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EVALUATION OF MASSETER MUSCLE ACTIVITY USING ELECTROMYOGRAM FOLLOWING TEMPOROMANDIBULAR JOINT ARTHROCENTESIS

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ABSTRACT

Purpose: The aim of this study was to measure the masseter muscles activity by electromyogram before and after arthrocentesis in patients with temporomandibular disorders.

Materials and methods: Twelve patients with unilateral painful TMJ, diagnosed by RDC/TMD as group II and indicated for unilateral TMJ arthrocentesis are considered as the study group. In this group, electromyographic analysis was performed before and four weeks following the arthrocentesis. The healthy control group included 6 volunteers without any signs and symptoms of temporomandibular disorders. Electromyographic analysis was performed and compared to that of the study group.

Results: Comparison of the electromyographic values of the affected side in the study group before and after arthrocentesis showed that only the amplitude during moderate clenching revealed significant differences after four weeks (p=0.02). Differences in all other parameters were statistically insignificant

Conclusions: TMJ arthrocentesis is an effective technique for the treatment of the disc displacements sub-types of TMDs. Following arthrocentesis, definite improvement in clinical results is achieved, but improvement in muscle function is only partial as measured by surface electromyography (SEMG). SEMG is a simple non-invasive technique for monitoring of the treatment outcomes on muscle activity in TMDs. EMG analysis for the diagnosis of TMDs is not specific, because the EMG values before and after the arthrocentesis were within the range of normal values of the control group.

INTRODUCTION

Temporomandibular disorders (TMDs) are a group of conditions affecting the temporomandibular joint (TMJ), the muscles of mastication and/or associated structures. These disorders are considered as one of the most common causes of chronic orofacial pain conditions. The American Academy of Orofacial Pain defines TMDs as: "A collective term embracing a number of clinical problems that involve the masticatory musculature, the temporomandibular joint and associated structures, or both" [1]. Therefore, (TMDs) are

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considered as a sub-classification of musculoskeletal disorders and are generally categorized into three sub-types; muscle disorders, disc displacements and other joint disorders [2].

The American Association for Dental Research on TMDs stated that conservative reversible therapy should be the initial management of TMDs [3,4]. These therapies include; soft diet, medical therapy, intraoral appliances, physiotherapy with home exercise programs and most recently the use of low-level laser therapy [5]. These therapies could be used individually or in combination and there is no evidence to support one therapy over another for the particular subtypes of TMDs. However, in non-responsive cases, the minimally invasive treatment modalities such as TMJ arthrocentesis are considered as a second-step therapy [6,7]. Several previous studies have compared conservative reversible therapies with the minimally invasive therapies [3,5], most recently, Vos et al [6], and Tatli et al [8], in their prospective studies to compare the effectiveness of splint therapy versus arthrocentesis reported that arthrocentesis decreases pain and improves TMJ functions more rapidly and effectively than splint therapy.

TMJ arthrocentesis was first introduced in 1991as a minimally invasive treatment modality for TMDs[9]. It is a simple, non-invasive, safe, inexpensive, with high success rates and is effective in relieving pain and reestablishing normal mouth opening[10]. TMJ arthrocentesis is a procedure where the superior joint space is entered by needle puncture, then lavage with a fluid is performed. The physical action of lysis and lavage in the superior joint space rather than repositioning the anteriorly displaced disc is thought to be responsible for the success of this technique [9,11]. This action of lysis and lavage will overcome the disc adhesion to the glenoid fossa [9]. Several previous studies have shown that arthrocentesis can result in significant improvements in joint pain and width of mouth opening with proven long term results [5,6,12]. Arthrocentesis is the most minimally invasive procedure used to treat TMDs. Because of the low risk and a high success rate, surgeons should use this method before exploring more invasive treatment options [3].

Because the etiology of TMDs is complex and multifactorial, the diagnosis of different sub-types of TMDs was not standardized. Therefore, for standard, reliable and accurate diagnosis of different TMDs, the Research Diagnostic Criteria for TMDs (RDC/TMD) was developed to produce a set of valid and reliable diagnostic algorithms by which researchers and clinicians could ensure they are examining and diagnosing TMDs in a similar correct ways [13]. This (RDC/TMD) offers a very organized and simple method to examine patients properly and at the same time assesses the outcome of treatment of TMDs. The Research Diagnostic Criteria (RDC) for TMDs Consortium have utilized the clinical symptoms to record and diagnose TMDs [14]. This clinical symptoms are still considered by many as a subjective tool for assessment. It has been reported that a need for objective data in decision making is necessary to reduce reliance on subjective improvement and clinically observed data [15,16].

