ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

A Randomized Controlled Trial of Arthrocentesis versus Mitek Mini Anchor in the Treatment of Anterior Disc Displacement without Reduction of Temporomandibular Joint

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Manuscript Info

Manuscript History:

Received: 15 September 2014
Final Accepted: 29 October 2014
Published Online: November 2014

Key words:

(QOS), delay.opnet.IPv4, IPv6,

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Abstract

Introduction: Arthrocentesis and disc plication are the most common techniques currently applied to treat anterior disc displacement without reduction (ADDWOR) of temporomandibular joint (TMJ).

Objective: The aim of this study was to compare the outcome of arthrocentesis and Mitek mini anchor in patients with ADDWOR of TMJ.

Materials and Methods: Sixteen patients (24 joints) with ADDWOR requiring treatment were randomized into two equal groups for either arthrocentesis or Mitek mini anchor (for disc repositioning). Patient's TMJ parameters recorded were pain intensity on visual analog scale (VAS), maximum mouth opening (MMO), muscle tenderness and magnetic resonance imaging (MRI). They were evaluated preoperative and 3 and 9 months postoperatively. P value < 0.05 was considered significance.

Results: This study showed significant difference (P value < 0.05) in most of outcomes (pain intensity, MMO and disc position) between arthrocentesis and Mitek mini anchor (for disc repositioning) during the follow up period. While, non significant difference between both groups in muscle tenderness (P > 0.05) was recorded.

Conclusion: It could be concluded that, both arthrocentesis and Mitek mini anchor are appropriate techniques for the treatment of ADDWOR with a significant difference between both groups in favor of Mitek mini anchor for disc repositioning

Introduction

Temporomandibular Joint (TMJ) internal derangement (ID) is one of the most common forms of temporomandibular disorder (TMD). The term refers to clinical criteria classifying TMDs but is generally used to denote a mechanical fault in the joint interfering with its smooth movement such as an abnormal positional relationship of articular disc to the mandibular condyle and the articular eminence. Thus, the term has been used synonymously with disc displacement. The TMDs have been associated with characteristic clinical findings; including pain, joint sounds and irregular or deviated jaw function[1,2,3].

Currently, the minimally invasive treatments such as arthrocentesis, as well as arthroscopic lysis and lavage are often used as first line-surgical treatment or in conjunction with non surgical modalities. They gained wide spread popularity among practitioners who treat TMJ disorders [4], as they have been shown to be reversible procedures with low morbidity and high efficacy [5,6,7,8].

However, arthrocentesis is not always successful; there is a need for alternative surgical option[4,9]. Various surgical procedures proposed for the treatment of IDs are categorized as eminectomy, high condylectomy, menisectomy, condyltomy and relocation of anteriorly or anteromedially displaced disc over the condyle [9].

Traditionally, disc repositioning techniques involve suturing (plication) of the inflamed and often degenerated discal ligaments but this can results in instability of disc repositioning surgery. To overcome this problem, Wolford [10] and Fields[11] developed a surgical technique of using a bone anchor such as Mitek anchor (Mitek surgical products, Inc, 60 clacier Drive West Wood, Massachsetts 2090) for stabilizing the TMJ articular disc.

So, the aim of this study was to compare the outcome of arthrocentesis and Mitek mini anchor in patients with disc displacement without reduction of TMJ.

PATIENTS AND METHODS

Sixteen patients (24 joints) (3 males and 13females) manifesting ID of TMJs with closed lock were selected from the out patients clinic of faculty of oral and Dental Medicine, Cairo University and Al-Azhar University, selection of each patient was based upon both clinical parameters and diagnostic imaging[5].

Conservative management protocol consisting of physiotherapy, occlusal splint and non steroidal anti-inflammatory drugs were used as a first line of treatment for all the patients, patients who did not respond to conservative management were included in this study. Patients who underwent previous TMJ surgery were excluded. All participants had given informed consent.

Patients were randomly divided into two equal groups and scheduled for arthrocentesis and disc repositioning.

Group I: Eight patients were included in this group treated by arthrocentesis using Ringer's lactated solution.

Group II: Eight patients were included in this group, in each patient Mitek mini anchor (Fig.1) was used for TMJ disc repositioning and stabilization. Mitek mini anchor is cylindrical in shape, measuring 1.8mm in diameter and 5mm in length. The body of the anchor is composed of titanium alloy (titanium 90%, aluminum 6%, vandium 4%), and its arcs are composed of nickel-titanium alloy, utilizing superelastic shape memory properties. An eyelet in the posterior aspects of the anchor allows placement of sutures that function as artificial ligament.

