

Normal Mouth Opening in an Adult Indian Population

Nishant Khare · Surendra B. Patil ·
Satish M. Kale · Jaiswal Sumeet · Ingole Sonali ·
Bharadwaj Sumeet

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Abstract

Background Mouth opening among different population has been shown to vary considerably and its range is specific for a given population. The present study is an attempt to calculate the normal mouth opening in adult Indian population.

Method A total of 894 adults, 463 males and 431 females, in the age range of 21 to 70 years were studied. The subjects were asked to open their mouth maximally till no further opening was possible. The distance from the incisal edge of the upper incisor teeth to the incisal edge of the lower incisor teeth was measured using a calibrated fiber ruler. To determine correlation of mouth opening with age a Pearson correlation analysis was performed and statistical significance was tested by the application of *t* test.

Observations The mean maximal mouth opening for males was 51.3 mm (SD 8.3) (Range 39–70 mm). The mean maximal mouth opening for females was 44.3 mm (SD 6.7) (Range 36–56 mm). There was significant difference between the mouth opening of male and female in all the age groups with *P* value <0.05. A linear relationship was observed between the mouth opening and age in both males and females and the mouth opening decreased as the age increased.

Conclusion The mean maximal mouth opening for Indian males is 51.3 ± 8.3 mm and for females is 44.3 ± 6.7 mm. The mouth opening seems to decrease with age. The mouth

opening of females is significantly less than the males in all the age groups.

Keywords Normal · Mouth opening · Indian · Age · Sex

Introduction

Mouth opening is a variable which we come across routinely in our daily practice. Increasing number of patients of maxillofacial fractures, temporomandibular joint diseases, oral malignancies, reconstructed oral defects and craniofacial syndromes are now referred to Oral and Maxillofacial surgery and Plastic surgery facilities. Mouth opening and its adequacy is an important component in treatment and follow up of all of these conditions. Normal mouth opening has been defined as the inter-incisal distance at maximal mouth opening [1]. A known normal range of mouth opening is necessary to enable the clinician conduct a thorough oral examination conveniently. Limitation of mouth opening is one of the early signs of many pathological and traumatic conditions. Early recognition of decreased or limited mouth opening is necessary for a prompt and efficient approach to diagnosis and to plan out the treatment options judiciously.

In order to make a diagnosis of decreased mouth opening it is essential to establish what constitutes the normal opening for the population [2]. Research has shown that the measurement of mouth opening varies significantly with age, gender and race [3–7]. Mouth opening among different population has been shown to vary considerably and its range is specific for a given population [2]. Numerous studies across the world have characterized the mouth opening in their population. It is fairly common to report the mouth opening in terms of finger breath in our

N. Khare (✉) · S. B. Patil · S. M. Kale · J. Sumeet
Department of Plastic Surgery, Government Medical College,
Nagpur, Maharashtra, India
e-mail: agyay@indiatimes.com

I. Sonali · B. Sumeet
Department of Preventive and Social Medicine, Government
Medical College, Nagpur, Maharashtra, India

daily practice. However, its numerical value in Indian population is still not clear. The present study is an attempt to calculate the normal mouth opening in adult Indian population. This will serve as a guide for various studies and will have clinical utility in treatment and diagnosis of diseases which directly or indirectly affect mouth opening.

Method

The present study was carried out in a tertiary health care centre in Central India. A total of 894 adults, 463 males and 431 females, in the age range of 21 to 70 years were studied. The mouth opening was measured using a standardized protocol [8]. The subjects were asked to open their mouth maximally till no further opening was possible. The distance from the incisal edge of the upper incisor teeth to the incisal edge of the lower incisor teeth was measured using a calibrated fiber ruler and the findings were recorded in ranges of millimeters (Fig. 1). Three readings were taken for each individual and their average was recorded as the final reading. To control for inter-examiner and intra-examiner reliability, each step was performed by a single examiner. Subjects with reverse overbite and persons who are edentulous or with no natural front teeth on which to get measuring points were excluded [2]. All subjects with history of tobacco chewing, smoking, previous maxillofacial trauma, oral malignancies, TM joint diseases, submucosal fibrosis and other conditions known to affect mouth opening were excluded from the study. The age and sex of the subjects were recorded. Continuous variables are reported as mean \pm 1 SD. To determine correlation of mouth opening with age a Pearson correlation analysis was



Fig. 1 Figure showing measurement of mouth opening

performed and statistical significance was tested by the application of *t* test. Continuous variables were compared using *t* test. We considered differences to be statistically significant when the *P* value was below 0.05. The analysis was performed using statistical programme (SPSS Version 10.0, SPSS Inc., Chicago, USA).