Electronic instrumentation provides objective measurement for many of the biological phenomena, and thus can be used throughout treatment to provide critical data that monitor and enhance treatment efficacy. Electromyography (EMG) is considered as one of the diagnostic tools used in identifying and analyzing TMDs [15,17]. It's mode of action is similar to the electrocardiogram which measures the muscular activity and dysfunctions of the heart muscle. EMG could measures the activity and dysfunction of head and neck muscles. This information is important in treatment planning and for the assessment of the outcomes of treatment [18]. When muscles are active, they generate an electrical activity that is usually proportional to the level of muscle activity. The EMG can detect abnormal muscle electrical activity in many diseases and conditions, including muscular dystrophy and inflammation of muscles [18].

Currently, there are no reports on the assessment of muscle activity following TMJ arthrocentesis.

Therefore, this study was designed to objectively assess the masseter muscle activity using electromyogram before and after treatment of TMDs by arthrocentesis and at the same time compare the pre-treatment base line EMG reading in these patients to a group of a healthy controls.

MATERIALS AND METHODS

Study design and ethical approval

The ethics committee at the Faculty of Dentistry, Alexandria University, approved the design of this study. Written informed consent after explanation of the nature and the purpose of the study was obtained from each participant.

The study group included 12 patients indicated for TMJ arthrocentesis selected from those attending the outpatient clinic of the Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Alexandria University. All patients were females, age ranging from 20-52 years (with a mean of 31.25±1.12). selection was based on the clinical diagnosis of internal derangement (ID) according to (RDC/TMD system). In this group, nine patients showed anterior disc displacement with reduction and three patients showed anterior disc displacement without reduction. In this group, electromyographic analysis was performed before the arthrocentesis and consider as a base line pre-treatment value. Following arthrocentesis, electromyographic analysis was performed and considered as post treatment value. Pre and post treatment results were compared.

The healthy control group included 6 volunteers (all females) age ranging from 25-43 years (with a mean of 28±1.19). Electromyographic analysis was performed and compared to that of the study group.

In the study group, clinical evaluation was performed before and one week, two weeks and four weeks follow up periods after TMJ arthrocentesis to the following parameters; TMJ pain score determined by the a visual analog scale (VAS) from zero to 10 ("0" is pain free and "10" is severe intolerable pain), maximal unassisted mouth opening, lateral and protrusive excursions movements, and presence of joint noise on opening and closing. Pre and post treatment results were compared. In addition, the EMG analysis after arthrocentesis was performed.

Inclusion criteria

1. Patients with unilateral painful TMJ, diagnosed by RDC/TMD as group II; disc displacement (DD) with reduction, DD without reduction with limited opening, and DD without reduction without limited opening.
2. Non responsive to conservative therapy.

Exclusion criteria

1. Patients assigned with a TMD diagnosis of myalgia
2. Degenerative joint disease, osteoarthritis.
3. Prior TMJ surgery
4. History of maxillofacial fracture
5. Use of muscle relaxants.

Treatment phases for the study group:

1- Preoperative phase

A. Clinical diagnosis
   i) Patient questionnaire
   ii) Clinical examination

B. Magnetic resonance imaging

C. Electromyographic analysis.

2- ***Operative*** **phase**

Superior joint space arthrocentesis of the affected TMJ was performed as following :

1. The ear and preauricular skin over the affected TMJ were cleaned with betadine swab then the area was isolated with sterile towels.
2. Two points were then marked over the articular fossa and eminence along the canthal-tragus line.

The first point was located 10 mm anterior to the tragus and 2 mm below the line. The second point was located 20 mm anterior to the tragus and 10 mm below the line.

3. Local anesthetic solution of 2% Lidocaine with 1:100:000 epinephrine (Novocol Pharmaceutical of Canada, Inc., Cambridge, Canada) was injected into the joint cavity, then the needle was withdrawn gently to the skin surface, thus allowing anesthesia for both hard and soft tissues of the joint.
4. The affected TMJ was palpated and the upper joint space enlarged by downward and forward displacement of the mandible.
5. 20-gauge needle was then introduced into the superior joint space at the glenoid fossa (posterior mark) and injection of about 2 ml of Ringer lactate solution was performed to distend the superior joint space.
6. 18-gauge needle was inserted into the distended compartment in the area of the articular eminence from an anterolateral approach to serve as an outlet. This needle provides an outflow for the solution which was collected in a kidney dish. Both needles were inserted to a depth of about 1.5 cm.
7. A total of 50-100 ml of the solution was used to lavage the superior joint space. During the procedure, the outlet needle was momentarily blocked with finger to help distend and break up the joint adhesions.
8. At the end of the procedure and following needles removal, the patient's jaw was gently manipulated in the vertical, protrusive and lateral excursions.

3- Postoperative phase

After the arthrocentesis, all the patients were:

- Prescribed postoperative analgesics Ketolac 10 mg (Amriya for pharmaceutical industries, Alexandria, Egypt) 3 times daily for 7 days.
- Soft diet and home physical therapy consisting of the application of moist heat and range of motion exercises 4 times daily for 7 days.
- Advised to continue using an occlusal appliance postoperatively.

