

Validity of Viscosupplementation with Arthrocentesis in Management of Temporomandibular Joint Internal Derangement

Abdullah Atef Hammuda¹, Mohamed Said Hamed², Eman Abdelhaleim Elsharawy³ and Mohammed Ahmed Elsholkamy²

¹Oral surgeon, Ain Shams university hospitals

²Professor, Department of Oral & Maxillofacial Surgery, Faculty of Dentistry, Suez Canal University

³Professor of General Anaesthesia, Department of Oral & Maxillofacial Surgery, Faculty of Dentistry, Suez Canal University

Hammuda81@gmail.com, Dr.Abdullahatef@gmail.com

Abstract: It is becoming evident that arthrocentesis with lavage of the joint space is effective treatment method for inflammatory and degenerative diseases of the temporomandibular joint. The question is whether the results would be better if accessory intra-articular application high molecular weight material. The aim of the present study was to validate the efficacy of viscosupplementation with temporomandibular joint arthrocentesis by hyaluronic acid. Forty patients were included in this study. They were divided randomly in two groups: group A, consisted of twenty patients and prone to arthrocentesis. Group B consisted of twenty patients and prone to arthrocentesis followed by injection of Sodium Hyaluronate. Results: Patients were followed up for one year. On the long term follow up there was a significant reduction in pain with increase in the range of maximal mouth opening and improvement in joint noise in comparison with group A that subjected to arthrocentesis without any additional drugs. Conclusion: Arthrocentesis is an effective conservative procedure in treatment of temporomandibular joint internal derangement. Validity of viscosupplementation using sodium hyaluronate in improving physical functions of temporomandibular joint.

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1. Introduction:

Articular cartilage and synovium are lining the inner aspect of all synovial joints; including the temporomandibular joint TMJ. The space bound by these two structures is termed the synovial cavity, which is filled with synovial fluid.^{1,2}

The synovial fluid is considered an ultra-infiltrate of plasma. It contains a high concentration of hyaluronic acid, which is thought to be responsible for the fluid's high viscosity. The proteins found in synovial fluid are identical to plasma proteins; however, synovial fluid has a lower total protein content, with a higher percentage of albumin and a lower percentage of α -2-globulin. Alkaline phosphatase which may also be present in synovial fluid is thought to be produced by chondrocytes. Leukocytes are also found in synovial fluid, with the cell count being less than 200 per cubic millimeter and with less than 25% of these cells being polymorphonuclear. There is free and rapid exchange between the vessels of the capsule, the synovial fluid, and the articular tissues. The inferior joint space contains about 0.9 ml of synovial fluid, and the superior joint space contains about 1.2 ml of synovial fluid.^{2,3}

Functions of the synovial fluid include lubrication of the joint, phagocytosis of particulate debris, and nourishment of the articular cartilage. Joint lubrication is a complex function related to the viscosity of synovial fluid and to the ability of articular cartilage to allow the free passage of water within the pores of its glycosaminoglycan matrix.⁴

Changes in the composition of the synovial fluid may increase the intra-articular friction; leading to unstable disc motion. These biochemical changes may also affect the joint lubrication and nutritional requirements of the articular surfaces.^{5,6}

Internal derangements of the temporomandibular joint are an abnormal relation of the articular disc to the mandibular condyle and the articular eminence. Jaw pain, clicking of the joint, irregular and limited movement of the jaw is the characteristic symptoms of this disorder.⁷

TMJ ID is defined as a progressive disorder which usually starts as clicking associated with normal opening (anterior disc displacement with reduction), to a stage where clicking gradually ceases but restricted mouth opening ensues (closed lock).^{8,9}

Arthrocentesis of the temporomandibular joint is used not only in cases of acute closed lock but also

in the treatment of various temporomandibular disorders. Thus, the most frequent indication is an acute anterior displacement of the articular disc without reduction or hypomobility of the joint with occurrences of disc adhesions (a stuck disc). It is possible to select arthrocentesis as a palliative procedure for patients with an acute episode of degenerative or rheumatoid arthritis and also for patients with a painful displacement of the disc with reduction, which rarely responds to conservative treatment. Treatment success is prominent in cases of acute patients or patients with a history of short-term problems¹⁰⁻¹²

It is becoming evident that arthrocentesis with lavage of the joint space is a very good treatment method for inflammatory and degenerative diseases of the temporomandibular joint. The question is whether the results would be better if accessory intra-articular application of corticosteroids or hyaluronic acid were used?¹³⁻¹⁵

Aim of the study: was to validate the efficacy of viscosupplementation with temporomandibular joint arthrocentesis by hyaluronic acid.

