

# Efficacy of Temporomandibular Joint Arthrocentesis with Sodium Hyaluronate in the Management of Temporomandibular Joint Disorders: A Prospective Randomized Control Trial

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## Abstract

**Purpose** This study was designed to investigate the efficacy of the temporomandibular joint arthrocentesis with and without injection of sodium hyaluronate (SH) in the treatment of temporomandibular joint disorders.

**Patients and Methods** A total of sixty two TMJs in 34 males and 28 females aged 20–65 years comprised the study material. The patients' complaints were limited mouth opening, TMJ pain, and joint noises during function. Patients were randomly divided into 2 groups in which arthrocentesis plus intra-articular injection of sodium hyaluronate was performed in 1 group and only arthrocentesis was performed in the other group. Both groups contained patients with disc displacement with reduction and without reduction. Clinical evaluation of the patients was done before the procedure, immediately after the procedure, at 1 week and 1, 3 and 6 months postoperatively. Intensity of TMJ pain was assessed using visual analog scales. Maximal mouth opening and lateral jaw movements also were recorded at each follow-up visit.

**Results** Both techniques increased maximal mouth opening, lateral movements, and function, while reducing TMJ pain and noise.

**Conclusions** Although patients benefitted from both techniques, arthrocentesis with injection of SH seemed to be superior to arthrocentesis alone.

**Keywords** TMJ · Arthrocentesis · Hyaluronate

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## Introduction

Dysfunction of the temporomandibular joint (TMJ) is a therapeutic challenge for oral and maxillofacial surgeons [1]. One of the most common forms of Temporomandibular disorder (TMD) is Internal derangement (ID). It has been reported that 80 % of patients with signs and symptoms of TMD have some form of ID of the TMJ [2].

Many conservative approaches to the treatment of temporomandibular disorders (TMD) have been proposed through the years, among which are occlusal splint therapy, physiotherapy, complimentary medicine, pharmacotherapy, and occlusal treatments [3]. In the past, treatment for TMJ dysfunction that did not respond to conservative treatment was surgical repair and repositioning of disc to reestablish normal MMO [4]. Controversy continues to surround the role of surgery in the management of pain and TMJ dysfunction, although only about 5 % of all patients being treated for TMJ disorders are actually operated on. Arthrocentesis is now increasingly recognized as first line surgical intervention in patients who do not respond to conservative treatment. Because of the minimal complications, low morbidity, relative ease, and less expense, arthrocentesis is ideal for early management of TMJ disorders [5].

Various pharmacological agents (Intra-articular injections) have been used for alleviating temporomandibular joint pain and dysfunction. They are Non-steroidal anti-inflammatory drugs (NSAIDs) (Piroxicam, Tenoxicam), Corticosteroids such as methylprednisolone, triamcinolone acetone, betamethasone, dexamethasone, Opioids (Morphine), Local anaesthetic agents (Bupivacaine, Mepivacaine), hyaluronidase and hyaluronic acid injections.

Out of all these agents hyaluronic acid is a major natural component of synovial fluid that plays an important role in

lubrication of synovial tissues [7]. Sodium hyaluronate, the sodium salt of hyaluronic acid has been reported to improve joint pain [8] and prevent intra-articular adhesions [9].

This study was undertaken to evaluate the efficacy of arthrocentesis with and without sodium hyaluronate injection in a group of patients suffering from TMJ disorders.

### Patients and Methods

Sixty two temporomandibular joints in 62 patients were evaluated in this study. Thirty four males and twenty eight females aged 20–65 years with chief complaints of limited mouth opening, TMJ pain, and clicking sounds in the TMJ were examined clinically and radiologically. Based on these examinations and the patient’s history, a diagnosis of TMJ internal derangements was made. Out of sixty two

patients thirty nine cases were diagnosed as anterior disc displacement with reduction (ADcR), twenty three cases were diagnosed as anterior disc displacement without reduction (ADsR). Patients were randomly divided into 2 groups in which arthrocentesis plus intra-articular injection of sodium hyaluronate was performed in 1 group (SH group), and only arthrocentesis was performed in the other group (arthrocentesis only group). Both groups contained patients with disc displacement with reduction and disc displacement without reduction. Patients were informed about the procedure, its possible complications, and about the materials used. Patient consent was obtained before the procedure. The patient is seated at a 45 degree angle, with the head turned to the unaffected side to provide an easy approach to the affected joint (Fig. 1).

