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Comparative Evaluation of the Effect Usage of Hyaluronic Acid with that of Dexamethasone as Intra Articular Injection in Temporomandibular Joint Arthrocentesis - A Prospective Clinical Study

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Background and aim: The temporomandibular joint is a complex ginglymoarthroidal that has several associated disorders. Several treatment modalities have been proposed in the management of temporomandibular joint disorders. One of the simplest and most minimally invasive of them is Arthrocentesis or lavage of the joint. In addition to the irrigation of the joint, certain medications or supplements are utilised to relieve the symptoms and improve the outcome of the procedure. Methods: A total of twenty four participants were included in this study, divided into two groups (n=12). Patients in each Group I underwent arthrocentesis and an intra-articular administration of dexamethasone, while Group II included patients receiving intra-articular administration of hyaluronic acid after the procedure. The post operative pain levels using the Visual Analogue Scale (VAS) scores, maximum mouth opening and the mandibular function was evaluated using the Mandibular Function Impairment Questionnaire (MFIQ) at baseline, one week and one month. The statistics were analysed using the t tests and Mann-Whitney U test for inter group analysis, and paired t test and Wilcoxon test for analysis of effect of the intervention within the group. Results: Patients who received hyaluronic acid intra-articular injection had lesser VAS scores when compared to patients who were administered dexamethasone, and were statistically significant (p value < 0.05). The maximal mouth opening and MFIQ scores were comparatively better in Group II however not statistically significant. Conclusion: The study shows good results with both intra articular injections - dexamethasone and hyaluronic acid in improving mandibular function and relieving pain, however, arthrocentesis with dexamethasone has shown to provide superior pain relief.

Keywords: temporomandibular joint pain, hyaluronic acid, dexamethasone, mouth opening,

arthrocentesis, intra articular drugs.

1. Introduction

Temporomandibular joint disorders (TMD) refer to pain originating from the facial region [1]. It usually involves both the joint and the muscles. It is generally diagnosed by facial and jaw pain, pain on jaw movements, restricted mouth opening, joint sounds and clicking or locking of the joint [2]. The etiology for TMDs is unclear and may arise due to occlusal discrepancies, para functional habits and emotional stress. It is important to analyse and examine the entire masticatory apparatus to arrive at a proper diagnosis [3]. Based on history and examination, temporomandibular joint disorders have been classified into three types: inflammatory disease like synovitis, internal derangement (ID) and osteoarthritis (OA) [4].

TMDs do not cause mortality but can decrease the functional capacity of the patient. TMDs have been treated using both non-surgical and surgical methods [5]. The non-surgical methods include physical therapy, occlusal appliances, drug therapies (including intra-articular injections), thermal therapy, lifestyle modifications, laser therapy, etc. In case these procedures prove to be ineffective, then surgical procedures are planned. Surgical procedures may be invasive or minimally invasive. The common invasive surgical procedures are menisectomy, disc repositioning, and condylotomy [6]. The important drawback of the surgical procedures is that they are invasive and may lead to other complications. The minimally invasive surgical procedures include arthroscopy or arthrocentesis. Arthrocentesis or lavage of the temporomandibular joint, an evolving alternative to surgery is a simple procedure of irrigating the joint without visualising it [7].

Intra-articular drugs injected into the joint space nourish the joint space and hasten the process of regeneration of the joint tissues and stimulate repair of the damaged tissues [8]. Numerous studies have been undertaken to evaluate the effect of various intra-articular drugs on TMDs either with or without arthrocentesis [9]. Below are some of the drugs that have been used as a supplement to arthrocentesis.

The aim of the present study is to evaluate and compare the efficacy hyaluronic with dexamethasone as intra-articular injection in temporomandibular joint arthrocentesis. The objective of the study is to analyse the reduction of pain and improvement of mandibular function with usage of two different intra-articular irrigants.