2. Patients and methods:

Forty patients were included in this study from the outpatient clinic at the department of Oral and Maxillofacial surgery, Faculty of Dentistry, Suez Canal University. They were presented with limited movement, pain in the TMJ function and clicking.

Diagnosis is confirmed by history and clinical examination. Patients with History of previous surgery, systemic inflammatory joint disease, and direct trauma to the facial bone, Hyperplasia, hypoplasia or tumor in the joint were excluded from this study. Patients with limited mouth opening caused by only muscle pain or muscle spasm were excluded also. All patients received different treatment modalities for TMJ dysfunction (muscle relaxants, diets, and physical therapy or oral splints) with no clinical improvement. TMJ tomogram was requested for all patient, further MRI was requested to confirm diagnosis in eighteen patients. All patients included in this study were diagnosed as having temporomandibular joint internal derangement and subjected to treatment by arthrocentesis.

They were divided randomly in two groups: group A, consisted of twenty patients and prone to arthrocentesis. Group B, consisted of twenty patients and prone to arthrocentesis followed by injection of Sodium Hyaluronate (Curavisc 20mg / 2ml syringe, by IDT Biologika GmbH Company, Germany) into the upper joint space.

All surgical procedures were performed in the outpatient clinic under local anesthesia. All selected patients were informed about the procedure, precautions, follow up appointments and

complications. And they signed an informed consent. The patient was lying on supine position on the dental chair. The field was isolated with sterile drapes. The skin was disinfected with Providone-Iodine 10% (Betadine, the Nile Co. for Pharma, Cairo, Egypt (under license from Mundipharma AG, Basel, Switzerland.). The points of needle insertion was determined according to Talaat et al by drawing the canthus-tragus line and a point 10 mm in front of the tragus and 2 mm below the canthus-tragus line in cases where the canthus–tragus distance was more than or equal to 70 mm. In cases where the canthus – tragus distance was less than 70 mm, the point of needle insertion was marked at a point 7 mm in front of the tragus and 2 mm below the canthus – tragus distance. Another point 2 mm anterior to the formed point was marked to serve as the point of insertion of the second needle.¹⁶

Arthrocentesis was performed in both groups using 20-gauge needle inserted at the point 10 mm in front of the tragus and 2 mm below the canthus-tragus line and injecting 2 ml of saline solution was performed through the first needle to distend the joint space and the patient is instructed to open and close his joint. The second needle is inserted in the second point for the flow out of the solution. The joint was washed with about 200 ml. of saline solution injected into the upper joint compartment. The procedure was terminated and both needles were withdrawn in group A. In group B, Sodium Hyaluronate was injected through the first needle after removal of the outflow needle. Assessment of joint pain and functions were carried out by scoring pain scale and maximal mouth opening. On a visual analogue scale (VAS) with endpoints 0 score for no pain and 10 score for the worst pain experienced. All patients were asked to place a mark on the VAS line to represent their intensity of pain during joint function. Maximal mouth opening were measured inter-incisally with a millimeter caliper. Assessment of clicking sound was performed using stethoscope and palpation method.

3. Results:

Pain levels were significantly decreased in both groups from preoperative to the immediate postoperative, then at two days, one week, two weeks, one month, and six months postoperatively. After the first year pain score reported in Group A was (mean 1.600 ± 0.737) showing high significant difference ($P < .001$) compared to group B (mean 0.533 ± 0.743) as indicated in table 1.

Maximal mouth opening was improved significantly in all patients along one year follow up. It was reported statistical significant change in all records after arthrocentesis in study groups. There was no statistical significant differences between the preoperative records of the maximal mouth opening

were reported for both groups. Analysis of the records at postoperative, two days, one week and two weeks revealed that there were no statistical significant differences between both groups however After 1 month, six months and one year : a significant increase in the mouth opening records were reported in group B in comparison with group A ($P < 0.027$), ($P < 0.004$) and ($P < 0.001$) respectively. Table 2

In the group A, 15 joints presented with clicking (60%) and 10 joints without clicking (40%) of total 25 joints in 20 patients. In the group B, it was reported 14 joints presented with clicking (53.85%) and 12 joints without clicking (46.15%) of total 26 joints in 20 patients. Table 3

As shown in table, at postoperative and after 2 days there were no clicking reported in both groups. After 1 week clicking was reported in six joints (40 %) of joints in group A whereas no clicking was reported in group B. After 2 weeks clicking was reported in seven joints (46.67%) in group A whereas no clicking was reported in group II. After 1 month, in group A clicking was reported in eight joints (53.33 %) whereas no clicking was reported in group B. After 6 months, in group A clicking was reported in eleven joints (85.71%) of joints in comparison with group B it was reported in two joints (16.66%) of joints. After 1 year, in group A clicking was reported in twelve joints (80%) in comparison to 28.57 % in group B. Table 4

Table 1: comparison in the pain levels of the study groups.