Electromyographic analysis

Surface Electromyogram (SEMG) was used to record muscle activity of the right and left masseter muscles. During the EMG recordings, the patients were kept in a comfortable sitting position with no headrest, feet apart, shoulders relaxed, hands resting on thighs, and the Frankfort horizontal plane parallel to the floor.

EMG registrations were taken using a 2-channel surface EMG system (Nihon Kohden apparatus; Kogyo Co., Ltd., Tokyo, Japan) for simultaneous recording of the myoelectrical activity from right and left sides (input impedance 100 MΩ, bandwidth 2 Hz-1 kHz, gain 100 -200μV)

The active recording electrode was placed over the motor point of the masseter and the reference electrode over the angle of the jaw parallel to the muscle fibers direction. The conductivity of the electrode-skin interface was increased using conductive gel after thorough cleaning of the skin with alcohol. A ground electrode was placed at the forearm.

EMG recordings were made in the mandibular position at rest. Then, the patient was asked to moderately clench her teeth, and keep them clenched for two seconds. Electric activity was also recorded during maximum tooth clenching. Lastly, electric activity was recorded during gum chewing at right then left side. Activities from both sides were compared.

The following parameters were measured:

- The presence of any activity at rest.
- The amplitude of EMG signal measured during clenching and chewing.

- The duration of EMG signal measured during chewing.

EMG analysis of masseter muscle activity was performed before and four weeks after TMJ arthrocentesis and the results were compared.

Statistical analysis

Statistical analysis was done using SPSS software version 15.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were displayed as means and standard deviations. Normal ranges were calculated based on the mean values of the control and the standard deviations. Comparison between values before and after the intervention was done with paired t test. Comparison of the values with the mean of the control was done using t test. Comparison between affected and unaffected sides was done using paired t test. Significance level was set at 5%.

RESULTS

TMJ Pain

Pain decreased significantly from preoperative value (7±1.55) compared to that of one week follow up (4.33+ 1.51) as measured by the VAS. (paired t-test: t-value=3.024, p-value=0.029). Following 2 weeks, the mean pain score was (3.33+ 2.07). There was a significant decrease in pain intensity between the preoperative value and that at 2 weeks postoperative follow up (t-value=3.841, p-value=0.012). following 4 weeks, the mean pain score was (2.33±1.63). There was a significant decrease in pain intensity between the preoperative value and that at 4 weeks postoperative follow up (t-value=4.3, p-value = 0.008).

Maximal mouth opening (MMO)

Patients showed a significant increase in the maximum mouth opening from preoperative 25.33±4.63 to 4 weeks postoperative follow up 38.90±3.48 mm (P<0.005). Following 1 week follow up, the mean MMO was 33.00±7.27mm. The increase in MMO from preoperative to 1 week postoperative follow up was found to be statistically significant (paired t-test: t-value=4.171, p-value=0.009). Following 2 weeks, the mean MMO was 35.00±8.25 mm. The increase in MMO from preoperative to 2 weeks postoperative follow up was found to be statistically significant (t-value=5.26, p-value =0.003). following 4 weeks, the mean MMO was 38.90 ± 3.48 mm. The increase in MMO from preoperative to 4 weeks postoperative follow up was statistically significant (t-value=4.88, p-value =0.005) (Table 1).

Protrusive movement

The protrusive movement of the patients increased from preoperative to 4 weeks postoperative follow up (3.57 ± 1.03 mm to 6.67±2.42 mm, respectively). This increase was statistically significant. (paired t-test: t-value=6.325, p-value =0.001) (Table 1).

Lateral excursions

Lateral excursions increased from preoperative 3.83±0.89 mm to 6.50±0.98 mm after 4 weeks postoperative follow up. This increase was statistically significant (paired t-test: t-value=3.236, p-value =0.023) (Table 1).

TABLE (1) Comparison of maximal mouth opening, protrusive movement and lateral excursion before and 4 weeks after the operation.

	Before Mean ± SD	After Mean ± SD	Paired t test	P value
Maximal mouth opening	25.33±4.63	38.90 ± 3.48	4.88	0.005*
Protrusive movement	3.57 ± 1.03	6.67±2.42	6.325	0.001*
Lateral excursion	3.83 ± 0.89	6.50 ± 0.98	3.2326	0.023*

: Statistically significant at P ≤ 0.05

EMG Recordings

In the study group, the electromyographic activity of the masseter muscles was measured preoperatively and 4 weeks postoperatively. While in the control group the electromyographic activity was recorded only one time. The following parameters were measured; amplitude of moderate & maximum clenching, amplitude during chewing on affected &unaffected sides, duration during chewing on affected and unaffected sides.

Table 2 shows the normal range of electromyographic activity recorded from the control group during clenching and chewing. The values of moderate clenching ranged from 56.55 to 143.71, while the values of maximum clenching ranged from 145.69 to 300.97. The values of amplitude while chewing from 133. 31 to 475.14 and of duration while chewing from 128.54 to 399.73.

