Official Dental Journal of Suez Canal University
DENTAL SCIENCE Updates
Print ISSN 2636-3836
Online ISSN 2636-3844
www.dsujournals.ekb.eg
DSU — Vol. 5, No. 1, March (2024) — PP. 59:67

COMPARATIVE STUDY BETWEEN MELOXICAM AND PIROXICAM INTRA-ARTICULAR INJECTION AFTER ARTHROCENTESIS FOR MANAGEMENT OF TEMPOROMANDIBULAR JOINT INTERNAL DERANGEMENT

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DOI: 10.21608/dsu.2024.193841.1172
Manuscript ID: DSU-2304-1172

KEYWORDS

Internal derangement, TMJ, Arthrocentesis, Piroxicam and Meloxicam

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ABSTRACT

Introduction: Internal derangement of the temporomandibular joint is the term used to describe a pathologic entity that obstructs the smooth function of the temporomandibular joint. Arthrocentesis is most used in patients not responding to conservative approach. **Aim**: The aim of study was designed to compare between cyclooxygenase-2inhibitor (meloxicam) and non-steroidal anti-inflammatory (piroxicam) in the management of patients with TMJ internal derangement. **Patients and methods:** The present study was conducted on 12 adult joints with impaired jaw movements, limited joint function, limited mouth opening, pain with movement of the temporomandibular joint and TMJ noise (Clicking at the affected joint) and divided randomly into two equal groups 6 joints in each group. Group 1: where arthrocentesis were performed for the affected joint followed by intraarticular injection of one ml of piroxicam. Group 2: where arthrocentesis were performed for the affected joints followed by intraarticular injection of one ml. of Meloxicam. **Results:** Intra-articular injection of piroxicam is effective more than Meloxicam in long term management of pain of the joints and both of them give statistically significant result in both management of clicking sound and mouth opening**.** **Conclusion:** Arthrocentesis followed by piroxicam is safe and more effective than Meloxicam treatment of temporomandibular joint dysfunction.

INTRODUCTION

Temporomandibular disorders (TMDs) represent a set of musculoskeletal disorders associated with the masticatory system[(1)]. Internal derangement (ID) is the most common disorder of (TMJ), it is an intra-articular condition characterized by disruption in the normal relationship of the articular disc to the articular eminence and the condyle when the joint is at rest or in function. ID of the TMJ includes patients with disc displacement with reduction and without reduction. Patients with ID of the TMJ often complain of pain, joint clicks and limitation of mouth opening [(2)].

The disc which is a vital component of the TMJ sometimes undergoes displacement. Medial and lateral displacement of the disc may occur, but the most common form of internal derangement is the anterior disc displacement with or without reduction. The inability of the disc to

return to the initial position in the open position is termed disc displacement without reduction[3].

Pain is the most common symptom usually present in masticatory muscles and/or temporomandibular joints (TMJs) but stimulated by mandibular movement and stomatognathic functions. In addition to the joint noise (Clicking sound), tenderness and pain in joint and muscle is usually revealed on examination of the patients suffering from ID.[4]Untreated disc displacement (DD) leads to degenerative joint disease. Osteoarthritis (OA) is characterized by abrasion and articular cartilage deterioration, as well as by remodeling thickening of the subjacent bone. It causes secondary inflammatory reactions, like joint effusion, revealed by magnetic resonance imaging (MRI).

Arthrocentesis is most used in patients not responding to conservative approach. It's considered ease, simple, cheap and minimally invasive technique for the treatment of TMJ dysfunction[5].

The ID of the TMJ was often accompanied by the increased expression of COX-2 in both synovium and synovial fluid. This allows the accumulation of prostaglandins in synovial fluid, accompanied by peripheral Vaso permeability, that may lead to swollen synovium. Patients may become suffering from limited jaw motion and associated pain around the TMJ in this stage[6]. Arthrocentesis reduce the pain through removing the adherences, eliminates the negative pressure in the joint, washes the inflammatory mediators, distends the joint space, recovering the space of the joint disc and fossa, changes the viscosity of the synovial liquid[7]. The aim of this study was to evaluate the effect of Meloxicam and Piroxicam Intra-Articular Injection after arthrocentesis for Management of Temporomandibular Joint Internal Derangement.

