

Assessment of mouth opening limitation in myogenic temporomandibular disorder patients

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ABSTRACT

This research was to evaluate a new assessment of mouth opening limitation in myogenic temporomandibular disorder (TMD) patients. The suggested assessment was accomplished by calculating the opening ratio (OR) which depends on the ratio between maximum comfortable mouth opening and maximum assisted mouth opening.

There was a remarked significant difference in the OR between the TMD patients and control groups. There was no significant relationship between OR with age or sex in both groups. A significant reversible correlation between OR with number of tender muscles and temporomandibular joint tenderness was found.

It could be concluded from this research that the OR has diagnostic value in TMD patients, but unlike other measures, as it independent on age and gender.

Key Words: Mouth opening, temporomandibular disorder.

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INTRODUCTION

The limitation of mouth opening is one of the cardinal signs of temporomandibular disorder (TMD).⁽¹⁾ Therefore, evaluation of mouth opening is commonly used as part of routine function assessment of the temporomandibular joints (TMJ)^(1, 2) and as outcome parameter in studies evaluating the efficacy of therapeutic interventions.⁽³⁾

The opening movement is caused by relaxation of the temporalis, masseter and medial pterygoid muscles with combined action of the lateral pterygoid, geniohyoid and digastric muscles.⁽⁴⁾

Assessment of mouth opening is usually accomplished by measuring the interincisal distance with millimeter ruler when patient open widely.⁽⁵⁻⁷⁾ Wood and Branco⁽⁸⁾ examined three methods of measuring interincisal distance and concluded that direct measurement using a ruler was more accurate than using either a Willis Bite Gauge or dividers. But this measurement has a number of limitations, as the normal

range in healthy subjects remain debatable and varied from 35-70 depending on age^(1,6,7) and gender.^(7,9) The authors could not be able to define an end line of limitation of mouth opening in TMD patients.^(1,10-14) Therefore, a number of other techniques have been suggested, including angle of mouth measurements,⁽²⁾ cephalometric radiographs⁽¹⁵⁾ and the use of instruments such as the Mandibular Excursiometer.⁽¹⁶⁾ These are often costly and require special apparatus.

The aim of this research was to evaluate a new assessment of mouth opening limitation in myogenic TMD patients. The suggested assessment depends on the ratio between maximum comfortable mouth opening and maximum assisted mouth opening.

MATERIALS AND METHODS

One hundred patients who had myogenic TMD were included in this research. The diagnosis was made according to Sarnat and Laskin.⁽⁴⁾ The sample was selected

from those patients referred to the Department of Oral and Maxillofacial Surgery, College of dentistry, University of Mosul. All patients were examined clinically regarding their TMD problems.

The control subjects were randomly selected from those patients attending to Oral Diagnosis Clinic, College of Dentistry, University of Mosul for dental treatment. They were consisting of 100 age- and sex- matched subjects with no current or history of TMD problems.

The patient was sitting in an upright position in a dental chair, his/her head supported by the headrest. For determining

maximum comfortable opening, patients were asked to open as wide as possible without report of pain and then the distance from the incisal edge of the upper central incisor to the incisal edge of the lower central incisor was measured by a ruler.^(1,7) Maximal assisted mouth opening was measured interincisally when the mandible was gently forced further apart with pressure from the examiner's thumb on the maxillary incisors and index finger on the mandibular incisors. The patient may feel pain for moments.^(1,17)

The Opening Ratio (OR) was then determined as follows:

$$OR = \frac{\text{Maximum comfortable mouth opening}}{\text{Maximum assisted mouth opening}} \times 100$$

Statistical analyses were done using MINITAB (version 13.20) computer software. The difference in means between two variables was tested for statistical significance using Student's t-test. While analysis of variance (ANOVA) was used to declare any significant differences between age groups. The strength and direction of linear correlation was tested with Pearson Correlation Coefficient. Significant levels of $p < 0.05$ and $p < 0.01$ were established.

