

Arthrocentesis with Injection of Tramadol and Cox-2 Inhibitor for the Management of Internal Derangements of the Tempromandibular Joint (A Comparative Study)

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Abstract: Aim of the study: The aim of this study was to compare arthrocentesis using COX-2 inhibitor versus tramadol in management of internal derangements of the tempromandibular joint. **Patients and Methods:** Twenty four joints with anterior disc displacement with and without reduction were included in this study, they were randomly divided into two groups. Group (I) were arthrocentesis was performed on twelve joints followed by intraarticular injection of COX-2 inhibitor and Group (II) where the other twelve joints were treated by arthrocentesis followed by intraarticular injection of tramadol solution. The pain was assisted by a visual analogue scale (VAS) preoperatively, three days, one month and six months post operative, the maximum mouth opening (MMO) and lateral excursion were also recorded preoperatively and at the same previously mentioned periods. **Results:** There was a statistically significant decrease in mean VAS as well as a significant increase in both the maximum mouth opening and the lateral excursion through all periods in Groups I and II, however, Group II showed a significant improvement in VSA, maximum mouth opening and lateral excursion over those of group I. **Conclusion:** Intraarticular injection of tramadol is effective in management of clinical symptoms associated with internal derangements of the tempromandibular joint.

[Tamer A. Hamed. **Arthrocentesis with Injection of Tramadol and Cox-2 Inhibitor for the Management of Internal Derangements of the Tempromandibular Joint (A Comparative Study)**] Journal of American Science 2012; 8(1):277-283]. (ISSN: 1545-1003). <http://www.americanscience.org>.

Keywords: Arthrocentesis Tramadol, Cox-2 inhibitor

1. Introduction

Internal derangements of the tempromandibular joint (TMJ) is 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 are the characteristics symptoms of this disorder⁽¹⁾.

Internal derangement of the tempromandibular joint is one of the most common forms of tempromandibular disorders. The term internal derangement comprises anterior disc displacement with or without reduction, perforation of the articular disc or the retrodiscal tissue and various degenerative changes of the disc and / or the articulating surfaces^(2,3).

Internal derangements of the tempromandibular joint are characterized by displacement of the articular disc, which act as an obstacle to normal joint movements and result in clicking and popping sounds or locking and inability to open the mouth widely. These conditions may be painless or they may be associated with pain especially during function. the most common causes are trauma, which results in immediate displacement of the disc, or chronic parafunction which results in degenerative changes in articular surfaces, increased friction and gradual disc displacement^(3,4).

The overall prevalence of symptomatic disc displacement or internal derangement may range

between 20% and 30%, making them frequently encountered conditions⁽⁵⁾.

Arthrocentesis of the tempromandibular joint was first described in 1991 by Nitzan *et al.*,⁽⁶⁾ arthrocentesis with joint lavage was suggested as the simplest form of surgical intervention into the TMJ that is required for treatment of painful limited mouth opening caused by TMJ derangement, besides being the least invasive of all the surgical procedures, arthrocentesis carries a very low risk and it is relatively easy to accomplish as an in office procedure under local anesthesia alone or in combination with conscious sedation, arthrocentesis is now widely used in various internal derangements as well as diagnostic purposes^(7,8,9). Shinya *et al.*,⁽¹⁰⁾ stated that arthrocentesis is a highly efficient procedure to decrease joint pain and increase the range of mouth opening in patients with closed lock of the TMJ, this can be performed under local anesthesia in the outpatient clinic, it is also suggested that lavage under sufficient hydraulic pressure could widen the narrowed joint space release adhesions within the joint space.

