Original Article

Mouth opening range for Jordanian population and its relation to gender, age, height, and weight

ABSTRACT

Aim: Maximum mouth opening (MMO) is an important parameter in the assessment of several clinical situations, and its measured value is documented to have gender, age, and anthropometric variation.

Background: This study measures the average value of MMO in a sample of the Jordanian population. MMO might be different for different regions of the world and is important for all dental disciplines. We attempt to find correlations between MMO and body characteristics such as gender, age, body weight, and height.

Materials and Methods: A total of 565 Jordanian patients (191 males and 374 females; aged 3–70 years) were randomly selected for this cross-sectional study. Mouth opening was measured using a calibrated ruler between the incisal edges of the upper and lower central incisors (interincisal length), and weight and height were measured using a medical scale. In addition, age and gender were recorded. Patients were informed of the study and agreed to participate. Statistical differences of MMO between male and female patients in each age group were assessed using the *t*-test, the correlation between the MMO and body weight and height was assessed using a Pearson correlation coefficient and simple linear regression using the SPSS program.

Results and Conclusions: The mean MMO across the sample was 45 ± 4.78 mm with a range of 36–61 mm. The mean MMO in males was 45.7 ± 5.2 mm, varied from females, which was 44.65 ± 4.4 mm in all age groups with the level of significance of ($P = 0.013$). No significant relation was found between age and MMO with a P of (>0.05), but a significant correlation was found between MMO and body weight and height with a P of (<0.01).

Keywords: Age, body height, body weight, gender, maximum mouth opening

INTRODUCTION

The maximum distance between the incisal edge of the maxillary central incisors and the incisal edge of the mandibular central incisors at the midline when the mouth is open as wide as possible is defined as maximum mouth opening (MMO). MMO is very important in the diagnosis of several clinical conditions such as temporomandibular joint (TMJ) disorders, odontogenic infections, facial trauma, neurological disorders, hyperplasia of coronoid process, pharmacological side effects, oral and neck cancers, radiotherapies, myopathies, oral malignancies, and rheumatic diseases.[1-5] In addition, its value has been recognized in preoperative assessment before intubation for general anesthesia and before any dental or oral surgical procedure to determine access and visibility.[6,7] MMO is also important in following up on patient's undertreatment to check their progress and has a known implication in patient's normal life.

MMO is quite variable and can be related to many factors such as gender, age, and many anthropometric characteristics of a patient such as race, body height and weight, cranial

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base size, mandibular size, and joint condition.[2,5,8-12] Few studies have been performed worldwide to determine the normal MMO in healthy individuals,[13,14] but more studies are required to quantify the variations between different populations. That is why we aim in this study to measure the MMO and to find its correlation to gender, age, and body weight and height in a randomly selected sample of Jordanian patients.

MATERIALS AND METHODS

A total of 565 randomly selected Jordanian patients with an age range of 3–70 years old (191 male patients and 374 female patients) attending a comprehensive public health center (seeking dental treatment) were enrolled in this study. This public health center is considered a training center and provides health services within a large region in the city of Amman (the capital of Jordan). Patients agreed to participate in the study and demographic information was recorded.

Patients with missing teeth or incisor prostheses, severe attrition, orthodontic treatment, infection, history of facial trauma, tumor, TMJ symptoms, developmental facial anomaly or congenital anomaly affecting stature and systemic diseases such as rheumatoid arthritis or osteoarthritis, and pregnant women were excluded from the study.

The distance between the mesioincisal edge of the upper right central incisor and the mesioincisal edge of the lower right central incisor was used to calculate the mouth opening. MMO was measured using a calibrated fiber ruler while the patient seated comfortably in an upright relaxed position, gazing forward, and was instructed to open his or her mouth as wide as possible. Weight and height were taken using a medical scale. Single examiner (the author) made the clinical examination and interviews with patients.

Statistical analysis

Collected data were entered into a spreadsheet in SPSS software (Version 16.0; SPSS Inc., Chicago, IL, USA) for statistical analysis. Student's *t*-test was used to assess the statistical difference between MMO for males and females. Another *t*-test was used to assess the significant difference between MMO in each age group and MMO between males and females in each age group. Pearson correlation coefficient and a simple linear regression were used to assess the correlation between body weight and height and MMO.

