ORIGINAL ARTICLE

The normal range of maximum mouth opening and its correlation with height or weight in the young adult Chinese population

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Abstract *Background/purpose:* Maximum mouth opening (MMO) is an important diagnostic reference for dental clinicians. However, the relationship between either body height or weight of the individual and their subsequent MMO has, up to now, been unclear. The purpose of this study was to measure the MMO of healthy young Chinese adults and to analyze the possible correlation of MMO with either height or weight.
Materials and methods: A total of 452 young Chinese adults, aged 20—35 years (238 males, 214 females) were selected for this cross-sectional study. We recorded the MMO, age, sex, height, and weight of the participants. Two standardized examiners performed the clinical oral assessments. Independent sample t tests were used to examine the difference in MMO relative to sex. Pearson's correlation and simple linear regression were used to estimate the correlation between MMO and either height or weight.
Results: The average MMO across the 452 participants was 52.02 ± 5.09 mm, and the average MMO of males (54.18 ± 5.21 mm) was significantly larger than that of females (49.62 ± 3.69 mm; $P < 0.001$). The mean MMO was moderately positively correlated with height ($r = 0.54$; $P < 0.001$) and weight ($r = 0.50$; $P < 0.001$). In the regression model, it was estimated that, for every 10 cm or 10 kg, MMO increased by about 3.6 mm or 1.8 mm, respectively.
Conclusion: With the limits of the present study, both height and weight were found to be significantly correlated with the MMO of Chinese young adults and may be significant predictors of MMO measurement.
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Introduction

Mandibular function is evaluated using a series of diagnostic tests, including palpation of the masticatory muscles and temporomandibular joint (TMJ), occlusal evaluation, and radiographic examination.[1] Maximum mouth opening (MMO) is also an important diagnostic reference for dental clinicians as a preliminary evaluation. Limited mouth opening during mandibular movements may result from a temporomandibular joint disorder (TMD), oral submucous fibrosis, rheumatic disease, infection, malignancies, or facial trauma.[2,3]

Establishing a normal range for MMO could allow dental clinicians to objectively evaluate the treatment effects and set therapeutic goals for patients performing mandibular functional exercises. Previous studies have attempted to compile an average range of physiological mouth opening capacity measurements, but the variability in MMO is quite large because it varies dramatically with age, sex, race, joint condition, mandibular size, cranial base size, body height, and weight.[4–11] There is, as yet, no reference for clinicians to determine whether a patient has limited mouth opening capacity, as it is so dependent on other particular physiological characteristics. It is therefore necessary to investigate the correlation between MMO and any related physiological indicators.

The correlation between age and MMO in ethnic Chinese adults has previously been studied and published in the literature.[4] However, no correlation has been established between MMO and either body height or weight. The objective of the present study was to establish a normal range of MMO in a sample of young Chinese adults and to analyze possible correlations of MMO with either height or weight.

Materials and methods

The study included 452 young ethnic Chinese adults, aged 20—35 years (238 males, 214 females), who were undergoing regular physical examinations in the Medical Examination Center of the Third Hospital of Hebei Medical University (Shijiazhuang, China). A dental examination was performed for volunteers meeting the following inclusion criteria: (1) generally healthy; (2) had signed the informed consent; (3) had full permanent dentitions and no dental prosthesis; (4) no history of oral submucous fibrosis; (5) no history of head or neck tumors; (6) no history of jaw or face pain, either at rest or during activity; (7) no history of TMD or bruxism; (8) no history of TMJ, jaw, head, or face trauma; (9) no clinical symptoms of excessive dental attrition (2nd and 3rd degrees of severity); and (10) no Class III malocclusion (anterior crossbite). The Ethics Committee of the Bethune International Peace Hospital (Protocol No. 2014-12-8) approved the protocol of this study, and informed consent was obtained from each participant.

Age, sex, MMO, height, and weight were collected from each participant. The methods for height and weight measurements have been previously reported in detail.[11] Height and weight were both measured to the nearest tenth in centimeters and kilograms, respectively.

The MMO measurements were taken by two previously trained examiners and were then standardized (kappa > 0.8). Prior to measuring MMO, the participants were asked to rest for at least 10 minutes. They were then seated comfortably in the dental chair in an upright and relaxed position, looking straight ahead. Each participant was instructed to open his or her mouth as wide as possible. The linear distance was measured between the mesioincisal edge of the upper right central incisor and the mesioincisal edge of the lower right central incisor, using a Boley gauge (Pearson Dental Suppliers Corporation, Sylmar, CA, USA). In order to ensure the accuracy and reproducibility of the results, each participant was repeatedly measured three times within 15 minutes. The mean value of the MMO readings was recorded as the outcome for all analyses.

The collected data were entered into spreadsheets in Microsoft Excel 2007 (Microsoft Corporation, Redmond, WA, USA) and imported into SPSS software (version 19.0; SPSS Incorporated, Chicago, IL, USA) for statistical analysis. An independent sample t test was used to examine the differences in MMO, relative to sex. Pearson's correlation and simple linear regression were used to estimate the correlations between MMO and either height or weight. A P value < 0.05 was considered statistically significant.

Results

The mean age of the 452 participants was 27.8 ± 4.2 years, and the average age of females (26.9 ± 4.2 years) was significantly younger than that of males (28.6 ± 3.9 years, P < 0.001). The average MMO for all participants was 52.02 ± 5.09 mm, and the mean MMO of males (54.18 ± 5.21 mm) was statistically larger than that of females (49.62 ± 3.69 mm; $t = 10.63$, P < 0.001).

There was a moderately positive correlation between MMO and height (Pearson's correlation coefficient $r = 0.54$; P < 0.001), as well as between MMO and weight ($r = 0.50$; P < 0.001). The tendency of MMO to increase with height or weight was obvious, as shown in Figures 1 and 2, displaying scatter and linear regression diagrams. In the regression model, it was estimated that for every 10 cm or 10 kg, MMO increased by about 3.6 mm or 1.8 mm, respectively. Regression equations were deduced by calculating the regression coefficient and intercept. For the 20—35-years age group, the regression equations for height and weight were: $MMO\ (mm) = 0.36 \times height - 10.15$ ($F = 180.37$, P < 0.001), and $MMO\ (mm) = 0.18 \times weight + 39.87$ ($F = 151.80$, P < 0.001), respectively.

Discussion

The values for a restricted mouth opening have generally been reported to be <35 mm for joint-related disorders and <40 mm for muscular disorders.[12] These parameters, however, are not applicable to all individuals, because MMO varies considerably from one individual to another. The MMO of healthy young Chinese adults in the present study was 52.02 ± 5.09 mm (54.18 ± 5.21 and 49.62 ± 3.69 mm for males and females, respectively). The tendency for the MMO of males to be significantly greater than that of females was seen consistently across studies. This may be