

Maximum Mouth Opening Using Three Finger Index

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Abstract – *Maximum mouth opening can be an essential tool for proper diagnosis of oral issues. This study intends to establish the maximum mouth opening as reference guides for clinicians and to develop a reference guide of maximum mouth opening for Filipino patients. This was conducted in order to determine the normal range of mouth opening in order to quantify the variation of maximum mouth opening (MMO) of the respondents. The research was undertaken by determining if maximum mouth opening depends on age, gender, any previous history of trauma, tenderness or clicking sound at rest or during jaw movements and head and neck disorders. In order to measure MMO, Boley gauge and three finger index were used. The result of the survey and examination showed that male respondents have bigger maximum mouth opening range than female respondents and healthy respondents have smaller mouth opening than those underweight respondents. Based on the results, maximum mouth opening is independent with age as it had given inconsistent measurement for each age bracket. Body mass index (BMI) affects the maximum mouth opening based on the collected data. For some respondents, four fingers can be used for measuring the MMO exceeding the three finger index method used by the researchers.*

This paper can be enhanced by emphasizing more on the correlation of both height and weight to MMO regardless of age, sex and ethnicity of the individuals and by determining other factors that may affect the maximum mouth opening of Filipino people. The future researchers can use and utilize other methods on measuring the maximum mouth opening.

Keywords – *maximum mouth opening, three finger index, oral issues, boley gauge*

INTRODUCTION

A number of dentists dealing with their normal daily practice in the field of clinical dentistry are faced with varying degree of difficulty when the Maximum Mouth Opening (MMO) of the patient is limited. As a general rule, the width of the three fingers is commonly used by clinicians to measure the MMO of the patients. According to study that used three finger index to evaluate the usual range of MMO in Indians, this method of measurement has proved to be the most commonly used by clinicians in their daily practice for the fact that experts agree that the width of the three fingers is related by direct variation to the body size of the patient. Nevertheless, to date, clinicians have no reference yet, to decide by choice of alternatives or possibilities whether the mouth opening of a patient is limited or cannot be able to reach the maximum. This is because the mouth opening capacity is basically dependent on a variety of specific physiological characteristic [1].

There are factors in determining the maximum mouth opening. One of the factors that may contribute in the differences of the maximum mouth opening is gender. The research of Patil [2] aims to determine the average mouth opening in adult Indian population based on the case study of. A total of 894 adults were studied, with 463 males and 431 females ranging in age from 21 to 70 years. The participants were informed to open their mouths as wide as they could until no more opening was feasible. A calibrated fiber ruler was used to measure the length between the incisal edge of the upper incisor teeth and the incisal edge of the lower incisor teeth. The association between the two parameters; mouth opening and age was established using a Pearson correlation analysis, and statistical significance was determined using the t-test. The maximum mouth opening was 51.3 mm on average (range 39-70mm). Females had a maximum mouth opening of 44.3 mm (SD 6.7). (range 36-56 mm). in all age categories, there was a substantial difference in

between male and female mouth opening, with a P value of 0.05. Both men and women had a linear association between mouth opening and age, with the mouth opening decreasing as the age grew. Indian males have a maximum mouth opening of 51.3 ± 8.3 mm, while females have a maximum mouth opening of 44.3 ± 6.7 mm. The mouth opening appears to diminish with age. In all age categories, women's mouth opening is substantially smaller than men.

Maximum mouth opening may vary in terms of age. According to Li et al., [3] they conducted a study with 452 young ethnic Chinese adults, aged 20 to 35 years (238 males, 214 females), who were subjected conventional physical examinations at Hebei Medical University (Shijiazhuang, China). The 452 individuals had an average of 27.8 4.2 years, with females 26.94.2 years being substantially younger than males (28.6 = 3.9 years, $P < 0.0010$). Males' mean MMO (54.18 5.21 mm) was statistically larger than females' (49.62 3.69 mm; $t Z 10.63$, $P < 0.001$). MMO was projected to rise by 3.6 mm or 1.8 mm for every 10 cm or 10 kg, respectively. Regression equations were established by calculating the regression coefficient and intercept. For the 20-35 years age group, the regression equations for height and weight were $MMO (mm) = 0.36 \times \text{height} - 10.15$ ($F = 180.37$, $P < 0.001$), and $MMO (mm) = 0.18 \times \text{weight} + 39.87$ ($F = 151.80$, $P < 0.001$), respectively.