The pre-auricular area of the affected site is prepared aseptically with betadine solution and the area was isolated with sterile drapes. Auriculotemporal nerve block given.

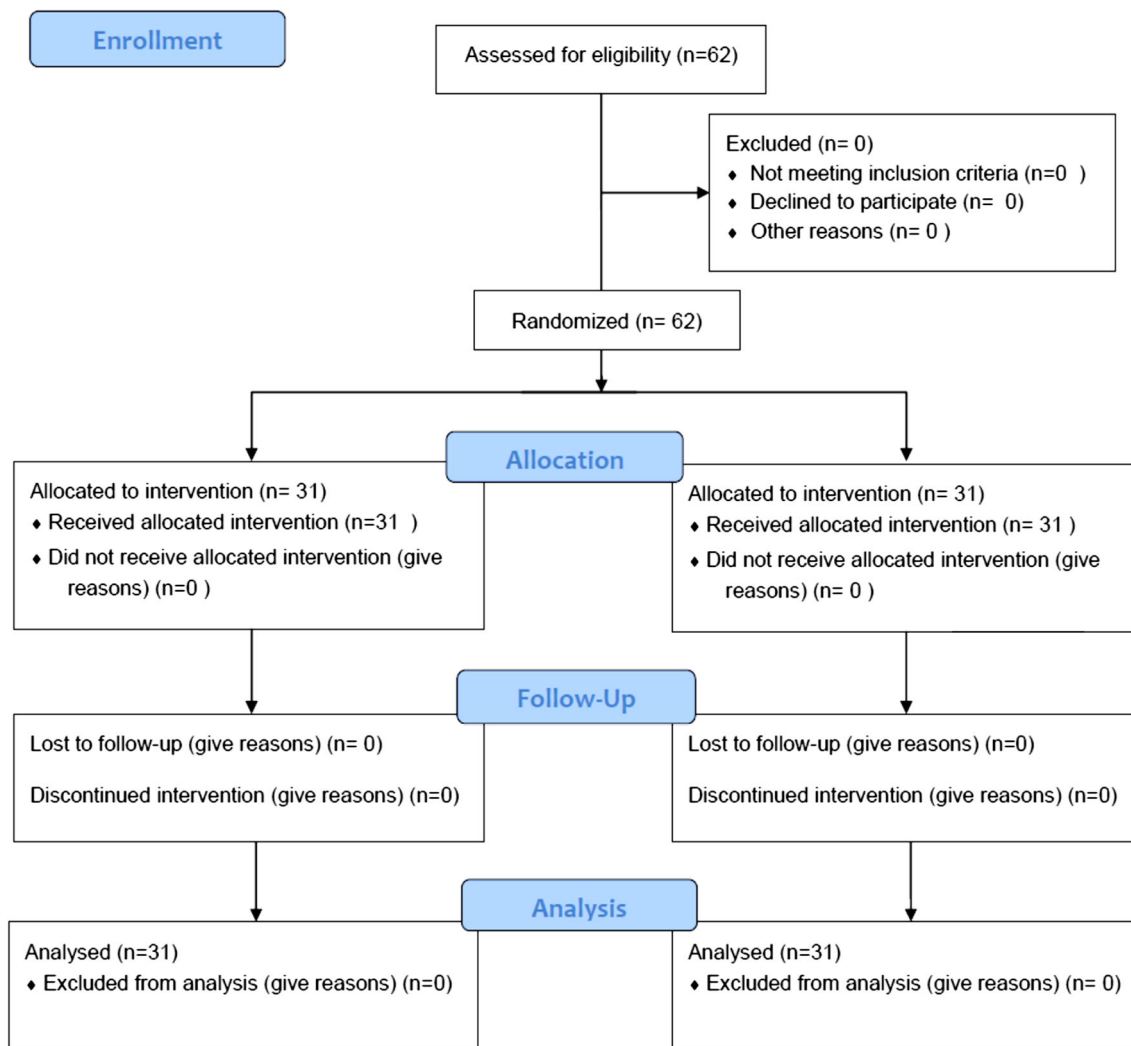


Fig. 1 Consort flow diagram

The external auditory meatus is blocked with vaseline gauze to prevent the entry of lavage fluid into the external auditory meatus. The points of needle insertion are marked on the skin according to method suggested by Mc.Cain as follows: A line is drawn from the middle of the tragus to the outer canthus (Cantho-tragal line). The posterior entrance (Articular fossa) point is located along the cantho-tragal line, 10 mm from the middle of the tragus and 2 mm below the cantho-tragal line. The anterior point of entry (Articular eminence) is placed 10 mm farther along the line and 10 mm below the cantho-tragal line (Fig. 2). These markings over the skin indicate the location of the articular fossa and the articular eminence of the temporo-mandibular joint (TMJ) Table 1.

