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Normal Range of Maximal Mouth Opening Amongst North Indian Population: A Cross Sectional Study in Meerut

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ABSTRACT

Knowledge of normal range of mouth opening in a subgroup of population is of utmost importance to the concerned clinician as restriction of it could signal problems in masticatory system, odontogenic infection, developmental anomalies, and advanced malignancies.

Objective: Because of the wide variation amongst different population groups all over the world this study was a attempt to assess the range of maximal mouth opening in Indian subjects, and to investigate the relationship between heights, weight, age, body build, and facial profile with the maximal interincisal opening.

Materials and methods: The present study was conducted amongst 1500 Indian subjects in the age range of 3 to 82 years. These patients were randomly enrolled from the outpatient department of Subharti Dental College, Meerut. Those with previous history of maxillofacial trauma, neck pain, TM joint disorders and those currently suffering from odontogenic infection, oral malignancies, post-operative/post-extraction trismus, submucosal fibrosis and other conditions known to affect mouth opening were excluded from the study. Maximal mouth opening was measured using a calibrated fiber ruler and divider. Descriptive statistics and uni- and multivariate analysis were used to determine factors affecting maximal mouth opening.

Results: A large variation in maximal mouth opening ranging from 20-67mm was seen. Mean maximal mouth opening was 43.17mm. A significant gender difference amongst the study population; men had significantly higher MMO (44.56±7.668mm) as compared to females (41.24±6.797mm). Multivariant regression analysis revealed height, body mass index and overbite as independent predictors of this study population.

Conclusion: It establishes that the maximal mouth opening in the study sample is independent of the age, and is more dependent on body stature with a clear cut difference seen in male and female population.

KEYWORDS: mouth opening, maximal, India, children, adult, Trismus, incisal edge.

Introduction:

Trismus or restricted mouth opening is a common problem encountered in dentistry. Restricted mouth opening can be associated with TMJ dysfunction syndrome, trauma, neuromuscular disorders, odontogenic infection, congenital and developmental anomalies including craniofacial syndromes, advanced malignancies, myopathies and oral submucous fibrosis. This restriction or limited mouth opening may cause not only masticatory and social difficulties for the patient, but may also be of great concern to the clinician especially the dentist, oral and maxillofacial surgeons, plastic surgeons, oncosurgeons and anaesthetist in treatment planning.[1,2]

Unfortunately, the high variability of normal maximal mouth opening (MMO) measurement makes the evaluation more difficult. One of the most convenient ways to record maximal mouth opening is to measure the interincisal distance. Interincisal opening has been defined as "the greatest distance between the incisal edges of the maxillary central incisor to the incisal edge of the mandibular central incisor at the midline when the mouth is open as wide as possible." Values from 32 mm to 77 mm have been reported in the literature for adults.[3,4] Research has shown that the measurement of mouth opening varies significantly with age, gender and race. Mouth opening among different population has been shown to vary considerably and its range is specific for a given population.[2] Very few studies have been reported in India till date.[2,5]

The aim of the present study is to assess the range of maximal mouth opening in Indian subjects, and to investigate the relationship between height, weight, age, body build, and facial profile with the maximum interincisal opening.

Materials and methods:

The present cross-sectional study was carried out on 1500 subjects visiting the outpatient department of a dental college in Meerut. The study patients were randomly selected and were in the age range of 3 to 82 years. Informed consent was obtained from each participant in the study. A small especially designed performa was filled that included the age, gender, maximal mouth opening, height, weight, facial profile, build, and overbite.

Exclusion criteria:

All subjects with history of previous maxillofacial trauma, neck pain, TM joint disorders including ankylosis, disc displacement

without reduction and arthritis of TMJ; patients currently suffering from odontogenic infection, oral malignancies, post-operative/post-extraction trismus, submucosal fibrosis and other conditions known to affect mouth opening were excluded from the study. Subjects with severe bruxism, anterior crossbite, edentulous or with no natural front teeth were also excluded.