There are a variety of anti-inflammatory agents available for use in treating inflammatory joint conditions, clinically, inflammations are most often treated using non selective COX- 1 inhibitors, that is non steroidal anti-inflammatory drugs (NSAIDs),

such as ibuprofen and COX-2 inhibitors⁽¹¹⁾. The NSAIDs have been used because they are inexpensive, easy to obtain (available over the counter) and have relatively few side effects such as gastrointestinal upsets and suppression of food intake. As a result of gastrointestinal upset following chronic use of non selective NSAIDs, a new type of NSAIDs was introduced, that is the selective COX-2 inhibitors, because these medications do not affect COX-1 which is necessary for normal protection of stomach mucosa, fewer side effects have been reported. COX-2 is an inducible enzyme that is unregulated in-vitro by various proinflammatory agents such as lipopolysaccharide and tumor necrosis factor, the COX-2 enzyme causes increase prostaglandine synthesis at the site of inflammation. Immunohistochemical analysis of synovial membrane biopsy samples from rheumatoid arthritic, osteoarthritic, and normal human joints showed no staining in normal joints but intense staining for COX-2 in synovial lining cells and endothelial cells of patients with inflammatory joint disease^(12,13).

Tramadol hydrochloride is an opioid which have the additional property of inhibiting intersynaptic reuptake of noradrenaline and serotonin, thus giving it a dual mode of analgesic effect and a unique place in the pain relieving armamentarium in that not only does it provide analgesia over a wide range of pathologies^(14,15), but it also have a significant advantages over the other opioids, these include its lack of significant respiratory depressant effects, unlikely development of tolerance and dependence and a low adverse event profile⁽¹⁶⁾. Tramadol has proved to be a valuable addition to the range of effective analgesic drugs, and as further aspects of its use are revealed, may will be the analgesic of choice for patients in moderate to severe pain⁽¹⁷⁾.

Aim of The study

The aim of this study was to compare arthrocentesis using COX-2 inhibitor versus tramadol in management of internal derangements of the tempromandibular joint

2. Patients and Methods

Twenty four joints in twenty four patients were evaluated in this study, six males and eighteen females aged 21 to 47 years (mean = 39.6) with chief complain of unilateral TMJ pain associated with limited mouth opening and clicking sounds.

Patients with degenerative joint diseases or those who had performed previous surgical intervention were excluded as well as patients with limited mouth opening caused only by muscle pain.

All patients within the study were subjected to a

clinical and radiographic evaluation by panoramic radiographs, the presence of anterior disc displacement was confirmed by a magnetic resonance imaging for the affected joints in an open and closed positions.

The patients were asked to complete a visual analogue scale (VAS) for pain scoring, The VAS is graduated from 0 to 10 with two endpoints marked score 0 (no pain) and 10 (worst pain ever experienced). The VAS was completed for each patient preoperatively and at six months postoperatively with 3 days and one month intervals.

The maximum mouth opening and the lateral excursion toward the unaffected joint were recorded for each case preoperatively and at the same previously mentioned periods. The obtained data were recorded in tables for statistical analysis.

The tested joints were randomly divided into two groups:

Group I, Consisted of twelve joints, where arthrocentesis was performed for the affected joints followed by intraarticular injection of one ml. of commercially available COX – 2 inhibitor (Anti-Cox-2 II 15 mg ampules by Adwia company, Egypt). This group was further classified to two subgroups I-A which consist of seven joints having anterior disc displacement with reduction, and I-B which consists of five joints having anterior disc displacement without reduction.

Group II: Consisted of twelve joints, where arthrocentesis was performed for the affected joints followed by intraarticular injection of one ml. of tramadol hydrochloride (Tramal 100 mg amuples by Minapharm company, Egypt). This group was further classified to two subgroups II-A which consist of six joints having anterior disc displacement with reduction, and II-B which consists of six joints having anterior disc displacement without reduction.

All patients were informed about the procedure, its possible complications and about the materials used.

Technique of arthrocentesis

The operative area was isolated with sterile drapes and the operative site was prepared aseptically using betadine solution.

