

## Arthroscopic Injection of Lateral Pterygoid Muscle with Botulinum Toxin Versus Lysis and Lavage in Treatment of Anterior Disc Displacement

Eman F. Elsewasy<sup>1</sup>, Ahmed A. Mosleh<sup>2</sup>, Nowair I M<sup>3</sup>, KA. Saad<sup>4</sup>,  
MM.Shoushan<sup>5</sup>

<sup>1</sup>Master candidate of oral and maxillofacial surgery, Faculty of dentistry, Tanta University.

<sup>2</sup>Assistant lecturer of oral and maxillofacial surgery, Faculty of dentistry, Tanta University.

<sup>3</sup>Associate professor of oral and maxillofacial surgery, Faculty of dentistry, Tanta University.

<sup>4</sup> professor of oral and maxillofacial surgery, Faculty of dentistry, Tanta University.

<sup>5</sup> professor of oral and maxillofacial surgery, Faculty of dentistry, Tanta University.

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### Abstract:

**Introduction:** The long-standing contraction of the lateral pterygoid muscle has been suggested to be one of the causes of temporomandibular joint disc displacement. So, a novel method is presented to use arthroscopic guided injection of Botox with maximal control and minimal hazards.

**Patients and methods:** Randomized clinical study was carried out on twelve patients who had TMJ anterior disc displacement with reduction not responded to conservative treatment. Patients were divided randomly into two equal groups. First one was treated with arthroscopic guided lysis and lavage with Ringer's lactate solution. Second one was treated with arthroscopic guided injection of superior head of lateral pterygoid muscle with Botox. Then followed up clinically at interval of 1 week, 2 weeks, 1,2,3 and 6 months to evaluate: pain by visual analogue scale, maximal mouth opening, clicking and evaluated disc by imaging using magnetic resonance image after 3 months.

**Results:** Group I and group II showed highly significant results regarding the maximal mouth opening. The pain score showed a significant decrease in group I and a highly significant decrease in group II.

Group I still had clicking with persistent anterior disc displacement in their magnetic resonance image unlike those of group II that only one patient had recurrent clicking after 3 months and anterior disc displacement in the magnetic resonance image.

**Conclusion:** The arthroscopic guided botulinum toxin injection of superior head of lateral pterygoid muscle is useful in the treatment of anterior articular disc displacement with reduction.

**Key words:** Botox, lateral pterygoid muscle, temporomandibular joint.

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### I. Introduction:

The temporomandibular joint disorder (TMD) is the general term used to describe the manifestations of pain, clicking and crepitation, dysfunctions of mandibular motions and facial deformity, which predominant affects the functions on mastication and mouth opening. Up to 70% of the populations are affected by TMD, with significantly more frequent and more severe signs and symptoms appearing in women and older adults. <sup>(1)</sup>

TMJ internal derangement is the most common TMJ affliction treated surgically. <sup>(2)</sup> It is classified into stages one to five (according to Wilkes classification) starting from stage one of painless clicking with unrestricted function till stage five of severe joint dysfunction with variable pain. <sup>(3)</sup>

Patients who had persistent symptoms of internal derangement after conservative treatment were often referred to oral and maxillofacial surgeons and there were a variety of surgeries designed to solve the problem. Discoplasty, was a common surgical procedure. Discectomy was often performed if there was a

perforation in the disc., <sup>(4)</sup> resulted in a significant change in the surgical management of patients with severe symptoms and internal derangement. Arthroscopic temporomandibular joint surgery was shown to be a safe and effective alternative to arthroplasty, which reliably reduce pain and improve maximum interincisal opening distance. <sup>(5)</sup>

Many authors have emphasized the efficiency of the Botulinum Toxin A (BTX-A) injection procedure in the upper part of the lateral pterygoid muscle in the cases of articular disc displacement. <sup>(6)</sup>

**Aim of the work:**

The aim of this study was to compare the outcomes of the arthroscopic guided Botox injection in superior head of lateral pterygoid muscle to the arthroscopic guided lysis and lavage in treatment of anterior disc displacement with reduction of the TMJ.

**Patients and methods:**

This is a prospective, interventional, comparative study that was carried out on twelve adult patients who had unilateral TMJ anterior disc displacement with reduction causing functional disability and pain not responded to conservative treatment. Patients were selected from the out-patient clinic of Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Tanta University, and divided randomly into two equal groups.