TABLE (2) Normal limits of electromyographic activity in the control group.

	Normal ranges
Amplitude while moderate clenching (μv)	56.55- 143.71
Amplitude while maximum clenching (μv)	145.69- 300.97
Amplitude while chewing (μv)	133.31- 475.14
Duration while chewing (m sec)	128.54- 399.73

Table 3 shows the comparison of moderate clenching values in the unaffected side before and after the intervention. In the unaffected side the decrease in the value of moderate clenching from 95.00 to 70.00 was not statistically significant (P= 0.08). These values before and after the intervention were within the range of normal values of the control group (56.55- 143.71).

Table 4 shows the comparison of moderate clenching values in affected side before and after the intervention and in relation to control normal range. Moderate clenching decreased significantly from 117.33 to 90.00 after the intervention. This decrease was statistically significant (P= 0.02). These values in the affected side before and after the intervention were within the range of normal values, and no significant differences were observed between the mean values of the control and affected side before or after the intervention (P= 0.44 and 0.66 respectively) (Figure 1).

TABLE (3) Comparison of moderate clenching values in unaffected side before and after the intervention.

	Before	After
Mean ± SD	95.00 ± 58.57	70.00 ± 41.47
Normal range	56.55- 143.71	
Paired t test P value	2.18 0.08	

TABLE (4) Comparison of moderate clenching values in affected side before and after the intervention and in relation to control normal range.

	Before	After
Mean ± SD	117.33±54.06	90.00±47.33
Paired t test P value	3.30 0.02*	
Normal range	56.55- 143.71	
Control group: mean ± SD	99.17 ± 12.42	
T test P value	0.80 0.44	0.46 0.66

: statistically significant at P ≤ 0.05

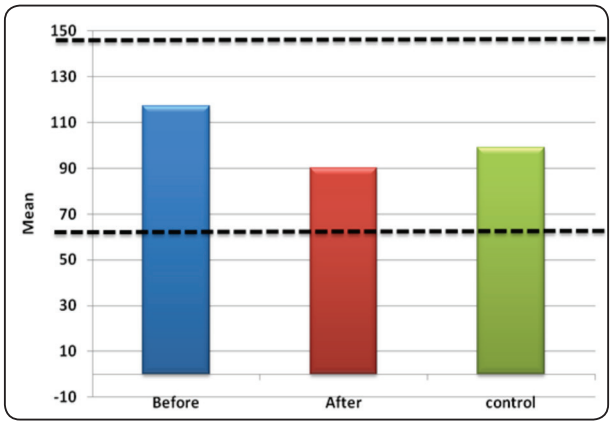

Fig. (1) Comparison of moderate clenching values in affected side before and after the intervention and in relation to control normal range.

Table 5 shows the comparison of maximum clenching values in the unaffected side before and after the intervention. Maximum clenching decreased from 233.33 to 206.67 and this was statistically significant (P=0.03). These values before and after the intervention were within the range of normal values (145.69- 300.97).

TABLE (5) Comparison of maximum clenching values in unaffected side before and after the intervention.

	Before	After
Mean ± SD	233.33 ± 156.29	206.67 ± 146.24
Normal range	145.69- 300.97	
Paired t test P value	3.16 0.03*	

: statistically significant at P ≤ 0.05

Table 6 shows the comparison of maximum clenching values in the affected side before and after the intervention and in relation to control normal range. Maximum clenching decreased from 260.00 to 230.00 after the intervention. This decrease was not statistically significant (P= 0.17). These values before and after the intervention were within the range of normal values, and no significant differences were observed between the mean values of the control and affected side before or after the intervention (P= 0.44 and 0.87 respectively) (Figure 2).

TABLE (6) Comparison of maximum clenching values in affected side before and after the intervention and in relation to control normal range.

	Before	After
Mean ± SD	260.00 ± 121.98	230.00 ± 157.35
Paired t test P value	1.63 0.17	
Normal range	145.69- 300.97	
Control group: mean ± SD	219.17 ± 24.17	
T test P value	0.80 0.44	0.17 0.87

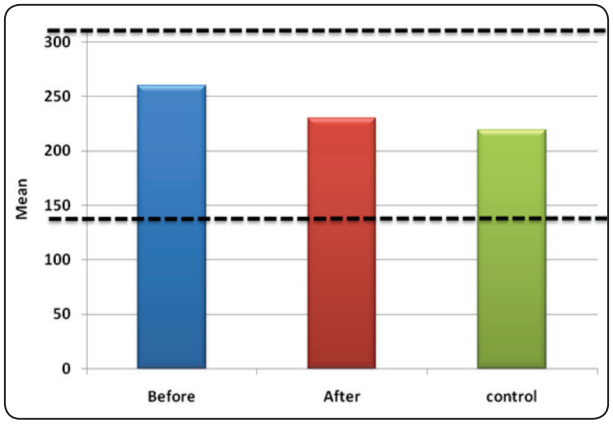

Fig. (2) Comparison of maximum clenching values in affected side before and after the intervention and in relation to control normal range.

