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Efficacy of Hyaluronic Acid Injection for Temporomandibular Joint Disorders with and without Arthrocentesis

Twana Hoshyar Saleem[(1)]

ABSTRACT

Temporomandibular disorder affects millions of people worldwide. Temporomandibular joint internal derangement, is a common condition. Temporomandibular joint internal derangement is a progressive disorder that begins with clicking during nor- mal opening and progresses to restricted mouth opening (closed lock). Arthrocentesis and Visco supplementation as Hyluronic acid are minimally invasive techniques that involves wash out the joint and replacement of synovial fluid by intra-articular injection of Hyaluronic Acid which restores its concentration and molecular weight in joint cavity.

Aims for this study is to comparison the effect of Hyaluronic acid injection to temporomandibular joint in addition to Arthrocentesis and without arthrocentesis, to see the effect of Hyaluronic acid injection to temporomandibular joint without arthrocentesis.

Patient and Methods: : The study was prospective, randomized, and clinical, with a period of 3 months follow-up comparing the efficacy of arthrocentesis with HA injection to that of HA injection alone. The data were collected after first and third months in order to gauge the effectiveness of the treatment modality at Rizgary Teaching Hospital. It included patients from November 2023 to February 2024.

Result: A total of (60) patients 13 males and 47 females, as they distributed on three groups (Group A: 20 patients undergone Arthrocentesis and Hyaluronic acid injection, Group B1: 20 patients undergone single time Hyaluronic acid injection and Group B2: 20 patients undergone double time Hyaluronic acid injection).

P value were highly significant for pain, maximum mouth opening and joint sound for group A and B2 in compare to group B1, while there were no significant different seen between group A and B2.

Conclusion: The combination of arthrocentesis and HA injection showed much better outcome than hyaluronic acid injection alone, but procedure HA injection alone is less invasive.

Keyword: Temporomandibular joint disorders, Arthrocentesis, Hyaluronic acid .

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Affiliation Info

[(1)]College of Dentistry, Hawler Medical University, Kurdistan Region, Iraq.
Corresponding Author: Twana Hoshyar Saleem.
Email: twana.hoshyar@hmu.edu.krd.

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INTRODUCTION

Temporomandibular disorder (TMD) affects millions of people worldwide. Temporomandibular joint internal derangement (TMJ ID) is a common condition. TMJ ID is a progressive disorder that begins with clicking during normal opening and progresses to restricted mouth opening (closed lock).[1]

Trauma and parafunctional behaviors are the usual causes of TMJ ID, as they cause degenerative alterations in the articular structures, increased friction, and progressive disc displacement.[2] TMJ ID is typically characterized by jaw deviation, clicking, pain, and restricted jaw movement.[3]

Over the years, a number of conservative methods have been put forth, including occlusal treatment, complementary medicine, jaw physiotherapy, and occlusal splint therapies. TMJ ID was previously treated that was surgically repositioned and recontoured after conservative measures failed. [4]

The first description of TMJ arthrocentesis as the most straightforward and successful minimally invasive method for treating TMJ closed lock was provided by Nitzan et al.[1] The transition from nonsurgical to surgical treatment was made possible by the TMJ arthrocentesis procedure. It included flushing out inflammatory substrates, releasing adhesions, and irrigating the upper joint compartment with a therapeutic substance to relieve pain and enhance function. The term TMJ arthrocentesis refers to the in- and out-flow lavage of the upper joint compartment with physiological saline or Hartmann's solution (Ringer's lactate) via a needle.[1]

Viscosupplementation (VS) is newly coined term to describe a minimally invasive technique that involves replacement of synovial fluid by intra-articular injection of HA which restores its concentration and molecular weight in joint cavity.[5]

Aim for this study is to comparison the effect of Hyaluronic acid injection to temporomandibular joint in addition to arthrocentesis and without arthrocentesis, and, to see the effect of Hyaluronic acid injection to temporomandibular joint without arthrocentesis.

PATIENT AND METHODS

The present study comprised 60 patients with internal derangement of TMJ visiting the outpatient Department of Oral and Maxillofacial Surgery at Rizgary Teaching Hospital. It included patients from November 2023 to February 2024. The study was prospective, randomized, comparative, and clinical, with a period of 3 months follow-up comparing the efficacy of arthrocentesis and HA injection to that of HA injection without Arthrocentesis. Through history and clinical examination was done. All patients provided written informed consent before inclusion in the study. The study was approved by Hawler Medical University- College of Dentistry ethical committee.