Observations

The mean maximal mouth opening for males was 51.3 mm (SD 8.3). The range was 39–70 mm. The mean maximal mouth opening for females was 44.3 mm (SD 6.7). The range was 36–56 mm (Table 1). In the age group of 21–30 years, the mouth opening was 56.7 ± 7.2 mm for males and 51.7 ± 4.5 mm for females. In the age group of 31–40 years, the mouth opening was 57.1 ± 6.5 and 50.7 ± 2.0 mm for males and females, respectively. For the age group 41–50 years, the mouth opening was 52.5 ± 8.8 mm for males and 47.7 ± 3.9 mm for females. In the age group of 51–60 years, the corresponding values for males and females were 48.3 ± 6.2 and 42.0 ± 4.6 mm. In the age group of 61–70 years, the mouth opening for males and females was 45.8 ± 5.2 and 40.2 ± 6.6 mm, respectively (Table 2). There was significant difference between the mouth opening of male and female in all the age groups with *P* value <0.05 . A linear relationship was observed between the mouth opening and age in both males and females with correlation coefficient of -0.771 , -0.783 , respectively, which showed that mouth

Table 1 Normal mouth opening in male and female subjects

	Male	Female
<i>n</i>	463	431
Mean (mm)	51.3	44.3
Standard deviation	8.3	6.7
Range (mm)	39–70	36–56

Table 2 Variation in mouth opening with age

Age group	Sex	<i>n</i>	Mean \pm SD (mm)
21–30	Male	102	56.7 ± 7.2
	Female	99	51.7 ± 4.5
31–40	Male	98	57.1 ± 6.5
	Female	96	50.7 ± 2.5
41–50	Male	99	52.5 ± 8.8
	Female	86	47.7 ± 3.9
51–60	Male	87	48.3 ± 6.2
	Female	79	42.0 ± 4.6
61–70	Male	77	45.8 ± 5.2
	Female	71	40.2 ± 6.6

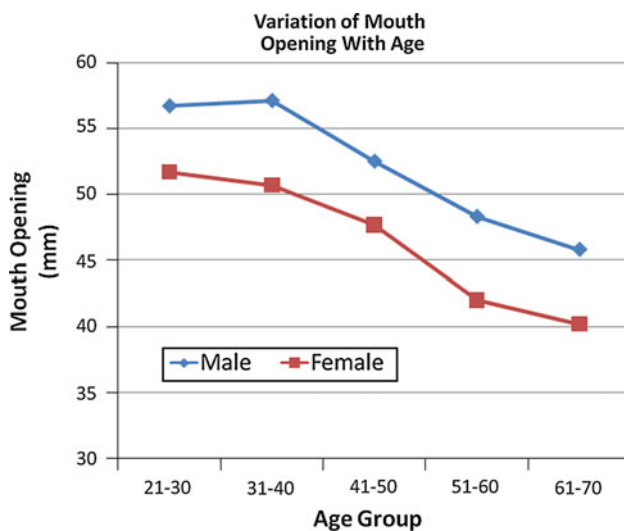


Fig. 2 Variation of mouth opening with age

opening decreases as the age increases and this relation was found to be statistically significant (P value <0.05) (Fig. 2).

Discussion

Mouth opening is a commonly used term in our daily practice. It is the denominator for a number of pathological entities. Patients with Temporomandibular joint diseases, craniofacial syndromes, maxillofacial trauma, oral malignancies and those who have been treated for these conditions often complain of restricted mouth opening. As with any other disease or condition, the aim of treatment of disorders affecting mouth opening is to restore the mouth opening to its normal value. It is thus important to know the normal value. Maxillofacial and Plastic surgery facilities frequently encounter these conditions and it is hence imperative that maxillofacial surgeons should be acquainted with normal mouth opening.

A large number of methods have been described in the literature to measure the mouth opening. The measurement most often used to assess mouth opening is the interincisal distance attained during active opening by the subject. However, this method underestimates the movement of the mandible as it does not include the overbite [2]. Interincisal distance plus overbite has been used as a measure of mouth opening and is thought to be a more accurate reflection of the vertical distance travelled by the mandible [9]. However, clinically important is sufficient mouth-opening to allow normal social function for the patient and adequate access to the oral cavity for clinicians which in effect is the interincisal distance without the overbite [2]. The majority of investigators measure active mouth opening, although some have examined passive mouth opening

and found it to be greater. Dijkstra et al. [8] have stated that the variable force applied to obtain passive mouth opening introduces error. The clinically relevant measurement is the active opening achieved by the patient without assistance [2]. Many different instruments have been used to measure linear mouth opening. Wood and Branco [10] examined three methods of measuring inter-incisal distance and concluded that direct measurement using a ruler was the most accurate.

Mouth opening is influenced by a number of factors which include age, gender and race [2–7]. Gallagher et al. [2] studied the normal mouth opening in Irish population and found that the normal mouth opening in males was 43.3 mm and in females was 41.4 mm. Mezitis et al. [4] studied 1,160 Greek individuals aged 18–70 years. The average maximum inter-incisal distance was found to be 52.85 mm for men (Range 38.74–67.27 mm) and 48.34 mm for women (Range 36.67–60.45 mm). Cox and Walker studied 700 symptom-free Nepalese adults, aged 18–68 years. They reported a mean value for an inter-incisal distance of 47.1 mm (Range 33.7–60.4 mm) [7]. In the present study the mean mouth opening for males was 51.3 mm (Range 37–70 mm; SD 8.3). Females had a mean mouth opening of 44.3 mm (Range 32–61 mm; SD 6.7).

