

# Effectiveness of TMJ intra-articular injections of Sodium Hyaluronate on clicking in patients with temporomandibular disorders (Clinical Study)

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## ABSTRACT

**Aims:** In this part of study, we assess the effect of HA in clicking.

**Materials and Methods:** This study include 21 patients with TMDs were diagnosed clinically and confirmed by Trans cranial radiography. The age range was from 18 to 50 years old, with a mean of 30.03 years. Three cycles of intra articular injections of 0.6 ML sodium hyaluronate were performed weekly for three successive weeks. Pain intensity was measured by the visual analog scale. Maximal mouth opening, clicking, joint noise, and lateral movements were measured before and one week after first ,second & third injections.

**Results:** The majority of patients were at age ranged 21-40 years which represent 66.6% of the sample, regarding the sex distribution female to male ratio was 3:1. TMJ clicking at left side 11 ( 52.4%) was more frequent than right side clicking 6 (28.6%) were as bilateral clicking was 4 which represent (19%). no significant differences between right & left site clicking  $p \geq 0.005$ , only 7 patients( 33.3%) have osteoarthritis & no significant relationship between clicking & osteoarthritis.  $X^2 = 0.127$  ,  $p \geq 0.005$ . osteoarthritis were more frequent in female which represent 85.8% (6 patients) than male patient which represent 14.2% (one patient) also there is no significant relation between osteoarthritis & sex, Friedman test = .527 ,  $p \geq 0.005$ . the response of TMJ clicking one week after first, second & third injections of HA were studied . The result shows that 18 patients from 21 patients with no clicking. Highly significant difference in clicking before & one week after third injection of HA while non significant difference between clicking & one week after first & second injections of HA & highly significant difference in clicking before & after injections of HA.  $p \leq 0.001$ . were found. highly significant difference  $p \leq 0.001$  of clicking scores one week after first & third injections of HA in TMJ & no significant difference  $p \geq 0.005$  one week after first & second injections of HA in TMJ was found.

**Conclusion:** This study shows that intra articular injection of HA is a safe & effective treatment modalities of TMDs include clicking, this technique is a simple, safe & accepted by patients & it needs no devices & instruments as in a construction of a bite plate & it can be employed in any place i.e. no need for dental chair, no complications of this treatment like change of occlusion as in a bite plate were reported.

**Key words:** Hyaluronic acid, clicking, TMJ, Intra articular injection.

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## INTRODUCTION

Temporomandibular disorders is a collective term embracing a broad spectrum of clinical joint and muscle problems in the orofacial area ,these disorders characterized primarily by pain , joint sounds and irregular or limited jaw function<sup>(1)</sup>. American Dental Association(ADA) thought that clicking can occur in individuals with a normal disk position in MRI. Others believed that clicking are due to condylar hypermobility ,enlargement of the lateral poles of the condyles , structural irregularities of the articular eminence and loose intra-articular bodies other than disc<sup>(2)</sup>. The pathogenesis of internal derangement of the temporomandibular Joint (TMJ) has shifted focus from a disc displacement theory<sup>(3,4)</sup> to more emphasis on the biochemical causes<sup>(5-7)</sup>. It has been suggested that TM internal derangement often progresses from a stage of clicking with normal maximal mouth opening (MMO) through one where clicking gradually ceases with varying degrees of restriction in mouth opening to a stage of closed lock<sup>(8)</sup>. The latter stage is customarily attributed to a clinical state of non reducible anteriorly displaced disc acting as an obstacle to the gliding condyle<sup>(9-11)</sup>. In the past, treatment of TMJ dysfunction that did not respond to conservative treatment was surgical disc repair and repositioning

to reestablish normal MMO<sup>(12-14)</sup>. Arthroscopy<sup>(15)</sup>, simple lysis and lavage, and the use of hydraulic pressure in the upper joint space were found to be highly effective in reestablishing normal MMO and relieving the symptoms<sup>(15-17)</sup> despite the disc position not have been corrected.