2. Materials and methodology

Study setting

The study participants were those who reported to the Oral and Maxillofacial Surgery Department with complaints of temporomandibular joint pain and difficulty in mouth opening, seeking treatment for the same. The study has been approved by the Ethics committee of the institute (IHEC/SDC/OMFS-2104/23/084). Each of the study participants were explained about the study and an informed consent was obtained from them.

Inclusion criteria

Participants included those from 20 to 40 years of age who had presented with pain in front of the ear or in the TMJ region, with reduced or difficulty in mouth opening. Patients who had undergone conservative management and yet had no response to treatment were included.

Exclusion criteria

Patients with a history of being operated with open joint surgeries or any degenerative disorders of the joint were excluded. Patients with systemic diseases and patients with irregular follow-up were excluded.

Intervention

A total of twenty four patients with TMJ disorder symptoms were enrolled into the study. These participants were equally distributed into two groups - Group I (n=12) and group II (n=12). The patients were assigned into two groups randomly based on sealed opaque envelopes that were prepared by the primary investigator. The study was double blinded, i.e., both the operator and the participant were unaware of the study grouping. All the participants underwent TMJ arthrocentesis following which they received an intra-articular injecion. Group I participants received dexamethasone as the irrigant and Group II participants were administered hyaluronic acid.

The procedure was carried out under local anaesthesia and proper aseptic conditions. The surgical area of interest was scrubbed with an antiseptic solution and the Holmlund - Hellsing's line was marked from the lateral canthus of the eye to the tragus of the ear. Two points were marked on the line corresponding to the entry points of the two needles (Picture 1). The first point is marked 10 mm from the tragus of the ear and 2 mm inferior to the line. The second point was marked 20 mm from the tragus and 10 mm inferior to the line. An 18 gauge injection needle was inserted into the first point to reach the upper joint cavity. The position was confirmed by injecting saline and aspiration. A second needle was inserted into the other point and outflow of saline was observed. The procedure was then carried out by injecting 100 ml of Ringer's lactate solution passively through one needle and outflow was observed through the other needle. Once this was completed, the second needle was removed and depending upon the randomisation, Group I participants received an intra-articular injection of dexamethasone while those in Group II received hyaluronic acid injection. The first needle was also removed and hemostasis was achieved. Sterile dressing was placed over the site of injection. All the participants were advised to be on a soft diet and were prescribed an oral muscle relaxant for the first week and painkillers for the first two days.

Picture 1: Markings for Arthrocentesis - Holmlund - Hellsing's line

Assessment

Each of the parameters were measured at the baseline, at the end of one week and one month post operatively. The pain scores were measured using the Visual Analogue Scale from 0 to 10 in increasing order, wherein 0 means least or no pain and 10 refers to terrible unbearable pain. The maximum mouth opening was measured as the inter-incisial distance in mm. Each of the patients were asked questions from the MFIQ and each of the questions had a scale from 0 to 5. The sum of the scores were compared amongst the participants.

Statistical Analysis

Data were analyzed using SPSS for Windows version 23.0. Categorical variables were compared using Chi-square test. Inter group analysis was done using Wilcoxon test and paired t tests before and after the treatment. Analysis between the groups was done using Mann-Whitney U test and Student's t-test. A p value of <0.05 was considered significant.