Auriculotemporal nerve block was performed with 0.5 ml of the local anesthetic solution. the point of the first needle insertion was determined by drawing the canthal-tragus line and a point 10 mm in front of the tragus and 2 mm below the canthal-tragus line was marked another point 2 mm anterior to the former one was marked for the insertion of the second needle, after insertion of the first needle 3.5 ml of local anesthetic solution was

injected. The TMJ was palpated and the upper joint space was enlarged by downward and forward displacement of the mandible, hydraulic pressure was created by injecting about 2 ml of saline solution into the joint space. the second needle was placed at the previously marked point (2 mm anterior to the first needle) to establish an outflow, the joint was then lavaged with 300-500 ml saline solution injected into the upper joint compartment, the outflow needle was periodically occluded in order to create hydraulic pressure within the joint

space. On termination of the procedure, one ml of commercially available COX-2 inhibitor was injected into the upper joint space in twelve joints (Group I) while in the other twelve tested joints (Group II) one ml of tramadol was injected.

After removal of both needles, the mandible was gently manipulated, and the patients were asked to practice opening the mouth as wide as they could.

Post operative antibiotics were prescribed for each patient for three postoperative days.



Figure (1) A- Landmarks for needles insertion B – insertion of both needles and joint lavage

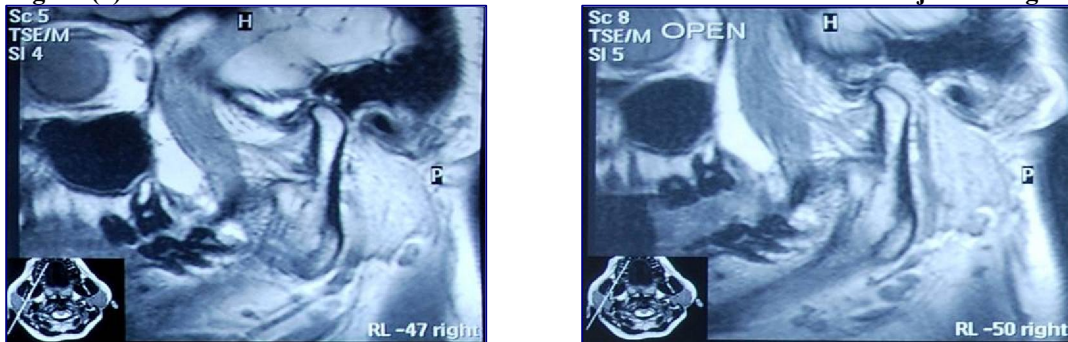


Figure (2) Magnetic resonance image A- closed mouth, B- Open mouth showing evidence of anterior disc displacement with reduction

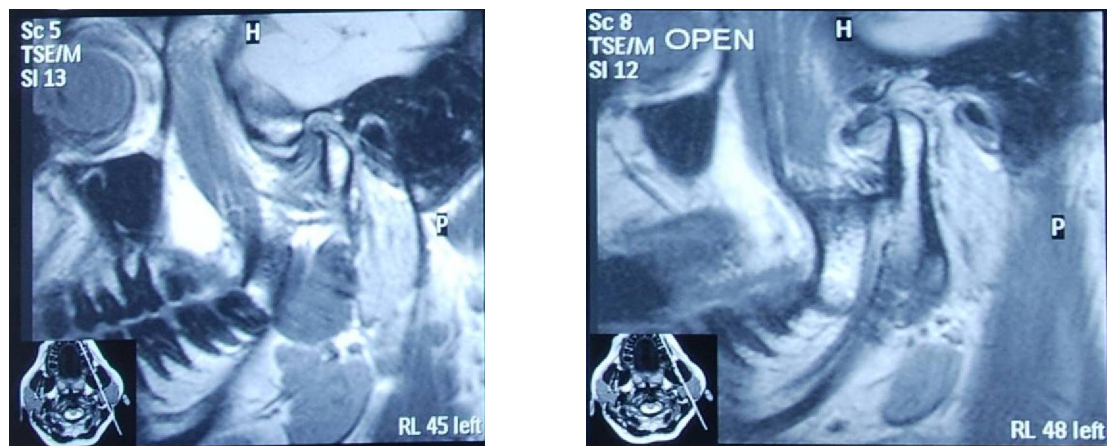


Figure (3) Magnetic resonance image A- closed mouth, B- Open mouth showing evidence of anterior disc displacement without reduction

3. Results

During arthrocentesis of the tested joints with either COX-2 inhibitor (Group I) or tramadol (Group II), there were no intra operative complications encountered except severe pain in two of the patients that required more anesthetic injection with subsequent increase in the operative time.

