Original Article

Temporomandibular Joint Arthrocentesis: A Prospective Study and Audit of 500 Joints of Central India

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ABSTRACT

Aim and Objectives: Aim of this study was to compare prospective effectiveness of arthrocentesis of temporomandibular joint by single- and double-needle technique in central India population.

Materials and Methods: Out of 230 patients, 500 joints were included in the study and were randomly selected into two groups: single needle and double needle. Follow-up of patients were done as 1 week, 1 and 3 months. (The statistical analysis was done using SPSS [Statistical Package for Social Sciences] Version 15.0 Statistical Analysis Software).

Results: Both techniques were equally effective at reducing pain and increasing the maximal mouth opening. The single-needle technique was easier to perform and required a shorter operative time ($P < 0.01$).

Conclusion: The results obtained indicate that single versus double arthrocentesis techniques were equally effective in reducing the pain and increasing the mouth opening and reducing the clicking sound. However, single-needle technique was easier to perform and required a shorter operative time.

KEYWORDS: *Arthrocentesis, double-needle technique, single-needle techniques*

INTRODUCTION

Arthrocentesis of the temporomandibular joint (TMJ) was first described by D. W. Nitzan in 1991 as the simplest form of surgical therapy with the aim of washing out inflammatory mediators, releasing the articular disc, and disrupting adhesions between the surface of the disc and the joint fossa by hydraulic pressure of the lavage solution. There are essentially two types of therapy for temporomandibular disorders (1) conservative and (2) surgical. Conservative treatment includes bite splints, rehabilitation exercises, isometric exercises, massage of the muscles, analgesic treatment, thermotherapy, or laser therapy. Surgical treatment can be divided into invasive (open) and minimally invasive (arthrocentesis and arthroscopy).[1]

Ringer's lactate and physiological saline are commonly used to lavage the joint by the use of a needle introduced into the upper joint space after local anesthetic infiltration of the overlying skin. This compartment will take up to 5 mL of fluid, and by filling under pressure, any minor adhesions are broken down or lysed. A second needle was then placed into the same joint compartment to achieve continuous flow of fluid and to allow thorough washing or lavage of the joint.[2]

It was estimated that approximately 50–100 mL of total arthrocentesis volume was sufficient for a therapeutic lavage of the superior joint space of TMJ.[3]

Arthrocentesis was considered as an effective minimally invasive surgical treatment for TMJ closed lock based.[4]

In TMJ arthrocentesis, irrigation pump from a surgical and dental implant motor, providing the highest hydraulic pressure reported in the literature for TMJ lavage.[5,6]

In particular, the present study underlined that baseline physical findings and the type of

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intervention (two-needle vs. single-needle approach) were not predictors for treatment effectiveness in patients with TMJ inflammatory-degenerative disease. Furthermore, studies related to the presence of interleukin (IL), prostaglandin, and several disc-related disorders (Disc rupture) may be a variable to evaluate the outcome of procedure.

Materials and Methods

The prospective study was carried out in the Department of Oral and Maxillofacial Surgery over the period 2013–2016. Patients who reported to the dental outpatient Department of Oral and Maxillofacial Surgery of Sardar Patel Postgraduate Institute of Dental and Medical Sciences, Lucknow (U.P) with clearance from institutional ethics committee [SPPGIDMS 05(05/12/Dec 2013)]. Patient's diagnosed with TMJ disorders such as inflammatory disorders, adhesion of articular disc, disruption of disc, and disc-related arthralgias was selected were included in this study. Informed written consent was obtained from each patient after explaining the nature and outcome of procedure and the possible consequences and complications.

Preoperative Alprazolam (0.25 mg, H.S [1 day before]) and stat dose of amoxicillin (2 g orally) was given 45 min before procedure.

Sample size

Five hundred joints randomly included over the study period time (All the patients came to the department between time period 2013 and 2016 with TMJ arthralgia) was included in the study.

Group design

All the cases was divided into two groups:

1. Group A (single-needle group)
2. Group B (double-needle group).

Two hundred and fifty joints were studied in each group.

All patients was given postoperative antibiotics (amoxicillin 500 mg TDS) and analgesic (ibuprofen + paracetamol + chlorzoxazone) TDS for 3 days.

Periodic follow-up was done as per scheduled guidelines.

Statistical analysis

The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 15.0, (IBM, USA) statistical analysis software. The values were represented in number (%) and mean ± standard deviation. Chi-square test, Mann–Whitney U-test, The Wilcoxon-signed rank statistic, Student "*t*"-test, paired "*t*"-test tests were used for the evaluation of different data.