PATIENTS AND METHODS

The present research was waived from the approval of the Research Ethics Committee (REC) of the Faculty of Dentistry, Suez Canal University with protocol number 29/2017. The present study was conducted on 12 adult joints. The patients were selected from the outpatient clinic of the Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Suez Canal University with impaired jaw movements, Limited joint function, limited mouth opening, Pain with movement of the temporomandibular joint and TMJ noise (Clicking at the affected joint). Patients were divided randomly via research randomizer software into two equal groups **Group 1: (Piroxicam group)** this group consisted of 6 cases with T.M.J.D., where arthrocentesis were performed for the affected joint followed by intraarticular injection of one ml of piroxicam (*feldene 20 mg ampules by Global Pharmaceutical Industries, for: Pfizer Egypt)* **Group 2: (Meloxicam group)** This group consists of 6 cases with T.M.J.D, where arthrocentesis were performed for the affected joints followed by intraarticular injection of one ml. of Meloxicam (*Anti-Cox-2 II 15 mg ampules by Adwia co.10th of Ramadan City-Egypt*)

Inclusion criteria:

1. Internal derangement of temporomandibular joint with or without disc reduction.
2. Limited temporomandibular joint function.
3. Limited mouth opening.
4. Pain with movement of the temporomandibular joint.
5. Clicking at the affected joint.

Exclusion criteria:

1. Patients had previous arthroscopy, arthrocentesis or previous surgery.
2. Pregnant or lactating women.
3. Patients with systemic diseases (ASA III, IV, V).
4. Patients allergic to any components of the injecting solution.
5. Patients with prosthetic joint replacement.

All selected patients were informed about the details of the study, signed an informed consent. Personal data of all patients were taken. Medical history including presence of any medical problems, diseases, medications taken, and the chief complaint taken briefly.

Preoperative examination included the following parameters:

1. Maximal mouth opening (MMO): Maximum mouth opening was measured by using calibrated digital caliper that measures the inter-incisal distance between upper and lower incisors at maximum opening (Figure 1-A).
2. Pain scores (VAS): All patients reported their pain intensity by using visual analogue scale (VAS), graduated from 0 to 10 with two end-points marked score 0 indicated no pain and score 10 means the worst pain ever experienced.
3. Clicking sounds: Joint sounds were evaluated preoperatively. The presence or absence of joints sounds (clicking, popping, or crepitus) in the TMJ were determined with stethoscope auscultation over each joint during active opening and closing jaw movements and, during palpation of the pre-auricular and intra-auricular spaces.
4. Diagnostic Imaging: All selected patients were subjected to magnetic resonance imaging (MRI) to evaluate structure of articular surface, disc form, and location during close &open positions, or presence of joint effusion (Figure1-B, 1-C).

Operative Management:

Patients who fulfill the criteria of selection signed the informed consent and prepared to undergo arthrocentesis procedure using Nitzan technique[7] under complete aseptic precautions, and under local anesthesia using (*Artinibsa anesthetic solution carpule 1.8ml, 4% articaine with 1/100,000 epinephrine manufactured by Inibsa*).