Table 7 shows the comparison of amplitude of masseter muscle activity of the unaffected side while chewing on the affected side before and after the intervention. The amplitude decreased from 236.67 to 168.33 and this was not statistically significant (P= 0.20). The values before and after the intervention were within the range of normal values (133. 31- 475.14).

TABLE (7) Comparison of amplitude of masseter muscle activity of the unaffected side while chewing on the affected side before and after the intervention and in relation to control normal range.

	Before	After
Mean ± SD	236.67 ± 109.12	168.33 ± 70.26
Normal range	133. 31- 475.14	
Paired t test P value	1.49 0.20	

Table 8 shows the comparison of amplitude of masseter muscle activity of the affected side while chewing on the affected side before and after the intervention and in relation to control normal range. The amplitude decreased from 340.00 to 228.33 after the intervention. This decrease was not statistically significant (P= 0.07). These values before and after

the intervention were within the range of normal values, and no significant differences were observed between the mean values of the control and affected side before or after the intervention (P= 0.08 and 0.65 respectively).

TABLE (8) Comparison of amplitude of masseter muscle activity of the affected side while chewing on the affected side before and after the intervention and in relation to control normal range.

	Before	After
Mean ± SD	340.00 ± 161.99	228.33 ± 122.87
Paired t test P value	2.26 0.07	
Normal range	133. 31- 475.14	
Control group: mean ± SD	202.50 ± 60.97	
T test P value	1.95 0.08	0.46 0.65

Table 9 shows the comparison of duration while chewing on affected side for the unaffected side before and after the intervention. In the unaffected side, the duration decreased from 420.00 to 298.33 and this was not statistically significant (P= 0.08). The mean before the intervention was above the range of normal values, while after the intervention it was within the normal range.

TABLE (9) Comparison of duration of chewing on affected side for the unaffected side before and after the intervention and in relation to control normal range.

	Before	After
Mean ± SD	420.00 ± 129.61	298.33 ± 150.79
Normal range	128.54- 399.73	
Paired t test P value	2.21 0.08	

Table 10 shows the comparison of duration while chewing on affected side for the affected side before and after the intervention and in relation to control normal range. The duration decreased from 406.67 to 311.67 after the intervention. This decrease was not statistically significant (P= 0.07). The mean before the intervention was above the range of normal values, while after the intervention it was within the normal range. The mean before the intervention was significantly higher than the mean of the control (P= 0.04) whereas after the intervention the difference between the means of the affected side and the control was not significantly different (P= 0.64).

TABLE (10) Comparison of duration of chewing on affected side for the affected side before and after the intervention and in relation to control normal range.

	Before	After
Mean ± SD	406.67 ± 110.03	311.67 ± 116.69
Paired t test P value	2.27 0.07	
Normal range	128.54- 399.73	
Control group: mean ± SD	286.67 ± 49.67	
T test P value	2.44 0.04*	0.48 0.64

: statistically significant at P ≤ 0.05

Table 11 shows the comparison of masticatory forces in affected side and unaffected side in the study group before and after the intervention. EMG activity recorded from the masseter before the operation showed absence of significant difference between both sides during clenching and chewing denoting loss of dominance. After the operation, there were no significant differences between both sides regarding their EMG activity. (Table 11 and Figures 3 & 4).

TABLE (11) Comparison of masticatory forces in affected side and unaffected side in the study group before and after the operation.

	Before the operation			After the operation		
	Affected side Mean ± SD	Unaffected side Mean ± SD	Paired t test P value	Affected side Mean ± SD	Unaffected side Mean ± SD	Paired t test P value
Amplitude while moderate clenching (μ v)	117.33 ± 54.06	95.00 ± 58.57	1.88 0.12	90.00 ± 47.33	70.00 ± 41.47	1.69 0.15
Amplitude while maximum clenching (μ v)	260.00 ±121.98	233.33 ± 156.29	1.00 0.36	230.00 ±157.35	206.67 ± 146.24	0.91 0.40
Amplitude while chewing on affected side (μ v)	340.00 ±161.99	236.67 ± 109.12	1.46 0.20	228.33 ±122.87	168.33 ± 70.26	1.43 0.21
Duration while chewing on affected side (m sec)	406.67 ± 110.03	420.00 ± 129.61	0.35 0.74	311.67 ± 116.69	298.33 ± 150.79	0.54 0.61
Amplitude while chewing on unaffected side (μ v)	186.67 ± 72.30	256.67 ± 206.07	0.89 0.41	208.33 ±101.28	255.00 ± 212.39	0.63 0.59
Duration while chewing on unaffected side (m sec)	290.00 ± 75.63	326.67 ± 84.54	0.94 0.39	313.33 ±101.72	326.67 ± 93.52	0.93 0.39