Pre and postoperative magnetic resonance imaging of all the patients in both groups were performed, sagittal and coronal T1 and T2 weighted and proton density images in open and closed mouth positions were obtained and compared. The magnetic resonance imaging was performed at 3 and 9 months intervals postoperatively.

Patients were evaluated for severity of symptoms before treatment, as well as 3 and 9 months postoperatively. All patients were clinically followed up on weekly basis for the first month postoperatively, then on monthly basis.

The parameters used in the evaluation were the visual analog scale (VAS), maximum mouth opening (MMO), muscle tenderness and disc position (ADDWOR). VAS was used to assess pain intensity. Zero was used for "no pain" and 10 for the worst. MMO was measured with a caliber in millimeter. Muscle tenderness was examined by palpation to determine the tender muscle. This included examination of masseter, temporalis and medial pterygoid.

Statistical analysis was carried out to determine whether the evaluated parameters differed with statistical significance during the three evaluation periods. A significant level of P value less than 0.05 was used.

Technique of arthrocentesis:

Two points were marked over the skin of the affected joint on the tragalcanthal line at 1 and 2 cms in front the tragus. Two mms below the first point is considered inlet point, while the outlet point is located below the second one by 8mm. The preauricular area of the affected TMJ was scrubbed with povidone iodine solution. Intra-articular injection procedures of 2% lidocain was done to block auriculotemporal nerve as described by Nitzan et al[12]. A 22 gauge needle was inserted in the inlet point in an anterior, superior and medial directions till it touched the upper surface of glenoid cavity then the needle withdrawn 0.5mm and reinserted little below[12,13]. Now the needle is in the superior compartment at the articular fossa. Then, 2ml of Ringer's lactated solution was injected to distent this compartment. Another 22 gauge needle was inserted in the outlet point in an inferosuperior direction in the distended compartment to enable free flow of the solution through the superior compartment. 250 ml of the lactated Ringer's solution was injected in inlet needle (Fig.2) with sufficient manual pressure to assure free flow of the solution from outlet needle.

We ask the patient to mobilize as much as possible the mandible and we passively manipulate the joint to aid in the release of adhesions. At the end of the procedure, the outlet needle was removed and methyl prednisolone acetate (Depo-Medrol: Egyptian International Pharmaceuticals Industries Co. ARE) was injected through inlet needle in a dose of 5mL (200 mg). Then the needle was completely withdrawn. A small elastoplasts covered the puncture site. The patient was discharged when stable, usually 30 minutes after the procedure.

Surgical technique of Mitek mini anchor for TMJ disc repositioning:

The patients were anaesthetized via nasoendotracheal intubation. TMJ was approached through endaural incision. Wilkes retractor and K wires was used to distract the condyle inferiorly. A 2 x 10 mm hole was made in the posterior head of the condyle with standard Mitek drill bit (2.1mm diameter) with a built in stop using very low drilling speed and copious irrigation. The position of the anchor was generally positioned 8-10mm below the superior aspect of the condyle. The Mitek mini anchor was placed into the prepared hole and using hand pressure, the trigger was advanced, delivering the anchor below the cortical bone level in the soft medullary bone. The nickel-titanium wings which possessed superelastic properties, were compressed against the body of the anchor as it passed through the more dense cortical bone, and reopened when they enter the softer medullary bone (Fig. 3). The sutures were tugged to ensure proper seatintg of the anchor. The two ethibond sutures were then attached to retrodiscal tissue in a mattress fashion. The sutures were tied posterior and inferior to the disc.

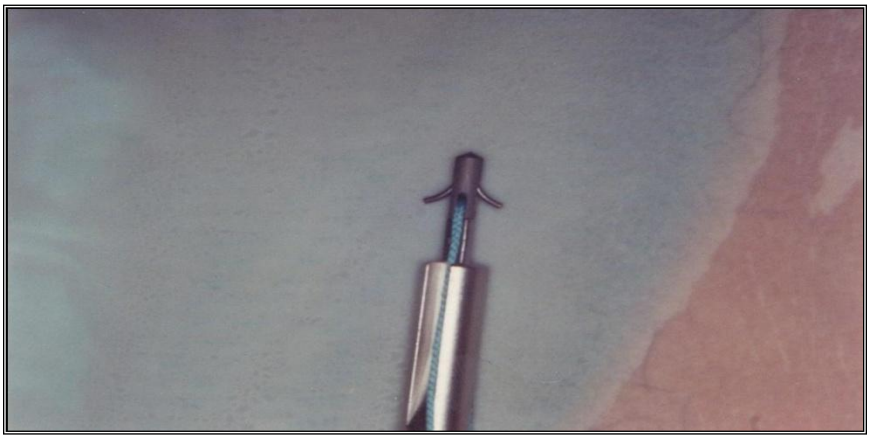


Fig. (1): Mitek mini anchor.