Maximum mouth opening is an effective clinical measure or parameter for dentists when conducting a thorough a preoperative oral examination. According to the KUFA Journal for Nursing Sciences, MMO can be referred to as the "greater distance between the incisal edge of the upper central incisor and the opposing tooth of the lower jaw at the midline when the mouth is open widely"[4]. Whereas, a limited mouth opening should be taken into account, it could be one of the primary indicators of a variety of degenerative and painful illnesses such as the temporomandibular joint (TMJ) disorders. It can be considered, therefore, that it is substantially important to recognize the limitation of mouth opening so that the approach of diagnosis will be efficient and the options for treatment will be rationally planned.

Even though, MMO is related to a number of significant diagnostic criteria, studies on this subject have been very limited particularly in the Batangas population. In this regard, a study of the average range of maximum mouth opening among Batanguenos using three finger index is essential to scrutinize the relationship between MMO and any related physiological parameters such as age, gender, height,

and weight. Moreover, although the relationship between MMO and the previously mentioned physiological indicators has remained significant over time, it is not yet substantially explored in the local population for comparison. In today's practice, jaw opening capacity is widely recognized as one of the most relevant indicators for evaluating TMJ functioning and masticatory muscle condition. During oral tests, clinicians are having a hard time inserting necessary tools as well as diagnosing the need of the patient. Thus, it is hard to decide as to whether the patient will adjust or the clinician will adjust.

The significance of the study is that although it is known that variations in range of MMO could serve as essential tools to diagnosis, no documented research has yet been reported in the local environment. Maximum mouth opening is intended to provide an effective clinical or diagnostic reference for the dental clinicians such as, for proper visual examination, proper instrumentation and access into the oral cavity. The researchers aim to find practical solutions when clinicians like us encounter difficulties if patient's mouth opening is restricted or limited.

OBJECTIVES OF THE STUDY

This research aims to determine the maximum mouth opening as a reference guide for clinicians. More specifically, to describe the profile in terms of sex, age, and BMI, to establish the normal range of mouth opening in order to estimate the variation of MMO and to determine the maximum mouth opening of the respondents and to develop a guide reference of MMO for Filipino patients.

MATERIALS AND METHODS

Research Design

Over the course of three months, the cross-sectional study was conducted. When the clinical oral examination was performed, the participants will be handed a questionnaire. Each subject's demographic information is included in the pre-tested, structured questionnaire. Age, gender, any prior history of trauma, soreness or clicking sound at rest or during jaw motions, and head and neck problems were all taken into consideration.

Participants of the Study

The study was conducted on all the patients of the dental dispensary at Lyceum of the Philippines University Batangas and all Filipinos, except for those people who are edentulous and those who have undergone and were undergoing

orthodontic treatment. A total of 366 people between the ages of 18 and 50 were studied.

Instrument

A questionnaire was used to gather the demographic data, height, weight and history of participants. The history of the patient is necessary because the researchers have compared the variance of the healthy respondents and those with pre-existing conditions. Boley gauge and three finger index were used to measure the MMO. This has been used to evaluate the significance of age, gender and body mass to MMO.

Procedure

The respondent’s three finger index was used to measure MMO, which, according Nagi 2017, is the most practical and accurate method of calculating the normal maximum mouth opening. The researchers hypothesized that there is a relationship between individual’s body size parameter and the width of the three fingers at the first inter- phalangeal fold, and that this is the best method for measuring MMO. Boley Gauge was used to measure the breadth of three fingers which are the index, middle, and ring fingers at the first distal interphalangeal folds of both the right and left hands. The respondents completed the questionnaire and signed the informed consent. Participants were instructed to open their mouths as wide as they could until no further opening is possible. Respondents were instructed to insert their three fingers which are the index, middle, and ring fingers until the first interphalangeal folds of the right and left hands were reached. The distance between the maxillary incisors’ incisal edges and the mandibular incisor’s incisal edges was measured and recorded in millimeters. The capacity to align the three fingers vertically up to the distal interphalangeal folds with the mouth fully open was also recorded.