**Ethical consideration**

Approval for this project was obtained from Research Ethics Committee (REC) of faculty of Dentistry, Tanta University. The purpose of the present study was explained to the patients and informed consents were obtained according to the guidelines of human research adopted by the REC at Faculty of Dentistry, Tanta University.

Inclusion criteria included patients with anterior disc displacement with reduction of TMJ who did not respond to conservative treatment (NSAIDs, soft diet, hard occlusal splint, hot fomentation on the affected side and muscle relaxants) and were still complaining of pain and joint noise.

While exclusion criteria included patients with systemic disease that affect the joint as rheumatoid arthritis, patients with high risk of hemorrhage, patients with TMJ neoplastic changes and patients with recent history of facial trauma.

Clinical examination was performed preoperatively and compared with the postoperative results at one-week, two weeks, one, two, three and six-months follow-ups. **Extraoral examination by** Examining the joint (Palpation, Auscultation), Measuring maximal mouth opening (MMO), Evaluation of pain by Visual Analogue Scale (VAS). **Intraoral examination, Radiographical examination and Imaging**

**Treatment procedures:**

**conservative phase:** Patients were followed the conservative phase for 3 months.

**pharmacological approach:** Non-steroidal anti-inflammatory, Topical gel, Muscle relaxant

**Hard occlusal splint:** Help to put the mandible in suitable resting position so as to allow a better seating of the condyle in the glenoid fossa. <sup>(7)</sup>

**Occlusal adjustment:** The treatment aimed to restore the normal occlusion without premature contacts or cuspal interference. Selective extractions and orthodontic treatment may be undertaken. <sup>(8)</sup>

**Operative phase:** For patients who did not respond to the preoperative conservative phase for 3 months.

**Arthroscopic technique:**

Arthroscopy was performed under general anesthesia through nasotracheal intubation, using the posterolateral approach.

The arthroscopic sheath with sharp obturator was inserted in two determined points, The HOPKINS telescope (arthroscope) was introduced through one of the two sheaths, which also serves as an irrigation port. The irrigation liquid was drained through the second sheath, which also provided access for passing instruments to the operative site.

The joint was irrigated with 500 ml lactated Ringer's solution, for group I patients, and 0.5 ml of solution containing 25 units of Botox was injected in upper belly of the lateral pterygoid muscle after exposing an anteromedial capsulotomy through the working cannula with a long spinal needle in group II patients. **(Fig. 1-6)**

**Post-operative phase:**

**Follow up and patients' assessment:**

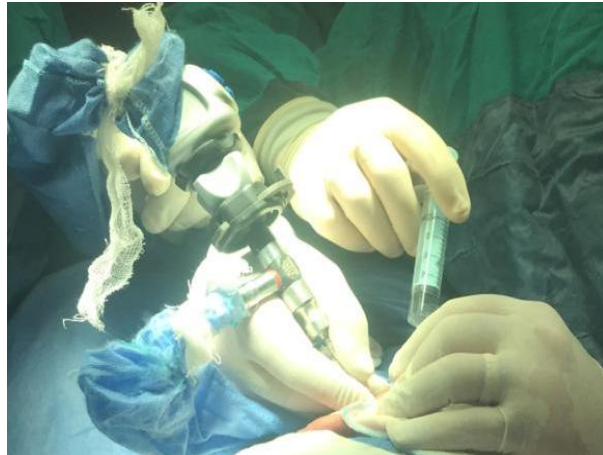
- Clinically at interval of 1 week, 2 weeks, 1,2,3 and 6 months to evaluate: clicking or crepitation, maximal mouth opening and pain (during opening, closing and lateral excursion of mandible) by VAS.
- Imaging: by MRI after 3 months: to determine any change in the position of the disc.