3. Results

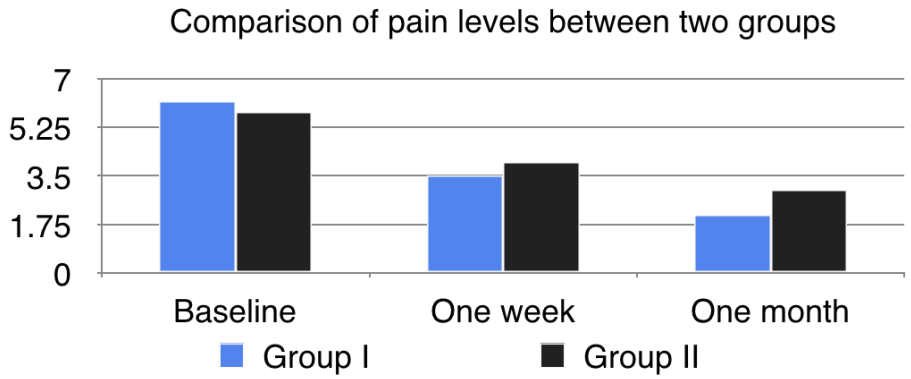
The study consists of two groups, with each of the groups having 12 participants. The baseline values of pain measured using the Visual Analog scale were comparable in both groups and were not statistically significant (p value > 0.05). The patients in Group II (Hyaluronidase) showed a slight improvement in the pain levels at the end of 1 month, while those in Group I (Dexamethasone) showed comparatively better reduction in the pain levels, with statistically significant values (p value = 0.0167). Throughout the study, the scores were consistently lesser in Group I, thus proving that dexamethasone has better pain reliving efficiency compared to hyaluronidase (Table 1) (Graph 1).

On the other hand, mouth opening improved steadily across the timeline in both groups. At the end of one month, the maximum mouth opening values in Group II were lesser than that of Group I, but were statistically significant (p value > 0.05) (Table 2) (Graph 2). Similarly, participants of Group I showed a lesser disability in mandibular function when compared to patients in Group II, however not statistically significant (p value > 0.05). In this study, no

complications or any adverse effects were reported due to these drugs (Table 3) (Graph 3).

Table 1: Comparison of pain levels using VAS scores between two groups

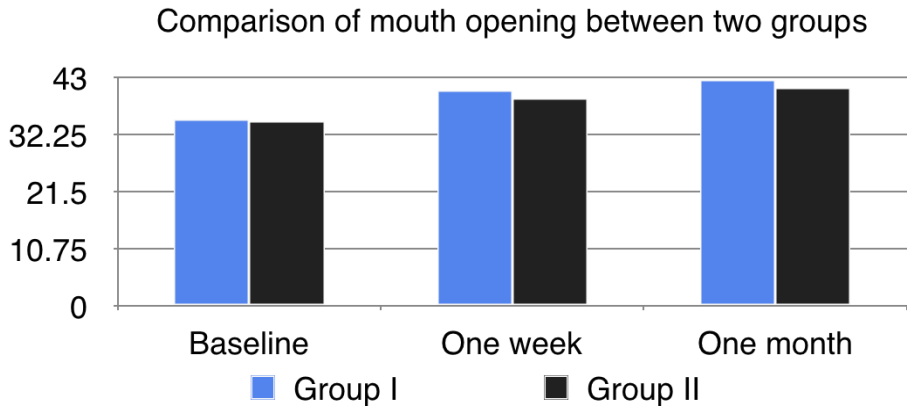
Group/ VAS scores	Baseline (Mean ± SD)	One Week (Mean ± SD)	One Month (Mean ± SD)
Group I (Arthrocentesis + Dexamethasone)	6.2 ± 1.5	3.5 ± 1.2	2.1 ± 0.9
Group II (Intra-articular Hyaluronic Acid)	5.8 ± 1.2	4.0 ± 1.1	3.0 ± 0.8
p value	0.4783	0.2989	0.0167



