

EVALUATION OF ROLE OF BODY MASS INDEX (BMI) WHILE PREDICTING NORMAL MAXIMUM MOUTH OPENING USING THREE FINGER INDEX METHOD – A CROSS SECTIONAL STUDY.

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Abstract

Aims and Objectives: To study the role of BMI while predicting normal maximum mouth opening using three finger index.

Materials & Methods: 520 subjects for the study were chosen, equally distributed among the sexes ie; 260 males & 260 females. Height and weight of the subjects were measured and BMI was calculated. Maximum Mouth Opening and three finger width was measured using Vernier calipers. Based on BMI, subjects were categorized into 4 groups and were subjected to ANOVA for statistical analysis.

Results: BMI and the mean maximum mouth opening of the subjects did not show any significant correlation.

Conclusion: This study demonstrated that mean Maximum Mouth Opening of an individual does not correlate with the individual's BMI. Individuals irrespective of their BMI were able to vertically align their 3 fingers between the upper and lower central incisors, and thus is a convenient index for assessing normal mouth opening.

Key words: Body Mass Index, Maximum Mouth Opening, Three finger Index, Vernier Caliper, Mangalore population.

Clinicians dealing with the oral cavity face varying degrees of difficulty when mouth opening is limited. Research has shown that this range varies significantly with age, gender, body size and race. The most common used method to assess the mouth opening is the measurement of interincisal distance attained during active opening by the subject. The average maximum inter-incisal distance was found to be 52.85mm for men and 48.34mm for women, according to one of the largest studies carried out by Mezitis et al; in symptom free adults aged 18-70yrs¹.

Evaluation of range 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. It is also a valuable method for assessing the function of the masticatory system. Assessment of mandibular function is performed by means of several diagnostic tests out of which one of

the elementary tests to evaluate temporomandibular joint function is measurement of the range of motion of joint during maximum mouth opening (MMO)².

Hence, determination of MMO can be incorporated as a screening procedure for assessment of TMJ dysfunction. Similarly a progressive inability to open mouth fully is an important clinical feature in Oral submucous fibrosis³ and measurement of MMO could therefore be useful for screening large population for such serious oral diseases.

In an oral and maxillofacial surgery clinic, surgeons often deals with situations that may lead to compromised mouth opening such as congenital and traumatic cases or various types of infections and tumors¹. Mouth opening during management of such conditions has been identified as crucial for successful airway management⁴.

Hence this study is undertaken to evaluate the role of BMI while predicting normal maximum mouth opening using three finger index method.

Aims and Objectives

To study the role of BMI while predicting normal maximum mouth opening using three finger index.

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Materials and Methods

Source of data:

Subjects of the study were chosen from patients reporting to the Department of Oral Medicine & Radiology, Yenepoya dental college, Yenepoya University, Derlakatte, Mangalore among the population of Derlakatte area.

Methods of collection of data:

Based upon the following criteria, 520 patients were selected for this study, equally distributed among the sexes ie; 260 males & 260 females.

Inclusion criteria:

1. Patients in the age group between 20 to 60 years.
2. Anterior teeth with normal positioning with normal overjet and overbite.
3. Completely erupted and functional maxillary and mandibular central incisors.
4. Patients with a full complement of permanent teeth.

Exclusion criteria:

1. Patients with history of maxillofacial trauma.
2. Patients with developmental disorders of jaws.
3. Patients who have undergone prosthesis rehabilitation.
4. Patient with Oral submucous fibrosis and any other disorders which causes restricted mouth opening.
5. Patients with advanced periodontitis.
6. Patients with obesity disorders.

Method:

Patient consent was taken before the procedure and were subjected to the following methods:

- The patients were asked to open their mouth wide and interincisal distance between maxillary and mandibular incisors was measured using Vernier calipers and recorded.
- Width of three fingers of both right and left hands at the first distal interphalangeal level were also measured using Vernier calipers and recorded.
- Body height of the respective patients was recorded in centimetre (cm) using cm scale.
- Body weight of the respective patients was recorded in kilograms using weighing scale.
- Body Mass Index (BMI) was calculated using BMI Metric System.

$$\text{FORMULA} - \text{Weight (Kg)} / [\text{Height (m)}]^2$$

Above collected data was subjected to appropriate statistical analysis for correlation and level of significance.

