Assessment the Efficacy of Arthrocentesis with Corticosteroid and Arthrocentesis with Sodium Hyaluronate in Treatment Temporomandibular Joint Disorders: A Comparative Study

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Abstract

Background: Temporomandibular joint disorders (TMD) refer to a group of heterogeneous pain and dysfunction conditions involving the masticatory system, reducing life quality of the sufferers. **Aim of study:** The aim of the study was to evaluate the effectiveness of arthrocentesis with corticosteroid (betamethasone) injection and with sodium hyaluronate injection in treatment temporomandibular joint disorders, in conjunction with a stabilizing splint, for improving function and reducing pain, for preventing further deterioration of the TMJ dysfunction, to maintain improvements over time, and compare between them. **Patients and methods:** Fifty –four patients with TMJ disorders with age limit between 18 and 55 years of age, 9 males and 36 females, were enrolled in this study. Patients were randomly divided into two groups, in which one group received arthrocentesis with intra-articular corticosteroid (betamethasone) injection (1 ml), and another group received arthrocentesis with intra-articular sodium hyaluronate injection (1 ml) in superior joint space ,in single puncture. Patients were followed at regular interval of 7th day, one month, 3, 6, 9, 12 months (follow up) after last injection. **Results:** The mean age of patients was 8.873 ± 34.112 years in Group-A treat by betamethasone and10.973± 33.27 years in Group-A treat by sodium hyaluronate (ranged from 18.2 to 55.0 years).

Keywords: *Arthrocentesis, corticosteroid(betamethasone),Sodium hyaluronate, temporomandibular joint disorders*

Introduction

Internal derangement of the temporomandibular joint (TMJ) is a progressive disorder which usually starts with clicking associated with normal mouth opening (anterior disc displacement with reduction),to a stage where clicking gradually ceases but restricted mouth opening ensues (closed lock). This was attributed to a nonreducible anteriorly displaced articular disc acting as an obstacle to the gliding condyle[1] . In the meantime, the pathological changes were found in synovial membrane and synovial fluid. Hyaluronic acid is a principal component of the synovial fluid which plays an important role in nutrition, lubrication, anti-inflammation and cartilage protection and repairing. The synthesis, molecule weight, and concentration of hyaluronic acid are decreased during TMD and cause TMJ degenerative changes[2].TMD treatment can be divided into two categories: conservative method and surgical method. Among the surgical interventions, arthrocentesis is generally suggested for patients who are not responsive to conservative therapy[3].

Arthrocentesis is generally suggested for patients who are not responsive to conservative therapy[4]. Arthrocentesis is an easy, minimally invasive, highly efficient procedure designed to decrease joint pain and increase the range of mouth opening in patients with closed lock of TMJ[5].This improvement in clinical outcomes after arthrocentesis can be attributed to the facts that the flow of liquid under pressure in joint causes flushing of catabolites, distension of joint with breakage of adhesions, and mobilization of disc[6].

Corticosteroids (CSs) are anti-inflammatory drugs that interrupt the inflammatory and immune pathways. They have been used for both therapeutic and diagnostic purposes. Also, they showed their palleviating effects by suppressing inflammatory responses[7] .Intra-articular corticosteroid injection alone or after arthrocentesis provides long-term palliative effects on subjective symptoms and clinical signs of TMJ pain[8].

Hyaluronic acid (HA) is a polysaccharide which is produced by chondrocytes and synoviocytes of the joints. HA has been shown to improve and restore normal lubrication in joint, provide nutrition to the avascular articulating disc, and stabilize the joint. The therapeutic mechanism of action of HA is chondroprotection, effect on proteoglycan and glycosaminoglycan synthesis, anti-inflammatory, mechanical (viscosupplementation), effect on subchondral bone, and analgesic[2,9].

HA is a polysaccharide of low, medium, or high molecular weight ,its properties can vary in relation to its molecular weight and shape, and has been used successfully as a TMJ injection, to reduce inflammation , restore normal lubrication and cartilage repair[2].