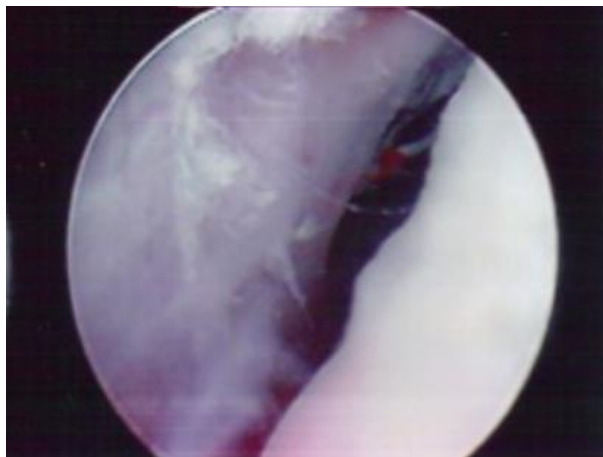
**Figure (1): Intraoperative clinical photograph showing disinfection of the operation site (pre auricular region) by using povidone iodine and planning the trocar site for TMJ arthroscopy.**



**Figure (2) Intraoperative clinical photograph showing insertion of sharp obturator/sheath assembly in superior compartment of right TMJ**



**Figure (3) Intraoperative clinical photograph showing the attachment of video camera after performing the white balance into the sheath, and connect the irrigation line to the arthroscopic sheath**



**Figure (4) Arthroscopic view photograph showing the presence of fibrous adhesions in the superior joint space limits normal translatory function of the disc–condyle complex**



**Figure (5) Botox vial and long spinal needle.**

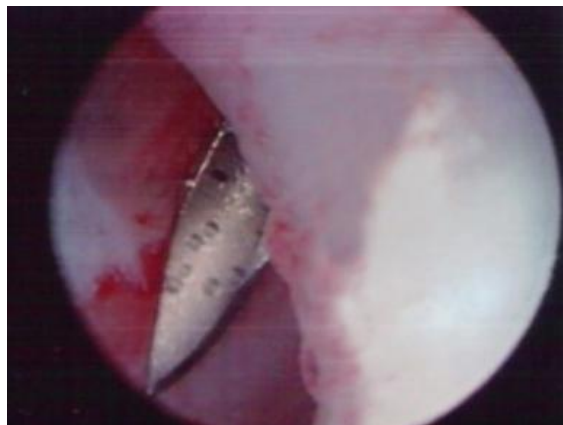


Figure (6) Arthroscopic view photograph showing direct infiltration of BTX-A in LPM

**II. Result:**

This study was conducted on twelve patients who had TMJ anterior disc displacement with reduction causing functional disability and pain and who had not responded to conservative treatment for three months. All patients were selected from the out-patient clinic of Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Tanta University and divided randomly into two equal groups for arthroscopic intervention. All patients involved in this study were females their ages ranged from 20 to 50 years with a mean age range of 33.67±10.79. All patients with ID, diagnosed clinically and also by using MRI.

**1- Pain**

The pain score showed a significant decrease in group I at P value (0.002) and a highly significant decrease in group II at P value (0.000) as shown in table (1).

**2- Maximal mouth opening:**

Patients of both groups showed a highly significant improvement of the MMO at the end of the follow up period as shown in table (2), and there were a highly significant difference starting from 1 month till the end of follow up period. fig (7)

**3- Clicking:**

By comparing the 2 groups there was a significant difference between them regarding the clicking table (3)

**4-MRI:**

By comparing the 2 groups there was a significant difference between them regarding MRI findings (P-value=0.005). table (4) fig (8-9)

Table (1) Showing statistical analysis of pain score in group I and group II using Tuckey test.

Groups	Pre	After 1 week	After 2 weeks	After 1 month	After 2 months	After 3 months	After 6 months	p-value
Group I	7.50 ±1.38	6 ±1.55	5 ±1.55	4.67 ±1.63	4 ±1.67	3.83 ±1.72	3.67 ±1.86	0.002*
Group II	8.33 ±1.03	3.50 ±1.05	2.67 ±0.52	1.17 ±0.75	0.83 ±0.75	0.67 ±0.82	0.67 ±0.82	0.000**
P-value	0.263	0.008*	0.006*	0.001*	0.002*	0.002*	0.005*	-----

Table (2): Showing the difference between the 2 groups regarding maximal mouth opening using randomized block ANOVA test.