Results

520 samples were collected from our Dental OPD. Out of 520 samples, it was equally distributed among the gender; ie; 260 samples were males and 260 samples were females. Then they were divided according to their Body Mass Index into 4 groups. Group I (Underweight) consisted of samples with BMI less than 18.5 and had total of 110 samples. Group II (Normal) consisted of samples with BMI between 18.5 and 24.9 and had a total of 138 samples. Group III (Overweight) consisted of samples with BMI between 25 and 29.9 and had a total of 157 samples. Group IV (Obese) consisted of samples with BMI above 30 and had a total of 115 samples. [Table 1].

The Body Mass Index of 520 samples were correlated with the Mean Maximum Mouth opening and width of three fingers of left and right hand using Pearson's Coefficient test. BMI and Mean Maximum Mouth opening had a positive correlation of Pearson's Coefficient .061 with *p* value of 0.168. BMI and Mean width of three fingers of right hand had a negative correlation of Pearson's Coefficient -.004 with *p* value of 0.927. BMI and mean width of three fingers of left hand had a positive correlation of Pearson's Coefficient .005 with *p* value of 0.912 [Table 2].

Group 1 BMI when compared with the other 3 groups for the mean differences in the Maximum Mouth opening showed .081 of mean difference with a significant value of .737 with Group 2, -.050 mean difference with a significant value of .916 with Group 3 and -.060 mean difference with significant value of .887 respectively. Group 2 BMI when compared with the other 3 groups for the mean differences in the Maximum Mouth opening showed .081 of mean difference with a significant value of .737 with Group 1, -.131 mean difference with a significant value of .270 with Group 3 and -.141 mean difference with significant value of .274 respectively. Group 3 BMI when compared with the other 3 groups for the mean differences in the Maximum Mouth opening showed .050 of

mean difference with a significant value of .916 with Group 1, .131 mean difference with a significant value of .270 with Group 2 and -.010 mean difference with significant value of .999 respectively. Group 4 BMI when compared with the other 3 groups for the mean differences in the Maximum Mouth opening showed .060 of mean difference with a significant value of .887

with Group 1, -.141 mean difference with a significant value of .274 with Group 2 and -.010 mean difference with significant value of .999 respectively. The mean differences between different BMI categories when compared with the variables of mouth opening did not show any statistical significance [Table 3].

Table 1: Group division according to the Body Mass Index (BMI)

N=520

Group	Number (n)	%
Underweight	110	21.2
Normal	138	26.5
Overweight	157	30.2
Obese	115	22.1
Total	520	100.0

Table 2: Correlation between Body Mass Index and Mouth opening variables

		Pearson's Coefficient	P value
BMI	Max mouth opening	.061	0.168
	Width right	-.004	0.927
	Width left	.005	0.912

Table 3: Correlation between Mean Maximum Mouth Opening among the BMI**Categories**

(I) BMI_categ	(J) BMI_categ	Mean Difference (I-J)	Sig.	95% CI	
				Lower	Upper
Underweight	Normal	.081	.737	-.12	.29
	Overweight	-.050	.916	-.25	.15
	Obese	-.060	.887	-.27	.15
Normal	Underweight	-.081	.737	-.29	.12
	Overweight	-.131	.270	-.32	.06
	Obese	-.141	.274	-.34	.06
Overweight	Underweight	.050	.916	-.15	.25
	Normal	.131	.270	-.06	.32
	Obese	-.010	.999	-.21	.19
Obese	Underweight	.060	.887	-.15	.27
	Normal	.141	.274	-.06	.34
	Overweight	.010	.999	-.19	.21

