



**INVESTIGATION AMOUNT OF MAXIMUM MOUTH OPENING AND
ASSOCIATION WITH TEMPOROMANDIBULAR JOINT DISORDERS IN
TURKISH ADULT POPULATION**

**ERİŞKİN TÜRK TOPLUMUNDA MAKSİMUM AĞIZ AÇIKLIĞI MİKTARI VE
TEMPOROMANDİBULAR EKLEM BOZUKLUKLARI İLE İLİŞKİSİNİN
ARAŞTIRILMASI**

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ABSTRACT

Objectives: The aims of this study were to estimate the amount of maximum mouth opening in Turkish adult population, and to compare mouth opening in patients with and without symptoms of temporomandibular joint dysfunction syndrome.

Material and Methods: Maximum mouth opening was measured and questionnaire data collected from 551 men and 504 women (1055 adults), aged 16–72 years. Age, gender, presence of temporomandibular joint pain on palpation, tenderness of masticatory and neck muscles on palpation, type of bite, presence of temporomandibular joint sound, and a history of attendance of physician or dentist because of trouble with the jaw joint were all recorded.

Results: The amount of maximum mouth opening was measured as 50.38 mm for males and 46.35 mm for females. 32 patients had open bite, 594 patients had normal bite, and 429 patients had deep bite, and their mean mouth opening is 52.53mm, 48.62 mm, and 47.09 mm, with respectively.

Conclusions: We found relation between reduced tenderness of at least one masticatory or neck muscles, mouth opening with temporomandibular joint pain, and type of bite. However sound from temporomandibular joint was not found an evidence of limited mouth opening. Amount of mouth opening was found significantly different within groups of temporomandibular joint pain on palpation, and attendance to doctor or dentist suffering from jaw joint groups.

Keywords: Mouth opening; temporomandibular joint disorders; Turkish adult population

ÖZET

Amaç: Bu çalışmanın amacı, erişkin Türk toplumunda maksimum ağız açıklığını tespit etmek ve bu sonucun varsa temporomandibular eklem bozukluğu ile olan ilişkisini tespit etmektir.

Gereç ve Yöntem: Çalışmamızda maksimum ağız açıklığı 16–72 yaş aralığında 551’i erkek, 504’ü kadın olan 1055 erişkinden yapılan ölçümler sonucu elde edilmiştir. Yaş, cinsiyet, palpasyonda temporomandibular eklem ağrısı, palpasyonda çiğneme ve boyun kaslarında hassasiyet, kapanış tipi, temporomandibular eklemdede ses varlığı ve çene ekleminde sorun nedeniyle diş hekimi ya da doktora gitme hikayesi kaydedildi.

Bulgular: Maksimum ağız açıklığı erkeklerde 50,38 mm kadınlarda ise 46,35 mm olarak tespit edildi. 32 hastada açık kapanış, 594 hastada normal kapanış ve 429 hastada derin kapanış vardı ve hastaların ortalama ağız açıklıkları sırasıyla 52,53 mm, 48,62 mm ve 47,09 mm olarak kaydedildi.

Sonuç: Ağız açıklığı ile kapanış tipi, temporomandibular eklemdede ağrı, çiğneme ve boyun kaslarında ağrı olması arasında ilişki bulundu. Bununla beraber çene ekleminde ses gelmesinin ağız açıklığı üzerine belirgin bir etkisinin olmadığı tespit edildi. Palpasyonda temporomandibular eklem ağrısı olan ve çene eklem şikayeti ile hekimine başvuran gruplarda ağız açıklığı miktarında belirgin bir farklılık olduğu tespit edildi.

Anahtar Kelimeler: Ağız açıklığı; temporomandibular eklem hastalıkları; erişkin Türk nüfusu.

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INTRODUCTION

All clinicians dealing with the oral cavity are faced with varying degrees of difficulty when mouth opening is limited. The maximal incisal opening is defined as the measurement between the maxillary and mandibular incisal edges with voluntary opening.¹ The maximal interincisal measurement may help clinicians to assess the function of the temporomandibular joint (TMJ) and the masticatory musculature. The Maxillofacial Surgery Clinic in Zurich accepts 36 to 38 mm incisal edge distance as the minimum limit for adults.²

The amount of mouth opening is a significant factor in the diagnosis of many clinical conditions, and can have implications for the management and treatment of patients. A reduction in the amount of mouth opening is associated with a number of clinical conditions; one of the most common being TMJ dysfunction syndrome.³ In addition, limited mouth opening can be associated with trauma, neuromuscular disorders, odontogenic infection, congenital and developmental anomalies and advanced oral malignancy.⁴

In order to make a diagnosis of decreased mouth opening, it is essential to establish what constitutes the normal opening for the populations. Researchers have shown that this measurement varies significantly with age, gender and race.^{1,2,5,6} Ingervall⁷ and Agerberg⁶ stated that this difference is not evident in children.