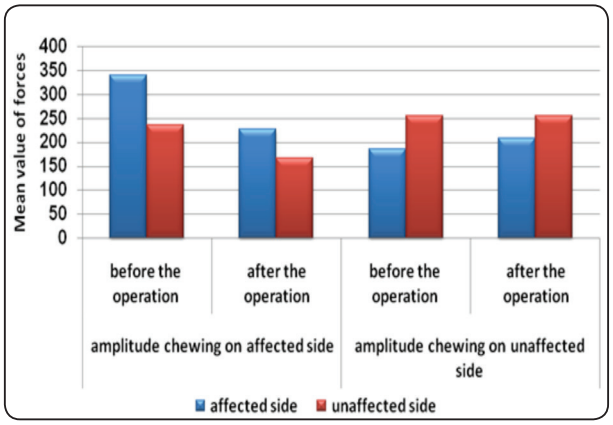

Fig. (3) Comparison of amplitude of chewing on affected side to amplitude of chewing on unaffected side in the study group before and after the operation.

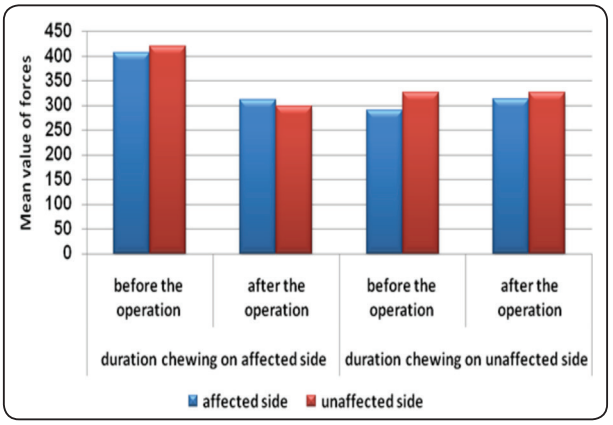

Fig. (4) Comparison of duration while chewing on affected side to that of unaffected side in the study group before and after the operation.

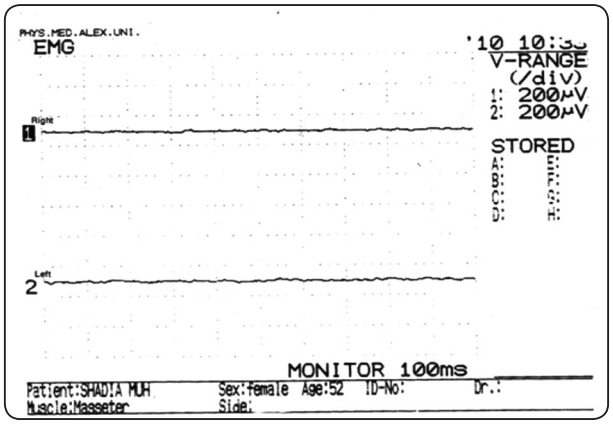

Fig. (5) SEMG activities recorded from the masseter muscles in one of the control group showing normal activity at rest (1= right masseter, 2= left masseter).

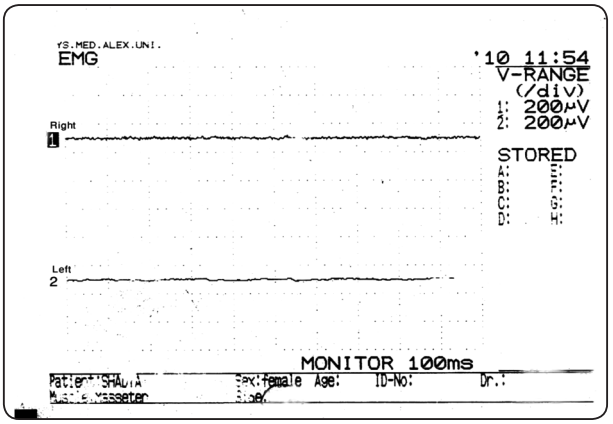

Fig. (6) SEMG activities recorded from the masseter muscles in one of the study group showing normal activity at rest (1= right masseter, 2= left masseter).

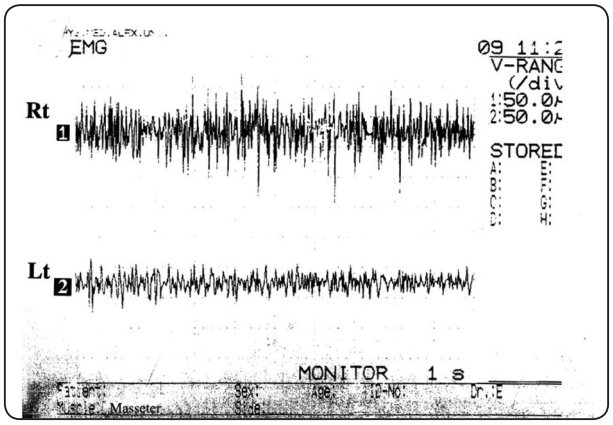

Fig. (7) SEMG activities recorded from the masseter muscles in one of the control group during moderate clenching showing increased EMG activity recorded from the right side (1) compared to that from the left side (2) consistent with right side dominancy.