Results

The present study was conducted in the Department of Oral and Maxillofacial Surgery, Sardar Patel Postgraduate Institute of Dental and Medical Sciences, Lucknow, to compare arthrocentesis of TMJ by single- and double-needle technique [Table 1]. Out of 230 patients, 500 joints were included in the study and were randomly selected in two groups as under:

Proportion of females and males in both the groups was found to be similar. In both, the groups majority of participants were female (66.67%), and the rest were male (33.33%) [Table 2].

Intraoperative time in Group A ranged from 5 to 8 min with a median of 6 min while in Group B ranged from 8 to 12 min and median 10 min. Mean intraoperative time in Group B (9.60 ± 1.40 min) was found to be higher than that of Group (5.87 ± 1.06 min). The difference in intraoperative time of Group A and Group B was found to be statistically significant ($P < 0.001$) [Table 3].

At 1-week p.o. pain score of Group A (1.00 ± 1.13) was found to be higher than that of Group B (0.73 ± 1.28) though this difference was not found to be statistically significant ($P = 0.325$).

At 1 month p.o. and at 2 months p.o. pain score of Group A (0.67 ± 1.18) was found to be higher than that of Group B (0.47 ± 1.13), but this difference was not found to be statistically significant ($P = 0.567$).

At 3 months p.o. pain score of Group A (0.80 ± 1.21) was found to be higher than that of Group B (0.60 ± 1.18), but this difference was not found to be statistically significant ($P = 0.595$) [Table 4a].

In Group A, at 1 week p.o., a decline of 77.61% (3.47 ± 1.36) in pain score from baseline (before surgery) was observed. Decline of 85.07% (3.80 ± 1.37) in pain was observed at 1 month and at 2 months p.o. At 3 months p.o., decline in pain was found to be 82.09% (3.67 ± 1.35). Change in pain from baseline was found to be statistically highly significant ($P < 0.001$) at 1 week p.o., 1 month p.o., 2 months p.o., and at 3 months p.o.

In Group B, at 1 week p.o., a decline of 84.72% (4.07 ± 1.67) in pain score from baseline (before surgery) was observed. Decline of 90.28% (4.33 ± 1.50) in pain was observed at 1 month and at 2 months p.o. At 3 months p.o., decline in pain was found to be 87.50% (4.20 ± 1.52). Change in pain from baseline was found to be statistically highly significant ($P < 0.001$) at 1 week p.o., 1 month p.o., 2 months p.o., and at 3 months p.o. [Table 4b].

At 1 week p.o. mouth opening in Group A and Group B ranged from 32 to 50 mm. Mean mouth opening of

Group A (42.13 ± 4.45 mm) was found to be higher than that of Group B (41.20 ± 4.83); however, difference in mean mouth opening between the groups was not found to be statistically significant (P = 0.586). Thereafter, at 1 month p.o., 2 months p.o., and at 3 months p.o. mouth opening remained same as at 1 week p.o [Table 5a].

In Group A, an increment of 9.34% (3.60 ± 2.26 mm) in mouth opening from its baseline value was found at 1 week p.o. This change in mouth opening was found to be statistically highly significant (P < 0.001). No further change in mouth opening was observed at 1 month, 2 months and 3 months p.o.

In Group B, an increment of 8.99% (3.40 ± 2.13 mm) in mouth opening from its baseline value was found at 1-week p.o. This change in mouth opening was found to be statistically highly significant (P < 0.001). No further change in mouth opening was observed at 1, 2 and 3 months p.o [Table 5b].

At rest of the follow-up periods, i.e., at 1 week p.o., 1 month p.o., 2 months p.o., and 3 months p.o. incidence of TMJ clicking was higher in Group A (46.67%) as compared to Group B (20.00%); however, difference was not found to be statistically significant (P = 0.121) [Table 6].

Postoperative facial nerve damage was found in none of the patients of either groups.

Table 1: Distribution of study population

Group	Description	Number of joints (%)
Group A	Single needle	250 (50.00)
Group B	Double needle	250 (50.00)
	Total	500

Table 2: Between-group comparison of demographic variables

	Group A (n=250)	Group B (n=250)	Statistical significance	
			t	P
Mean age (±SD)	36.13±16.84	38.07±16.73	0.315	0.755
range (median)	18–75 (32.00)	18–75 (35.00)		
	Group A (n=250)	Group B (n=250)	χ^2	P
Gender, n (%)				
Female	77 (66.67)	77 (66.67)	0.000	1.000
Male	38 (33.33)	38 (33.33)		

SD=Standard deviation

Table 3: Between-group comparison of intraoperative time

Group	Number of joints	Minimum	Maximum	Median	Mean±SD
Group A	250	5	8	6	5.87±1.06
Group B	250	8	12	10	9.60±1.40
Total	500	5	12	8	7.73±2.26