Few studies assessed the mouth opening of normal subjects in a population and compared this with mouth opening in patients with TMJ dysfunction syndrome.^{1,2,5,6} This information is necessary in order to draw a conclusion with regard to the affect of TMJ dysfunction syndrome on mouth opening. Some investigators have looked at mouth opening in relation to occlusion,⁸ but a reduction in mouth opening has not been shown to correlate with malocclusion, in general. However, studies have shown a reduction in mouth opening in malocclusions with features such as reduced mandibular length⁹ and deep bite.¹⁰

Since range of mouth opening of Turkish adult population has not been evaluated yet, we decided to determine this measurement. The purposes of this study were: (i) to estimate the amount of maximum mouth opening in Turkish adult population; (ii) to compare mouth opening in patients

with and without selected symptoms of TMJ dysfunction syndrome; and (iii) association between type of bite and range of mouth opening.

MATERIAL AND METHODS

This questionnaire study was carried out randomly selected on 1055 patients have various complaints about dental and/or TMJ problems at Cumhuriyet University, Faculty of Dentistry, Department of Oral and Maxillofacial Surgery. The range of maximum mouth opening was determined by the interincisal distance. Data were obtained by four dentists that work in department of oral and maxillofacial surgery clinic. Maximum mouth opening was measured and questionnaire collected for 504 females and 551 males adults, aged between 16–72 years with no history of TMJ involvement trauma, tumor, infection, or congenital anomaly in the maxillofacial area. Patients who have lack of anterior teeth were excluded the investigation. The distance between the incisal edges of the upper and lower central incisors at the same side was measured by a caliper while the mouth completely opened voluntarily. Two measurements were made in each case, and the mean value of the two values was recorded. Each patient was examined by one dentist.

The samples were stratified according to age; the age groups being 1:16–20; 2:21–30; 3:31–40; 4:41–50; 5:51 + years. Age, gender, presence of TMJ pain on palpation, tenderness of masticatory and neck muscles (m. masseter, m. temporalis, m. pterygoideus lateralis, m. pterygoideus medialis, m. sternocleidomastoideus, and m. trapezius) on palpation, type of bite, presence of TMJ sound (presence or absence of a click of crepitation at the time of examination), and a history of attendance of physician or dentist because of trouble with the jaw joint were all recorded.

The data were analyzed to investigate differences in mean maximum mouth opening between those who were defined as TMJ 'normal' and those who were defined as TMJ 'abnormal' as Jagger did.¹¹ TMJ 'abnormal' was defined if above conditions had been presence: TMJ pain on palpation, at least tenderness of one masticatory and neck muscles, presence of TMJ sound, and history of TMD treatment.

Clinical examination of masticatory muscles and TMJs were performed according to Jagger¹¹ did

as following: Pain or tenderness of the TMJs was determined as following: the fingertips were placed over the lateral aspects of both joint areas simultaneously. The fingertips should feel the lateral poles of the condyles passing downward and forward across the articular eminences. Once the position of the fingers over the joints had been verified, the subject was asked to relax and medial force was applied to the joint areas. The subjects were asked to report any symptoms. While the patient opens maximally, the fingers were rotated slightly posterior to apply force to the posterior aspect of the condyle. Tenderness of pain of TMJs was determined by these manners.

Patients were separated into three groups as according to type of bite as Ferraro et al.⁸ did; (i) anterior open bite, (ii) normal, and (iii) excessive or deep bite. Anterior open bite group is defined when bite is lower than 0 mm, normal bite was limited to 0–3 mm, deep bite is defined as a vertical overlap in excess of 3 mm.

Left and right temporalis, masseter and pterygoid muscles, sternocleidomastoid and trapezius muscles were palpated and the subjects were asked whether palpation caused pain. Any specific muscle causing pain was noted. The presence of a click was recorded if the sound was heard or if a sudden movement of the mandibular condyle occurred during opening or closing of the mouth.

All data management and statistical analyses were performed in SPSS (version 10.0). Differences were examined using an independent samples t-test, One-Way Anova and Tukey test. The level of statistical significance was set at $p=0.05$.

RESULTS

The amount of maximum mouth opening measured for males and females were 50.38 and 46.35 mm respectively, and it was found significant differences with genders ($p<0.05$). When compared age groups of genders according to maximum mouth opening, except 4th age group there was significant difference between all groups (Table 1, Figure 1). In males there was significant difference between 1st–4th, 2nd–4th, and 3rd–4th age groups; for females there was no significant difference between age groups (Table 2).