Discussion

Body Mass Index (BMI), previously known as Quetelet index, was proposed by Lambert Adolphe Jacques Quetelet (1796-1874), a social scientist from Belgium. He proposed this index in an attempt to describe the relationship between body weight in proportion to height in humans to determine the best body weight for the height. However, at a later stage it was suggested that BMI could be used as an indicator of body fat content. It is an indicator, not a direct measurement, of a person's total body fat. In most cases BMI correlates with total body fat, meaning that as one's BMI score increases so does his or her total body fat. An individual's BMI may be calculated in a number of ways. A normal score indicates that a person is within the normal weight status for his or her height. A BMI chart

is used to categorize a person as underweight, normal, overweight, or obese. While BMI is an accurate assessment of total body fat in most people, there are a few exceptions. Very muscular people may fall into the "overweight" category when they are actually healthy and very fit. For example a body builder with a very low body fat percentage could have the same BMI score as someone who is considered overweight. On the other hand an elderly person may fall into the "normal" weight category when actually they have little muscle mass and a high percentage of body fat.⁵

In order to evaluate the normal mouth opening range, in present study the patients were asked to open mouth till their functional limit. The maximum incisal distance between maxillary and mandibular central incisors at the midline

was then measured with Vernier calipers. Patient's height and weight were measured using height chart and weighing machine. Similar study of evaluation of mouth opening using Vernier Caliper was reported by Cox SC and Walker DM (1997) on 700 Nepalese subjects, this method of measurement was a non-invasive technique and was simple to perform.³ However, Various other methods are reported in literature to evaluate the range of mouth opening like, using Pachymeter by Mezitis M (1989), disposable scale by Zawawi K H et al (2003) measuring interincisal distance at midline, Steel Ruler by Ingervell B (1970) adding the value of vertical overbite with the interincisal distance, Bowley Gauge by Miller VJ et al (1999), Oral Kinesiology Analysis System by Vissher CM (2000), self-registration using spatula markings by Hagberg C (2003), Willis Bite Gauge by Gallagher C et al (2002) and El – Abdin et al (1991) , using Electronic Digital Caliper by Sari et al (2008) and Rosenbaum and Downey (1975) used a method of measurement of surface marking below the patients nose and over chin when the mouth was widely opened.^{1,6,7,8,9,10,11,12,13}

The largest studies to evaluate the mouth opening were reported by, Gallagher C et al (2002) on 1513 Irish adult population (657 males and 856 females) aged between 16-99 years.¹⁰ Yao K (2009) evaluated 1442 Chinese adult subjects aged 20-80 years (705 males, 737 females).¹⁴ Mezitis M (1989) conducted study on 1,160 Greek adults consisting of 500 men and 660 women of age range 18-70years.¹ El – Abdin et al (1991) conducted on 1158 Saudi population, 594 males and 564 females, aged between 5 – 70 years.¹¹ Cox SC and Walker DM (1997) on 700 Nepalese subjects, 389 males and 311 females, age range 18-70 years.³ Similar studies were also reported by Chima O and Obiechina AE (1995) in 512 Nigerians, Placko et al (2005) in 228 French population and by Zawawi K H et al (2003) in 140 Tufts University students.^{2,15,16} This present study was conducted in 520 Mangalorian adults, comprising of 260 males and 260 females of age range between 20 and 60.

In the present study it was found that the mean value and range of maximum mouth opening