Groups	Pre	After 1 week	After 2 weeks	After 1 month	After 2 months	After 3 months	After 6 months	p-value
Group I	23 ±3.35	24.50 ±3.1	25.33 ±2.8	26 ±3.16	26 ±3.16	26 ±3.16	26 ±3.16	0.000**
Group II	21.67 ±2.7	28.1 7±4.3	31.33 ±3.9	34.33 ±1.6	34.67 ±1.5	35.17 ±1.3	35.33 ±1.4	0.000**
P-value	0.467	0.116	0.012*	0.000**	0.000**	0.000**	0.000**	-----



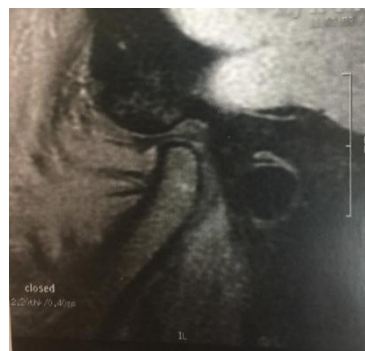
**A**  
**Figure (7):** Clinical photographs showing  
**A-** Preoperative MMO 18mm.  
**B-**After 1 week 27 mm.  
**C-**After 6 months 35 mm.

**Table (3):** Showing the percentage of TMJ clicking in both groups during the study period

Durations	Group I		Group II		P-value
	Yes	No	Yes	No	
After 1 week	6(100%)	0(0%)	0(0%)	6(100%)	0.001*
After 2 weeks	6(100%)	0(0%)	0(0%)	6(100%)	0.001*
After 1 month	6(100%)	0(0%)	0(0%)	6(100%)	0.001*
After 2 months	6(100%)	0(0%)	0(0%)	6(100%)	0.001*
After 3 months	6(100%)	0(0%)	1(16.7%)	5(83.3%)	0.005*
After 6 months	6(100%)	0(0%)	1(16.7%)	5(83.3%)	0.005*

**Table (4):** showing the percentage of improvement in disc position according to MRI findings after 3 months follow up.

Durations	Group I		Group II		P-value
	Disc ant. disp	no ant disc disp	Disc ant. disp	no ant disc disp	
After 3 months	6(100%)	0(0%)	1(16.7%)	5(83.3%)	0.005*



**Figure (8):** A- Preoperative MRI photo-radiograph of closed left TMJ: arrow showing disc anteriorly displaced.  
 B- Three months post-operative MRI photo-radiograph: arrow showing disc still anteriorly displaced.



**Figure (9):** A- Preoperative MRI photo-radiograph of closed right TMJ: arrow showing disc anteriorly displaced. B- Three months post-operative MRI photo-radiograph: arrow Showing normal disc position.

### III. Discussion:

TMJ ID are therapeutic challenge in the oral and maxillofacial clinic. This disorder may cause pain, sounds such as clicking or crepitus, and irregular or deviating jaw function.<sup>(9)</sup> ID of the articular disc of the TMJ was described as a potential clinical problem more than 100 years ago. It was the postulated cause of joint pain, limited mandibular movement, joint sounds, and osteoarthritic changes.<sup>(10)</sup>

Alternative explanation for these problems is reasonable and should be considered. Observations during TMJ arthroscopy and outcomes after such treatment have provided new insights into the pathology of TMJ ID. For example, the role of inflammation in the TMJ was not appreciated until the use of TMJ arthroscopy. Signs of inflammation, e.g., hypervascularity and erythema, are commonly observed and have been shown to correlate with the severity of the pain.<sup>(11)</sup>

Since BTX-A discovery in 1897 to its introduction as a therapeutic agent in 1977 to present day, BTX-A has evolved from a toxin to a versatile clinical tool with an expanding list of uses. It was very useful in the treatment of a broad array of disorders resulting from muscular hyperfunction and, more recently, autonomic dysfunction.<sup>(12)</sup>

In our study we injected the optimum lowest effective dose and was 25 IU of Botox which is the reasonable therapeutic dose for LPM. This Botox dose was agreed by Bakke et al<sup>(13)</sup> who performed a study on the treatment of severe TMJ clicking with BTX-A injection in the LPM, single injection of BTX-A in group II was performed, and this was in agreement with Karacalar et al, that suggested an administration of a single injection<sup>(14)</sup> but was not in agreement with Von Lindern<sup>(15)</sup> who found that 17% of patients received a second injection. Generally, in these studies, the impact of single dose normally last until the end of the follow-up period. In all investigated cases, the first dose yielded relatively favorable outcomes and repeated doses after 6 months were performed to strengthen the effect of previous injection.