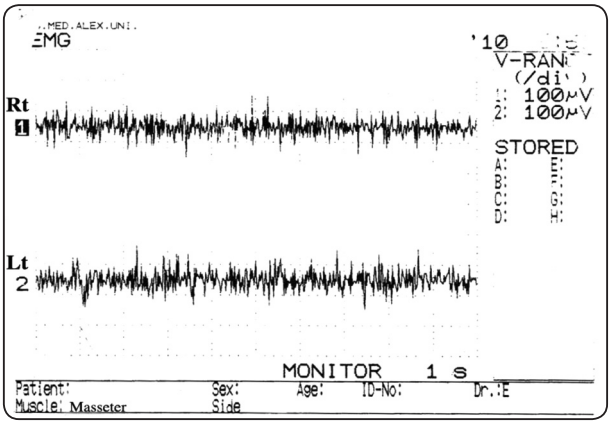

Fig. (8) SEMG from the masseter muscles in one of the studied patients before operation showing loss of dominancy during moderate clenching (EMG activity at the affected side (right) is comparable to that at the unaffected side (left)).

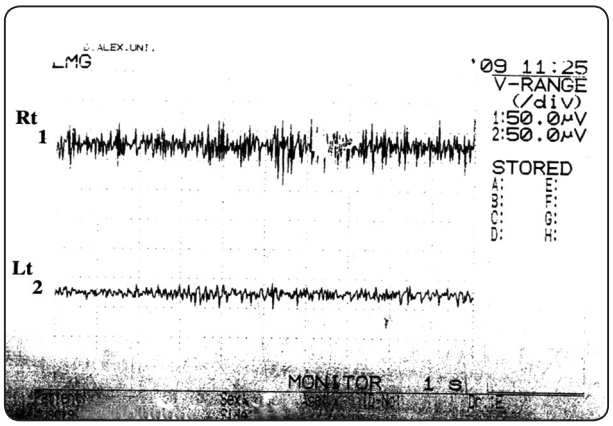

Fig. (9) SEMG recordings from the masseter muscles of same patient during moderate clenching after the operation showing dominancy of EMG activity (increase of activity at the right affected side compared to the left unaffected side).

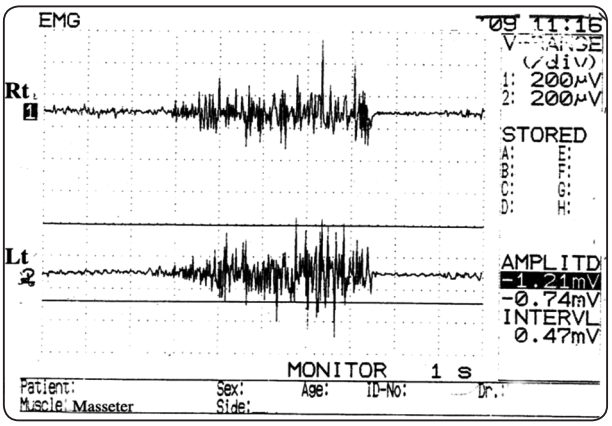

Fig. (10) SEMG activity recorded from the masseter muscles in one of the studied patients before operation showing increase EMG-activity (amplitude and duration) recorded from the right affected side during chewing on the left unaffected side.

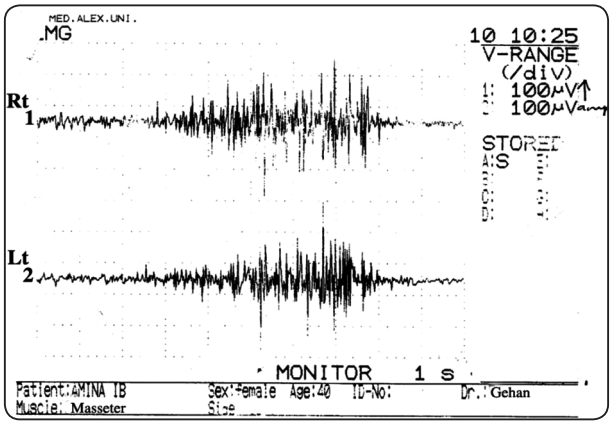

Fig. (11) SEMG recordings from masseter muscles in the same patient after the operation showing still increase in EMG activity at the right affected side during chewing on the left unaffected side (no improvement).