SD=Standard deviation

Discussion

In our study, the difference in intraoperative time of single-needle technique and double-needle technique was found to be statistically significant, [Table 3]. A similar result was in accordance with Talaat W, Ghoneim MM, Elsholkamy M. 2016,[7] in which they suggested the advantages of single-needle technique as compared to traditional two-needle arthrocentesis would be faster execution time.[8]

Similar to the studies of several authors, single-puncture reduces patient pain in the postoperative period, reducing the need for extracare postoperatively.[9]

Many authors suggested the use of a single and more stable needle should limit the traumatism of the intervention, so reducing pain and disability in the postoperative phase.[10]

Arthrocentesis as the simplest form of surgery in the TMJ, aiming to release the articular disc and to remove adhesions between the disc surface and the mandibular fossa by means of hydraulic pressure

Table 4a: Between-group comparison of pain at different time intervals

Time of observation	Group	Minimum	Maximum	Median	Mean±SD	Statistical significance*	
						Z	P
Before surgery	Group A	3	6	4	4.47±0.83	0.924	0.412
	Group B	4	7	5	4.80±0.94		
1 week p.o	Group A	0	4	1	1.00±1.13	1.113	0.325
	Group B	0	4	0	0.73±1.28		
1 month p.o	Group A	0	4	0	0.67±1.18	0.747	0.567
	Group B	0	4	0	0.47±1.13		
2 months p.o	Group A	0	4	0	0.67±1.18	0.747	0.567
	Group B	0	4	0	0.47±1.13		
3 months p.o	Group A	0	4	0	0.80±1.21	0.670	0.595
	Group B	0	4	0	0.60±1.18		

SD=Standard deviation, P > 0.05

Table 4b: Intragroup change in pain from baseline (before surgery) at different time intervals (Wilcoxon signed-rank test)

	Group A (*n*=15)				Group B (*n*=15)			
	Mean±SD	Percentage change	*Z*	*P*	Mean±SD	percentage change	*Z*	*P*
1 week p.o.	−3.47±1.36	−77.61	−3.341	0.001	−4.07±1.67	−84.72	−3.321	0.001
1 month p.o.	−3.80±1.37	−85.07	−3.336	0.001	−4.33±1.50	−90.28	−3.375	0.001
2 months p.o.	−3.80±1.37	−85.07	−3.336	0.001	−4.33±1.50	−90.28	−3.375	0.001
3 months p.o.	−3.67±1.35	−82.09	−3.342	0.001	−4.20±1.52	−87.50	−3.370	0.001

SD=Standard deviation

Table 5a: Between-group comparison of mouth opening at different time intervals

Time of observation	Group	Minimum	Maximum	Median	Mean±SD	Statistical significance*	
						t	*P*
Before surgery	Group A	32	45	40	38.53±4.36	0.443	0.661
	Group B	32	45	36	37.80±4.71		
1 week p.o	Group A	32	50	42	42.13±4.45	0.822	0.586
	Group B	32	50	40	41.20±4.83		
1 month p.o	Group A	32	50	42	42.13±4.45	0.822	0.586
	Group B	32	50	40	41.20±4.83		
2 months p.o	Group A	32	50	42	42.13±4.45	0.822	0.586
	Group B	32	50	40	41.20±4.83		
3 months p.o	Group A	32	50	42	42.13±4.45	0.822	0.586
	Group B	32	50	40	41.20±4.83		

SD=Standard deviation, $P > 0.05$

Table 5b: Intragroup change in mouth opening from baseline (before surgery) at different time intervals (paired t-test)

	Group A (*n*=15)				Group B (*n*=15)			
	Mean±SD	Percentage change	*t*	*P*	Mean±SD	Percentage change	*t*	*P*
1 week p.o.	3.60±2.26	9.34	−6.165	<0.001	3.40±2.13	8.99	−6.178	<0.001
1 month p.o.	3.60±2.26	9.34	−6.165	<0.001	3.40±2.13	8.99	−6.178	<0.001
2 months p.o.	3.60±2.26	9.34	−6.165	<0.001	3.40±2.13	8.99	−6.178	<0.001
3 months p.o.	3.60±2.26	9.34	−6.165	<0.001	3.40±2.13	8.99	−6.178	<0.001

SD=Standard deviation

Table 6: Between-group comparison of incidence of temporomandibular joint clicking at different time intervals