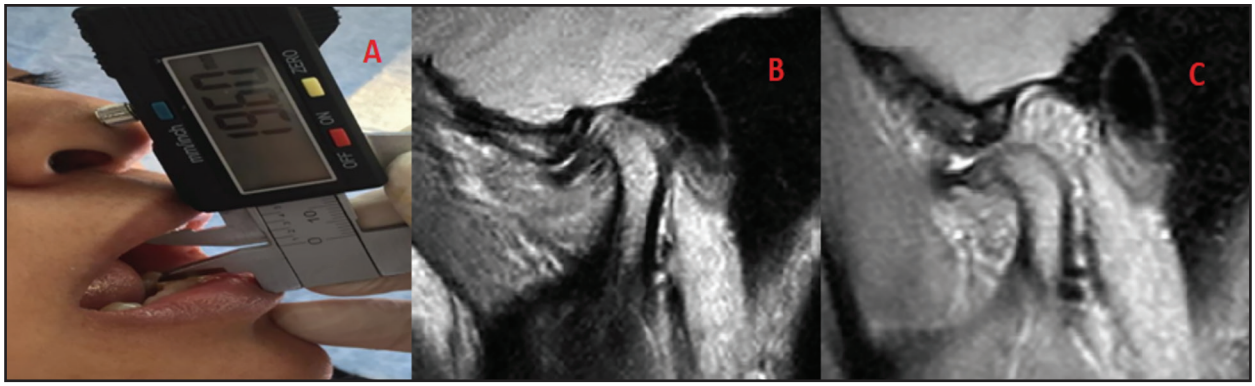

Fig. (1) (A) Clinical Photograph showing preoperative measurement of maximal mouth opening (B) Preoperative T1 magnetic resonance imaging (MRI), sagittal view showing anterior displacement of the disc in a closed position. (C) Preoperative T1 magnetic resonance imaging (MRI), sagittal view showing anterior displacement of the disc in an open position.

Operative Procedure:

The surgical armamentarium was prepared (Figure 2-A), Betadine solution supplied by (*Nile Co. for pharmaceuticals and chemical industries Cairo-A.R.E.R.C.C.*) was applied to the target site.

The patient seated at angle 45 degree, with the head turned to the contra lateral side to provide an easy approach to the joint to be treated. Needle insertion points were marked on the skin according to the technique of Nitzan et al [7].

The external auditory canal was protected from fluid and blood accumulation using a cotton pledget. A line was drawn from the lateral canthus of the eye to the most posterior and central point on the tragus of the ear (Holmlund-HellsingLine). Entry points were marked along this canthal–tragus line. The first point was corresponding to the glenoid fossa. It was marked 10 mm from mid tragus and 2mm below this point. The second point was corresponding to articular eminence. It was marked 10 mm from the first point and 10 mm below this point (Figure 2-B).

The procedure was achieved under local anesthesia at chair-side via auriculo-temporal nerve block and infiltration to the pre-auricular area for joint penetration (Figure 2-C).

Patients were asked to open their mouth as wide as possible and mandible was held in protruded position. A 19-gauge needle was then inserted at the first point in an anterior-medial-inferior direction. A syringe filled with Sodium Chloride (saline solution) 0.9% manufactured by (*Egypt Otsuka Pharmaceutical Co., S.A.E. 10th of Ramadan city, A.R.E.*) was injected under pressure into the superior joint space through the first needle. Approximately 150-200 ml of saline was injected for lavage with jaw movements (Figure 2-D).

With the needle in place, the syringe was removed. Another 19-gauge needle was then inserted at the second point to establish a free flow of solution through the joint space (Figure 2-E). After the procedure was completed the second needle was

