



### **Assesment of Normal Mouth Opening in an Adult Anatolian Population**

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**Type of Publication:** Original Research Paper

**Conflicts of Interest:** Nil

#### **Abstract**

**Aim:** This study was undertaken to assess the normal mouth opening on an adult Anatolian population. Mouth opening has clinical significance and varies between populations. Age, gender, race and body size also affects mouth opening.

**Materials and Methods:** 251 hospital workers (115 male-136 female) between 19-52 years of age admitting to Baskent University Adana Hospital occupational outpatient clinic who had no trauma, infection, pathology or congenital anomaly of maxillofacial region and temporomandibular joint were recruited. The weight and height of the cases were recorded. They were asked to open their mouth until no further opening was possible and the distance between the upper and lower incisor teeth were measured with a fiber ruler. Besides; the measure of 3 fingers of the cases from both hands were unified (2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> fingers) and were taken at the narrowest vertical distance to check if the middle three fingers could be placed into the mouth.

**Results:** Mean body mass index (BMI) was found to be  $26,2 \pm 3,0$  kg/m<sup>2</sup> for males and  $23,5 \pm 3,9$  kg/m<sup>2</sup> for females. Mean mouth opening was  $49,7 \pm 6,1$  mm for

males and  $46,6 \pm 6,1$  mm for females. Three finger width was  $48,0 \pm 4,7$  mm at the left hand and  $48,6 \pm 4,6$  mm at the right hand for males. Three finger width was  $43,8 \pm 4,5$  mm at the left hand and  $43,9 \pm 4,4$  mm at the right hand for females.

**Conclusion:** Knowledge on the mouth opening is important for clinical assessment, diagnosis and treatment. The result of this study can help clinicians and surgeons deal with aesthetic, speech, chewing problems and functional problems of the temporomandibular joint and support primary care for early diagnosis of temporomandibular problems.

**Keywords:** Body Mass Index, Gender, Mouth Opening, Three Finger Width.

#### **Introduction**

Mouth opening is the distance between incisal edge of the upper central incisor and the incisal edge of lower central incisor teeth and is a good indicator of mandibular range of motion as well as mandibular function. Maximum mouth opening is the distance between the same points when the mouth is opened maximally [1,2]. It ranges from 40 to 75 mm in normal population[3-6]. Mouth opening depends on age, gender, body size and height[7-10]. Thus,

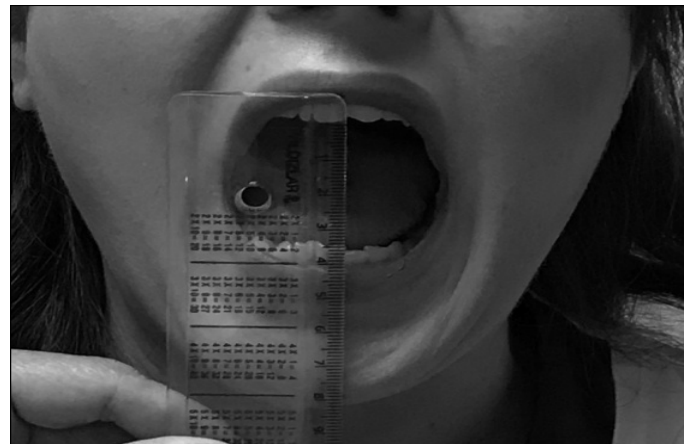
bigger and taller people can open their mouth wider than smaller and shorter people. Mouth opening for women is smaller compared to men although women have greater joint flexibility and greater temporomandibular joint (TMJ) opening angle.

Mouth opening size is relevant for diagnosis and management of oral disorders. Restricted mouth opening may go along with many problems like intra or extracapsular pathology of the TMJ causing dysfunction, congenital or developmental anomalies, infections, traumas, neuromuscular disorders and oral malignancies[10,11]. Range of motion of the TMJ and lateral protrusive moves are landmarks to evaluate TMJ function during maximal mouth opening[12,13]. Usually the values reported for restricted mouth opening have been <35 mm for joint-related disorders and <40 mm for muscular disorders. As mouth opening varies from one individual to another, these parameters are not applicable for all people[11]. Restricted mouth opening may effect the social life of the patient, disturb communication, limit food intake and have a negative effect on oral hygiene. Clinicians working on oral cavity, encounter problems when mouth opening is reduced. There is no gold standard technique to identify restricted mouth opening because its range is labile between individuals. Normal mouth opening for any given population should be determined to clarify what a limited opening is. There is no accepted standard to determine whether a patient displays reduced mouth opening because it is mostly dependent on different physiologic conditions. Besides standardized protocol, three finger index is also suggested as a valuable tool for assessing normal mouth opening[7,11].