These have motivated us to perform the current study , to evaluate the effectiveness of arthrocentesis with corticosteroid (betamethasone) injection and with sodium hyaluronate (low molecular weight) injection in treatment temporomandibular joint disorders, in conjunction with a stabilizing splint, for improving function and reducing pain, for preventing further deterioration of the TMJ dysfunction, to maintain improvements over time, and compare between them during 12 months following injection.

Patients and Method

Fifty –four patients with TMJ disorders with age limit between 18 and 55 years of age, 9 males and 36 females, were enrolled in this study. All patients were examined clinically and radiolographically. Based on the history and examination of patient a diagnosis of internal derangement was made. Patients were informed about the procedure, it is possible complication and about the material used and after the consent, patients were randomly divided into two groups, (27 in each group) and arthrocentesis was performed in each group following which 1 ml of betamethasone was given in first group and 1 ml of sodium hyaluronate in second group in superior joint space. Patients were followed at regular interval of 7th day, one month,3,6,9,12 months (follow up) after single injection. Assessment of clinical outcome was done in terms of reduction in pain (visual analog scale score), maximum mouth opening (MMO) in millimeters, painful/pain-free lateral or protrusive jaw movement, and clicking/crepitus of joint in pre-treatment visit about 1week before injection and post-treatment follows up visits . This study was performed in Samir Dental Clinics in Karbala city, from October 2016 to Jun 2019. All patients were diagnosed with TMD based on Clinical finding supported by CT scan. In this study , selection of patients based on the following

Inclusion Criteria :

1- Clinical diagnosis of anterior disc displacement(Limitation of mouth opening, Pre-auricular pain, temporal and occipital tenderness, headache,Persistence of symptoms at least for 3 months, Clicking).

2-CT scan(soft tissue window depend on disk density) diagnosis of anterior disc displacement with reduction.

Each patient received pharmacotherapy and then if no or delay response splint fabricated then if no progression in treatment, arthrocentesis with intra-articular betamethasone injection and arthrocentesis with intra-articular sodium hyaluronate injection in superior joint space were done .Patients were informed of the use of their medical records. Ethical approval for the study was obtained from the ethical committee.

Also, we exclude other patients according to **exclusion criteria :** Systemic disease, Arthritis or history of condylar trauma, Degenerative change of condylar head,Facial asymmetry, retrognathism, prognathism. Fibromyalgia,use of NSAIDS within 48 hours,allergy to study medications,edentulous subjects pregnancy or breast feeding,

The statistical analysis was carried out using Statistical Package for Social Sciences (SPSS Inc). All quantitative variables were estimated using measures of central location (mean) and measures of dispersion (standard deviation). As data was normally distributed, paired t-test was applied for comparison of every two visits of each group. All statistical tests were two-sided and performed at a significance level of α=.05.

Results

The mean age of patients was 8.873±34.112 years in Group-A treat by betamethasone and10.973± 33.27 years in Group-A treat by sodium hyaluronate (ranged from 18.2 to 55.0 years). A detailed sex and age distribution is shown in (Table- 1).more reducing of mean and ±SD(standard deviation)values of the pain intensity, maximum mouth opening, joint click and deviation on opening were recorded in post-treat at 12 month follow-up visit of Group -B(SH)than pre-treat visit ,followed by Group-A(CS) is shown in (Table-2).

Inter study visits comparisons of each group regarding of the pain intensity, maximum mouth opening, deviation mouth opening and joint click revealed, Highly signifiant differences between pre-treatment visit and post-treat at 12 month follow-up visit after the single injection in both groups (Table-3) HS differences between post-treat at 12 month follow-up visit of Group -B(SH)and post-treat at 12 month follow-up visit of Group - A(CS) (Table -4).