Apart from slight to moderate pain related to the operative site within the six hours postoperatively for some of the patients, no post operative complications were recorded.

Statistical analysis:

Data were presented as mean and standard deviation (SD) values. Student's t-test was used to compare between the two groups. Repeated measures ANOVA test was used to study the changes by time within each group. Tukey's post-hoc test was used for pair-wise comparisons between different

time periods when ANOVA test is significant.

The significance level was set at $P \leq 0.05$. Statistical analysis was performed with PASW Statistics 18.0 (SPSS: An IBM Company, Chicago, IL, USA, Predictive Analytics SoftWare) for Windows.

I. Visual analogue scale (VAS)

Comparing groups (I –A) and (I –B) as well as groups (II-A) and (II – B), the results showed no statistically significant difference between mean VAS in disc displacement cases with and without reduction through all periods among the groups.

Meanwhile, there was no statistically significant difference between the two groups pre-operatively and after 3 days however, after 1 month and after 6 months, Group I showed statistically significantly higher mean VAS than Group II.

Table (1): The mean, standard deviation (SD) values and results of Student's t-test for the comparison between VAS in the two groups

Period	Group	Group I		Group II		P-value
		Mean	SD	Mean	SD	
Pre-operative		8.5	0.9	8.8	0.9	0.385
3 days		5.8	1.2	5.3	1.1	0.294
1 month		3.8	0.7	2.5	1.1	0.003*
6 months		3	0.6	1	0.7	<0.001*

*: Significant at $P \leq 0.05$

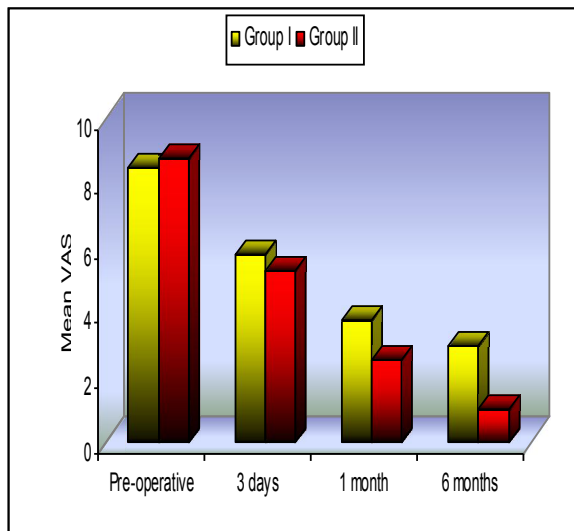


Figure (3): Bar chart representing mean VAS in the two groups

Comparison between percentage decrease in VAS of the two groups.

The percentage decrease was calculated as:

$$\frac{VAS(after) - VAS(before)}{VAS(before)} \times 100$$

There was a statistically significant decrease in mean VAS through all periods in Group I and Group II,

As represented in table (2), After 3 days, there was no statistically significant difference between the two groups, however, after 1 month and 6 months Group II showed statistically significantly higher mean percentage decrease in VAS than Group I.

II. Maximum mouth opening (MMO)

Comparing groups (I –A) and (I –B) as well as groups (II-A) and (II – B), the analysis showed no statistically significant difference between mean MMO in disc displacement cases with and without reduction through all periods among the groups.

Pre-operatively, after 3 days and after 6 months, Group II showed statistically significantly higher mean MMO than Group I, however there was no statistically significant difference between the two groups after 1 month.