Fig. (2): Arthrocentesis technique.

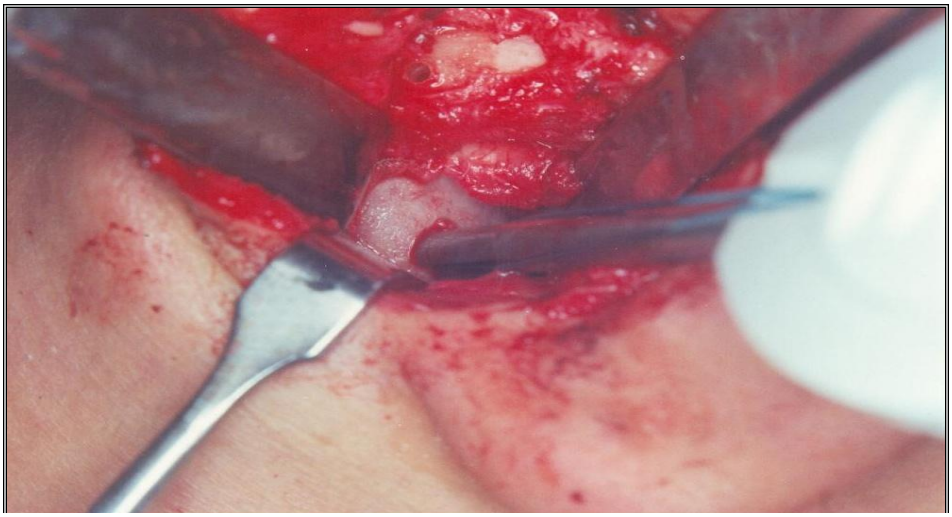


Fig . (3): Insertion of Mitek.

RESULTS

Sixteen patients (24 joints) were included in this study with ages ranging from 15 to 50 years (mean of 24.8 years). **At the preoperative examination,** there was no significance difference between the two groups as far as TMJ pain, MMO, muscle tenderness and disc position (ADDWOR) (Fig 4&7). **At three months postoperatively,** the TMJ pain of the patients treated with Mitek mini anchor was significantly lower when compared with other group ($P < 0.01$) (Table 1). The increase in mean MMO was 30.5 mm for arthrocentesis and 36.38mm for Mitek mini anchor group (Table 2).

As regard to muscle tenderness, there was an improvement in 3 patients in each group with no significant difference among group I when compared to group II ($P > 0.05$) (Table 3). As far as disc position, in group I, 5 joints showed better relation to the condylar head (Fig 5) but still slightly displaced in closed mouth position (ADDWR). The other 8 joints, the disc was still displaced anteriorly (ADDWOR) despite treatment (Table 4). In group II, the disc position became normal in 1 joint (Fig 8) while in 6 joints, the position of disc had improved (ADDWR). The other 4 joints, the disc was still displaced anteriorly (ADDWOR) (Table 4).

At nine months postoperatively, comparing the incidence of TMJ pain among both groups revealed a highly significant improvement concerning pain among group II compared to group I ($P < 0.01$) (Table 1). The comparison between the incidence of increasing of MMO pre and postoperatively revealed an increase of the average of MMO at the end of postoperative (36.13mm) for group I and (42.25mm) for group II. Significant difference between both groups were noticed ($P < 0.05$) in favor of group II (Table 2). The comparison between the incidence of patients without muscle tenderness pre and postoperatively revealed an increase of number of cases without tenderness in muscles at the end of postoperative period in both groups with non significant difference ($P > 0.05$) (Table 3). As far as disc position at 9 months postoperatively; in group I, 6 joints showed slightly displaced disc in closed mouth (ADDWR) (Fig 6) while the other 7 joints still had marked displaced disc anteriorly in closed position (ADDWOR) (Table 4). In group II, 2 joints became with normal disc position (Fig 9), 8 joints showed better disc position while, in only one joint, the disc was still displaced anteriorly in closed mouth position (ADDWOR) (Table 4).