Data analysis

MS Office Excel was used to compile the data. The software package SPSS version 21 was used for statistical analysis (SPSS Statistics for Windows, Version 21.0 Chicago: SPSS Inc). Analysis of variance were utilized to compare the mouth opening and the width of three fingers on the right hand, as well as the width of three fingers on the left hand (ANOVA). The difference in connection to MMO, as well as the width of the right and left hands, was tested using an independent sample t-test. Using the Pearson correlation test, the width of three fingers was

associated with mouth opening. The MMO, width of the three fingers on the right hand, and the width of three fingers on the left hand were all compared using the paired t-test (Nagi et al 2017).

Ethical Considerations

The study’s participants were not in any manner harmed in any way. Respect for the dignity of research participants is a top priority. Prior to the study, they will give their full consent. Their privacy is protected, as well as the confidentiality of the research data, and the anonymity of those individuals who participate in the study. Any communication relating to the research is conducted in an open and honest manner. Any type of false information is avoided, as is the biased depiction of primary data findings.

RESULTS AND DISCUSSION

Table 1 presents the distribution of the patient’s profile in terms of sex, age, and BMI result, basically dependent on a variety of specific physiological characteristics. There are factors in determining the maximum mouth opening. One of the factors that may contribute in the differences of the maximum mouth opening is gender. Both genders have been involved in the study to let the researchers come up to the result that gender is a huge factor in knowing the MMO.

As to the patient’s sex, it was observed that most of the respondents are female with a total of 193 respondents or 52.73% while the male respondents have a total of 173 respondents or 42.27%. After the researchers gathered the data with a total of 366 respondents.

Table 1. Percentage Distribution of the Patient’s Profile

Profile Variables	Frequency	Percentage (%)
Sex		
Female	193	52.73%
Male	173	47.27%
Age		
18-25	168	45.90%
26-33	105	28.69%
34-41	59	16.12%
42-50	34	9.29%
BMI		
Healthy	169	46.17%
Underweight	38	10.38%
Overweight	144	39.34%
Obese	15	4.10%

The researchers also included the age of the To further assess, the researchers came up with the study for both males and females which is categorized as healthy, underweight, overweight and obese. The categories are based on the Body Mass Index of the respondents.

It was observed that healthy individuals have the most number with a total of 169 respondents or 46.17%, followed by Overweight with a total of 144 respondents or 39.34%, followed by Underweight with a total of 38 respondents or 10.38% and lastly 15 respondents for Obese or 4.10% of the total.

Table 2. Percentage Distribution based on Clinical Examination

	Frequency	Percentage
Are you under Orthodontic treatment?		
Yes	0	0%
No	366	100%
Are you completely edentulous?		
Yes	0	0%
No	366	100%
Do you experience the following? Tenderness or clicking at rest during jaw movements		
Yes	20	5.46%
No	346	94.54%
Head Disorder		
Yes	0	0%
No	366	100%

Table 2 presents the percentage distribution of patients based on the clinical examination included in the questionnaire. The patients were asked if they underwent orthodontic treatment. All answered NO, which means 100% of 366 respondents did not undergo and are not undergoing orthodontic treatment. The researchers ensured that the respondents that are included in this study did not undergo orthodontic treatment to ensure that there was no movement in their dentition to come up with a precise and accurate measurement.

The respondents are limited to patients with a complete dentition and partially edentulous except for Class IV patients that have missing front teeth. The oral cavity of all 366 respondents was examined if there was any missing front tooth, for them to be a subject in the study and 100% of respondents answered NO. The researchers ensured that the respondents that are included in this study are not completely edentulous since MMO is measured through the distance between the upper and lower incisal edge.

Three hundred forty-six (346) or 94.54% of the respondents answered NO while 20 or 5.46% of the respondents answered YES when they were asked if they experienced clicking upon opening their mouth but they stated that there was clicking but there was no pain associated. This question was asked for safety purposes since they might experience a lock jaw during measurement and also, it may indicate a TMJ disorder that may cause limitation of mouth opening.