Preoperatively, the baseline data in the form of maximal mouth opening (MMO), TMJ pain at rest and on movement and joint sound. Post operatively the aforementioned parameters were assessed along with subjective judgment of efficacy till 3 months follow-up period. The data were collected after first and third months in order to gauge the effectiveness of the treatment modality. Data were analyzed using the Statistical Package for Social Sciences (SPSS, version 20). For descriptive statistic and Paired sample t-test was used to assess the reliability of data. A p-value of ≤ 0.05 was considered as statistically significant. MMO was measured as distance between mesio-incisal angle of upper central incisor and lower central incisor on maximal active pain free mouth opening as tolerated by the patient.

Pain at rest and during functional movement is measured via Visual-Analog Scale (VAS) with grades 0 to 10, where 0 denotes no pain and 10 attributed to worst pain imaginable to patient,, and recorded as (0= no pain, 1-3= mild pain 4-6= moderate pain, and 7-10= sever pain).[6] Temporomandibular joint clicking was recorded by score: (0 = no sound heard even by stethoscope, 1 = mild sound heard just by stethoscope , 2 = moderate click that can be felt by palpation, and 3 = severe sound audible by the patient or others).[7]

Patient selection

Patients were included in the study on the basis of the following criteria.

Inclusion criteria:

1. Age more than 14 years
2. Wilkes stage ≥2 disease for at least 2 months
3. TMJ pain >3 on VAS

4.Patients not responding to conservative treatment for at least 2 months.

Exclusion criteria:

1.Infection of the affected joint and pre-auricu- lar area.

2. Previous surgery of the affected joint.
3. History of injection of any substance into the target TMJ during previous 6 months.
4. History drug allergy.
5. Pregnant and lactating female.

Participants were chosen in a regular order from an included list, and they were divided into three study groups in a repeating pattern, as the first patient went to Group A, the second to Group B1, and the third to Group B2, This process continued until all patients were placed into groups evenly.

Group A: arthrocentesis with Ringer's lactate solution plus intra-articular injection of HA immediately after arthrocentesis.
Group B: only IA-HA, without arthrocentesis
Group B1: single injection IA-HA
Group B2: Double Injection IA-HA, 1 week interval.

Arthrocentesis technique
This procedure was done under local anesthesia with auriculotemporal nerve block. The patient is seated inclined at a 45° angle with the head turned contralateral side to provide an easy approach to the joint to be treated. After proper sterile preparation of pre-auricular area with povidone iodine, the external auditory meatus is covered with wet cotton.
With palpating index finger on the affected side, the TMJ movements are palpated. A line was drawn from the lateral canthus to the most posterior and central point on the tragus (Holmlund–Hellsing Line).8 Two points are marked over the skin indicating the articular fossa and eminence. The posterior point of entry was located along the cantho-tragal line, 10 mm from the middle of the tragus and 2 mm below the canthotragal line (point A). The anterior point of entry was 10 mm farther along the canthotragal line and 10 mm below it (point B). see figures (1,2,3,4)

A B

Figure 2. patient undergone arthrocentesis with Ringer solution (A), followed by immediately (1 ml) Hyluronic acid injection (B)

Figure 1. patient preparation for Temporomandibular arthrocentesis

Figure 3. (1 ml) Hyluronic acid injection without arthrocentesis

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A B C D

Figure 4. two cases follow up, photo A&C: pre operative, B&D: 3 months post operative follow up

RESULTS

A total of (60) patients 13 males and 47 females, mean age (± SD) was 20.12 ± 2.744 years, ranging from 17 – 26 years. The median age was 19 years.

There was highly statistically significant difference
were detected between the mean ages of three groups as seen in (Table 3.1)

Table 1. Comparison between mean ages of three study groups

procedure	N	Mean	Std. Deviation	P- Value Anova
Group A	20	22.75	2.221	0.0001
Group B1	20	17.70	1.129	
Group B2	20	19.90	1.917	
Total	60	20.12	2.744	

Tmj arhrocentesis and IA-HA injection was effective in alleviating pain as the 1st month post operatively as p-value was 0.0001 its highly significance but on 3rd months follow up it was no ststestically significant as p- value was 0.091, table 3.2 and figure (4) shows first Month follow-up, group A and B2 according to VAS scale they have a mild pain mostly and little size number of them complain for moderate pain, while for group B1 patients mostly complain of severe pain post IA-HA.