Graph 1: Comparison of pain levels using VAS scores between two groups

Table 2: Comparison of maximum mouth opening between two groups

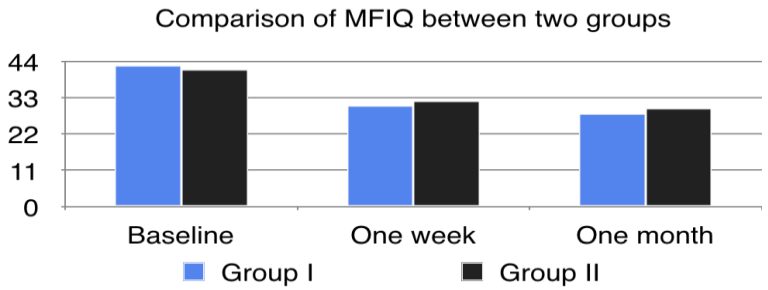
Group/ Maximum mouth opening (mm)	Baseline (Mean ± SD)	One Week (Mean ± SD)	One Month (Mean ± SD)
Group I (Arthrocentesis + Dexamethasone)	35.1 ± 5.2	40.5 ± 4.7	42.3 ± 5.1
Group II (Intra-articular Hyaluronic Acid)	34.7 ± 4.9	39.0 ± 4.2	41.1 ± 4.5
p value	0.8480	0.4186	0.5473



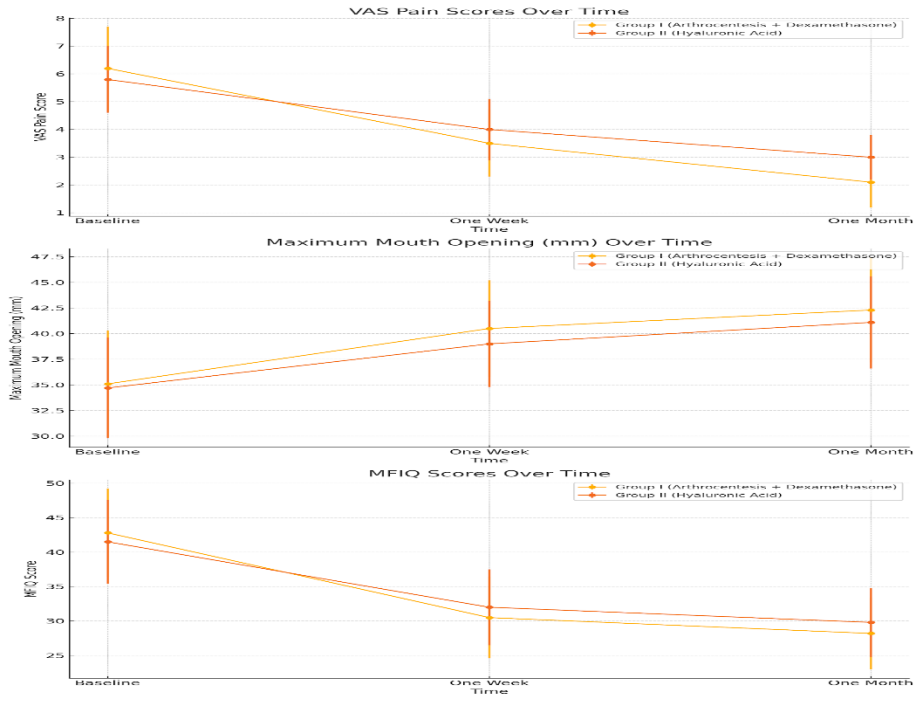
Graph 2: Comparison of maximum mouth opening between two groups

Table 3: Comparison of mandible disability using MFIQ scores between two groups

Group/ MFIQ Scores	Baseline (Mean ± SD)	One Week (Mean ± SD)	One Month (Mean ± SD)
Group I (Arthrocentesis + Dexamethasone)	42.8 ± 6.4	30.5 ± 5.9	28.2 ± 5.2
Group II (Intra-articular Hyaluronic Acid)	41.5 ± 6.1	32.0 ± 5.5	29.8 ± 5.0
p value	0.6156	0.5261	0.4505