Table 1: Sex and age distribution

Group	**Age**	**Gender**	
	mean±SD	**male**	**Female**
Group-A treat by betamethasone	8.873± 34.112	5	22
Group-A treat by sodium hyaluronate	10.973± 33.27	4	23

Table-2: Descriptive statistics of the pain intensity, maximum mouth opening, joint click and deviation on opening of mouth

Clinical Para meter	**Group A Pre-treat mean±SD**	**Group-A Post-treat at 12 month mean±SD**	**Group-B Pre-treat mean±SD**	**Group-B Post-treat at 12 month mean±SD**
Pain intensity	7.27±0.273	1.85±0.260	7.77±0.381	0.36±0.231
Maximum mouth opening	35.16±0.259	41.02±0.281	35.48±0.411	43.67±0.227
Joint click	8.41±0.440	1.60±0.247	8.79±0.352	0.45±0.404
Deviation of mouth	7.77±0.278	1.94±0.249	8.38±1.571	0.41±0.345

Table-3: Comparisons between pre-treatment visit and follow-up visits of each group in the pain intensity, maximum mouth opening, joint click and deviation on opening of mouth

Clinical Para meter	**Group A Pre-treat vs. Post-treat at 12 month**			**Group B Pre-treat vs. Post-treat at 12 month**		
	T-test value	**Df**	**P-value**	**T-test value**	**Df**	**P-value**
Pain intensity	84.043	26	0.000	90.292	26	0.000
Maximum mouth opening	80.995	26	0.000	112.061	26	0.000
Joint click	62.479	26	0.000	95.923	26	0.000
Deviation of mouth	24.963	26	0.000	88.499	26	0.000

***Df: degree of freedom**

Table -4: comparisons between post-treat at 12 month follow-up visits of each group in the pain intensity, maximum mouth opening, joint click and deviation on opening of mouth

Clinical Para meter	Group-A Post-treat at 12 month vs. Group-B Post-treat at 12 month		
	T-test value	Df	P-value
Pain intensity	21.871	52	0.000
Maximum mouth opening	37.257	52	0.000
Joint click	12.291	52	0.000
Deviation of mouth	18.209	52	0.000

Discussion

In the present study, clinical parameters such as pain, MMO, lateral and protrusive movement of jaws, and improved significantly in both the treatment arthrocentesis with intra-articular injection corticosteroid and arthrocentesis with Sodium hyaluronate (SH). However, more significant improvement in pain, MMO, lateral and protrusive movement was observed in patients receiving arthrocentesis with intra-articular SH injection .

The outcome of the recent study is agree with systematic review of Eduardo etal.2013[10], they were found that the effects of intra-articular injections with sodium hyaluronate are similar to those regarding the injections with corticosteroids to control TMJ internal derangements at short and medium terms , while in long-term treatments, injections with sodium hyaluronate showed better results.

The result of recent study is agree with study of Kapusuz G.et al. 2014[11] ,that studied effectiveness intra-articular injections of hyaluronic acid, tenoxicam and betamethasone on the relief of temporomandibular joint disorder complaints , they found that HA produced better pain relief scores when compared to the other anti-inflammatory agents studied.

Radiological assessment preoperatively and postoperative 12 months follow-up with CBCT was showed significant difference. The erosion on condyles disappeared in the patients in both groups, it was significant, and showed radiological thin layer of new bone formation, remodeling of condyles and glenoid fossa in patients who treated by arthrocentesis with betamethasone ,and cortical bone formation and remodeling of severe degenerative changes at 12months follow-up in patients who treated by arthrocentesis with sodium hyaluronate, it is highly significant in patients receiving arthrocentesis with sodium hyaluronate injection than significantly in patients receiving arthrocentesis with betamethasone.

The result of recent study is agree with study of Li et al. 2015[12] ,that studied changes of TMJ disorders in CBCT in patients who received HA injection in superior joint and reported cortical bone formation and remodeling of severe degenerative changes by 9 months follow-up.