Nitzan et al<sup>(18)</sup> proposed that closed lock was a result of reversible restriction in gliding movements of the disc caused by its adherence to the fossa. Such adherence may arise from a number of possible causes such as fibrous adhesions, severe friction between damaged rough surfaces, stickiness that may be a direct result of an increase in synovial fluid viscosity, or a vacuum effect. A vacuum effect or alteration in synovial fluid consistency may create the environment for a suction effect of the disc to the fossa, restricting gliding movement and therefore resulting in limited mouth opening. The technique of TMJ arthrocentesis and lavage described by Nitzan et al<sup>(7)</sup> is a simple means of releasing the “stuck” disc from the fossa by simple irrigation of the superior joint space under local anesthesia on an outpatient basis. After arthrocentesis, pain and disturbance in jaw function decreased dramatically and in that study<sup>(17)</sup> 13 of 17 patients did not have clicking following the arthrocentesis procedure.

The disc displacement theory has been well accepted in the past<sup>(3,4)</sup>, however many researchers are currently focusing on the biochemistry of the synovial fluid in various stages of TMJ disease in trying to elucidate the pathogenesis of temporomandibular disorders (TMD)<sup>(5,6,20)</sup>. The role of inflammation has been investigated and proposed as an underlying mechanism of pain and dysfunction of the TMJ because cellular and biochemical signs of inflammation were frequently observed in the TMJs of patients with longstanding pain and tenderness of this joint<sup>(21,22)</sup>. Agus et al.<sup>(23)</sup> in 1983, simplified the therapeutic injection of steroids and reported a good response in 10 of 14 patients with unilateral TMJ synovitis.

Sodium hyaluronate had been identified and tested in animals with promising results<sup>(24,25)</sup>. Clinical trials in patients who had severe knee arthritis not responding to conventional treatment showed considerable relief of symptoms<sup>(26-28)</sup>. Kopp et al<sup>(29-30)</sup> reported that intra-articular injections of hyaluronate or corticosteroids combined with local anesthesia had short-term and long-term palliative effects on subjective symptoms and clinical signs of TMJ pain. Because of the unpredictable prognosis of intra-articular injections of corticosteroids for patients with TMJ osteoarthritis and the uncertainty regarding local side effects of these drugs on joint tissues, corticosteroid injection remained unpopular<sup>(32,33)</sup>. In the use of sodium hyaluronate in TMJ, Kopp et al<sup>(29)</sup> investigated 33 patients with TMJ pain and tenderness to palpation of at least 6 months' duration and who did not respond to previous conservative treatment. They used a volume of 0.5 mL of sodium hyaluronate or 0.5 mL corticosteroid injected twice into the superior joint compartment of the TMJ with a 2-week interval between injections. The results revealed that both drugs reduced symptoms and signs without a statistically significant difference, prompting conclusion that sodium hyaluronate could be used as an alternative to corticosteroids in patients with signs of TMJ inflammation including symptomatic osteoarthritis. This led to a new horizon of therapeutic options.

Kopp et al<sup>(31)</sup> and Bertolami et al<sup>(34)</sup> injected hyaluronic acid of different molecular weights into the joint after arthrocentesis in patients with osteoarthritis. Later, Fader et al<sup>(35)</sup> reported the injection of combined local anesthesia and hyaluronic acid in patients with persistent, painful, non-translatory closed lock of the TMJ and reported short-term beneficial effects. Yustinet al<sup>(36)</sup> reported the use of 1 mL of hylan GF-20 by intra-articular injection to manage osteoarthritis of the TMJ and their patient functioned well and felt comfortable for 4 months after 3 injections. Sato et al<sup>(37)</sup> injected 1 mL of sodium hyaluronate (Artz, Seikagaku Kyogo Co., Tokyo, Japan) into the superior joint space of patients with unilateral non-reducing disc displacement once a week for 5 consecutive weeks and reported resolution of TMJ symptoms. Heppguler et al.<sup>(38)</sup> also reported the intra-articular injection of 0.5 mL of hyaluronic acid (15 mg mL<sup>-1</sup> orthovisc, Anika Therapeutics Inc., Woburn, MA) into the superior joint compartment of the TMJ in patients with reducible TMJ disc displacement and reported promising results.