Pain score	Group A			Group B			T-test	
	Mean	±	SD	Mean	±	SD	t	P-value
Pre-Operative	6.333	±	0.900	6.533	±	1.246	1.089	0.880
Post-Operative	1.600	±	0.632	1.267	±	0.640	2.190	0.223
After 2 Days	2.267	±	0.799	1.733	±	0.799	2.056	0.138
After 1 Week	0.600	±	0.910	0.533	±	0.516	2.625	0.963
After 2 Weeks	0.067	±	0.258	0.200	±	0.414	2.558	0.644
After 1 Month	0.333	±	0.488	0.200	±	0.414	3.093	0.588
After 6 Months	0.400	±	0.632	0.000	±	0.000	3.541	0.100
After 1 Year	1.600	±	0.737	0.533	±	0.743	9.808	0.001*

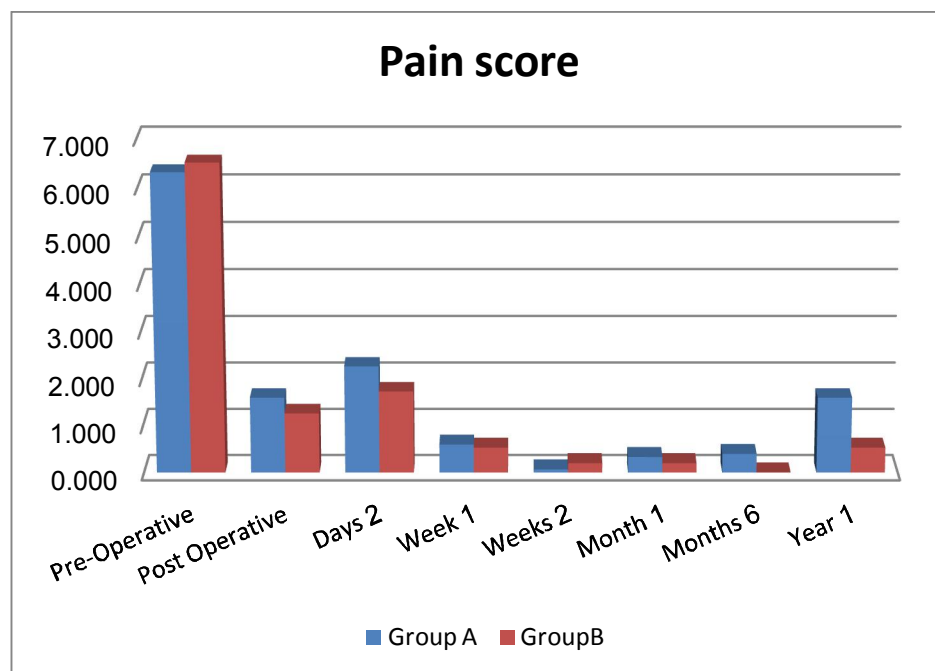


Figure 2: Graph showing comparison in the pain levels of the study groups.

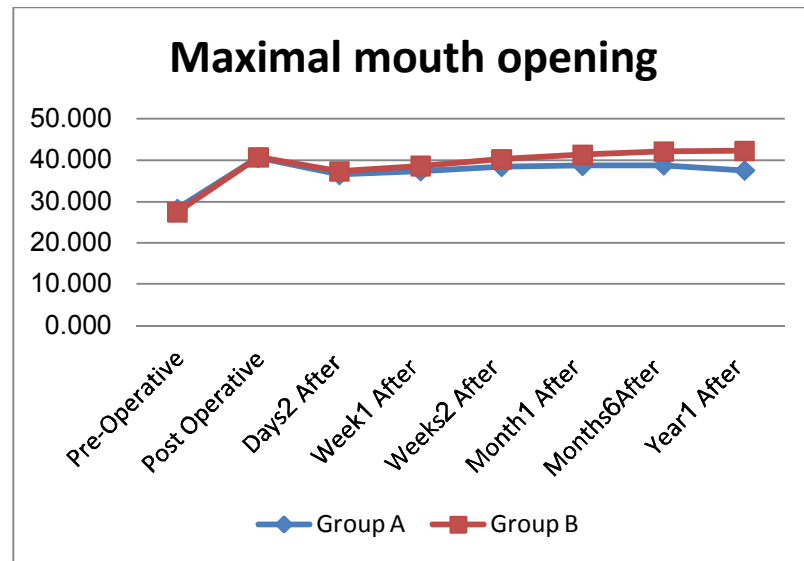


Figure 2: comparison in the Maximal mouth opening of the study groups.