Table 1. Normal range of maximum mouth opening (mm) by age.

Age	N	Range of maximum mouth opening (mean ± S.E.)
16–20 ^a	352	49.74 ± 7.31
21–30 ^b	373	48.50 ± 6.59
31–40 ^c	143	48.41 ± 5.98
41–50 ^d	102	45.14 ± 5.71
51+	85	47.06 ± 6.33

a-d, b-d and c-d $p<0.05$ F=5.58 $p=0.000$

Table 2. Mean maximum mouth opening by age group and gender.

Age	Male (mean ± S.E.) n	Female (mean ± S.E.) n	t	p
16–20	52.05 ± 6.86 n=179	47.36 ± 6.68 n=173	t=6.53	p=0.000
21–30	50.32 ± 6.76 n=198	46.45 ± 5.85 n=175	t=5.16	p=0.000
31–40	49.89 ± 6.02 n=77	46.69 ± 5.40 n=66	t=3.96	p=0.001
41–50	46.42 ± 5.31 n=43	44.20 ± 5.88 n=59	t=1.83	p=0.070
51+	48.92 ± 6.51 n=54	43.64 ± 3.90 n=31	t=3.02	p=0.004

F= 5.36 $p=0.000$ F=1.70 $p=0.149$

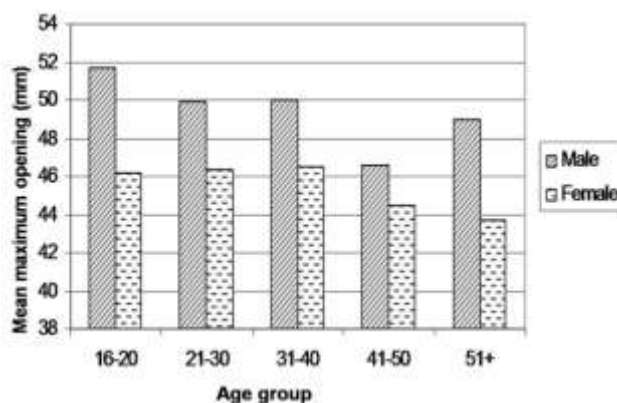


Figure 1: Mean maximum opening (mm) by age group and gender.

Amount of mouth opening was found significantly different within groups of TMJ pain on palpation, tenderness of at least one masticatory or neck muscles, and attendance to doctor or dentist suffering from jaw joint groups; in addition in group of presence of sound from TMJ it was found no significant difference within groups according to mean mouth opening range (Table 3). 32 patients had open bite, 594 patients had normal bite, and 429 patients had deep bite, and their mean mouth opening is 52.53mm, 48.62 mm, and 47.09 mm, with respectively. When compared this mean mouth openings, deep bite were found to have a mean maximal incisal opening significantly less than normal bite and anterior open bite individuals, also there was significant difference between normal bite and anterior open bite groups (Table 4).

Table 3. Maximum mouth opening according to TMJ status.

Symptoms	Answer (Yes/No) N	Maximum mouth opening (mean ± S.E.)	Results
TMJ pain on palpation	No: 845	48.96 ± 6.63	t=3.11 p=0.000
	Yes: 210	47.01 ± 7.17	
Tenderness of masticatory muscle	No: 676	49.22 ± 6.70	t=3.37 p=0.001
	Yes: 379	47.34 ± 6.69	
Crepitation at the time of examination	No: 996	48.79 ± 6.80	t=0.47 p=0.577
	Yes: 59	47.61 ± 6.65	
Click at the time of examination	No: 816	48.49 ± 6.81	t=0.75 p=0.409
	Yes: 239	49.07 ± 6.70	
Attendance at doctor	No: 946	48.74 ± 6.55	t=4.26 p=0.000
	Yes: 109	45.21 ± 7.80	

Table 4. Relationship between type of bite and amount of mouth opening.