## AIMS OF STUDY

The aims of this study is to evaluate the effect of TMJ intra articular injection of Hyaluronic acid on TMJ clicking in patients with TMDs.

## MATERIALS AND METHODS

### Materials

- 1- Patient sample .twenty one patients collected from Dentistry College Oral & Maxillofacial surgery Department University of Mosul & from private clinic were complain from temporomandibular disorder<sup>(39)</sup> including pain &/or clicking with or without limitation of mouth opening.
- 2- Hyaluronic acid sodium salt (Hylgan ) 2ml/20mg Fidia Farmaceutici S.P.A-Abano Terme (PD) Italy. Figure(1) .
- 3- Local anesthesia ( Lidocain 2% with Epinephrine 1:180000) Antiqia – Colombia.
- 4- Dental needle 27 G Dentject Korea.

- 5- Vernier.
- 6- Millimeter roller.
- 7- Soft pen.
- 8- Gauze.
- 9- Antiseptic chlorohexidine gluconate ( Hebetene 4%) Sahab-Gorden
- 10- Stethoscope.

## Methods

A special case sheet ( Figure 2) was used to record the information from the patients. Trans cranial view was taken to check the osteoarthritic changes (decrease intrarticular spaces ,spure formation ,flattening of the articular surfaces & sub cortical radiolucency Elye`s cyst)<sup>(40)</sup>

A twenty one patients were participated in this study ,their age ranged 18-50 years & sex distribution 16 females & 5 males as shown in table (1). All patients in the study sample were with no systemic diseases.

All patients were examined by the same examiner to provide standardization, inspection to see any asymmetry of face ,scar formation on chin ,then digital examination of TMJ & muscles of mastication to evaluate the tenderness, maximum inter incisal distance were recorded by vernier , a stethoscope was used to detect any clicking in TMJ. All selected patients have clicking ,pain with or without limitation of mouth opening. The pretragus area was disinfected by hebeten ,then 0.5 ml of alocal anesthesia was injected in pretragus area while the patient open the mouth to block the auricotemporal nerve. waiting 3-5 minutes ,cartridges were emptied to be used for injection of hyaluronic acid ,then 10 mm front & 2 mm below from mid trago-canthus line was marked by soft pen which denote the upper compartment of the TMJ. Then the cup of the prefilled HA syringe was withdrawn ,then 5ml syringe needle was tighten & 0.6ml of HA was pushed into the emptied cartridge then the drug was injected into the upper compartment of the TMJ at 45 degree<sup>(41)</sup> (Figure 3).Asterile gauze with hebeten was placed at the injected site for 1minute ,the patient was instructed to open & close the mouth several times to allow distribution of the drug. Any immediate complications like severe pain. facial paralysis, fainting earache & bleeding were recorded.

The remaining HA was stored in refrigerator at 20 c<sup>0</sup>,the patients were instructed not to open their mouth widely & eat on both sides , analgesic was prescribed to be taken only on severe pain. The second & the third injections were given with the same manner after one & two weeks respectively. The visual analogue scale 0-10 was used to assess the pain intensity were as the clicking was checked by stethoscope during opening & closing & the inter incisal distance & the lateral movements were measured by the vernier at each visit before & one week after the first, second & third injections of HA. In this study we use a simple clicking scorers referred as Bassar clicking score to evaluate the clicking response to HA injections.

- 1- Score 1 Slight improvement of clicking.
- 2- Score 2 Well improvement of clicking & still present.
- 3- Score 3 No clicking.
- 4- Score 4 Worsening of clicking.

## STATISCAL ANALYSIS

Data was processed in computer with use of slandered program (SPSS 11.5 for windows) ,the statistical calculation of differences was done with the chi square & Friedman tests .The following symbols were used for different levels of significance in tables . NS not significant,  $p \geq 0.005$ . significant  $p \leq 0.005$ . highly significant  $p \leq 0.001$ .