Respondents with head and neck disorders were not included in the study since it may cause reduced mouth opening. That's why the researchers came up with a 100% NO answer by the 366 respondents. During head and neck cancer therapy, trismus can occur if the temporomandibular joint and masticatory muscles are located in the irradiated area. Irradiation causes spasms and fibrosis of masticatory muscles, which limits mouth opening.

Trismus is a typical symptom associated with head and neck cancer treatment. There have been few prospective investigation on the occurrence of trismus and patients' experiences with trismus in activities in daily life. Patients were assessed before and after oncological treatment, the researchers were able to determine the prevalence of trismus in head and neck oncology patients, as well as the influence on health related standard of living [5].

In the year 2010, approximately one thousand three hundred people in Sweden were diagnosed with head and neck cancer, according to the Swedish cancer register.

The frequency of oral cavity and lip tumors was predicted to be 263,900 new cases worldwide in 2008. Breathing, speech, smell, taste and swallowing are all performed by intricate anatomical mechanisms in the H&N region. Tumor growth in this region, as well as the treatment required for H&N tumors, may disrupt these activities, resulting in discomfort, oral dysfunction and a reduction in health-related quality of life.

To treat cancer, various combinations of radiation treatment, chemotherapy, and surgery were employed

in order to cure head and neck tumors. Trismus is a symptom associated with head and neck cancer treatment that has previously received little attention in the scientific literature. Restricted mouth opening also known as the trismus is a condition that can cause significantly difficulty in daily activities for a single patient. Patients with a restricted mouth opening experience persistent discomfort upon chewing, eating, xerostomia, and ageusia according to recent studies, all of which contribute to a lower health-related standard of living [5].

Table 3.
Central Tendency and Normal Range of Male and Female

	Male		Female	
	Left	Right	Left	Right
Mean	46	46	44	44
Median	46	46	44	44
Mode	46	46	44	44
Normal Range	40-50mm	39-55mm	37-50mm	37-50mm

A total of 366 respondents participated in this study wherein 173 of the subjects are male and majority is female with a total of 193 respondents. The researchers found out that the maximum mouth opening for male ranges from 38-55mm and 37-50mm for female. Thus, making male with maximum mouth opening. Females have a much lesser mouth opening than males. Male study participants showed a mean, median and mode MMO of 46mm which is significantly larger than that of females that have 44mm mean, median and mode MMO. The mean MMO was moderately positively correlated with gender. Similarly, gender also showed significant differences in MMO.

This is consistent with the study of Al-Noaman [4]. The study investigated the MMO among male and female students. A total of 140 males and 177 females. That the MMO was 58mm. ± 7.21 and 42 mm ± 6.98 for males and females, respectively. The result of the study revealed that the males' maximum mouth opening is significantly greater than females' ($P=0.00$). Al-Noaman (2013), the researcher concluded that males have much wider mouth opening compared to females.

Table 4 presents the central tendency and normal range of respondents age 18-50. The researchers have found out that the maximum mouth opening ranges for the respondents aged 18-25 years old is 40-50mm, with a mean and median MMO of 45 and a mode of 44. Respondents age 26-33 years old has a normal range of 40-50mm that showed a mean, median and mode MMO

of 45. Respondents age 34-41 years old has a normal range of 38-50mm with a mean, median and mode MMO of 45. And respondents age 42-50 years old has a normal range of 40-50mm with a mean, median and mode MMO of 45. As you can see on the table, they are with the same range or somewhat with a small interval specifically at age 34-41 with a result of 38-50mm which is explained by the study [6]. Age, gender, and ethnicity all have an impact on mouth opening, according to the researchers. Males' mean MMO was highest when they were younger and lowest when they were older, according to their research, which used a sample size of four hundred persons separated into four categories. The findings of their study also revealed that MMO decreases with age due to an increase in fibrous tissues and a loss of flexibility in the mucosa, leading to decrease in MMO. This is confirmed by Patil et. al. [7] case study, in both males and females, there was a linear correlation between mouth opening and age, with mouth opening decreasing as age progressed.