DISCUSSION

Patients selected for the present study were complaining from the clinical signs and symptoms of TMJ internal derangement, only patients with unilateral painful TMJ, diagnosed by RDC/TMD as group II were included in this study. These patients were also complained of pain at the TMJ surrounding muscles. A functional impairment in the masticatory system can cause diagnostic difficulties, because the source of pain can be various and overlap each other in this musculoskeletal disorder. TMD patients usually present mixed, arthrogenous and myogenous

symptoms [19,20]. arthrocentesis will not be effective in patients with muscle or myofascial pain origin, but will be effective in patients with disc displacement with or without reduction. These patients were diagnosed clinically and radiographically using magnetic resonance imaging.

Arthrocentesis was performed only on the affected side (unilateral). Clinically, all patients treated with arthrocentesis showed postoperative consistent continuous improvement in the signs and symptoms from the first week till the fourth week follow up period. These findings are in agreement with the currently available evidence that the therapeutic effects of arthrocentesis and lavage is an efficient and effective treatment modality for TMDs [6,8,21]. This increase in success rates following arthrocentesis could be attributed to the reduction in the inflammatory mediators, matrix-degrading enzymes, and the removal of the degradation products within the joint as well as the improvement in the natural lubrication [8,10].

Several previous studies suggested that SEMG is a useful objective tool for diagnosis of the dysfunction of the masticatory muscles in patients with TMDs [15,22-24], while other studies contradict this opinion and stated that SEMG has limited role in TMDs diagnosis and could leads to a unnecessary dental treatment to treat these disorders[25-27], in between these two opposite opinions, recent studies mentioned that SEMG can be used only as a complementary tool for the diagnosis of the myogenous TMDs [17].

Earlier EMG researches have had problems in their study designs due to the absence of comparative control which is considered as a base line for comparison [28]. Therefore controversies have been existed between the earlier and more recent studies for the value of using EMG. In the present study, the EMG values of masseter muscle activity were recorded in a study group with TMDs and compared to that of healthy control group. Furthermore, this study also evaluated the effectiveness of arthrocentesis procedure on TMDs. It was hypothesized that successful treatment by arthrocentesis will decrease the severity of muscle dysfunction and that comparison of post treatment muscle activity with pretreatment base line will document the treatment efficacy.

In this study, the EMG values were recorded simultaneously from the right and left masseter muscles at rest and during moderate and maximum clenching, the masseter muscle is directly related to jaw motion, previous studies have shown that TMDs cause asymmetry of masseter muscle strength during the clenching motion [29].

Results of this study showed that the EMG in the study and control groups had recorded decreased activity in the rest position. This finding is in agreement with the results obtained by Manns et al, [30] where the EMG muscle activity decreased when the mandible was moved from the teeth being in occlusion to the rest position. While, during clenching and chewing, the patients in the study group showed increase in EMG activity compared to normal values of the control group. This is in agreement with many authors who suggested that TMDs could be associated with increased EMG activities [16,22,24].

In this study, the difference between the means of the EMG activity of the masseter muscle at the affected side and unaffected side in the study group before and after the arthrocentesis and that of the healthy controls were not statistically significantly. This is in agreement with Lyons and Baxendale[31] in their study that showed that the difference in muscular activity between the patients and the controls was not statistically significant. These results showed that EMG analysis is not specific in diagnosis of TMDs as the results of the study group were within the normal range of the control group. These findings were reported in similar previous studies [17,26,27]. In the other hands, the EMG activities

at the affected side in the study group were higher than the contralateral unaffected side before the arthrocentesis, although these values were within the range of the normal control group, following arthrocentesis the EMG values declined and became very close to the values of the unaffected sides before the arthrocentesis. These findings suggest that the EMG analysis could have a role in monitoring the effects of therapy (arthrocentesis in this study) on the TMDs. These findings are in agreement with previous studies [26,32].

Results of the EMG analysis of masseter muscle activity in the affected side during moderate clenching showed significant reduction in EMG values from 117.33 μ v before arthrocentesis to 90.00 μ v after the arthrocentesis (p=0.02). This results may indicate the efficacy of arthrocentesis in normalizing the muscle activity at the affected side during moderate clenching. While during maximum clenching and all the other EMG parameters the values decreased but didn't show a statistically significant difference. This reduction in postoperative EMG values ,although not significant, could indicate the partial improvement in masseter muscle activity following arthrocentesis. Further studies with large sample size and longer follow-up period are required for further speculation.

CONCLUSIONS

TMJ arthrocentesis is an effective technique for the treatment of the disc displacements sub-types of TMDs. Following arthrocentesis, definite improvement in clinical results is achieved, but improvement in muscle function is only partial as measured by SEMG. SEMG is a simple non-invasive technique for monitoring of the treatment outcomes on muscle function in TMDs. EMG analysis for the diagnosis of TMDs is not specific, because the EMG values before and after the arthrocentesis were within the range of normal values of the control group.

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CONFLICT OF INTEREST:

There are no conflicts of interest related to this study.

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