Procedure:
The mouth opening and overbite measurements was done with divider and scale; height registered on the height chart. Weight measured on a weighing scale (KRUPS) in kilograms. 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 divider. The findings were recorded in ranges of millimeters. 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. Body mass index was calculated using the formula- BMI=Mass (kg)/height (m^2).

Statistical analysis used:
Statistical analysis was performed using Statistical package for Social Sciences 16 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were generated. Means were followed by the value of standard deviation (mean±SD), student t-test, two-way ANOVA and Pearson correlation test were used to examine the differences between groups. Multiple stepwise regression analysis was applied for determination of the best predictors of MMO among gender, age, height, weight, BMI, facial profile, build and overbite. Coefficient of regression and 95%CI were calculated for each significant independent variable. We considered differences to be statistically significant when the P value was below 0.05.

Results:
The present study conducted in 1500 subjects (M=869; F= 631)of age range 3-82 years showed a large variation in maximal mouth opening (20-67mm). Mean maximal mouth opening was 43.17mm. Mean maximal mouth opening to gender and age is shown in Table 1. Mean age among male was 28.92±13.191 years and in female was 29.85±12.33 years. Pearson correlation coefficient showed a positive correlation between MMO with height (r^2=0.262], weight (r^2=0.202], body mass index (r^2=0.091] and overbite (r^2=0.087).

Two-way ANOVA revealed a significant gender difference amongst the study population; men had significantly higher MMO (44.56±7.668mm) as compared to females(41.24±6.797mm). Multivariant regression analysis revealed height, body mass index and overbite as independent predictors of this study population. However, considering the highly significant gender related differences, regression analysis was carried out for each gender Table 2.

Multivariate regression equation for males is 17.4149+0.151*height+0.106*BMI.

Multivariate regression equation for females is 33.574+0.109*weight+0.749*overbite.

Discussion:
Mouth opening measurement is important from both the patient and clinician's point of view. It should be sufficient to allow for the normal social function for the patient; and adequate access to the oral cavity for clinician. Keeping this in mind, the present study uses the most convenient method to measure the active maximal mouth opening of a patient is the interincisal distance.

There are various methods to determine maximal mouth opening like directly by using a calibrated fiber ruler[2,6], scale and divider, vernier caliper or wiley's bite gauge[1,7], modified vernier caliper[5], extraoral measures like subject's finger[4,8], Therabite range of motion scales.[8,9] Wood and Branco[10] compared direct and extraoral measurements, and suggested that direct measurements using a ruler or Vernier caliper were more precise and accurate. The present study was done using a divider and a calibrated fiber ruler.

A wide range of maximal mouth opening has been reported from all over the world. Mean mouth opening in the present study has been reported to be 43.17±7.49 which correlates well with study by Cox and Walker [11], Sawair FA et al[7], Gallagher et al.[1] Two other Indian studies- one in 894 adults by Khare N et al[2] reported the mean maximal mouth opening as 51.3mm among males and 44.3mm among females; and the other reported by Kumar A et al[5] in 856 children of 6-12 years age was 46mm. Our study covered a wide age range from 3-82 years and has a larger sample size of 1500 subjects.

The minimal maximal mouth opening in the present study was 20 mm which was close to that reported by Lukas Muller et al[6] in 20719 European subjects of age range 2.8-18.7 years. It was significantly lower than the other studies reported in the literature.[1-5,7-9] This could possibly be because of the large sample size and wide age range of the subjects in our study.