Table (2): The mean percentage changes, standard deviation (SD) values and results of Student's t-test for comparison between percentage decrease in VAS of the two groups

Group / Period	Group I		Group II		P-value
	Mean %	SD	Mean %	SD	
Pre-operative – 3 days	31.8	10.4	39.8	14.3	0.199
Pre-operative – 1 month	54	11.5	70.6	16.7	0.010*
Pre-operative – 6 months	64	9.9	88.6	7.8	<0.001*

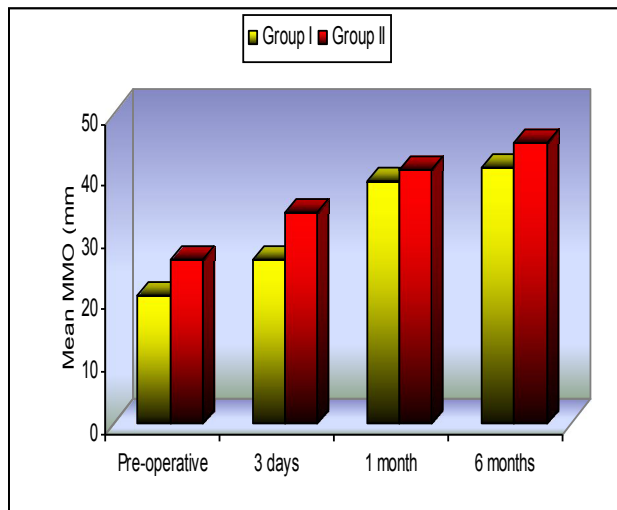
*: Significant at $P \leq 0.05$

Table (3): The mean, standard deviation (SD) values and results of Student's t-test for the comparison between MMO in the two groups

Group / Period	Group I		Group II		P-value
	Mean	SD	Mean	SD	
Pre-operative	20.8	3.8	26.4	6	0.012*
3 days	26.6	3.5	34	4.1	<0.001*
1 month	39.3	1.7	40.8	2	0.064
6 months	41.3	2.7	45.2	2.9	0.003*

*: Significant at $P \leq 0.05$

Figure (4): Mean MMO in the two groups



Comparison between percentage increase in MMO of the two groups

The percentage increase was calculated as:

$$\frac{MMO(after) - MMO(before)}{MMO(before)} \times 100$$

There was a statistically significant increase in mean MMO through all periods in Groups I and II.

As represented in table (4), after 3 days, there was no statistically significant difference between the two groups, however, after 1 month and 6 months Group II showed statistically significantly higher mean percentage increase in MMO than Group I.

III. Lateral excursion

Comparing groups (I–A) and (I–B) as well as groups(II-A) and (II–B), the results showed no

statistically significant difference between mean lateral excursion in disc displacement cases with and without reduction through all periods among the groups.

Table (4): The mean percentage changes, standard deviation (SD) values and results of Student's t-test for comparison between percentage increases in MMO of the two groups

Group / Period	Group I		Group II		P-value
	Mean %	SD	Mean %	SD	
Pre-operative – 3 days	31.7	8.4	29.4	7.8	0.740
Pre-operative – 1 month	61.1	23.5	93.1	27.9	0.017*
Pre-operative – 6 months	77.5	15.6	102.6	31.3	0.030*

*: Significant at $P \leq 0.05$

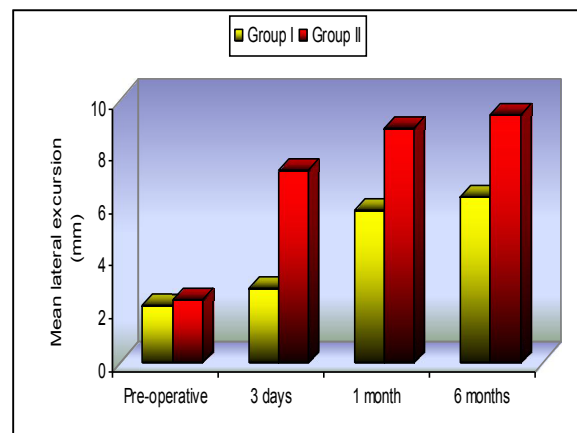


Figure (5): Mean lateral excursion in the two groups

Pre-operatively, there was no statistically significant difference between the two groups, however, after 3 days, after 1 month and after 6 months, Group II showed statistically significantly higher mean lateral excursion than Group I.