RESULTS

MMO was measured in 565 Jordanian patients (191 males and 374 females) with a mean age of 21.46 years. The average MMO for all patients was 45.01 ± 4.78 mm, and the average MMO for males (45.71 ± 5.29 mm) was statistically larger than the MMO of females (44.65 ± 4.46 mm; $P = 0.13$). There was an increase in the MMO value for patients in the 3–42 years old, followed by a decrease in this value after the age of 42 years, as shown in Figure 1, but the *t*-test did not show that this difference was statistically significant ($P > 0.05$).

Figure 1 shows the comparison between mean male and female MMO values by the age group. There was a positive significant correlation between MMO and height (Pearson's correlation coefficient $r = 0.242$; $P < 0.0001$) as well as between MMO and weight ($r = 0.209$; $P < 0.0001$). Data are shown in Figures 2 and 3.

Figure 2 shows scatter and linear regression diagrams of MMO associated with height.

Figure 3 shows scatter and linear regression diagrams of MMO associated with weight.

From the linear regression model, equations were inferred by calculating regression coefficient and intercept for both height and weight as shown in the following equations: MMO (mm) $= 0.0539 \times$ Height $+ 37.163$ ($P < 0.0001$) and MMO (mm) $= 0.0391 \times$ Weight $+ 42.996$ ($P < 0.0001$). Hence, it was estimated that for every 10 cm or 10 kg, there is an increase in MMO of 0.5 mm or 0.4 mm, respectively.

DISCUSSION

The normal range of mouth opening is a variable that shows up in all aspects of dental practice, especially maxillofacial and plastic surgery since it is both a diagnostic tool and a goal to achieve after treatment (i.e., to restore normal mouth opening). Hence, this value needs to be known by dentists and surgeons. The normal range of MMO was studied in some populations, but a limited number of studies were conducted in Middle Eastern countries.

Care should be taken when positioning the patient's head before making MMO measurements, as MMO can increase

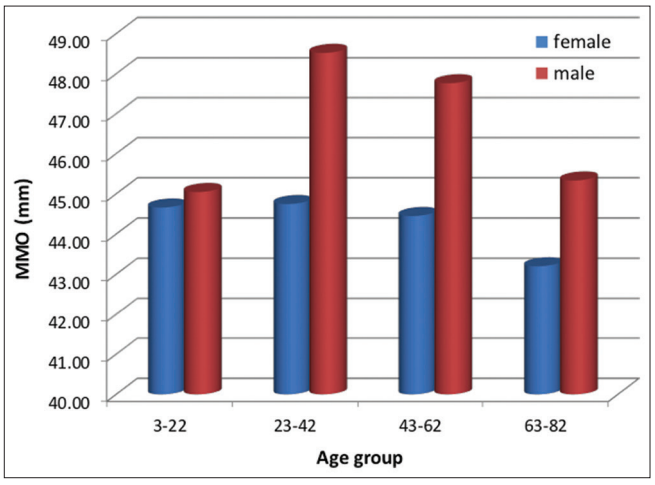

Figure 1: Comparison between mean male and female MMO values by the age group. MMO: Maximum mouth opening

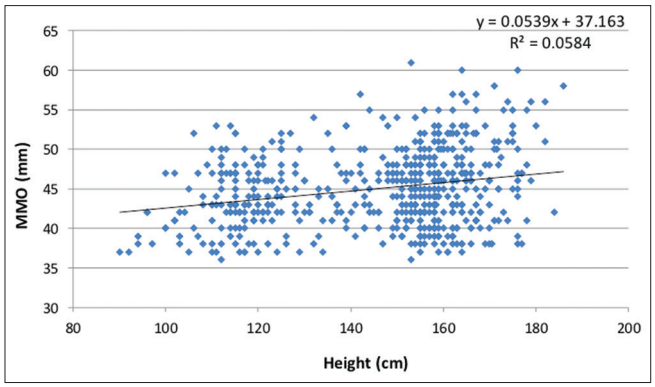

Figure 2: Scatter and linear regression diagrams of MMO associated with height. MMO: Maximum mouth opening