## RESULTS

This study include 21 patients 5 males & 16 females , with age ranged 18-50 years ,the majority of patient were at age ranged 21-40 years which represent 66.6% of the sample, regarding the sex distribution female to male ratio was 3:1 (Table 1). TMJ clicking at left side 11 ( 52.4%) was more frequent than right side clicking 6 (28.6%) were as bilateral clicking was 4 which represent (19%). no significant differences between right & left site clicking  $p \geq 0.005$ , as shown in Table (2). Table (3) revealed that only 7 patients( 33.3%) have osteoarthritis & no significant relationship between clicking & osteoarthritis.  $X^2 = 0.127$  ,  $p \geq 0.005$ . Tables (4) showed that osteoarthritis were more frequent in female which represent 85.8% (6 patients) than male patient which represent 14.2% (one patient) also there is no significant relation between osteoarthritis & sex, Friedman test = .527 ,  $p \geq 0.005$ .

Tables (5) (6) (7) shows the response of TMJ clicking one week after first, second & third injections of HA . They show that 18 patients from 21 patients with no clicking. Highly significant difference in clicking before & one week after third injection of HA while non significant difference between clicking & one week after first & second injections

of HA & highly significant difference in clicking before & after injections of HA.  $p \leq 0.001$ . as demonstrated in Table (8) . Table (9) reveals highly significant difference  $p \leq 0.001$  of clicking scores one week after first & third injections of HA in TMJ & non significant difference  $p \geq 0.005$  one week after first & second injections of HA in TMJ.

## DISCUSSION

The large & variety of treatment modalities were used for TMJ & muscle dysfunction indicate its complexity<sup>(42)</sup>. Hyaluronic acid is a linear unbranched polysaccharide consisting of repeated disaccharide units. Proteoglycan monomer bind to HA to form large aggregates that are enmeshed in the collagen matrix of intact cartilage. HA is also a critical macromolecular component in a normal synovial fluid & seems to play a role in joint stabilization & joint surfaces nutrition<sup>(43)</sup>. The use of sodium hyaluronate was first described in the 1970s by Rydell and Balazs<sup>(43)</sup> and by Helfet<sup>(45)</sup> in the treatment of osteoarthritis of the knee. HA injections are gaining attention as a treatment option to manage symptoms of TMDs, but update evidence –based data on their effectiveness are actually lacking<sup>(45)</sup>, repeated intra – articular TMJ injections of HA appear to be safe & effective way of inhabiting the progression of osteoarthritic changes in the joint through the development of articular cartilage & reducing fibrous tissue proliferation<sup>(47)</sup>. In this study the majority of the patients were at age ranged 21- 40 years & this result is consistent with other studies<sup>(2,48,49)</sup>. Regarding sex, female to male ratio was 3:1 and it agree with other studies<sup>(2,48)</sup>.

The reason why women make up the majority of patients presented for treatment is still unclear<sup>(2)</sup>, however physiological & hormonal factors should also be considered as possible components of remarkable gender distribution among TMD patients<sup>(1)</sup>, recently they found that the testosterone level help to explain the lower prevalence of TMJ pain & also show that testosterone reduces TMJ pain at sub physiological level<sup>(50)</sup>. In this study the clicking at left side ( 11 , 52.4% ) was more frequent than right side clicking ( 6 , 28.6% ) & bilateral clicking ( 4 , 19% ), no significant difference between right & left sides clicking & this result is consistent with other study<sup>(51)</sup>. The present study shows that only 7 patients (33.3%) have osteoarthritis in their TMJ , no significant relation between clicking & osteoarthritis were found , & this result agrees with other study which claimed that clicking does not progress to osteoarthritis<sup>(1)</sup>. We found that 18 of 21 patients (85.7%) presented without clicking in their TMJ one week after third injection of HA, & there is highly significant differences in clicking before treatment ,one week after first & second injections of HA.,& one week after third injection of HA. This result is consistent with other studies<sup>(36,37,38)</sup>

There is no significant difference in clicking before treatment & one week after first & second injections of HA & this result agree with Yeung et al 2006<sup>(52)</sup> finding , this result denote that HA need enough time to possess their action & explain that HA not work as lubricant only but it induce repair of articular surfaces & disc<sup>(47)</sup> also it may be explained by a low volume of injected HA (0.6 ml at each session) which is used in this study , however a 2ml was used by other study & the clicking still present after one week of injection<sup>(52)</sup>, the result of this study indicates that clicking of TMJ need more than one injection of HA. to be faded. In this study no immediate & delayed complications were found, only one patient develop fainting ,no facial paralysis, no bleeding ,no severe pain. & no infections ,this result agree with Yeung et al 2006<sup>(52)</sup> results.