After the points of insertion for the two needles have been marked, two needles of 18 gauge each are selected and the bevels of the syringes should face each other to enable the free flow of the lavage fluid through the exit needle. After first needle insertion into the posterior entrance point (Articular fossa) approximately 2 ml of Normal Saline solution is then injected to distend the superior joint space. A second 18 gauge is then inserted into the distended compartment in the area of the articular eminence to establish a free flow of the solution through the superior joint space (Fig. 3). A 20 ml syringe



**Fig. 2** Marking of cantho-tragal line, anterior and posterior entrance points

**Table 1** Patient characteristics and treatment protocols

	Internal derangements	ADcR	ADsR
Patients (n)	62	39	23
Female/male (n)	28/34	17/22	11/12
TMJs (n)	62	39	23
Arthrocentesis +SH	31	21	10
Arthrocentesis alone	31	18	13



**Fig. 3** Placement of 18 G needles

containing Normal Saline solution is then connected to one of the needles. Proper positioning of the needle in the joint space is confirmed when injection of the solution results in its exit from the other needle.

The joint is then irrigated with 100 ml of Normal Saline (NS) solution. During the lavage, the mandible is moved through opening, lateral excursive and protrusive movements to facilitate lysis of adhesions. After the joint lavage is completed, the anterior needle is removed and then 1 ml of Sodium Hyaluronate (Hyalgan) is injected through the posterior needle in first group.

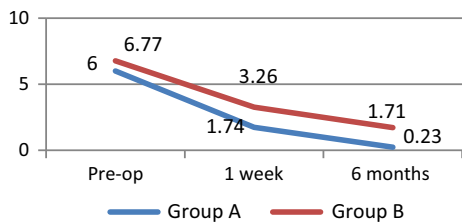
All patients are given postoperative instructions and pain relief medication is prescribed. A course of physiotherapy is commenced immediately postoperatively to promote and maintain an improved range of mandibular movement. A soft diet is recommended for the first few days. The patients were followed up clinically after 1, 2 weeks, 1 month, 3 months, 6 months.

## Results

Intensity of pain was significantly decreased ( $p < 0.001$ ) in both the groups postoperatively and at 6th month follow up when compared to preoperative pain (Table 2). According

**Table 2** Mean  $\pm$  standard deviation of pain in patients diagnosed with internal derangements

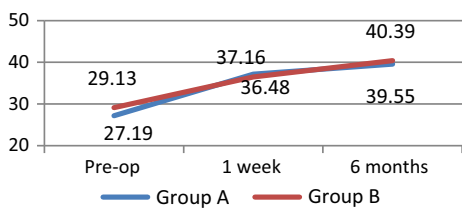
	Arthrocentesis +SH		Arthrocentesis Only		p value
	Mean	SD	Mean	SD	
Preop	6.00	1.63	6.77	1.59	0.063; NS
1 week	1.74	.89	3.26	.86	<0.001; Sig
6 months	.23	.43	1.71	.86	<0.001; Sig



**Fig. 4** Pain on VAS

**Table 3** Mean ± standard deviation (mm) of MMO in patients diagnosed with internal derangements

	Arthrocentesis +SH		Arthrocentesis Only		<i>p</i> value
	Mean	SD	Mean	SD	
Preop	27.19	7.04	29.13	4.84	0.212; NS
1 week	37.16	6.75	36.48	3.58	0.623; NS
6 months	39.55	5.42	40.39	4.10	0.494; NS



**Fig. 5** Maximum mouth opening (MMO)

to our study, injection of Sodium hyaluronate (SH) proved to be better compared to arthrocentesis without SH injection and there was statistically significant difference between two groups ( $p < 0.001$ ) (Fig. 4). Maximum mouth opening was increased in both the groups post operatively and at 6th month follow up when compared to preoperative maximum mouth opening, (Table 3) but there was no statistically significant difference between the two groups (Fig. 5).