RESULTS

A total of 100 patients with myogenic TMD were included in this research; 38% of them were males and the remaining 62% were females. Their age was ranged from 12-54 years with mean age of 25.2 years.

The control group was comprised of 100 sex- and age- matched individuals with range of age between 14-55 years and mean age of 24 years.

The distribution of TMD group and control group by age and sex was illustrated in Table (1).

Table (2) illustrated the means of maximum comfortable mouth opening in the control group according to age and sex. There was a significant difference in the means of maximum comfortable mouth opening between the age groups (F value = 5.53; $p < 0.05$). Also it was found a significant difference in the means of maximum mouth opening between males and females (t value = 4.4; $p < 0.05$).

Table (1): Age and sex distribution in temporomandibular disorder group and control group

Age (Years)	Temporomandibular Disorder Group		Control Group	
	Male	Female	Male	Female
10-19	6	8	7	8
20-29	23	26	23	25
30-39	4	15	5	15
40-49	3	9	2	9
> 50	2	4	2	4
Total	38	62	39	61

Table (2): Means of maximum mouth opening in control group according to age* and sex**

Age (Years)	Males	Females	Total
	Mean (mm) ± Standard Deviation		
10-19	37.3 ± 6.01	35.4 ± 4.18	36.4 ± 5.16
20-29	47.5 ± 3.93	42.9 ± 3.53	45.3 ± 3.64
30-39	42.4 ± 6.81	42.5 ± 11.43	42.4 ± 8.74
40-49	39.7 ± 3.91	35.5 ± 3.41	36.6 ± 3.64
≥ 50	39.3 ± 5.31	36.8 ± 5.42	39.1 ± 5.38

*Significant difference among the age groups (F value = 5.53; $p < 0.05$).

**Significant difference between males and females (t value = 4.4; $p < 0.05$).

Table (3) showed the mean of OR in TMD group and control group according to age and sex. It was found that the mean of OR in TMD patients was 72.96 (standard deviation = 12.2), while in control group it was 90.9 (standard deviation = 4.28). There was a remarkable significant difference between the two groups (t value = 6.23; $p < 0.01$). In the control group there was no significant differences in OR between age groups (F value = 2.7; $p > 0.05$). Also there was no significant difference in the mean of OR between males and females (t value = 3.5; $p > 0.05$).

Regarding the relationship between OR and the other signs of TMD, as shown in Table (4), there was a significant reversible correlation between OR with TMJ tenderness ($r = -0.331$; $p < 0.05$) and with number of tender muscles ($r = -0.385$;

$p < 0.05$). The analysis of the correlation between OR and the tenderness of each muscle revealed a significant reversible relation with temporalis ($r = -0.435$; $p < 0.05$) and with lateral pterygoid muscles ($r = -0.29$, $p < 0.05$).

DISCUSSION

Limitation of mouth opening may cause masticatory and social difficulties for the patient and poses problems for the dentist.⁽⁷⁾ Assessment of the mouth opening limitation plays an important role in the clinical examination of the masticatory system. This is probably based upon the assumption that the maximum mouth opening reflects the capacity of the condyle to translate within the joint.⁽¹⁷⁾

Table (3): Mean of opening ratio in temporomandibular disorder group and control group according to age and sex distribution

Age (Years)	Temporomandibular Disorder Group		Control Group	
	Males	Females	Males	Females
Mean (mm) ± Standard Deviation				
10-19	70.12 ± 7.74	80.24 ± 11.39	92.11 ± 3.21	91.52 ± 1.95
20-29	72.90 ± 18.5	73.61 ± 10.24	90.91 ± 5.64	90.80 ± 1.41
30-39	76.71 ± 18.21	71.20 ± 12.31	88.97 ± 5.51	93.24 ± 4.24
40-49	74.11 ± 15.11	68.83 ± 15.55	89.93 ± 2.11	88.15 ± 2.20
≥ 50	80.10 ± 13.45	70.58 ± 7.22	93.12 ± 10.12	92.19 ± 3.43
Total	72.96 ± 12.2		90.9 ± 4.28	

Significant difference between temporomandibular disorder and control groups (t value = 6.23; $p < 0.01$).