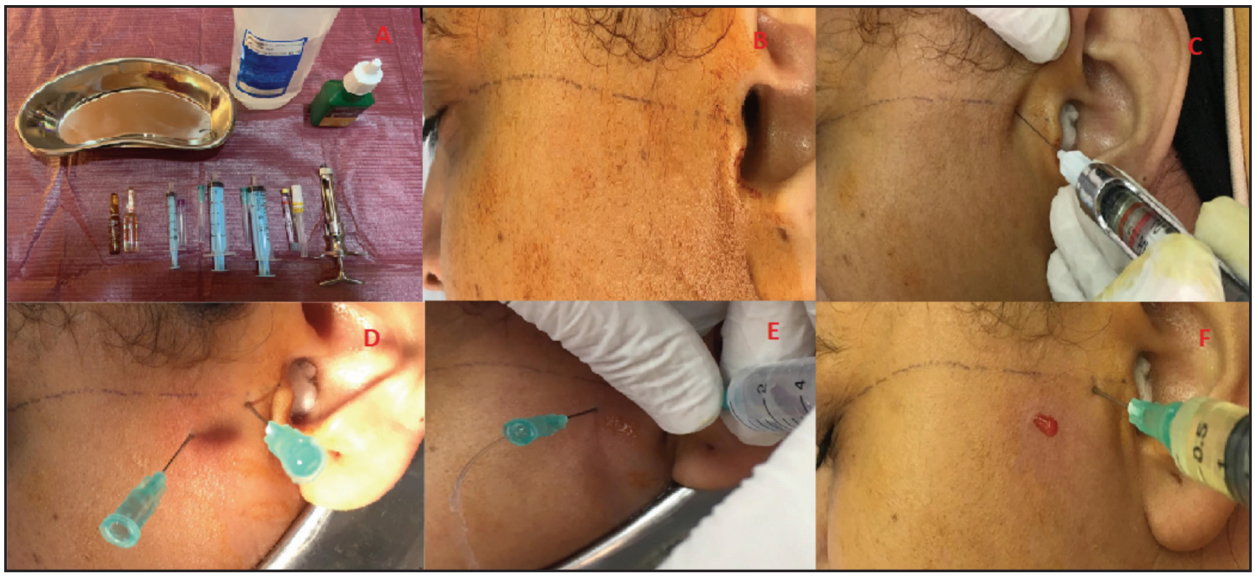

Fig. (2) (A) The used armamentarium. (B) Betadine application and canthal–tragus line (Holmlund-HellsingLine) (C) auriculo-temporal nerve block technique. (D) The insertion of two needles within superior compartment of the joint (E) The outflow of the mixture of synovial fluid and saline solution during arthrocentesis (F) Injection of the drug.

removed and the patient's lower jaw was gently manipulated in the vertical, protrusive and lateral excursions to free up the disc and facilitate lysis of adhesions. After complete lavage of the joint.

After removing the second needle 1ml of piroxicam was injected through the first needle into the upper joint compartment in the first group. Or Meloxicam, was injected through the first needle into the upper joint compartment in the other group (Figure 2-F).

Finally, the first needle was withdrawn, and postoperative instructions were given to the patients in a printed form.

Postoperative instructions and follow up:

On the day of surgery, the patients were instructed to apply ice packs over the surgical area for 10 minutes each hour of the first day in order to minimize post-surgical edema and reduce pain.

1) Diet: Patients were instructed to eat soft food and avoid aggravating factors such as chewing gum, fingernails, or ice biting. Cessation or limitation of these activities was encouraged during the treatment period.

2) Medications: Ibuprofen 400mg was used for 4 days post operatively.

Post-operative assessment:

Clinical assessment was carried out after one week, one month, three & six months postoperatively and included evaluation of the following measurements:

A. Subjective evaluation: -Pain.

B. Objective evaluation: 1) Inter-incisal opening. 2) Clicking.

Statistical analysis:

Statistical analysis was performed using (SPSS 19; SPSS, Chicago, IL, USA). As data related to patients' age and maximal mouth opening, protrusive and lateral movements were parametric, significance of the difference between both groups was evaluated using unpaired t test. Comparison between different times within the same group was performed using ANOVA test, followed by Tukey's post hoc test when ANOVA yielded a significant difference. Pain and tenderness scores revealed a non-parametric distribution and were compared between groups using Mann-Whitney U test. Friedman test for dependent samples was used to study the effect of time on pain and tenderness within the same group. Chi square test was used to compare gender distribution. The level of significance was set at $P < 0.05$.

RESULTS

The mean age of first group ranged from 18 to 50 years, with a mean of 28±13, whereas the mean age in study group was 29.1±14.9, with no statistically significant difference between both groups (p= 0.727), (Table 1)

Table (1) *Comparison of Age between the two groups*

Age	Piroxicam	Meloxicam
Mean	28	29.1
Median	27	29
Min	18	19
Max	41	44
Mann Whitney (U)	2.13	
P-value ≤0.05	0.726 ns	

ns= non statistically significant

The piroxicam group consisted of 6 (100%) females, while the meloxicam group consisted of 1male (16.66%) and 5 females (83.33%). Chi square test revealed that this difference was not statistically significant (p=0.434), (Table 2)

