including initiation of fibroblasts proliferation producing a thicker and stronger connective tissues. In other studies, a decrease in pain in knee osteoarthritis and a chondrogenic effect through postoperative arthroscopic examination was reported following dextrose injection. [22, 23]

Our results showed no statistically significant difference in pain scores after 3 months between Group I and Group II. However both groups showed statistically significant higher pain scores than group III. Concerning the MMO, Group III showed the highest statistically significant mean MMO.

This result can be attributed to combining of the advantages of both procedures of arthrocentesis and prolotherapy in the form of breaking up joint adhesions and washing away the inflammatory mediators achieved by arthrocentesis [14,15,16] together with induction of proliferation of cells, healing of tissues and the chondrogenic effect on joints reported after dextrose injection. [20,21,22,23]

CONCLUSION

Arthocentesis followed by prolotherapy resulted in better clinical outcomes concerning pain and MMO when compared to arthrocentesis alone or prolotherapy alone. It is a safe and simple procedure. Our findings suggests the need for further studies to asses this treatment protocol radiographically with a longer follow up time period.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest.

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