The lateral excursions towards affected side and unaffected side were increased in both the groups post operatively and at 6th month follow up compared to pre op lateral excursions (Tables 4, 5). According to the study, injection of Sodium hyaluronate (SH) proved to be better compared to arthrocentesis without SH injection but there was no statistically significant difference between two groups (Figs. 6, 7).

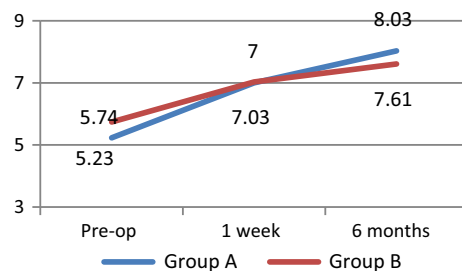
The joint sounds reduced in both the groups post operatively and at 6th month follow up. According to the study, arthrocentesis with SH injection reduced the joint sounds to a better extent compared to arthrocentesis without SH injection but there was no statistically significant difference between two groups (Table 6).

**Table 4** Mean ± standard deviation (mm) of lateral excursion; affected side in patients diagnosed with internal derangements

	Arthrocentesis +SH		Arthrocentesis Only		<i>p</i> value
	Mean	SD	Mean	SD	
Preop	5.23	1.59	5.74	1.83	0.239; NS
1 week	7.00	1.69	7.03	1.66	0.94; NS
6 months	8.03	1.20	7.61	1.36	0.202; NS

**Table 5** Mean ± standard deviation (mm) of lateral excursion; unaffected side in patients diagnosed with internal derangements

	Arthrocentesis +SH		Arthrocentesis Only		<i>p</i> value
	Mean	SD	Mean	SD	
5.23	5.23	2.04	4.81	1.51	0.235; NS
1 week	7.26	1.67	6.45	1.75	0.068; NS
6 months	7.68	1.47	7.55	1.26	0.712; NS

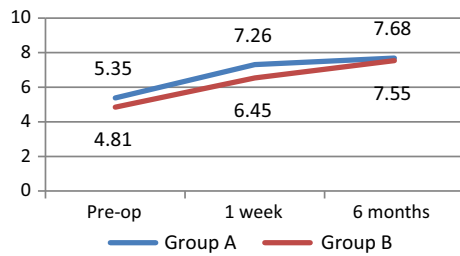


**Fig. 6** Lateral excursions towards affected side

**Discussion**

In the present study, maximal mouth opening and lateral jaw movements increased, while pain and joint noises disappeared or lessened, both in patients having intra-articular injection of SH following arthrocentesis and in those having arthrocentesis only. Although pain decreased in both groups after treatment, a greater decrease in pain was seen in the arthrocentesis + SH group throughout the postoperative period. This may be explained by the long-term lubricating effect of SH, which prevents the onset of inflammatory mediators that are responsible for pain.

Quinn and Bazan [6] identified prostaglandin E2 and leukotriene B4 in the synovial fluid from patients with painful dysfunctional TMJ joints, and they observed a strong correlation between the levels of these chemical mediators of pain and inflammation and an index of clinical joint pathology. They suggested that prostaglandin E2 and leukotriene B4 are among the factors which evoke TMJ



**Fig. 7** Lateral excursions towards unaffected side

**Table 6** Joint noise reduction between both groups

Clicking		Group A		Group B		p value
		N	%	N	%	
Pre-op	Yes	21	67.7	18	58.1	0.6; NS
	No	10	32.3	13	41.9	
1 week	Yes	2	6.5	11	35.5	0.005; NS
	No	29	93.5	20	64.5	
6 weeks	Yes	2	6.5	11	35.5	0.005; NS
	No	29	93.5	20	64.5	

pain [6]. In our patients, irrigation of the superior joint space might have excluded these chemical mediators. On the other hand, hyaluronic acid is a major natural component of synovial fluid that plays an important role in lubrication of synovial tissues [7]. Sodium hyaluronate has been reported to improve joint pain [8]) and prevent intraarticular adhesions [9]. Injected sodium hyaluronate might also have shown its analgesic effect by blocking pain receptors and endogenous pain substances in its molecule within synovial tissue as Gotoh et al. reported [8, 9]. Both ADcR and ADsR patients benefitted from arthrocentesis with or without injection of SH in terms of relief of pain.