Table (2) *Comparison of Gender between the two groups*

Gender		
Gender	Piroxicam	Meloxicam
Male	**0**	**1**
Female	**6**	**5**
Chi square (χ^2)	**0.358**	
P-value ≤0.05	**0.434**^{ns}	

ns= non statistically significant

VAS Score

Comparing the means of both groups, Pre-operatively, a higher mean value and mean rank was recorded in Meloxicam group, with no significant difference (p=**0.926**). At one month post-operatively, a higher mean value and mean rank was recorded in Meloxicam group, with no statistically significant difference (p=**0.653**). A three month post-operatively, a higher mean value was recorded in Meloxicam group, with statistically significant difference (p=**0.049**). At 6 months post-operatively, a higher mean value was recorded in Meloxicam group, with a highly statistically significant difference (p=**0.009**), (Table3).

Mouth opening

Comparing the means of both group, Pre-operatively, a higher mean value was recorded in Meloxicam group, with statistically significant difference (p=**0.41**). At one month post-operatively, a higher mean value was recorded in Piroxicam group, with no statistically significant difference (p=**0.165**). At three months post-operatively, a higher mean value was recorded in Piroxicam group, significant difference (p=**0.032**). At 6 months post-operatively, a higher mean value was recorded in Piroxicam group, with statistically significant difference (p=**0.04**), (Table 3).

Table (3) *Comparison of the means of VAS scores and mouth openings between the two groups*

Variable	Time of Assessment	Piroxicam		Meloxicam		Sig. (2-tailed)
		Mean	SD	Mean	SD	
VAS scores	Preoperative	**6.11**	**2.37**	**6.56**	**1.33**	**0.926**^{ns}
	1 month	**2.78**	**3.07**	**3.11**	**1.96**	**0.653**^{ns}
	3 months	**1.56**	**2.35**	**3.44**	**2.24**	**0.049***
	6 months	**0.89**	**2.03**	**3.44**	**2.30**	**0.009****
Mouth opening	**Pre operative**	22.28	7.93	**23.77**	**7.60**	**0.41**^{ns}
	1 month	33.44	8.368	**32.47**	**9.17**	**0.165**^{ns}
	3 months	35.28	9.316	**32.76**	**8.65**	**0.032***
	6 months	40.53	9.016	**33.5**	**8.24**	**0.04****

*SD= standard deviation, ns= non statistically significant, *= statistically significant, **= highly statistically significant*

Clicking sound

Comparing both groups, revealed no statistically significant difference between both groups (p=0.935). (Table 4).

Table (4) *Comparison of the presence of clicking sound between the two groups*

Clicking sound	Piroxicam	Meloxicam
Pre operative	5.0(83.33%)	5.0 (83.33%)
1 month	0.0 (0.0%)	0.0 (0.0%)
3 months	0.0 (0.0%)	0.0 (0.0%)
6 months	0.0 (0.0%)	0.0 (0.0%)
Chi square (χ^2)	2.825	
P value ≤.05	0.935 ns	

*ns= non statistically significant_*

DISCUSSION

Arthrocentesis is joint lavage which washes out these inflammatory mediators, thereby, relieving pain and alters the intra-articular pressure and reduces synovial inflammation improving joint function[8,9]. It's usually indicated following failure of other non-surgical and pharmacologic methods[7]. Arthrocentesis could be considered as a treatment modality lying between non-surgical treatment and arthroscopic surgery [10,11].

Clark and his associates [12] confirmed that lavage procedure can be performed by using either Ringer's lactate or normal saline, as these solutions do not have any difference in their effects when used. Nitzan[13] reported that 100 ml of fluid is necessary for therapeutic lavage of the superior joint space. While, Kaneyama[14] and his colleagues concluded that IL-6 and protein were effectively reduced by using more than 200 ml of lavage to wash the joint and improve its function.