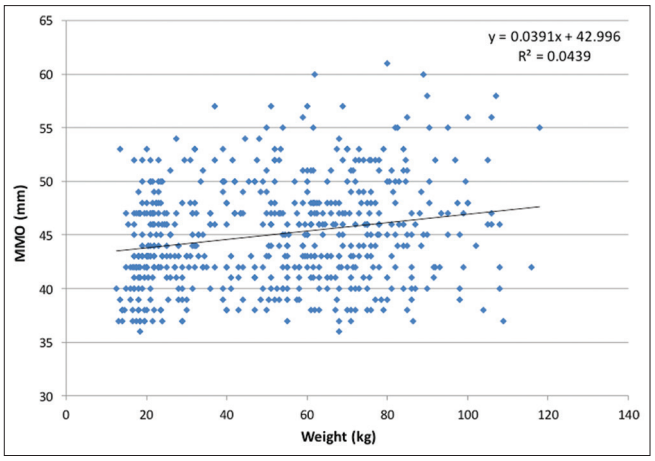

Figure 3: Scatter and linear regression diagrams of MMO associated with weight. MMO: Maximum mouth opening

as head position changes from retracted to natural to forward position.[15-17] That is why all patients were seated in a natural relaxed position looking forward before taking our own measurements. The methods described in the literature for measuring MMO are numerous. In this study, interincisal distance attained during active mouth opening by the patient was used, even if it underestimates the vertical distance traveled by the mandible in patients with a deep bite. This is because clinical importance lies in the functional opening of the mouth that actually affects chewing and dental treatment, not the distance that the mandible travels.[1,2,18,19]

Many tools have been described to measure the maximum interincisal distance. However, it was found that the ruler is an easier way and more accurate than the Willis gauge that requires a longer time and leads to fatigue and less cooperation from the patient.[20] The mean value of MMO in our overall Jordanian subpopulation is 45.01 ± 4.78 mm (45.71 ± 5.29 mm in males and 44.65 ± 4.46 mm in females). These values are coherent with those obtained for the Saudi Arabian population,[13] Swedish population,[14] and Mexican population.[21] Variations between studies in the mean value of MMO are due to sampling size, racial differences, facial morphology, and methods used to measure this value.

Male MMO is different from female MMO (especially in the younger age group), this is probably due to differences in mandibular size and whole skeleton,[1,2,22] even though joint mobility is greater in females[23] and the angle of opening at TMJ is higher.[18,24,25] This conforms with our study, where we found a significant difference between males and females in all age groups, especially between 23 and 42 years old ($P < 0.001$). It is worth mentioning that some studies found no such gender difference.[24,26] Our study showed a trend of increasing MMO from 3 to 42 years old that is explained by the development of temporomandibular eminence.[19,27,28] After that, MMO gradually decreases with the aging process as explained by skeletal muscle atrophy, declining strength, and degenerative changes as patient ages.[8,18,19]

The correlation between MMO and either weight or height is debatable in literature. Some authors found that body height was strongly correlated with MMO.[10,28-30] Others found the correlation between MMO and both height and weight,[4,22,26,28] while Ying *et al*.[12] found a significant correlation between MMO and weight but not height. However, Gallagher and Reicheneder *et al*. failed to find any association between weight and MMO.[2,11] In our study, a positive correlation was found between MMO and height ($r = 0.242$; $P < 0.0001$), and between MMO and weight ($r = 0.209$; $P < 0.0001$).

Limitations of this study include that the examined patients were recruited from a pool of patients seeking dental management in our department that represents one area of Jordan. Another is that radiographic images of TMJ were not collected to exclude any asymptomatic patients with mouth limitations, albeit a history of the absence of symptoms of temporomandibular dysfunction or trauma was taken to minimize this possibility. A larger sample and more areas of Jordan need to be studied to obtain nationwide results including more underlying factors such as cranial base length, mandibular size, and angle to confirm these findings.

CONCLUSIONS

Within the limitations of this study, we found a correlation between MMO and gender, height, and weight.

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Conflicts of interest

There are no conflicts of interest.

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