Comparing the incidence of improvement of disc position among both groups revealed a significant increase in joints with improved disc position in group II compared with group I ($P < 0.05$) (Table 4).

Table 1: TMJ pain among both groups.

TMJ Pain	Group I			Group II			P Value
	Pre-operative	Postoperative		Pre-operative	Postoperative		
		3months	9months		3months	9months	
No	0	2	5	0	1	8	0.01*
Mild	0	3	3	0	6	3	
Moderate	8	3	5	5	4	0	
Severe	5	5	0	6	0	0	
Total joints	13	13	13	11	11	11	

* Highly significant difference between both groups (P < 0.01) in favor of group II.

Table 2: MMO among both groups (mm).

	Group I		Group II		P Value
	Mean	SD	Mean	SD	
Preoperative	23.63	3.78	23.75	4.77	0.955*
3 months postoperative	30.50	4.38	36.38	4.90	0.024**
9 months postoperative	36.13	5.28	42.25	4.33	0.024**

* Non significant difference between both groups (P > 0.05) (preoperative).
** Significant difference between both groups (P < 0.05) (postoperative) in favor of group II.

Table 3: Muscle tenderness among both group.

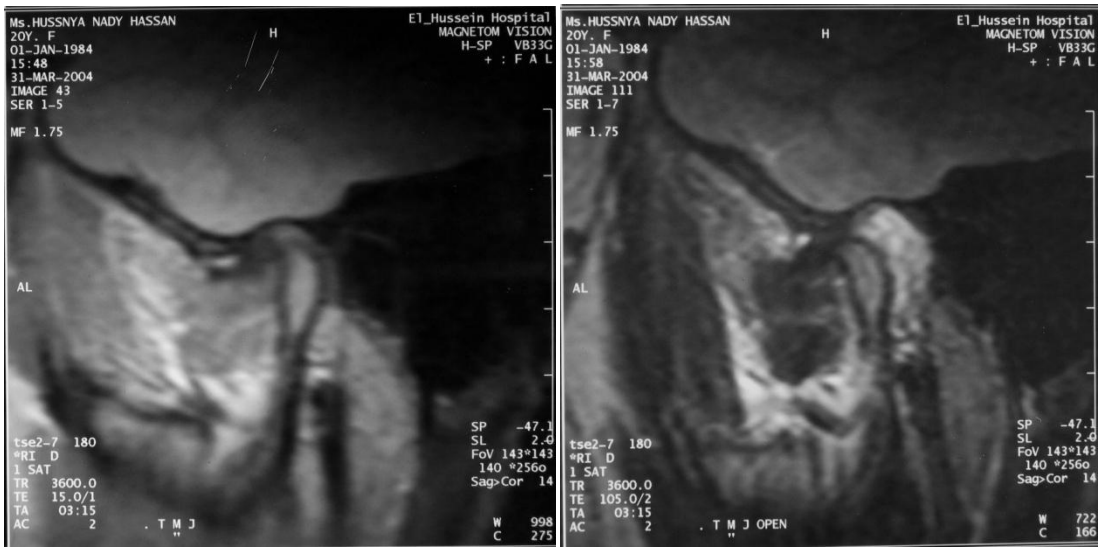
Muscle tenderness	Group I			Group II			P Value
	Pre-operative	Postoperative		Pre-operative	Postoperative		
		3 months	9 months		3 months	9 months	
Tender (+)	8	5	4	8	5	2	0.08*
Non tender (-)	0	3	4	0	3	6	
Total	8	8	8	8	8	8	

* Non significant difference between both groups (P > 0.05).

Table 4: Pre and postoperative disc positions among both groups.

Group	preoperative Displaced disc	3 months postoperative			9 months postoperative			P Value
		no change in disc position	improved disc position	normal disc position	no change in disc position	improved disc position	normal disc position	
I	13	8	5	0	7	6	0	0.01*
II	11	4	6	1	1	8	2	

* Significant different between both groups (P < 0.05).