Non-steroidal anti inflammatory drugs (NSAIDs) have been used to treat acute and chronic inflammatory articular disorders, such as rheumatoid arthritis and osteoarthritis. Combined treatment with arthrocentesis and NSAIDs for inflamed synovial joint removes the inflammatory mediators, alters the intra-articular pressure and reduces synovial inflammation[15].

The non-selective Cox inhibitors were also found to reduce both the gene and protein expression of IL-6 significantly in the Fibroblast Like Synoviocytes (FLS) stimulated with IL-1β at all time points examined. In contrast, selective COX-2 only slightly decreased the gene and protein expression of IL-6 in IL-1β-stimulated FLS, and this difference was not significant compared with FLS incubated with only IL-1β[16] .

It has been reported that delivering an NSAID at the site of injury might provide more profound pain relief compared with that after less targeted systemic administration by modifying the local inflammatory process[17].

Piroxicam, a new non-steroidal anti-inflammatory drug of the Piroxicam class, possesses analgesic, antipyretic, and anti-inflammatory properties and inhibits platelet aggregation in animal models. Piroxicam has been used for the treatment of rheumatoid arthritis and osteoarthritis. Piroxicam has also been shown to concentrate in the synovium rather than in the cartilage that may help to decrease cartilage catabolism in patients with OA[18].

Intra articular injection of piroxicam after lysis and lavage was found to be effective for the treatment of anterior disc without reduction and provide significant improvement in pain, range of motion, and joint sounds[19].

Meloxicam is a nonsteroidal anti-inflammatory drug (NSAID) that blocks cyclooxygenase (COX),

responsible for synthesis of prostaglandins, which mediates inflammation. Meloxicam, at its low therapeutic doses, selectively inhibit COX-2 over COX-1.[20] Meloxicam was found to be effective in treatments of patients suffering from ID of the TMJ that improves pain and mouth opening [21].

In the present study intra-articular injection of piroxicam improved mean pain score post operatively 1,3and 6 months, recording a level statistically significant lower than the pre-operative value .The results were consistent with Elhakim et al,[22] as he suggested that Intra-articular NSAIDs injection has better pain relief than systemic administration indicating a peripheral analgesic effect in OA and/or in postoperative pain.

Also, previous study of Pathak and Singh[19] was found to be effective for the treatment of anterior disc displacement with closed lock and provided significant improvement in pain while in the second group there was improvement in mean pain, pain gradually decreased in 1month then slightly increased in 3 and 6 months but still less than preoperative value(p=0.0126). As Piroxicam is considered as non-selective COX blocking both COX-1and 2 and Meloxicam selectively block COX-2 and both COX enzymes are considered iso-enzymes participating in production of PG that mediates inflammatory process and pain[23], this could explain high effectiveness of Piroxicam over Meloxicam in pain control and thus enhancement of mouth opening in the first group [7,24].

In the present study, the incidence of clicking in both groups disappeared in 1, 3 and 6 months in all patients. Kuruvilla and Prasad [25] conducted a study on eleven patients with clinically diagnosed internal derangement with and without reduction and some of the patients were associated with either osteo-arthritis (OA) and rheumatoid arthritis (RA) underwent arthrocentesis and were followed up for 3 months. At 1 month clicking decreased in 6 patients (54%), was absent in 3 (27%), increased in 1 (8.3%), and present in 1(8.3%). At 3 months clicking decreased in 4 patients (36%), absent in 3 (27%), increased in 2 (18%), and present in 2 patients (18%).While, Arati and his colleagues[26] examined 30 patients with TMJ internal derangement and failed conservative management, of whom 24 had non reducing disc displacement and 6 had closed lock which were subjected to TMJ arthrocentesis, the incidence of clicking significantly decreased starting from one week post-operatively, to reach 0% after 3 and after 6 months which was found highly significant reduction ($p<0.0001$). This is compatible with the results obtained from the present research.

CONCLUSION

From the results of the current study, it has been concluded that Intra-articular injection of either Piroxicam or Meloxicam is a safe and effective line of treatment for patients with temporomandibular joint internal derangement. It provides long term success in management of the symptoms. Piroxicam intra-articular injection is more effective than Meloxicam in long term management of pain of the joints.

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