### What is new in this study:

- 1- We use a dental needle 27 G instead of syringe needle 21 G & this allow good & rapid penetration of tissue ,less pain ,less tissue trauma, less opportunity to infection.
- 2- New TMJ clicking scores ( Basser clicking score ) as a simple clinical scoring , as there is no previous clinical score for clicking only one which is adopted by Wanman et al<sup>(51)</sup> which classified clicking as detected by palpation & auscultation, This clinical score is simple .cheap, time conserving, & no need for any devices just stethoscope . we can use the same scores as a patient verbal after treatment like the VAS.
- 3- Only one prefilled 2ml of HA was used in this study i.e. low cost to patient.

## CONCLUSION

Intra articular injection of HA is a safe & effective treatment modalities of TMDs include clicking, this technique is a simple, safe & accepted by patients & it needs no devices & instruments as in a construction of a bite plate & it can be employed in any place i.e. no need for dental chair, no complications of this treatment like change of occlusion as in a bite plate were reported.

### Suggestion :

- 1- Along term study to evaluate the effectiveness of intra articular injection of HA in TMDs after 6 moths & one year.
- 2- Study the effectiveness of intra articular injection of HA. on pain & mandibular movements in patients with TMDs.
- 3- Study the effectiveness of intra articular injection of ozone & compared with HA.