While in Figure (5), shows third month follow-up, in all groups sample sizes complain no pain, just a little number of sample sizes have a mild pain according to VAS scale

Table 2. proportion of patients complain of pain among study groups

Groups		Post operative 1st Month			Post operative 3rd Month		
		mild pain	moderate pain	sever pain	no pain	mild pain	sever pain
A	Count	15	5	0	15	5	0
	%	75.0%	25.0%	0.0%	75.0%	25.0%	0.0%
B 1	Count	0	7	13	12	8	0
	%	0.0%	35.0%	65.0 %	60.0%	40.0%	0.0%
B2	Count	4	16	0	18	2	0
	%	20.0%	80.0%	0.0%	90.0%	10.0%	0.0%
Total	Count	19	28	13	45	15	0
	%	31.7%	46.7%	21.7 %	75.0%	25.0%	0.0%
P value		0.0001			0.091		

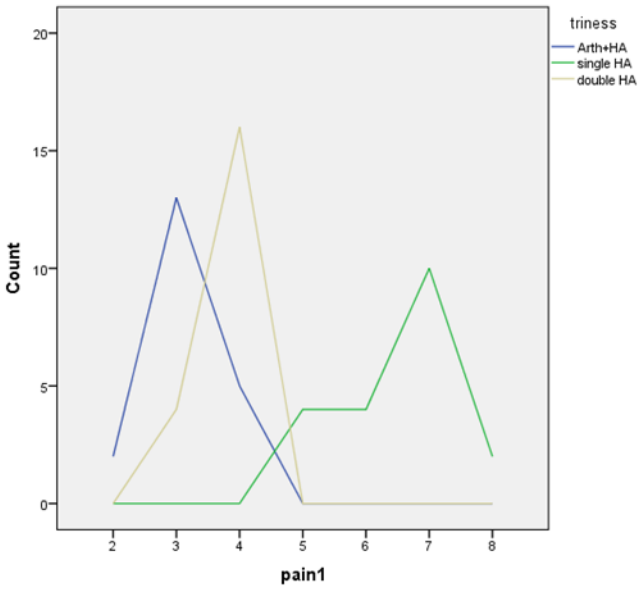

Figure 5. proportion of patients complain of pain at first month according VAS

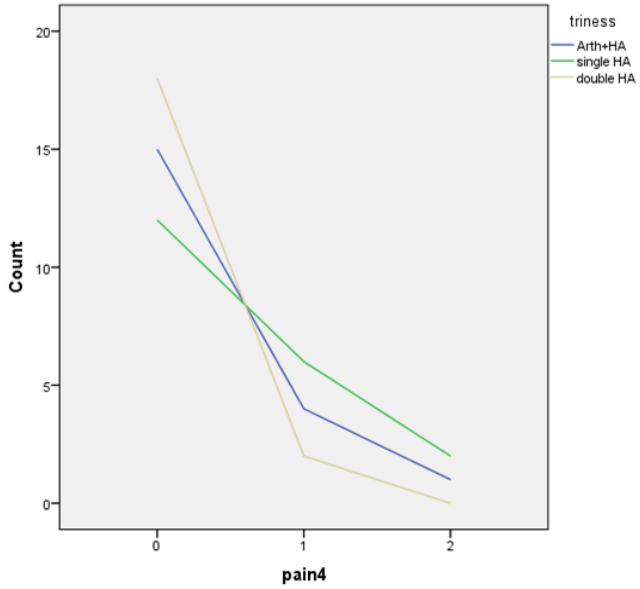

Figure 6. proportion of patients complain of pain at third month according VAS

Degree of mouth opening more than 30 mm at 1st month and more than 35 mm at 3rd months post-operatively were highly significance for group A&B 2 as p-value (0.00) in compare to group B1, Table 3. 3

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Table 3. proportion of patients improving maxim mouth opening among study groups

Groups		Post operative 1st Month			Post operative 3rd Month		
		less than 30 mm	more than 30mm	more than 35mm	less than 30 mm	more than 30 mm	more than 35 mm
A	Count	0	20	0	0	3	17
	%	0.0%	100.0%	0.0%	0.0%	15.0%	85.0%
B 1	Count	8	12	0	4	10	6
	%	40.0%	60.0%	0.0%	20.0%	50.0%	30.0%
B 2	Count	0	20	0	0	4	16
	%	0.0%	100.0%	0.0%	0.0%	20.0%	80.0%
Total	Count	8	52	0	4	17	39
	%	13.3%	86.7%	0.0%	6.7%	28.3%	65.0%
P value		0.0001			0.0001		

Joint sound at 1st Month p-value was 0.21 it no significant between groups, but, at 3rd months post-operatively were highly significance for group A&B2 as p-value (0.00) in compare to group B1, Table 3.4

Table 4. proportion of patients complain of joint sound among study groups

Groups		Post operative 1st Month		Post operative 3rd Month	
		no click-ing	clicking	no click-ing	click-ing
A	Count	3	17	18	2
	%	15.0%	85.0%	90.0%	10.0%
B 1	Count	0	20	4	16
	%	0.0%	100.0%	20.0%	80.0%
B 2	Count	2	18	16	4
	%	10.0%	90.0%	80.0%	20.0%
Total	Count	5	55	38	22
	%	8.3%	91.7%	63.3%	36.7%
P vlue		0.217		0.0001	

DISCUSSION

The present study, was to comparison the effect of Hyaluronic acid injection to tempromandibular joint either in addition to arthrocentesis or directly without prior arthrocentesis, see the effect of Hyaluronic acid injection to tempromandibular joint without arthrocentesis.