A B

Fig (4): Preoperative MRI, sagittal view, proton density right side, (A: closed, B: open), anteriorly displaced disc, limited condylar translation & moderate effusion.(case No.2, group I)

(A) (B)

Fig (5): Three months postoperative MRI, sagittal view, proton density right side, (A: closed, B: open) improved disc position & mild effusion .(case No.2, group I)

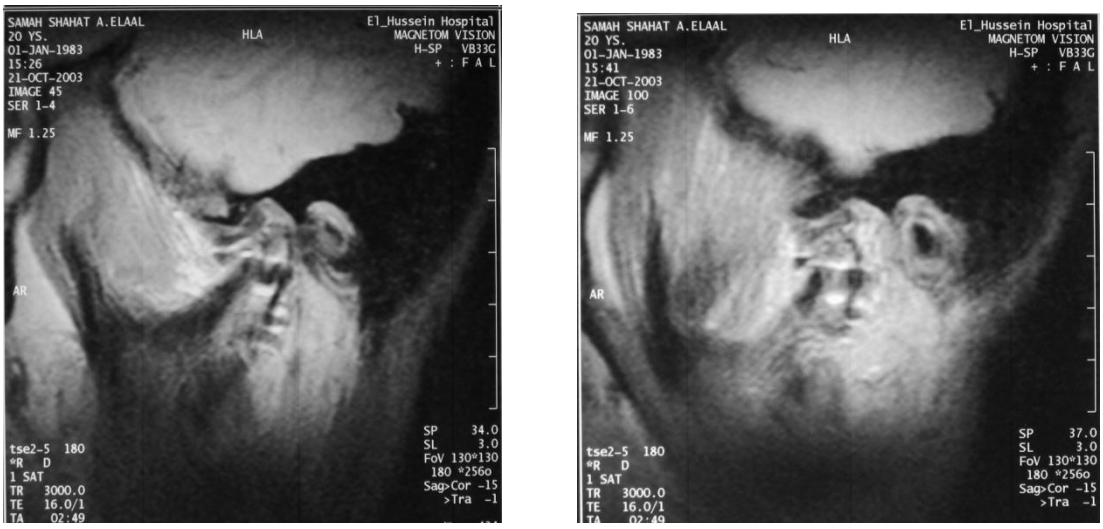
(A)

(B)

Fig (6): Nine months postoperative MRI, sagittal view, proton density right side, (A: closed, B: open). The disc is in the same position as 3 months postoperatively with minimal effusion. (case No.2, group I)

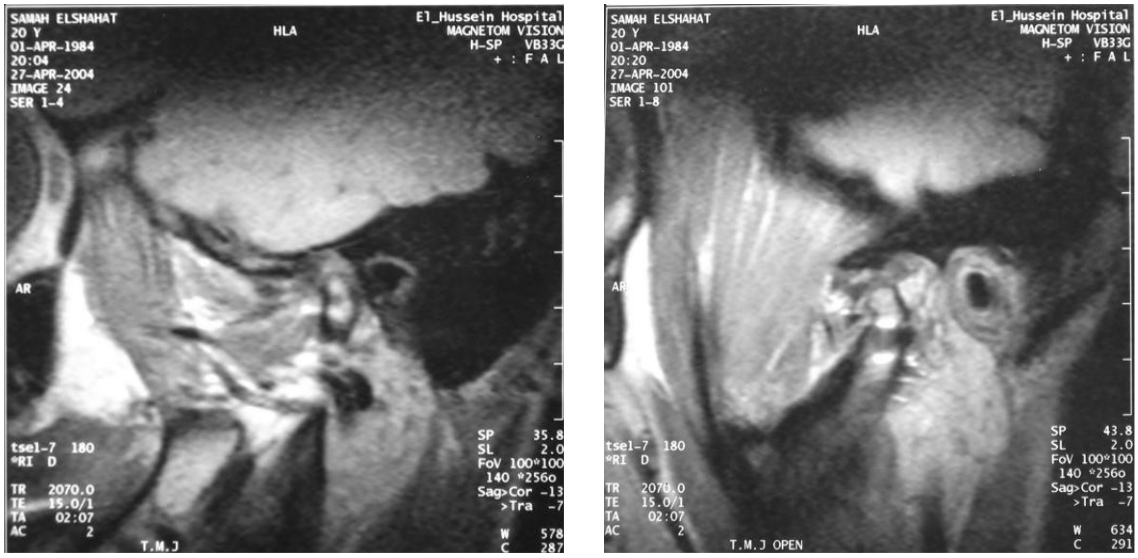
(A) (B)

Fig (7): Preoperative MRI, sagittal view, proton density ,left side, (A: closed, B: open), anteriorly displaced disc, thickened bowtie shaped disc, & sever effusion .(case No.2, group II)