Maximum mouth opening and lateral jaw movements increased comparatively better in patients who received SH. This improvement in jaw mobility might be due to lavage of inflammatory mediators from the upper joint space and analgesic, lubricatory effects of hyaluronic acid. SH either maintains lubrication and minimizes wear and tear mechanically, or plays a role in nutrition of the avascular parts of the disc and condylar cartilage [10].

Intraarticular injection of either corticosteroid or SH has a significant long-term effect on chronic arthritis of the TMJ, and SH might be the best alternative due to the lower risk of side-effects [11]. Bertolami et al. [12] showed that a single intra-articular injection of SH offered clear and consistent benefit for at least 6 months, primarily in patients with disc displacement with reduction, and this was attributed to the mechanical effect of SH. TMJ arthrocentesis, the least invasive and the simplest of all surgical techniques, has proven to be highly successful in

re-establishing a normal range of mouth opening in patients with closed lock [13]. Similarly, patients with either disc displacement with reduction and closed lock benefitted from arthrocentesis in this study.

## Conclusion

TMJ arthrocentesis when used with intra-articular sodium hyaluronate injection is a simple, minimally invasive, and effective day-care procedure and we recommend its use as first line intervention in patients with pain in the TMJ that is refractory to conservative treatment.

## Compliance with Ethical Standards

**Conflict of interest** None.

**Ethical Committee Approval** Ethical committee approval as obtained by the institutional Ethical Committee MNR Dental College & Hospital, Sangareddy, TELANGANA.

## References

- Kunjur J, Anand R, Brennan PA, Ilankovan V (2003) An audit of 405 temporomandibular joint arthrocentesis with intra-articular morphine infusion. *Br J oral Maxillofac Surg* 41(1):29–31
- Tan DBP, Krishnaswamy G (2012) A retrospective study of temporomandibular joint internal derangement treated with arthrocentesis and arthroscopy. *Proc Singapore Healthc* 21(1):73
- Guarda-Nardini Luca, Stifano Marco, Brombin Chiara, Salmaso Luigi, Manfredini Daniele (2007) Padova, Italy. A one-year case series of arthrocentesis with hyaluronic acid injections for temporomandibular joint osteoarthritis. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 103:14–22
- Yeung Richie Wai Kit, Chow Raymond Lop Keung, Chiu Ken (2006) Short-term therapeutic outcome of intra-articular high molecular weight hyaluronic acid injection for nonreducing disc displacement of the temporomandibular joint. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 102:453–461
- David E, Frost MS, Kendall BD (1999) The use of arthrocentesis for treatment of temporomandibular joint disorders. *J Oral Maxillofac Surg* 57:583–587
- Quinn JH, Bazan NG (1990) Identification of prostaglandin E2 and leukotriene B4 in the synovial fluid of painful, dysfunctional temporomandibular joints. *J Oral Maxillofac Surg* 48:968–971
- Radin EL, Paul IL, Swann DA, Shottstaedt ES (1971) Lubrication of synovial membrane. *Ann Rheum Dis* 30:322–325
- Gotoh S, Miyazaki K, Onaya J, Sakamoto T, Tokuyasu K, Namiki O (1988) Experimental knee pain model in rats and analgesic effect of sodium hyaluronate (SPH). *Folia Pharmacol Japon* 92:17–27
- Gotoh S, Onaya J, Sakamoto T, Tokuyasu K (1988) Protective effect of sodium hyaluronate (SPH) against adhesion formation in flexor tendon of rats. *Pharmacometrics* 35:359–364
- Hishashi N, Ishimaru JI, Kurita K et al (1997) The effect of hyaluronic acid on experimental temporomandibular joint osteoarthritis in the sheep. *J Oral Maxillofac Surg* 55:1114
- Kopp S, Carlsson GE, Haraldson T et al (1987) The long-term effect of intra-articular injections of sodium hyaluronate and

- corticosteroid on temporomandibular joint arthritis. *J Oral Maxillofac Surg* 45:929
12. Bertolami CN, Gay T, Clark GT et al (1993) Use of sodium hyaluronate in treating temporomandibular joint disorders: a randomized, double-blind, placebo-controlled clinical trial. *J Oral Maxillofac Surg* 51:232
  13. Nitzan DW, Samson B, Better H (1997) Long-term outcome of arthrocentesis for sudden-onset, persistent, severe closed lock of the temporomandibular joint. *J Oral Maxillofac Surg* 55:151