Understanding the cycle of deterioration has led researchers to study not only the biomechanics of the TMJ but also the biochemistry involved in the pathophysiology of arthralgia and joint inflammation. The lack of waste removal and blood supply generates a higher concentration of pain mediators and pro-inflammatory cytokines within the synovial fluid, has been related to bone remodeling as well as to proteoglycan degradation, impairing cartilage elasticity.[9]

There has been increasing clinical application of TMJ arthrocentesis in TMJ disorders. In patients with reduced range of jaw movements, the technique of arthrocentesis helps to break adhesions and adherences, widen joint spaces, and improve mouth opening.[10]

Thus, arthrocentesis may act by allowing the elimination of hyperviscous medium with catabolites and inflammatory cells, thereby counteracting the degeneration of tissues.[11]

Studies on larger joints such as knee joint, have suggested that viscosupplementation has positive effects on inflammatory degenerative diseases of larger joints, thus providing rationale for the use of HA injections in TMJ OA.[12]

Theories supporting the role of viscosupplementation of HA in TMJ has led to introduction of HA injections alone or with arthrocentesis in TMJ disorders.[13]

Its application in different articulations has been reported. In addition to an immediate response (e.g., improved mastication ability), it also induces long-term modifications, as is typical of structure-modifying drugs. Hyaluronate thus has a slow symptomatic action, but is persistent, with a so-called “tail effect.” In regeneration induced in degenerated arthritic tissues with slow metabolism, injection of exogenous hyaluronic acid stimulates the production of endogenous hyaluronate by synoviocytes. The immediate action, however, is explained by a reduction in pain mediators when infiltrated into an inflamed joint with hypomobility and functional limitations.[11]

Even Arthrocentesis is considered as a minimum invasive procedure, but is associated with certain postoperative complications and sequelae, the severity of these complications depends on the anatomy of the TMJ and its related surrounding structures and also the method employed for the procedure, as Injury to the facial nerve (0.7%–0.6%), which mostly due to repeated attempt in introducing a needle into the joint space after an unsuccessful primary needle insertion. In such cases, the single-needle approach appears to be very suitable.[14]

And Edema , as well, due to leakage of the lavage fluid (Ringer’s solution) into the extra-articular space which lead to Acute joint inflammation, This may be accompanied by preauricular edema, redness, pain, and restricted mouth opening.[15]

From these points of complications, if, multi time injection of H.A. injection it become less invasive and the same outcome result for those patients received arthrocentesis and H.A. , that’s why our results were aligned with Hypotheses are as follows: first, that each I.A-H.A. injection is causing a mechanical tear of adhesions through a hydraulic distension and expansion of the superior articular space, thereby eliminating the vacuum effect present in osteoarthritis (OA); and second, that the physiologically H.A. improves SF viscosity and nutrition of the intracapsular structures.[15]

also the our results were aligned with the studies that suggested good effects are likely due to the restoration of the joint environment, restoration of joint rheology, anti-inflammatory, and antinociceptive effects, the normalization of endogenous HA synthesis, and cartilage regeneration.[4, 11, 13, 16]

While our results not aligned with these studies that reported HA preparations possess short half-lives, and have not shown significant ad- vantages.[17,18]

And two patients excluded from group B2, as they need more than two IA-HA injections, to get a good result, as they still complained slight pain, and they got better after triple time of IA-HA. And one patient from group A excluded, as she received double time IA-HA post arthrocentesis, and finally in group B, four patients excluded, as they need more treatment intervention.

A strength of this present study was that all procedures performed by just one operator and that

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the final examinations were performed by two independents
Senior hose officers, who were unaware of treatment assignment, thus minimizing the risk of bias.

CONCLUSION

The combination of arthrocentesis and HA injection showed much better outcome than hyluronic acid injection alone, but procedure of HA injection alone is less invasive. However, long-term follow-ups with larger sample sizes are required to evaluate the effect of hyluronic acid without arthrocentesis vice versa arthrocentesis with HA.

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CONFLICTS OF INTEREST

There are no conflicts of interest.

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