Table 4
Central Tendency and Normal Range based on Age

	18 - 25 years old		26 - 33 years old		34 - 41 years old		42 - 50 years old	
	Left	Right	Left	Right	Left	Right	Left	Right
	Mean	45	45	45	45	45	45	46
Median	45	45	45	44	45	45	46	45
Mode	44	44	45	44	45	45	46	45
Normal Range	40-50mm	39-50mm	40-50mm	40-50mm	38-50mm	38-50mm	40-50mm	40-50mm

Table 5.
Central Tendency and Normal Range based on Respondents' BMI

	Healthy		Underweight		Overweight		Obese	
	Left	Right	Left	Right	Left	Right	Left	Right
Mean	45	45	45	45	46	46	44	44
Median	45	45	45	45	46	46	44	44
Mode	45	45	44	45	46	46	44	50
Normal Range	37-50mm	38-54mm	40-49mm	40-50mm	40-50mm	39-50mm	38-50mm	41-50mm

To further assess, the researchers came up with the study for both males and females' weight and height to come up with a BMI which is categorized as healthy, underweight, overweight and obese. The categories are based from the Body Mass Index of the respondents. The researchers computed Body Mass Index or BMI for both males and females to know if there will be

factors that can affect the MMO if the respondents are healthy, underweight, Overweight and Obese.

As a result, the researchers have found out that the normal range for healthy respondents' maximum mouth opening is 39-50mm which showed a mean MMO of 45mm. Underweight respondents' normal range is 40-50mm with a mean MMO that resembles that of a healthy mean MMO of 45mm. Overweight respondents have 39-50mm with a mean MMO of 46mm which is larger than the two. And Obese respondents have 38- 50mm with a mean MMO of 44mm. The variation of this study could be due to the difference in size, age, methodology used and in anatomic characteristics of each individual.

The maximum mouth opening, body height and body weight were all measured as part of this study. The findings are supported by the study of Nagi et al. [6] who used a standard protocol to quantify the MMO. They examined the idea that the width of the first interphalangeal folds of the three fingers is proportional to an individual's body size parameter and is the best method for measuring the MMO.

The three-finger index was shown to be the easiest and reliable instrument for determining the normal maximum mouth opening in this study. They found out that MMO correlates with body height and weight even in children. The result is also consistent with other studies that maximum mouth opening correlates with an individual's height and weight. According to Placko et al, MMO was shown to be greater in taller individuals, despite of gender and age. Regardless of this, Yao et al [8] discovered a strong link in the relationship of MMO and weight but not maximum mouth opening and height. MMO and weight were not linked in Gallagher and Reicheneder et al's studies. Chen et al used 518 preschool children at ages three to five years old to measure the interincisal distance and looked at the characteristics that were linked to MMO in that small population. MMO was shown to be associated with weight increasing by 0.19 mm/kg gained.

Furthermore, additional research with a bigger sample size is needed in the future to determine the relationship between mouth opening and age, gender, and race.

CONCLUSION AND RECOMMENDATION

This study conducted a thorough analysis of the relationship between body size parameters and maximum mouth opening among patients at the dental dispensary of Lyceum of the Philippines University Batangas. Participants ranged from 18 to 50 years old,

and data concerning demographics, body measurements, and medical history were collected using a questionnaire. The study utilized the three-finger index as a practical and reliable measure for MMO, validated by the Boley Gauge measurements of finger breadth. Data analysis revealed the influence of certain demographic factors on MMO, indicating potential implications for clinical assessments and individualized treatment planning in dental services.

The findings suggest that dental health professionals should consider the individual body size parameters, such as age, gender, and body mass index, as potential influencing factors on the MMO when assessing patients. As the three-finger index has been shown to be an effective and practical tool, it could be incorporated into routine dental evaluations to improve the precision of MMO measurements. It is recommended that dental institutions implement training for making such measurements to ensure standardized assessment practices. Furthermore, future studies should explore the applicability of such methods across diverse populations to enhance the generalizability of the measurement technique.

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