Table 3: representing percentage of clicking and non clicking joints

Clicking		Groups	
		Group A	Group B
Positive	N	15	14
	%	60	53.84
Negative	N	10	12
	%	40	46.15
Total	N	25	26
	%	100.00	100.00

Table 4: assessment of clicking joints of study groups along one year

Joints presented with clicking	Groups			
	Group A		Group B	
	N	%	N	%
Clicking Pre-Operative	15	100.00	14	100.00
Clicking Post-Operative	0	0.00	0	0.00
Clicking After 2 Days	0	0.00	0	0.00
Clicking After 1 Week	6	40	0	0.00
Clicking After 2 Weeks	7	46.67	0	0.00
Clicking After 1 Month	8	53.33	0	0.00
Clicking After 6 Months	11	73.33	2	14.28
Clicking After 1 Year	12	80	4	28.57

4. Discussion:

In the present study arthrocentesis was performed for all patients. In group I, patients were subjected to arthrocentesis only without drugs injection, wash and lavage with normal saline to the upper joint compartment. The patients were followed up for one year and the results revealed the efficacy of arthrocentesis as there were a significant improvement in Pain, maximum mouth opening, lateral jaw

movement and protrusive jaw movement were reported. Accordingly our results in group A indicate the efficacy of arthrocentesis as a simple non-invasive effective procedure in the treatment of the temporomandibular joint internal derangement.

Neeli et al evaluated the efficacy of arthrocentesis in the treatment of internal derangement of the temporomandibular joint in thirty patients with TMJ internal derangement using saline. Pain using

visual analog scale, maximum mouth opening, joint noises and mandible deviation were documented pre-operatively, post-operatively and monthly followed up till one year. 96% of cases showed a significant reduction in pain with arthrocentesis. In patients who presented with limited mouth opening, significant improvement was seen in the immediate post-operative period and with reduction in pain, mouth opening further increased from third to sixth month. Improvement was observed with jaw deviation and clicking.

In the current study, all patients in group B were subjected to arthrocentesis followed by injection of sodium hyaluronate for viscosupplementation. Patients were followed up for one year. On the long term follow up there was a significant reduction in pain with increase in the range of maximal mouth opening in comparison with group A that subjected to arthrocentesis without any additional drugs. These results were in accordance with Manfredini *et al.* who stated that, the first attempts on TMJ arthrocentesis focused on its application to increase jaw function and achieve relief from pain in patients with restricted mouth opening¹⁷.

With the increase in knowledge on the role of joint lubrication impairment as a risk factor for TMJ internal derangements, viscosupplementation with hyaluronic acid became an option for the management of symptoms in the clinical setting¹⁸.

Controversial with the results obtained by Yeung *et al.*, they studied Short-term therapeutic outcome of intra-articular high molecular weight hyaluronic acid injection for non-reducing disc displacement of the temporomandibular joint. In their study, mouth opening was noted to decrease when compared to pre-injection measurement in a statistically significant manner up to 1 month after injection. Later review did not show any further decrease in maximal mouth opening. Furthermore, there was no statistically significant difference in the mean lateral excursion at different postoperative periods¹⁹. They performed injections twice in the joint without arthrocentesis and this may explain the conflict in the results with those that obtained in present study. In addition to, it proves the efficacy of arthrocentesis in management of internal derangement. This led to the progressive expansion of potential clinical indications for the use of arthrocentesis plus hyaluronic acid injection.

Disappearance of the clicking postoperatively in both groups was suggested to be due to the effect of the arthrocentesis procedure as it dilutes inflammatory mediators and releases disc adhesion and lock inside the joint which facilitate disc gliding in the upper compartment which is proved by increased mouth opening and jaw movements to the normal range.

The long term improvement in the clicking sound that reported in group B after six month and one year may be attributed to the topical lubricant action of the injected sodium hyaluronate as it facilitated the movement of disc against the glenoid fossa i.e. viscosupplementation. The similar results were obtained by Alpaslan and Alpaslan, they investigated the efficacy of arthrocentesis with and without injection of sodium hyaluronate into the upper joint space in the treatment of temporomandibular joint internal derangements. They conclude that injection of sodium hyaluronate provided significant reduction in joint noises from 2 through 9 months in the closed lock patients when compared with those receiving arthrocentesis alone.²⁰

Conclusion: Arthrocentesis is an effective conservative procedure in treatment of temporomandibular joint internal derangement. Validity of viscosupplementation using sodium hyaluronate in improving physical functions of temporomandibular joint.

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