was 5.02cm for males and lesser value of 4.98 for females. Similar finding were reported by other investigators showing lesser mouth opening in females. Mezitis M (1989) reported a mean maximum mouth opening of 52.85 ± 7.41 mm in Greek males with range of 38.74 – 67.27mm and that of Greek females with lesser value of 48.34 ± 5.64 mm and range of 36.67 – 60.45mm.¹ El – Abdin et al (1991) demonstrated mean value and range of mouth opening for males to be 48.19mm (40.34-55.80mm) and for females to be 44.05mm (33.45 – 49.38mm) in Saudi population.⁸ Zawawi K H et al (2003) reported mean maximum mouth opening of 50.7 ± 0.7 mm in males and lesser value of 47.4 ± 0.4 mm in females.² Gallagher C et al (2002) also demonstrated lesser mouth opening value in females with mean maximum mouth opening of 43mm and 41mm in males and females respectively.¹⁰ Pullinger (1987) demonstrated a difference 2.7% in mean jaw opening between men (57mm) and women (55.4mm), stating men has slightly wider jaw movement then women.¹⁷ Placko et al (2005) also stated greater mouth opening in French males (50.7mm) than the French female population.¹⁶ Chima O and Obiechina AE (1995) reported the mean average mouth opening for Nigerian men to be 56.1 ± 4.8 mm with a range 44 mm to 73 mm and that of Nigerian women to be 52.3 ± 4.3 mm, with a range of 41 mm to 65 mm.¹⁵ Yao K (2009) evaluated Chinese adult and stated Maximum Mouth Opening of males (49.92 ± 6.55 mm) was significantly larger than that of females (48.32 ± 5.95 mm).¹⁴ The marginally greater mean mouth opening in men maybe due to greater mandibular length in males than in females or due to greater muscle strength in men allowing their maximum jaw opening.

In our study, it was also observed that the mean height of males was 161.03 cm and that of females was 159.64 cm. This can be one of the contributing factors for the difference in the range of mouth opening among the genders as the musculoskeletal growth is seen to be more in males which helps them for better mouth opening.

The 520 sample in present study was stratified in four groups according to their BMI. They were grouped into Underweight, Normal, Overweight and Obese. Group I(Underweight) had a mean mouth opening of 5cm, Group II(Normal) had a mean mouth opening of 4.92, Group III(Overweight) had a mean mouth opening of 5.05cm and Group IV(Obese) had a mean mouth opening of 5.06cm. Although the differences between the group was marginal, the Group IV(Obese) showed the higher value for mean of maximum normal mouth opening and Group II(Normal) showed the lower value for mean mouth opening. However, these differences were not statistically significant.

Group I (Underweight) participants were of BMI less than 18. This group consisted of 110 samples which showed a minimum of 4 cm and a maximum of 6.9 cm showing a mean value of 5 cm. Group II(Normal) participants were of BMI between 19 and 24. This group consisted of 138 samples which showed a minimum of 3.9 cm and a maximum of 7 cm showing a mean value of 4.9 cm. Group III(Overweight) participants were of BMI between 25 and 29. This group consisted of 157 samples which showed a minimum of 4.2 cm and a maximum of 6.8 cm showing a mean value of 5.05 cm. Group IV(Obese) participants were of BMI 30 and above. This group consisted of 115 samples which showed a minimum of 4.1 cm and a maximum of 7.1 cm showing a mean value of 5.06 cm.

There is period of rapid growth and also period when growth is slow. It is therefore reasonable to consider height and weight of individual to estimate the maximum mouth opening with

age. The reason could be probably that growth is not a constant and continuous phenomenon. Width of 3 fingers is directly proportional to the subject's body size, hence the ability of placing the 3 finger in mouth is a simple and quick method of assessing and recording the normal mouth opening of individual. This method can be used as an index to distinguish "normal" from "restricted" mouth opening. The limitation of using this index for assessing maximum mouth opening arises when the incisors are absent, traumatized, restored or incompletely erupted.

There was a significant correlation seen when only height was compared with the normal maximum mouth opening of the same individuals. This positive correlation can be due comparison with the individual's musculoskeletal growth alone. However, the present study showed Group IV (Obese) showed the higher value for mean of maximum normal mouth opening and Group II (Normal) showed the lower value for mean mouth opening but these differences were not statistically significant.

Conclusion

It was concluded from this study that a significant relationship does not exist between mouth opening and respective body mass indexes, where in all participants exhibited equal measurement of mouth opening and width of right and left hand three fingers. This observation in our study can be due to the fact that musculoskeletal growth of the individual is governed by the hereditary factors whereas the built of the individual is controlled by the environmental factors.

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Conflict of Interest: None Declared