Graph 3: Comparison of mandible disability using MFIQ scores between two groups



Graph 4: Comparison of all parameters between two groups

4. Discussion

Temporomandibular joint (TMJ) arthrocentesis was first described by D. W. Nitzan in 1991, however mentions about knee arthrocentesis came to be seen as early as 1552. D. W. Nitzan

refers to the procedure as the simplest form of surgical therapy with the aim of washing out inflammatory mediators, releasing the articular disc, and disrupting adhesions between the surface of the disc and the joint fossa by hydraulic pressure of the lavage solution [10]. The procedure helped to relieve symptoms i.e., to decrease pain and increase mouth opening [11]. The current applications of arthrocentesis are in the management of closed lock, anterior disc displacement and degenerative joint diseases. Joint diseases cause enzymatic breakdown of the joint matrix caused by inflammatory mediators. This results in residual microscopic debris and joint adhesions [12]. Arthrocentesis or lavage of the joint helps to remove such debris and adhesions and restores the normal disc, fossa and lubricating properties of synovial membrane [13].

Hyaluronic acid is a natural high molecular weight glycosaminoglycan that is found in the synovial fluid of all arthritic joints produced by chondrocytes and the synoviocytes. It is a protective layer responsible for movement of the joints. In most TMDs, there is a deficit of hyaluronic acid that caused friction and restricts normal movements [14]. Thus, it's supplementation in the form of intra-articular injections will help to replenish the synovial fluid and production of endogenous hyaluronic acid. It stimulates cartilage regeneration by promoting chondrocyte proliferation and differentiation. It is available in different forms, molecular weights, costs and half lives and each of them have their own advantages [15].

Corticosteroids suppress the pro-inflammatory mediators and increase the expression of anti-inflammatory mediators [16]. This helps in reducing inflammation related disorders of the joint. Generally, corticosteroids are capable of crossing the cell membrane and activating certain steroid receptors which carry out the required functions [17]. Corticosteroids are used in conjunction with hyaluronic acid to accentuate its actions.

In a study conducted by Björnland et al. [18], the authors assessed the effects of intra-articular injections of betamethasone, a corticosteroid, on pain intensity, mandibular vertical opening, and protrusion in patients with TMJ disorders. Their findings suggested that corticosteroids could potentially alleviate pain and enhance function in these patients. In addition, Moystad et al. [19] performed a CT evaluation on these patients at baseline and six months following intra-articular injections of the corticosteroid betamethasone; they observed progression (reparative remodeling), regression, and no changes in the osseous abnormalities of seven (36.7 %), four (21.1 %), and eight (42.1 %) TMJs, respectively.

Patients with TMJ arthritis who reported discomfort and tenderness upon palpation responded well to intra-articular injections of corticosteroid (betamethasone), as evidenced by the considerable reduction in both subjective symptoms and clinical indicators of arthritis observed by Wenneberg et al. [20] and Kopp et al. [21].

Giraddi et al. [22] assessed the effects of arthrocentesis following 1 mL of CS injection (betamethasone) on pain (VAS) and MIO before and after treatment up to 6 months later, in the cases with internal derangement of TMJ, and the changes in these parameters are similar to the changes observed in our CS plus arthrocentesis group. They reported significant decreases in pain (decreased from 6.75 VAS score to 1.13 VAS score) and significant increases in MIO (increased from 35.25 to 40.75 mm) after the treatment up to 6 months. We observed an increase in painless mouth opening (average 8.5 mm) and a decrease in pain complaints (average 4.17 VAS score) during the12-month follow-up period.

According to Bertolami et al. [23], the mechanical action of hyaluronidase was responsible for the evident and continuous advantage that a single intra-articular injection of the drug provided for at least half a year, especially in patients with disc displacement with reduction.

5. Conclusion

Arthrocentesis is a relatively simple and popular treatment for the management of temporomandibular joint disorders. The procedure can be performed when all other invasive treatment modalities have failed. Both dexamethasone and intra-articular hyaluronic acid are effective in reducing pain and improving mandibular function in patients with TMJ disorders. However, Arthrocentesis alone is also good enough and the intra-articular drug is just an adjunct.

Conflict of interest:

There are no conflicts of interest.

Funding statement:

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Ethical statement:

Not applicable.

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