(A) **(B)**

Fig (8): Three months postoperative MRI, sagittal view, proton density ,left side, (A: closed, B: open). Normal disc position in both closed and open views with mild effusion. (case No.2, group II)



(A) **(B)**

Fig (9): Nine months postoperative MRI, sagittal view, proton density ,left side, (A: closed, B: open), still normal disc position, in both closed and open views with no effusion. (case No.2, group II)

DISCUSSION

This study showed the joint arthrocentesis and disc placation with mitek mini anchor for the treatment of ADDWOR resulted in the improvement in TMJ pain, MMO muscle tenderness and disc position at 3 and 9 months follow up. Emphasis on the role of the disc in ID has resulted in extended efforts to visualize this structure. To date MRI is recognized as the preferred tool for determining the disc position.

Temporomandibular joint arthrocentesis and lavage first described in the North American literature in 1991 and since it was published, it has gained wide spread. Arthrocentesis is a simplified and efficient procedure that can be performed under local anesthesia [(12)]. Nitzan et al[(13)], Murakami et al[(14)] and Mc Carty and Farrar [(15)] specialized that sliding of the disc is totally prevented by its adherence to posterior slope of articular eminence and fossa. This inability of the disc to slide might result from adhesive forces originating from an increase in synovial fluid viscosity

as a result of long standing pressure applied to the joint. This pressure is claimed to force the synovial away allowing the adherence of the disc to the posterior slope for the articular eminence. In arthrocentesis, the injected fluid enables the disc to slide and thereby reestablished normal functional TMJ. Such a rule performs the base on which the current study was carried on.

By the end of follow up period, the relief of pain in these patients of group I (38%) most probability due to washing out of the chemical pain mediators in the synovial fluid that resulted from synovitis. Those findings are in agreement with Murakami et al[16] who proved synovitis is one cause of TMJ pain in patient with ID, while disagreed with Bronstein et al[17] and Schwartz[18] who stated that pain was the result of the condyle articulating against the bilaminar zone which contains blood vessels and nerves.

After conventional surgical disc plication, functional loading of the joint may cause failure of the procedure and displacement of the disc again with continued degeneration within the joint. Thus the concept of using bone anchor and artificial ligament for disc stabilization is attractive as it does not depend on structural integrity of soft tissues for maintaining postsurgical disc stability[9].

In the present study; at the end of follow up period, joint pain in group II were eliminated in 73% of joints due to disc repositioning to a more normal anatomic relationship with the condyle and fossa and to the elimination of the problem of instability of the disc by the use of Mitek min anchor in group II[19,20]. Those findings are in agreement with Wolford[10] and Dolwick et al[19]who proved the role of disc repositioning surgery in the management of TMJ pain and dysfunction in patients with ID. We must mention that patients who were still in pain postoperatively in both groups, had some improvement in the degree of pain which ranged from moderate to mid according to the VAS used.

Concerning the MMO; by the end of follow up period, the degree of MMO in group I ranged from 27mm to 42mm with an average 36.13mm, while in group II, the degree of MMO ranged from 38 to 50mm with an average 42.25mm.

The mean increase in MMO in group II is more than group I could be due to disc surgery, which allowed for repositioning of the disc back on the top of the condyle to a more normal anatomic relationship during translator mandibular movement. These findings were supported by Dolwick et al [19] who found that favorable outcome in TMJ function was the significant improvement in MMO after disc surgery.

In this study, by the end of follow up period, there was a relief of muscle tenderness in 50% of case of group I and 75% of group II. The rest of patients were still suffering from muscle tenderness which might be the result of long standing muscle spasm secondary to joint derangement and gradual ability of muscle to adapt functionally to the repositioned disc. The better ratio of relief of muscle tenderness in group II is consistent with the findings of Bronstein et al[17] who found a significant improvement in the return of muscle to a more relaxed position after disc surgery.

In the present study in group II, half of the cases were unilaterally affected with ADDWOR. The contralateral side suffered from ADDWR which were confirmed by MRI and were not indicated for surgery. The use of MRI at 3 and 9 months intervals postoperatively revealed that, there was no change in the disc and condylar position in the contralateral non operated side, however there were some degree of improvement on both sides clinically.

Finally on analyzing objective and subjective outcomes of the two groups, it seems that patients of group II showed considerable improvement in all of examined parameters all over the follow up period of study while patients of group I represented only mild improvement compared to group II. This could be referred to the nature of the performed surgery itself in group II using the Mitek min anchor which provides stability in disc repositioning.

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