## REFERENCES

- [1]. Carlsson G, Mangnusson T, Management of temporomandibular disorder in general dental practice .Quintessence publishing Co.Inc.1999;p 9
- [2]. Greenberg M, Glick M, Ship J. Burket`s oral medicine . Temporomandibular disorder 11<sup>ed</sup> BC Decker Inc.2008;p 229.
- [3]. Juniper RP. The pathogenesis and investigation of TMJ dysfunction.Brit J Oral Maxillofac Surg 1987;25:105-112.
- [4]. Stegenga B, de Bont LG, Boering G, van Willigen JD. Tissue responses to degenerative changes in the temporomandibular joint: a review. J Oral Maxillofac Surg 1991;49(10):1079-88.
- [5]. Milam SB, Schmitz JP. Molecular biology of temporomandibular joint disorders: proposed mechanisms of disease. J Oral Maxillofac Surg 1995;53(12):1448-54.
- [6]. Nitzan DW. The process of lubrication impairment and its involvement in temporomandibular joint disc displacement: a theoretical concept. J Oral Maxillofac Surg 2001;59(1):36-45.
- [7]. Nitzan DW, Etsion I. Adhesive force: the underlying cause of the disc anchorage to the fossa and/or eminence in the temporomandibular joint—a new concept. Int J Oral Maxillofac Surg 2002;31(1):94-9.
- [8]. Wilkes CH. Internal derangements of temporomandibular joint: pathological variation. Arch Otolaryngol Head Neck Surg 1989;115:469-77.
- [9]. Dolwick MF, Kaytzberg RW, Helms CA. Internal derangement of the temporomandibular joint. Fact or fiction. J Prosthet Dent 1983;49:415-8.
- [10]. Farrar WB. Characteristics of the condylar path in internal derangement of the TMJ. J Prosthet Dent 1978;39:319-23.
- [11]. Wilkes CH. Arthrography of the temporomandibular joint in patients with the TMJ pain dysfunction syndrome. Minn Med 1978;61:645-52.
- [12]. McCarty WL, Farrar WB. Surgery for internal derangement of the temporomandibular joint. J Prosthet Dent 1979;42:191-6.
- [13]. Poliotis C, Stoelinga PJW, Gerritsen GW, Heyboer A. Long-term results of surgical intervention on the temporomandibular joint. J Craniomandibular Pract 1989;7:319-30.
- [14]. Sanders B. Arthroscopic surgery of the temporomandibular joint: treatment of internal derangement with persistent closed lock. Oral Surg 1986;62:361-4.
- [15]. McCain JP. Arthroscopy of the human temporomandibular joint. J Oral Maxillofacial Surg 1988;46:648-52.
- [16]. Nitzan DW, Dolwick MF. Arthroscopic lavage and lysis of the temporomandibular joint: a change in perspective. J Oral Maxillofacial Surg 1990;48:798-81.
- [17]. Nitzan DW, Dolwick MF, Martinez GA. Temporomandibular joint arthrocentesis. A simplified treatment for severe limited mouth opening. J Oral Maxillofac. Surg 1991;49:1163-7.
- [18]. Dimitroulis G, Dolwick MF, Martinez A. Temporomandibular joint arthrocentesis and lavage for the treatment of closed lock: a follow-up study. Br J Oral Maxillofac Surg 1995;33(1):23-6; discussion 26-7.
- [19]. Nitzan DW, Dolwick WF. An alternative explanation for the genesis of closed lock symptoms in the internal derangement process. J Oral Maxillofacial Surg 1991;49:810-5.
- [20]. Nishimura M, Segami N, Kaneyama K, Sato J, Fujimura K. Comparison of cytokine level in synovial fluid between successful and unsuccessful cases in arthrocentesis of the temporomandibular joint. J Oral Maxillofac Surg 2004;62(3):284-7; discussion 287-8.
- [21]. Sato J, Segami N, Nishimura M, Demura N, Yoshimura H, Yoshitake Y, et al. Expression of interleukin 6 in synovial tissues in patients with internal derangement of the temporomandibular joint. Br J Oral Maxillofac Surg 2003;41(2):95-101.
- [22]. Sato J, Segami N, Nishimura M, Kaneyama K, Demura N, Yoshimura H. Relation between the expression of vascular endothelial growth factor in synovial tissues and the extent of joint effusion seen on magnetic resonance imaging in patients with internal derangement of the temporomandibular joint. Br J Oral Maxillofac Surg 2003;41(2):88-94.
- [23]. Agus B, Weisberg J, Friedman MH. Therapeutic injection of the temporomandibular joint. Oral Surg Oral Med Oral Pathol 1983;55:553-5.
- [24]. Brusie RW, Sullins KE, White NA 2nd, Coffin PC, Parker GA, Anver MR, Rosenberger JL. Evaluation of sodium hyaluronate therapy in induced septic arthritis in the horse. Equine Vet J Suppl 1992; Feb(11):18-23.
- [25]. Gaustad G, Larsen S. Comparison of polysulphated glycosaminoglycan and sodium hyaluronate with placebo in treatment of traumatic arthritis in horses. Equine Vet J 1995;27(5):356-62.
- [26]. Peyron JG, Balazs EA. Preliminary clinical assessment of sodium hyaluronate
- [27]. injection into human arthritic joints. Pathol Biol (Paris) 1974;22(8):731-6.
- [28]. Lussier A, Cividino AA, McFarlane CA, Olszynski WP, Potashner WJ, De Medicis R. Viscosupplementation with hylan for the treatment of osteoarthritis: findings from clinical practice in Canada. J Rheumatol 1996;23(9):1579-85.
- [29]. Scale D, Wobing M. Viscosupplementation of OA knee. Curr Ther Res 1994;55(3):220-31.
- [30]. Kopp S, Wenneberg B, Haraldson T, Carlsson G. The short term
- [31]. effect of intra-articular injections of sodium hyaluronate and corticosteroids on temporomandibular joint pain and dysfunction. J Oral maxillofacial Surg 1985;43:429-35.
- [32]. Wenneberg B, Kopp S. Short-term effect of intra-articular injections of a corticosteroid on temporomandibular joint pain and dysfunction. Swed Dent J 1978;2:189-96.
- [33]. Kopp S, Carlsson G, Haraldson T, Wenneberg B. Long-term effect of intra-articular injections of sodium hyaluronate and corticosteroid on temporomandibular joint arthritis. J Oral Maxillofacial Surg 1987;45:929-35.
- [34]. Toller PA. Use and misuse of intra-articular corticosteroids in treatment of temporomandibular joint pain. Proc Roy Soc Med 1977;70:461-3.
- [35]. Chandler GN, Wright V. Deleterious effect of intra-articular hydrocortisone. Lancet 1958;2:661-3.
- [36]. Bertolami C, Gay T, Clark G, Rendell BJ, Shetty V, Liu C, et al. Use of sodium hyaluronate in treating temporomandibular joint disorder. J Oral Maxillofacial Surg 1993;51:232-42.
- [37]. Fader KW, Grummons DC, Maijer R, Christensen LV. Pressurized infusion of sodium hyaluronate for closed lock of the temporomandibular joint. Part I: a case study. Cranio 1993;11(1):68-72.