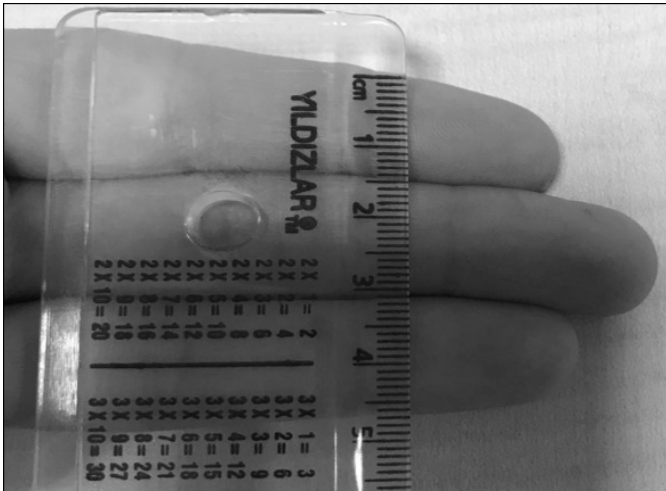
Documentation of normal range of mouth opening also helps the clinician conduct a detailed oral examination[12,13]. For a quick and effective route to diagnose and maintain the treatment; timely recognition of disorders of mouth opening is compulsory[9,14].

## Materials and Methods

The study was conducted at Baskent University Adana Dr. Turgut Noyan Practice and Teaching Hospital on 251 individuals (115 male, 136 female, aged 19-52 years) admitted to the outpatient clinic in relation to occupational health. Informed consent of the participants were taken. Our study was approved by Baskent University Institutional Review Board and Ethics Committee and was supported by Baskent University Research Fund (Project no: KA 17/331).The height and the weight of the cases were measured and the body mass indexes were calculated.The mouth opening was measured via standardized protocol. The cases were requested to open their mouth maximally till no further opening could be made. Best tool for measuring mouth opening was reported to be a fiber ruler. The distance between the incisal edge of the upper central incisor and the incisal edge of lower central incisor teeth was measured using a calibrated fiber ruler (Figure 1). The results were recorded in range of millimeters. Besides; the measure of 3 fingers (2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> fingers) of the cases from both hands were unified and were taken at the narrowest vertical distance (Figure 2-3). The middle 3 fingers of the cases from both hands were unified (2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> fingers) and placed into maximum mouth opening to check if the they could be placed into the mouth as per se the three finger protocol.



**Figure 1.** Mouth opening measurement.



**Figure 2.** The narrowest vertical distance of 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> fingers.



**Figure 3.** Placing three fingers into the mouth.

Three measurements were taken for each case and the average was accepted as the final reading. Each step was performed by the same researcher to provide inter-examiner and intra-examiner reliability. The age and the gender of the cases were recorded.

Statistical Analysis: The analysis of data was performed with SPSS 17.0 (SPSS Ver. 17.0, Chicago IL, USA) statistical package program. Continuous variables were reported as mean ± SD. Pearson Correlation analysis was performed to assess the correlation of mouth opening with gender and statistical significance was tested by the application of t test. Continuous variables were compared

by the t test. When the p value was below 0.05 the differences were considered to be statistically significant.

**Results**

Mean body mass index (BMI) was found to be 26,2 ± 3,0 kg/m<sup>2</sup> for males and 23,5 ± 3,9 kg/m<sup>2</sup> for females. Mean mouth opening was 49,7 ± 6,1 mm for males and 46,6 ± 6,1 mm for females. Three finger width was 48,0 ± 4,7 mm at the left and 48,6 ± 4,6 mm at the right for males. Three finger width was 43,8 ± 4,5 mm at the left and 43,9 ± 4,4 mm at the right for females (Table 1). There is a correlation between mouth opening and 3 finger width (r=0,63, p=0,0001).

**Table 1.** The means, standard deviations and ranges of the parameters of the males and females.

Parameters	Males (n=115)				Females (n=136)			
	Range		Mean±SD		Range		Mean±SD	
Age (year)	(21-52)		33,8±7,1		(19-52)		31,6±7,8	
BMI (kg/m <sup>2</sup> )	(18,2-35,2)		26,2±3,0		(17,0-38,4)		23,5±3,9	
Mouth Opening (mm)	(30-60)		49,7±6,1		(34-65)		46,6±6,1	
Three Finger Width (mm)	Left	Right	Left	Right	Left	Right	Left	Right
	(36-65)	(37-65)	48,02±4,7	48,62±4,6	(33-55)	(34-55)	43,85±4,5	43,9±4,4

**Discussion**

Assessment of mouth opening is common in daily practice, and may be the initial step to recognize some pathological conditions[9]. Restriction of mouth opening is an early finding of some pathological and traumatic conditions[15]. It is seen in patients with craniofacial syndromes, oral cavity malignancies, face trauma and especially temporomandibular joint disorders. The goal of treatment of mouth opening disorders is to restore the mouth opening to normal ranges. Therefore normal values of mouth opening need to be known. Maxillofacial and plastic surgery centers commonly see encounter such patients and therefore it is crucial for those medical team to be familiar with normal mouth opening. In literature many methods to measure mouth opening is available. Clinicians must be able to recognize “restricted” from “normal” mouth opening. Additionally; before a final

diagnosis is made, all aspects of a possible dysfunction related to mouth opening should be assessed in detail, because the range of mouth opening is only one variable[9]. Age, gender, race and body size are factors known to affect the mouth opening. The difference in mandible size can explain the mouth opening difference between genders.