Age is certainly correlated with body height and body weight, and this is also confirmed by the fact that the width of all finger measurements increased with age. In reality it would be expected that with increase of age, also MMO would increase, in addition to body height and body weight.[4] Various studies have shown that after birth until adolescence, the maximal mouth opening steadily progresses (reaching peak at age of 12-13 years in females and 14-15 years in males.)[4,5,6,9] and thereby decreases with age. However, the present study showed no correlation with age which was similar to that reported by Landtwig et al[12], Rothenberg LH[13], Sousa LM et al[14] and Ingervall et al[15] who stated that MMO increases significantly more with stature than with age. The reason is probably that children's growth is not continuous and constant in years, but there are periods of rapid growth and periods when the body grows more slowly. This is why, as age increases, the size of different parts of the body do not necessarily increase proportionally. Therefore, it is reasonable that MMO is more strongly correlated with body height and weight than with age.[4]

Gender difference in maximal mouth opening was also appreciable in the present study as has been previously reported by Mezitis et al[16], Sawair et al[7], Gallagher et al[1], Ageberger et al[17], and an Indian study by Khare N et al.[2] In general, females were found to have a lower mean MMO as compared to their male counterparts. Pullinger et al[18] proposed that this was due to the gender difference in mandibular length. Mandibular length measured from hinge axis to lower incisors is positively correlated with MMO since it allows a greater rotation to the hinge joint.

The present study clearly expresses that the MMO in adult Indian male is dependent on BMI and height of the individual, while in an adult Indian female, it is more dependent on body weight and overbite. Overbite as has been previously stated by various investigators is an important consideration in measuring maximal mouth opening. The corrected maximal mouth opening i.e by adding overbite to the distance between the incisors is an accurate reflection of the distance travelled by the mandible. [1]

Literature review suggests a wide amount of variation in the studies reported from different parts of the world till date. Investigators have studied and tried to correlate several factors with MMO like age, stature, body height, weight, overbite, racial variation, facial morphology and presence of third molar and loss of tooth.[1-18] Several authors have made an attempt to generalize the data available on MMO measurements based on the regional and racial differences as body height and facial morphology differs amongst different population groups. To the best of my knowledge, nothing concrete can be said as

there are only few scattered studies with meager sample size none exceeding the present study sample, except one retrospective study in European population by Lukas Muller et al.[6] In addition to it, there has been a large variation in the methods of measuring the maximal mouth opening, sample size and age. Studies have been done in both children[2,5,6,9] and adults.[1-3,8] The present study however includes both adult and child population.

We still recommend that till large multi-centric studies are done in various population groups in different parts of the world, facts cannot be established.

Conclusion:

The present study is one of the few studies in Indian population with a large sample size and wider age range including both children and adult population. It establishes that the maximal mouth opening in the study sample is independent of the age, and is more dependent on body stature with a clear cut difference seen in male and female population.

Age(-years)	Male			Female			Total		
	n	Range	Mean	n	Range	Mean	n	Range	Mean
<20	188	20-61	43.22	127	20-60	40.43	315	20-61	42.04
20-29	354	20-65	45.61	209	20-60	41.47	563	20-65	44.07
30-39	148	20-65	44.68	136	23-60	41.54	284	20-65	43.17
40-49	91	22-62	44.12	102	20-59	41.94	193	20-62	42.97
50-59	48	30-67	44.08	44	20-52	40.04	92	20-67	42.15
>=60	40	22-60	42.80	13	30-49	41.1	53	22-60	42.39
Total	869	20-67	44.56	631	20-60	41.24	1500	20-67	43.17

Table 1: Number of subjects and mean maximum mouth opening by age and gender

Table 2: shows significant independent predictors of maximal mouth opening in multivariate analysis in males and females.

Gender and independent predictors B		Unstandardized Coefficients	Standardized Coefficients	Sig. Lower Bound	95.0% Confidence Interval for B	
		Beta			Upper Bound	
Males	(Constant)	17.149		0.000	10.072	24.226
	HEIGHT	0.151	0.251	0.000	0.111	0.192
	BMI	0.106	0.159	0.000	0.061	0.152
Females	(Constant)	33.574		0.000	31.128	36.02
	WEIGHT	0.109	0.21	0.000	0.069	0.148
	OVERBITE	0.749	0.128	0.001	0.305	1.192

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