Time interval	Total	Group A (*n*=15) *n* (%)	Group B (*n*=15) *n* (%)	Statistical significance	
				χ^2	*P*
Before surgery	14	7 (46.67)	7 (46.67)	0.000	1.000
1 week p.o.	10	7 (46.67)	3 (20.00)	2.400	0.121
1 month p.o.	10	7 (46.67)	3 (20.00)	2.400	0.121
2 months p.o.	10	7 (46.67)	3 (20.00)	2.400	0.121
3 months p.o.	10	7 (46.67)	3 (20.00)	2.400	0.121

from irrigation of the upper chamber of the TMJ.[11] Pathophysiology of TMJ disorder could be described by several theories: (i) Changes in the shape and position of the articular disk, (ii) biomechanical and biochemical changes in TMJ, and (iii) joint overloading may cause hypoxia and on termination of overloading reoxygenation occurs.[12]

The hypoxia-reperfusion cycle can lead to the release and production of reactive oxygen species leading to degradation of hyaluronic acid and reduced viscosity of synovial fluid, resulting in more friction and adhesion of articular surfaces.[13]

Inflammatory cytokines in symptomatic TMJs include IL-1, IL-6, IL-8, and tumor necrosis factor-alfa while anti-inflammatory cytokines include IL-4, tissue inhibitors of metalloproteinases (TIMP)-1, TIMP-2, and tumor growth factor-beta 16. In the course of the inflammation, monocytes, and macrophages quickly release IL-1 as well as IL-6. Fibroblasts and chondrocytes also have this ability, but at the same time, through the action of IL-6, they release TIMP as well.[14,15]

Further, IL-6 was detected in synovial cells and mononuclear cells infiltrating the edge of the blood vessels. These cells produce IL-6 in both synovial tissue and synovial fluid.[16]

Lavage of the upper joint space reduces pain by removing inflammatory mediators from the joint, increasing mandibular mobility by removing intra-articular adhesions, eliminating the negative pressure within the joint, recovering disc, and fossa space and improving disc mobility, which reduces the mechanical obstruction caused by the anterior position of the disc.[17,18]

There was a significant decrease in pain scores at 1 week, 1 and 3 months with double-needle technique as reported by several authors.[19,11,20] Similar results were evaluated in the studies of many with double-needle technique at intervals of 1, 3 weeks, 3 and 6 months after the procedure with the improvement with emphasis on pain.[21]

Similar results were suggested by many authors shown significant improvement with respect to baseline levels were achieved in both treatment groups. The rate of improvement was not significantly different between the two treatment protocols in any of the outcome variables.[19]

Similar findings were seen in studies of several authors. They found the success rate was 70% at 6 months follow-up; it increased to 78.9% over the 3 years of follow-up.[22]

Similar findings were observed by many other authors. They observed good results in all patients with immediate improvement in mouth opening with double-needle technique.[21]

In our study, comparison of the incidence of TMJ clicking at different time interval was done. Incidence of TMJ clicking at baseline (before surgery) was similar in Group A (46.67%) and Group B (46.67%).

At rest of the follow-up periods i.e., at 1st week, 1st, 2nd, and 3rd month postoperatively incidence of TMJ clicking was higher in Group A (46.67%) as compared to Group B (20.00%) but difference was not found to be statistically significant.

In our study out of 500 joints, 400 initially complained of Clicking. At the end of 1 year, 248 (62%) patients stated no evidence of clicking were observed in the studies of many authors.[20]

Similar findings were demonstrated in the studies of many authors that clicking decreased in (63%) patients remaining (37%) patients it was absent in 1 week. Postoperatively after 1-month clicking decreased in 54%, absent in 27%, increased in 8.3%, and still present in 8.3% patients respectively. At 3 months clicking decreased in (36%) patients, absent in (27%), increased in 2 (18%), and present in 2 (18%).

In our study, postoperative facial nerve damage was found in none of the patients of either groups.

Results of our study shows that both the techniques have similar outcome in terms of pain, mouth opening, clicking, and facial nerve injury.

This may be explained as after needle inserted in the upper compartment and pressure exerted by forced fluid not only detaches adhered disc but also washes inflammatory exudates in inflammed joint which can be achieved through single-needle technique also.

Results of our study shows that both the techniques have similar outcome in terms of pain, mouth opening, clicking, and facial nerve injury.

In particular, the present study underlined that baseline physical findings and the type of intervention (two-needle vs. single-needle approach) were not predictors for treatment effectiveness in patients with TMJ inflammatory-degenerative disease. Furthermore, studies related to the presence of IL, prostaglandin and several disc-related disorders (disc rupture) may be a variable to evaluate the outcome of procedure. A more multicentric study with large sample size and long follow-up duration with biochemical evaluation of collected lavage fluid can make future study more informative.

Systematic review on this could help in better understanding about both the techniques and can be considered as the first-treatment option for patients with painful hypomobilized TMJ.

Conclusion

The results obtained indicate that single versus double arthrocentesis techniques were equally effective in reducing the pain and increasing the mouth opening and reducing the clicking sound. However, single-needle technique was easier to perform and required a shorter operative time.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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