Many studies have looked at the change in mouth opening with age and found that the mean maximum mouth opening in adults decreased with age. Gallagher et al. [2] concluded in their study on Irish population that mouth opening reduces with age and show that this reduction is independent of gender and TMJ status. The findings in the present study are consistent with the fact that the mouth opening decreases with age and this is true for both the sexes. In the present study, the mean mouth opening in the age group of 21–30 years was 56.7 ± 7.2 mm in males and 51.7 ± 4.5 mm in females. In the age group 31–40 the corresponding figures for males and females were 57.1 ± 6.5 and 50.7 ± 2.5 mm. Subjects in the age group of 41–50 years had a mean mouth opening of 52.5 ± 8.8 mm for males and 47.7 ± 3.9 mm for females. In the age group of 51–60, the mean mouth opening was 48.3 ± 6.2 mm for males and 42.0 ± 4.6 mm for females. Similarly in the age group 61–70 years, the mean mouth opening was 45.8 ± 5.2 mm for males and 40.2 ± 6.6 mm for females. These findings suggest that there is a gradual decrease in mouth opening with age.

The above figures also point to the fact that in the present study, the mean mouth opening was greater in males than in females (51.3 ± 8.3 mm vs. 44.3 ± 6.7 mm). This observation was true across all age groups. It has been reported earlier that mouth opening is greater in males than in females [3–7]. This is true in spite of the fact that the joint mobility in general is greater in females than in males [2]. Pullinger et al. [11] and Beighton et al. [12] studied the angle of opening at the TMJ and found it to be increased in

women. This finding is in line with the general finding of greater joint laxity in women and was further confirmed by Pullinger et al. [11] when they showed that women have a greater range of mouth opening when the measurements are corrected for stature and body mass but still have lesser mean mouth opening as compared to men. The mouth opening in general is supposed to be affected by multiple variables. These differences in behaviour between mouth opening and the mobility of other synovial joints may be attributable to the differences in mandibular length between males and females [2].

Mouth opening has also been reported to be different for different population [2]. Some studies have reported stature to be a significant factor influencing mouth opening and have offered this as an explanation for difference in mouth opening between populations. Landtwing [6] concluded that mouth opening increases significantly with stature and both age and stature should be taken into account when measuring mouth opening. For the Swedish population the mean maximum mouth opening, measured as inter-incisal distance plus overbite for males has been reported as 58.6 mm and as 53.3 mm for females [5]. The average height for Swedish adult males is 1.78 m and for females 1.66 m [13]. In the Nepalese population the mean maximum inter-incisal distance was reported as 47 ± 1 mm [7]. The average height for the adult Nepalese adult males is 1.62 m and or females 1.51 m [14]. The figures for the Greek population fall between these two extremes [2, 13]. These figures appear to suggest a trend, with a smaller range of mouth opening being seen in populations of lower average stature. Gallagher et al. [2] however, concluded that the hypothesis that the racial variation noted in the range of mouth opening is a product of the variation in stature might not be true. The average height for Indian male is 1.65 m and for Indian female is 1.52 m [15]. Our observations also suggest that simply correlating the stature of any population with its mouth opening might not be justified. It seems that multiple variables affect mouth opening and though stature might be one of them, it certainly is not the only factor which affects mouth opening.

The findings of the present study are in concordance with the study carried out by Puri et al. [16]. While the average range of mouth opening in the study done by Puri et al. is slightly higher than the present study, the values for the adult population are nearly similar. However, the present study shows definite decline in the mouth opening with age. This is an important finding which needs further investigation and analysis. We recommend that a large multicentre study should be carried out to conclusively establish the facts. A multivariate analysis assessing all confounding factors is thus warranted. The present study does not assess the mouth opening below 21 years of age. This is so because the study was aimed at determining mouth opening in adult population.

However, the authors acknowledge that this is a major limitation as the earliest recommended age for orthognathic surgery is when skeletal growth is 99% complete, that being 14.9 years for females and 16.5 years for males [17].

The present study attempts to calculate the mouth opening for Indian males and females. This data is important because a high number of complex surgical procedures are routinely performed in this part of the world without a proper reference value. Inevitable reference to international data is obviously not justified as the mouth opening is clearly different in different population. The mouth opening in Indian population seems to decrease with age but does not correlation directly with stature. There seems to be a number of factors which affect mouth opening. We recommend that large multi-centre trials should be undertaken internationally to clearly identify these variables and their implications on the mouth opening. We believe that such data will increase our understanding of various pathologies affecting mouth opening and will help us to rationalize the treatment plan objectively.

Conclusion

The mean maximal mouth opening for Indian males is 51.3 mm (SD 8.3) (Range: 39–70 mm). The mean maximal mouth opening for females was 44.3 mm (SD 6.7) (Range: 36–56 mm). The mouth opening seems to decrease with age. The mouth opening of females is significantly less than the males in all the age groups.

Conflict of interest None.

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