This improvement in clinical outcomes after arthrocentesis can be attributed to the providing viscosupplementation to joints, HA has anti-inflammatory effects on inflammatory mediators , and protection against the disintegration of proteoglycans and cytotoxity induced by oxygen free radicals. IL-1β is the key mediator in anti-inflammatory effects of HA and is regulated through HA-CD44 binding. IL-1β suppression results in downregulation of matrix metalloproteinases which also aids in anti-inflammatory effects of HA and further suppression of pro-inflammatory mediators IL-8, IL-6, prostaglandin E2, and TNF-α provides anti-inflammatory effects of intra-articular HA treatment[6]. In addition, it affects leukocyte adhesion, proliferation, migration and phagocytosis ; it directly influences the control mechanism of monocyte activation; in the cartilage it has been seen to suppress degradation of the cartilaginous matrix by fibronectin fragments[9,13,14].

Hyaluronic acid is found in the extracellular matrix of several connective tissues of high molecular weight, including joint cartilage and synovial fluid .In such

sites, HA molecules are predominantly synthesized ,It is synthesized by synoviocytes, fibroblasts and chondrocytes present in the connective tissue, In addition, it is the largest natural component of SF and an important component of the articular cartilage. Moreover, activates intrinsic repair processes of the cartilage and normalizes the endogenous production of HA by the synoviocytes, stabilize the extracellular matrix, stimulate the proliferation of chondrocytes, regulate the production/degradation of type II collagen,and metabolic HA activity in cell renewal helps the nutrition of avascular zones of the disk and joint cartilage through its combination with glycosaminoglycans coming from proteoglycans produced by chondrocytes[9,14].

It is the major component of the synovial fluid and has an important role in lubrication, Its action stems from the ability of the polysaccharides to connect to each other when they are in solution, forming a network that provides a high degree of viscosity to the SF so that it reduce joint friction coefficient ,that is the main risk factor for degenerative joint pathologies , maintaining intra-articular homeostasis by promote a better distribution of forces and load absorption of articular tissues[6,10].In cases of inflammatory and degenerative changes of joints, the concentration and molecular weight of HA acid reduced, theraputical effect sodium hyaluronate increases the concentration and molecular weight of HA in the synovial fluid,restoring tissues lubrication and nutrition as well as minimizing mechanic stress[9].Moreover, intra-articular SH injection is avoided sensitization of pain receptors in joints disorders ,by modulating neurotransmission and vasodilatation processes, provides an analgesic effect by blocking receptors and endogenous substances that cause pain in synovial tissues and. In addition, it promotes a release of adhesion areas between the articular disc and the mandibular fossa, increasing joint mobility and allowing better synovial fluid circulation[6,9,10].

Corticosteroids have a potent anti- inflammatory effect on synovial tissue and are known to reduce effusion, decrease pain and bring about an increase in range of motion of synovial joints[15].

Glucocorticoids have a very original mechanism of action, essentially genomic (transcriptional) and characterized by the activation (transactivation) or inhibition (transrepression) of numerous target genes. These molecules act in many cells, including not only innate immunity cells (macrophages, granulocytes, mast cells) and adaptive immunity cells (lymphocytes), but also other cells (fibroblasts, epithelial and endothelial cells)[10].

Therefore arthrocentesis with sodium hyaluronate injection is more effectiveness than arthrocentesis with betamethasone injection in therapeutic and return TMJ of healthy status in long term palliative effects .

Conclusion

In this study, the technique of arthrocentesis using 0.9% normal saline solution with betamethasone injection, with occlusal splint in group A and arthrocentesis with intra-articular injection of sodium hyaluronate in superior joint space with occlusal splint wear in group B , where showed therapeutic benefits , simplicity , safety , patients acceptance of injection technique and lack of significant side effects and complication. Both techniques increased maximal mouth opening, lateral movements, and function, while reducing TMJ pain and noise. Although patients benefitted from both techniques, arthrocentesis with injection of SH is significantly superior to arthrocentesis with betamethasone injection .As well as, Radiological finding is showed highly significant in patients receiving arthrocentesis with HA injection than significantly in patients receiving arthrocentesis with corticosteroid .

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