In control group, no significant differences between age groups (F value = 2.7; $p > 0.05$), or sex groups (t value = 3.5; $p > 0.05$).

Table (4): Relationship between opening ratio and temporomandibular disorder signs

Signs	Relationship	Significant Value
Temporomandibular Joint Tenderness	r= -0.331	p<0.05
Number of Tender Muscles	r= -0.385	p<0.05
Masseter Tenderness	r= 0.121	p>0.05
Temporalis Tenderness	r= -0.435	p<0.05
Lateral Pterygoid Tenderness	r= -0.29	p<0.05
Medial Pterygoid Tenderness	r= -0.226	p>0.05

The methods of measuring mouth opening described in the previous literatures are almost as numerous as the studies carried out.⁽⁷⁾

Measurement of interincisal distance is a simple, non-invasive technique but difficulties arise to make a diagnosis of decreased mouth opening. It is essential to establish what constitutes the normal opening for the population. Researches have shown that this measurement varies significantly with age, gender and race^(5, 6) and so they fail to define an end line of limitation of mouth opening. Some researchers judge the opening to be limited if the interincisal distance is <40 mm.⁽¹⁾ Others set the limit at <39 mm,⁽¹⁰⁾ at <38 mm,⁽¹¹⁾ at <37 mm⁽¹²⁾ and at <35 mm.⁽¹³⁾ Whereas other investigators consider <35 mm for men and <30 for women as restricted opening.⁽¹⁴⁾

A number of other methods have been devised. These concentrate on assessing movement at the TMJ rather than relying on an anterior measurement,^(2, 15, 16) but these are often require special apparatus and are costly.

In this research a new method for assessment of mouth opening limitation was suggested. This depends on the ratio between maximum comfortable mouth opening and maximum assisted mouth opening.

When muscle tissue have been compromised by fatigue and spasm, any contraction or stretching of muscle increase the pain. Therefore, to maintain comfort, the person restrict movement within a range that does not increase pain level. Clinically this is seen as inability to open the mouth to normal range. Generally if the patient is asked to slowly open wider, a greater opening could be achieved but pain is experie-

nced. So the OR use the maximum assisted mouth opening as a reference to estimate the amount of limitation for each patient.

The significant difference in mean of OR between TMD pateints and control individuals found in this investigation indicated that this index is reliable to be used to assess patient with TMD.

In this research, the decreased OR in the TMD group appears to be due to a mechanism of protection from pain. Both protective co-contractions of antagonist muscles⁽¹⁾ and structural changes such as muscle shortening may lead to lower active mouth opening.⁽¹⁸⁾ It has been reported that chronic disuse of the masticatory muscles may also contribute to the lower active opening.⁽¹⁹⁾

There was no significant relationship between OR with age or sex, while linear maximum comfortable mouth opening found to be dependent on age and gender. This result agreed with earlier studies.^(5, 6) There is a broad agreement between researchers that linear mouth opening is greater in males than in females and greater in adults than in children but the mean maximum mouth opening in adults decreased with age.⁽⁵⁻⁷⁾ So this index may be more appropriate method for assessment of mouth opening limitation as it independent on age or sex.

In this investigation there was a significant reversible correlation between OR with number of tender muscles and TMJ tenderness. Also the results revealed a significant reversible relation with temporalis and with lateral pterygoid muscles. The muscle hyperactivity may lead to spasm, pain and fatigue with a decrease in volunt-

ary opening.^(1, 18) Disorder of the TMJ may result in a decrease in its mobility and subsequently in a decrease of mandibular range of motion. As a consequence, mouth opening is reduced and the opening pattern may be changed.

CONCLUSION

From this research, it could be concluded that the OR has diagnostic value in TMD patients. It may be a better tool than linear mouth opening measurement for the evaluation of limitation of mouth opening. As unlike other measures of mandibular movement, it is independent on age and gender. It is a simple, inexpensive and useful diagnostic aid.

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