In this study all patients were females with age range varied from 20 to 50 years with a mean age range of  $33.67 \pm 10.79$ , this was because the female patients seek treatment more than male patients and this was in agreement with the study achieved by David C. McNamara and Zarb GA et al.<sup>(16,17)</sup>

Conservative measures had been exhausted before any interventional procedures. These non-invasive measures include a soft diet, non-steroidal analgesic agents, and bite raising appliances, in our study we found the hard splint is better than the soft splint especially if pain was related to bruxism and this was in agreement with Nishimura et al.<sup>(18)</sup> But it showed temporary clinical relief which extended for short periods of time and this was in agreement with Yura et al.<sup>(19)</sup>

The long-term outcome of studies including both lysis and lavage, and operative arthroscopy indicated that an arthroscopic surgery was a highly predictable and reliable procedure.<sup>(20,21)</sup> The long-term outcomes by sole arthroscopic lysis and lavage were also reported as excellent.<sup>(22)</sup>

In this study patients in group I had significant decrease of pain till 2 weeks and pain value continued to decrease till 6 months in spite of remaining the disc anteriorly displaced in all patients of this group and this was in agreement with the study by Moses JJ et al concerning the disc position and clinical interpretation showed that there was excellent outcome regardless of anatomical disc reduction.<sup>(23)</sup> This suggested that, in contradiction to the previous concept of the surgical disc repositioning procedure, the simple arthroscopic lysis enabled getting joint mobilization and lavage of diseased joint fluid, making significant pain reduction.

Regarding group II, patients had highly significant decrease in pain value till 1 month then pain value gradually decreased till the end of follow up period, and this with agreement with Aquilina et al,<sup>(24)</sup> that found injections of botulinum toxin for patients with articular disc displacement resulted in pain relief and return of the normal movements of the mandible.

As a result of these observations, a simplified technique of lavaging the superior joint space was advised and the results of the preliminary clinical trials were initially published, together with the first description of the technique by Nitzan *et al.*<sup>(25)</sup> Considering it as a valuable technique when patients fail to respond to simple non-invasive treatments.

Von Lindren<sup>(15)</sup> evaluated the effect of botulinum toxin injections on reducing the pain associated with ID, injecting the lateral pterygoid muscle. Accordingly, localized pain was recovered in 80% of patients, these results correspond with our result as VAS showed highly significant decrease at 1 week then significantly decreased till 1 month.

Previous studies of BTX-A treatment of TMDs yielded satisfactory results. For example, a study done by Freund *et al.*<sup>(26)</sup> suggested the beneficial effects of the toxin on severity of symptoms and functional abilities of patients. Likewise, Bakke *et al.*<sup>(13)</sup> showed the elimination of joint clicking by lateral pterygoid injections and this with agree the results of our study. as clicking was eliminated in 5 patients in group II post-operatively.

The absence of the click even after the end of the paralyzing effect of the BTX suggests that some sort of muscle deprogramming may have occurred within the muscle ensuring that once the effect of the BTX ends, the muscle fibers do not go back to their hyperactive state.

Another point is the disc position following injections. Bakke *et al.*<sup>(13)</sup> observed a small but distinct permanent positional improvement in the disc-condyle relationship shown on MRI. They proposed that this might reduce clicking in patients, and this with agreement of results of our study as 5 patients had positional improvement in their disc in MRI at the group II.

Arthroscopy of TMJ has been applied to clinical use primarily as a diagnostic procedure followed by minimally invasive surgical intervention. Basic investigations of TMJ arthroscopy and related surgery significantly inspire the progression of the diagnostic science through the findings of intra-articular pathology. Arthroscopic surgery is now established as a minimum invasive intervention for TMJ diseases. Based on the evidence-based management for TMD patient, further sound science clinical research would be awaited.

#### **IV. Conclusion:**

The arthroscopic guided botulinum toxin injection of LPM is useful in the treatment of anterior articular disc displacement. Arguments in favor of its application include selectivity and low incidence of side effects.

The arthroscopic guided lysis and lavage is minimally invasive TMJ procedures, and effective technique for the treatment of anterior disc displacement regarding pain and maximal mouth opening without changing disc position in MRI and respectively clicking.

#### **V. Recommendations**

- Further studies on larger number of patients for longer periods of follow up are recommended.
- More studies for modified dose and number of injections in correlation of patient symptoms are recommended.
- Arthroscopic intervention needs special training and the arthroscopic equipment is costly.

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