Comparison between percentage increase in lateral excursion of the two groups

The percentage increase was calculated as:

$$\frac{\text{lateral excursion(after)} - \text{lateral excursion}$$

(before) x 100

lateral excursion (before)

There was a statistically significant increase in mean lateral excursion through all periods in Groups I and II, as represented in table (6), after 3 days, 1 month and 6 months Group II showed statistically significantly higher mean percentage increase in Lateral excursion than Group I.

Table (5): The mean, standard deviation (SD) values and results of Student's t-test for the comparison between lateral excursion in the two groups

Period	Group I		Group II		P-value
	Mean	SD	Mean	SD	
Pre-operative	2.2	0.7	2.4	0.7	0.387
3 days	2.8	0.4	7.3	1.1	<0.001*
1 month	5.8	0.9	8.9	0.9	<0.001*
6 months	6.3	0.9	9.4	0.5	<0.001*

*: Significant at $P \leq 0.05$

Table (6): The mean percentage changes, standard deviation (SD) values and results of Student's t-test for comparison between percentage increase in lateral excursion of the two groups

Period	Group I		Group II		P-value
	Mean %	SD	Mean %	SD	
Pre-operative – 3 days	41.7	19.7	219.4	52.4	<0.001*
Pre-operative – 1 month	205.6	48.3	291	38.9	<0.001*
Pre-operative – 6 months	231.9	42	313.2	69.8	<0.001*

*: Significant at $P \leq 0.05$

Discussion

Tempromandibular joint arthrocentesis is usually an office –based procedure used for management of various TMJ disorders, although its mechanism of action is not clear, it was proposed that lavage and lysis of the upper joint compartment would eliminate the vacuum effect, resolve the adhesions and alter the viscosity of the synovial fluid thereby aiding translation of the disk and condyle, it is believed that washing out of inflammatory mediators is effective in pain reduction^(18,19,20). On the other hand, another article by **Honda et al.**, showed persistent joint pain following performance of arthrocentesis⁽²¹⁾.

Tramadol and opioids in general were used in various applications within the maxillofacial practice, the main clinical outcome was its ability to control moderate to severe post surgical pain^(15,22,23,24), Meanwhile, cyclooxygenase II inhibitors was previously investigated by **Kerins et al.**,⁽²⁵⁾ and proved to be clinically effective in modulating tempromandibular joint inflammation.

The results of this study showed that pain levels decreased significantly in patients received COX-2 inhibitor (Group I) and those received tramadol (Group II), these results are in accordance with the

results of **Ishimaru et al.**,⁽¹³⁾ which investigated single arthrocentesis with COX-2 inhibitor on patients with severe symptoms of tempromandibular joint disorders, they found that patients generally lost their symptoms and the severity of the disorders improved significantly.

Although there was no statistically significant difference in percentage of decrease after three days, the percentage of decrease in group II was higher than that of group I at three and six months post operative, these findings are in accordance with the results of **Kunjur et al.**,⁽²⁶⁾ which showed a significant improve in pain after arthrocentesis with intraarticular opioid infusion.

Maximum mouth opening (MMO) and lateral excursion (LE) were evaluated for patients in both groups, although the two groups showed a percentage increase in MMO and LE through postoperative follow up the increase was more significant in group II, these results are in accordance with the fact that pain free jaw movement showed a noticeable impact on mouth opening and lateral movements⁽²⁶⁾, longer follow up period may be required for investigation of long term effect of single arthrocentesis with intraarticular tramadol in pain control with its consecutive effect on pain free

jaw movements.

Conclusions

- 1-Arthrocentesis is a simple, office based, non invasive technique.
- 2- Intraarticular injection of tramadol is effective in management of clinical symptoms associated with internal derangements of the tempromandibular joint
- 3- Although tramadol showed a superior results over COX-2 inhibitors yet, arthrocentesis with intrarticular injection of COX-2 inhibitors represents a possible choice for patients with internal derangements of the tempromandibular joint.

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