- [38]. Yustin D, Kryshalskyj B, Galea A. Use of Hylan G-F 20 for viscosupplementation of the temporomandibular joint for the management of osteoarthritis: a case report. J Orofac Pain 1995;9(4):375-9.
- [39]. Sato S, Oguri S, Yamaguchi K, Kawamura H, Motegi K. Pump-injection of sodium hyaluronate for patients with non-reducing disc displacement of the temporomandibular joint: two year follow-up. J Craniomaxillofac Surg 2001;29(2):89-93.
- [40]. Hepguler S, Akkoc YS, Pehlivan M, Ozturk C, Celebi G, Saracoglu A, et al. The efficacy of intra-articular sodium hyaluronate in patients with reducing displaced disc of the temporomandibular joint. J Oral Rehabil 2002;29(1):80-6.
- [41]. Dworkin SF, Huggin KH, Leresche L, Vonkroff M, Howard J, Truelove E, Sommer E. Epidemiology of signs and symptoms in temporomandibular disorders, clinical signs in cases and controls. J Amer Dent Assoc. 1990; 120: 273-281.
- [42]. Ghom A. Textbook of Oral Medicine. TMJ disorder, 2ed. JAYPEE BROTHER MEDICAL PUBLISHER (P) LTD 2010; p 602-637.
- [43]. Marchon V, Rehorova M, Sedyj N, Foltan R. Platelet rich plasma in temporomandibular joint osteoarthritis therapy: A 3 months follow-up pilot study. J Arthritis 2013;2-2.
- [44]. Ash MM. Current concepts in the etiology, diagnosis and treatment of TMJ and muscle dysfunction. J Oral Rehabil. 1986;13:1-20.
- [45]. Guard A, Nardini L, Masiero S, Marioni G. Conservative treatment of intra-articular injection of sodium hyaluronate. J Oral Rehabil. 2005;729-734. Rydell N, Balazs EA. Effect of intra-articular injection of hyaluronic acid on the clinical symptoms of osteoarthritis and on granulation tissue formation. Clin Orthop 1971;80:25-32. Helfet AJ, editor. Disorders of the knee. Philadelphia: Lippincott; 1982. p. 183-97.
- [46]. Manferendini D, Piccotti F, Guarda Nardini L. Hyaluronic acid in treatment of TMJ disorders: a systematic review of the literature. Cranio. 2010;28(3):166-76.
- [47]. EL Hakim IE, Elyamani AO. Preliminary evaluation of histological changes found in mechanical arthropathic temporomandibular joint (TMJ) exposed to an intrarticular Hyaluronic acid (HA) injection in rat model. J Craniomaxillofac. Surg. 2011;39(8):610-4.
- [48]. Abdullah B. Temporomandibular disorder in Mosul city. Alraf. Dent. J 2007;7:3 sp 18-23.
- [49]. Droukas B, Linde C, Carlsson. Relationship between the occlusal factors & signs & symptoms of mandibular dysfunction. Acta Odontol. Scand. 1984;42:277-283.
- [50]. Fischer L, Clemente J, Tambeli C. The protective role of testosterone in the development of temporomandibular joint pain. The Journal of Pain. 2007;8:5437-442.
- [51]. Wanman A, Agerberg G, Umea. Temporomandibular sounds in adolescents: A longitudinal study. Oral Surg Oral Med Oral Pathol. 1990;69:2-9.
- [52]. Yeung R, Chow R, Samman N, Chiu K. Short-term therapeutic outcome of intra-articular high molecular weight hyaluronic acid injection for non-reducing disc displacement of the temporomandibular joint. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006;102: 453-61.