Evaluation of mouth opening is a routine of temporomandibular joint assessment. In our study it was  $49,7 \pm 6,1$  mm for males and  $46,6 \pm 6,1$  mm for females. A study on 1055 Turkish adults has reported mouth opening to be 50,3 mm for males and 46,3 mm for females[16]. This study has been conducted on a Turkish population like ours and has revealed similar results to our study. A Chinese study on 452 subjects registered a value of 54,1 mm for males and 46,3 mm for females[10]. Similar to our findings, in a study conducted on Indian population 894 adults; 463 males and 431 females, mouth opening was found to be 51,3 mm for males and 44,3 mm for females[9]. Additionally our findings are in accordance with many previous studies. The normal mouth opening of 700 Nepalese cases found the value for interincisal distance as 47,1 mm[8]. Another study on 1442 Chinese adults has reported average interincisal distance to be 49,9 mm for males and 48,3 mm for females[17]. A study assessing 450 Pakistani UAE cases was 59,7 mm for males and 46,5 mm for females[18]. And finally; a study on 680 Pakistani subjects has found mouth opening as 51,9 mm for males and 47,8 mm for females[19].

On the contrary there are several studies that report much less values compared to those listed above. A Saudi Arabian study on 1158 subjects registered a value of 48,1mm for males and 44,0 mm for females[20]. A study on 1513 Irish adults has reported the mouth opening to be 43,3 mm for males and 41,4 mm for females[21]. On 496 Jordanian subjects mouth opening was found to be 45,3

mm for males and 41,5 for female[22]. On a total of 34 Malaysian dental students the mouth opening was found to be 47,6 mm for males and 40,8 mm for females[23]. These differences given above may be due to racial variations.

Three finger width in our study was associated with mouth opening for both genders. For males it was  $48,0 \pm 4,7$  mm and  $48,6 \pm 4,6$  mm for right hand and left hand respectively, and for females it was  $43,8 \pm 4,5$  mm and  $43,9 \pm 4,4$  mm for right and left hand, respectively. All the cases in this study were able to place their right and left three middle fingers vertically between the upper and lower incisors up to the first distal interphalangeal fold. The South India perspective study revealed a similar finding[7]. A study for an index measurement for normal mouth opening found on 140 cases that 128 of them were able to place their three middle fingers into their mouth[24].

Comparison of mouth opening measurements in different populations were summarized in Table 2.

As a conclusion the findings of this study is in line with current literature. Our findings on three finger index also come in accordance with researches as discussed. This study will help clinicians, plastic surgeons, and dentists to conjure up a clear understanding of Turkish mouth opening and planning their examinations and procedures accordingly. The three finger index is found to be a simple and fast method to assess normal from restricted mouth opening. The ability to align three fingers into the mouth seems to be a reliable index for determining normal mouth opening. This study we believe will help develop a quick understanding of patients mouth morphism which can be associating many pathologies in primary care.

**Table 2.** Comparison of mouth opening measurements in different populations.

Authors	Population (number of cases)	Age (Years)	Mean Mouth Opening (mm)
Sheppard and Sheppard (1965) [24]	American (n=200)	16-70	49,8
Agerberg (1974) [4]	Sweden (n=200)	18-25	55,9 (male) 53,2 (female)
Mezitis et al. (1989) [5]	Greek (n=1160)	18-70	52,8 (male) 48,3 (female)
El-Abdin et al.(1991) [20]	Saudi Arabian (n=1158)	5-70	48,1 (male) 44,0 (female)
Cox and Walker (1997) [8]	Nepalese (n=700)	18-68	47,1
Qayyum and Khitab. (2002) [19]	Pakistani (n=680)	18-70	51,9 (male) 47,8 (female)
Gallagher et al. (2004) [21]	Irish ( n=1513)	16-99	43,3 (male) 41,4 (female)
Placko et al. (2005) [1]	French (n=228)	18-84	50,7 (male and female)
Yao et al. (2009) [17]	Chinese (n=1442)	20-80	20-39 years=52,3 (male) 49,8 (female) 51,1 (total) 40-59years=49,1 (male) 47,8(female)48,4(total) ≥60 years=46,9(male 46,3 (female) 46,6 (total)
Sawair et al. (2010) [22]	Jordanian (n=496)	15-80	45,3 (male) 41,5 (female)
Sohail et al. (2011) [18]	Pakistan UAE (n=450)	19-24	59,7 (male) 46,5(female)
Shaari et al. (2011) [23]	Malasian (n=34)		47,6 (male) 40,8 (female)
Khare et al. (2012) [9]	Indian (n=894)	21-70	51,3 (male) 44,3 (female)
Ezirganlı et al. (2013) [16]	Turkish (n=1055)	16-72	50,3 (male) 46,3 (female)
Li et al. (2016) [10]	Chinese(n=452)	20-35	54,1 (male) 49,6 (female) 55,0(total)

Al- Noaman (2016) [14]	Iraq (n=317)	20-25	58,0 (male) 42,0 (female)
Present study (2018)	Turkish (n=251)	19-52	49,7 (male) 46,6 (female)

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