Overbite	N	Maximum mouth opening (mean ± S.E.)
Open-bite	32	52.53 ± 7.88
Normal-bite	594	48.62 ± 6.29
Over-bite	429	47.09 ± 7.00
F=10.47 p=0.000		F= 10.47 p=0.000

DISCUSSION

Measurement of mouth opening is used to assess two variables: Functional mouth opening (the maximum anterior vertical measurement for access to the oral cavity) and TMJ mobility. The measurement most often used to assess mouth opening is the interincisal distance attained during active opening by the subject. Some studies used a measurement of interincisal distance plus overbite which was stated to be more accurate reflection of the vertical distance travelled by the mandible.¹⁰ Measurement of interincisal distance is a simple, non-invasive technique but difficulties arise when the incisors are absent, traumatized, restored or incompletely erupted. Therefore, all subjects included to this study had their own anterior teeth. Most investigators using this technique have taken an average of two or three successive measurements and have, in general, found the last measurement to be the largest;¹² However, Agerberg⁶ found that mouth opening decreased with repetition. The majority of investigators measure active mouth opening, although some have examined passive mouth opening and found it to be greater. We measure active mouth opening, and mouth opening is determined by interincisal distance. Two measurements were made in each case and mean value of the two values was recorded.

There is a broad agreement between authors that mouth opening reduces with age and that females have reduced mouth opening when compared with males.^{1,2,5,6} The results of present study showed that the average mouth opening is greater in males than in females. Gallagher⁴ found average maximum mouth opening 43 mm for females and 41 mm for males in Irish population, the average maximum interincisal distance was found to be 52.85 mm for men and 48.34 mm for women. Cox and Walker¹² studied 700 symptom-free Nepalese adults, and it was reported a mean value for an interincisal distance of 47.1 mm and 98% of population fell within this range. Agerberg⁶ in 1974 found the mean maximal vertical opening of the mandible in 20 year-old healthy men to be 58.6 mm, with a range of 44 to 77 mm, whereas for women of the same age it was 53.3 mm, with a range of 42 to 75 mm. Mezitis⁵ found mean maximal mouth opening 52 mm for men and 48.3 mm for women in Greek adult population. Carlsson and Svardstrom¹³ examined 299 men and



women and found 44.8 ± 9.4 mm maximal vertical mandibular opening for males and 39.2 ± 10.8 mm for females. These studies looked at the change in mouth opening with age and found that the mean maximum mouth opening in adults decrease with age. In the present study mouth opening reduces with age but in female population this is not statistically significant. For male, mouth opening reduce in 41–50 age group statistically significant. But mouth opening increase in the 51+ group but this increase is not statistically significant. This inconsistency may be due to small number of samples in 51+ groups.

As already noted, limitation of mouth opening is associated with a number of clinical conditions, one of the most common being TMJ dysfunction syndrome. TMJ dysfunction syndrome has a number of well-documented symptoms and signs.³ TMJ sounds, deviation during mouth opening, condyle asymmetry, TMJ pain, facial pain, headache and jaw ache during function are known as the most common symptoms of TMJ dysfunction. Since TMJ dysfunction signs and symptoms are presented at the very young children, a routine dental examination of TMJ and masticatory system should be done to identify subjects at high risk of having TMJ dysfunction.¹⁴ Patients also frequently complain of joint sounds on opening and closing. Limitation of mouth opening is a recognized sign of TMJ dysfunction syndrome and a small number of investigators have reported this finding.³ Thomson¹⁵ found that limitation of mouth opening occurred in 35% of patients suffering from mandibular joint pain. It was founded that there is a correlation between limited mouth opening and TMJ dysfunction syndrome. Wooten¹⁶ states that one of the most significant features of TMJ dysfunction syndrome is the limitation of mouth opening. This current study reveals that there is no difference in mouth opening in those patients who had a history of click or crepitation in the TMJ, on the other hand there is significant difference according to amount of mouth opening in subgroups of who had a past history of attendance at their doctor or dentist because of trouble with the jaw joint, TMJ pain, and tenderness of masticatory muscles at least of them on palpation. Tozoglu et al.¹⁷ found that TMJ dysfunction syndrome was appeared in young and adult female who had chewing muscular problems. Addition to, they determined that primary symptoms were varieties of mandibular function and a

sound of joint in all patients, respectively.

The relationship between the masticatory complex and psychosocial disorders is said to be bidirectional. One would therefore expect a significant co-existence of these two. However, Aditya et al.¹⁸ determined relatively low degree of co-existence in their study.

Patients identified as having a deep bite were found to have a mean maximal interincisal opening smaller than normal individuals who were significantly. This finding confirms Posselt's¹⁰ conclusion that evaluation of the maximum mouth opening should include an allowance for excessive vertical overlap. We found that there is statistically significant difference in mouth opening within type of bite groups.

CONCLUSION

In general, several factors influence the maximal interincisal opening. Age, gender, type of bite has been specifically shown to affect the measurement. The results of this present study revealed that there was a correlation between reduction in mouth opening, gender, type of bite and symptoms of TMJ dysfunction syndrome, except in presence of sound from TMJ study group in Turkish adult population.

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