**Table (1) Sample distribution.**

Age /Sex	Male	%	Female	%	Total	%
11-20	2	9.5	3	14.2	5	23.8
21-30	2	9.5	6	28.5	8	38.0
31-40	1	4.7	5	23.8	6	28.5
41-50	0	0	2	9.5	2	9.5
Total	5	23.8	16	76.2	21	100

**Table(2) TMJ clicking according to site.**

TMJ clicking	Right	%	Left	%	Right&Left	%	Total
	6	28.6	11	52.4	4	19.	21

$X^2=0.156$  df=2 p=NS

**Table (3) Osteoarthritis of TMJ in Trans cranial view.**

Osteoarthritis	+ ive	%	- ive	%	Total
Number	7	33.3	14	66.6	21

**Table (4) Gender distribution of Osteoarthritis of TMJ.**

Sex	Male	%	Female	%	Total
Osteoarthritis	1	14.2	6	85.8	7

Friedman test = .527 df=1 p=NS

Table (5) Clicking changes one week after first TMJ injection.

Click change	No. of patient	%
Slight improvement	9	42.9
Well improvement	8	38.1
No clicking	4	19
Worsen	0	0
Total	21	100

Table (6) Clicking changes one week after second TMJ injection

Click change	No. of patient	%
Slight improvement	6	28.6
Well improvement	8	38.1
No clicking	7	33.3
Worsen	0	0
Total	21	100

Table (7) Clicking changes one week after third TMJ injection

Click change	No. of patient	%
Slight improvement	1	4.8
Well improvement	2	9.5
No clicking	18	85.7
Worsen	0	0
Total	21	100

Table (8) Relationships of clicking before & one week after first ,second & third injections of Hyaluronic acid in TMJ.

Groups	Chi square test	Degree of freedom	Significance
O-A	2.000	2	.368 NS
O-B	2.000	2	.867 NS
O-C	26.000	2	0.00 **
OABC	45.765	3	.0000 **

O= Clicking score before injection of Hayluronic acid.

A= Clicking score one week after first injection of Hayluronic acid

B= Clicking score one week after second injection of Hayluronic acid

C= Clicking score week after third injection of Hayluronic acid.

NS= non significant difference. \*\*= highly significant difference.

$p \geq 0.005$

$p \leq 0.001$

Table (9) Relationships of clicking one week after first ,second & third injections of Hyaluronic acid in TMJ.

Groups	Chi square test	Degree of freedom	Significance
A-B	2.000	2	.867 NS
B-C	2.86	2	.000 NS
A-C	26.000	2	.000 **

O= Clicking score before injection of Hayluronic acid.

A= Clicking score one week after first injection of Hayluronic acid.

B= Clicking score one week after second injection of Hayluronic acid.

C= Clicking score one week after third injection of Hayluronic acid.

NS= non significant difference. \*\*= highly significant difference.

$p \geq 0.005$

$p \leq 0.001$



**Figure (1) Hyaluronic Acid Sodium Salt. Italy**

<b>TMJ Case sheet</b>			
<b>Name:</b>			
<b>Age:</b>			
<b>Sex:</b>			
<b>Chief complaint:</b>			
<b>TMJ sound:</b>	<b>right:</b>	<b>left:</b>	<b>both:</b>
<b>Injection :</b>	<b>Date:</b>		
<b>Pain:</b>	<b>0 1 2 3 4 5 6 7 8 9 10</b>		
<b>Joint sound:</b>	<b>Improved</b>	<b>slightly</b>	<b>well no clicking</b>
<b>Worsen</b>			
<b>Interincisal distance:</b>	<b>lateral right</b>	<b>lateral left</b>	
<b>x-Ray report:</b>			
<b>complications:</b>			

**Figure (2) TMJ Case sheet**





Figure (3) Intra articular injection of HA into the upper TMJ space.

