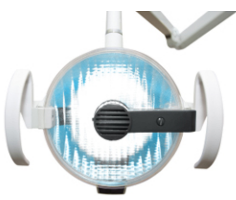
Dentistry 3000

Vol 6, No 1 (2018)
ISSN 2167-8677 (online)
DOI 10.5195/d3000.2018.82

Maximum mouth opening in healthy children and adolescents in Istanbul

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Abstract

Objectives: Mouth opening capacity is often regarded as one of the important parameters for evaluating the function of the temporomandibular joint (TMJ) and masticatory muscle status. A reduced mouth opening capacity may be one of the first clinical signs of TMJ involvement. The purpose of this study was to create age related percentiles for the maximal interincisal distance (MID) of healthy children. **Methods:** The patients admitted for routine dental examinations to Istanbul University Faculty of Dentistry, Department of Pedodontics were included in this study. The interincisal measurements were performed with metallic calliper and also malocclusions were recorded for all children. Oneway Anova test, Tukey HDS test, Tamhane's T2 test and Student t test were used for statistical analysis. **Results:** The study population comprised of 1059 (569 males, 490 females), 3-to 15-year-old (mean age 8.82±3.06) children. The mean score of maximal inter-incisal distance was found 33.24±5.54 for females; 33.32±5.71 for males. There was no statistically significant difference according to gender (p=0.815; p>0.05). The mean score of maximal inter-incisal distance was found 28.63±4.34 for 3-5 years; 33.52±4.84 for 6-11 years; 37.35±5.52 for 12-15 years children. Statistically significant differences were found between age groups (p: 0.001; p<0.01). The mean score of maximal inter-incisal distance was found 32.9±5.6 for class I; 34.92±5.51 for class II; 35.2±5.36 for class III malocclusions. Statistically significant differences were found between malocclusion groups (p:0.001; p<0.01). **Conclusion:** The result of this study indicated that positive relationship between the maximum mouth opening and age and malocclusion.

Citation: Koruyucu M, et al. (2018) Maximum mouth opening in healthy children and adolescents in Istanbul. Dentistry 3000. 1:a001 doi:10.5195/d3000.2018.82
Received: December 11, 2017
Accepted: February 21, 2018
Published: July 13, 2018
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Introduction

Palpation of muscle and joint, occlusal and radiographic examination are performed for assessment of mandibular function. To be able to assess temporomandibular joint (TMJ) function, the primary value to be known is how much joints move when mouth is opened fully maximum mouth opening (MMO) [1,2]. MMO is “ the greatest distance between two central incisors (maxillary and mandibular) at the midline when measured from their incisal edges during the possible wildest opening of the mouth” according to many researchers [3,4].

Mouth opening limitation may be associated with some clinical situations like temporomandibular disorders, odontogenic infections, oral malignancies, submucous fibrosis, mandibular fractures, myopathies, and trauma [5].

Sex, age and height have an impact on how much a person can open their mouth. As an important step, before diagnosing that a person is suffering from limited mouth opening, it is necessary to acknowledge normal opening of the population [6]. Some studies researched children and adolescents MMO values among different populations (Table 1) [6–15]. Also, most of these studies revealed as age increases, MMO increases as well. Moreover, girls have a decreased MMO compared to boys. For this reason, it is important to define normal MMO values for each specific population, so that it is possible to diagnose whether a person suffers from reduced mouth opening.

The aim of this study was to evaluate age related percentiles for the maximal inter-incisal distance of healthy children, based on sex and malocclusion.

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Table 1. Children and adolescent MMO values from different studies.

Studies	Country	Age Group	Sample Size	MMO (mm)
Rothenberg [7]	USA	4-14	189	43.99
Sousa et al. [8]	Brazil	6-14	303	43.79
Müller et al. [9]	Switzerland	4-17	20719	45
Kumar et al. [6]	India	6-8 8-10 10-12	856	45.95 (Girls), 46.04 (Boys) 47.27 (Girls), 48.53 (Boys) 52.05 (Girls), 52.38 (Boys)
Abou Atme et al. [10]	Lebanon	4-15	102	45.8
Feteih [11]	Saudi Arabia	12-16	385	46.5 (Girls), 50.2 (Boys)
Chen et al [12]	Taiwan	3-5	518	36.93 (Girls), 37.47 (Boys)
Benevides et al [13]	Brasil	8-12	181	49.06 (Girls), 49.59 (Boys)
Al-Dlaigan & Asiry [14]	Saudi Arabia	12-16	1825	35.5 (Girls), 43.5 (Boys)
Choi [15]	Korea	2-6	151	37.72 ± 5.10

Material and Methods

The study was approved by the Ethics Committee of the Istanbul University, Medical Faculty

(No:2013/105) and was carried out in agreement with the Declaration of Helsinki principles. The study consisted of 1059 Turkish children who were attending to Istanbul University Faculty of Dentistry, Clinics of Pedodontics, for routine dental examinations in 2013. 569 boys and 490 girls between the ages of between 3-15 years were included.

Medical and dental anamnesis was taken and a questionnaire filled for each patient. The children were examined by one experienced pediatric dentist (MK). They were positioned in a way that they would stay standing up and were soothed to be comfortable by the dentist by supporting their head. The MMO measurement was recorded by measuring the maximum distance between the incisal edges of the maxillary central incisor and mandibular central incisor at the midline while the mouth of the subject was open at its widest. The interincisal measurements were performed with metallic calliper (Seitz & Haag Munchner Modell).

Inclusion Criteria

This study includes the following criteria: healthy and immobile primary maxillary and mandibular central incisors, no dental trauma history, no anterior open-bite, no caries and no restorative materials that influenced the incisal edges, presence of fully erupted maxillary and mandibular central incisors and no orthodontic treatment that could influence the position of the central incisors.

Exclusion Criteria

The exclusion criteria were subjects with temporomandibular disorders, neurological disorders, craniofacial deformities, systemic diseases (juvenile rheumatoid arthritis), congenital abnormalities and neck pain, because these problems might cause limited mouth opening as in the previous cases reported.

Statistical analysis

All statistical analyses were performed using the IBM SPSS Sta

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Table 2. Distribution of maximal mouth opening according to gender, age, and malocclusion.

	n (%)	Maximal mouth opening (mm) Mean ± SD	p
[1]Gender			
Girls	490 (%46,3)	33,24 ± 5,54	**0,815**
Boys	569 (%53,7)	33,32 ± 5,71	
[2]Age			
3-5 year	220 (%20,8)	28,63 ± 4,34	**0,001****
6-11 year	625 (%59,0)	33,52 ± 4,84	
12-15 year	214 (%20,2)	37,35 ± 5,52	
[2]Malocclusion			
Class I	872 (%82,3)	32,9 ± 5,6	**0,001****
Class II	98 (%9,3)	34,92 ± 5,51	
Class III	89 (%8,4)	35,2 ± 5,36	

[1]Student t Test *[2]Oneway ANOVA* ***p<0.01*

tistics 22 (IBM SPSS, Turkey). The assumption of normal distribution was confirmed using the Shapiro Wilk test and MMO was found appropriate to normal distribution. One-way ANOVA followed by the post Tukey HDS and Tamhane's T2 tests were used to examine differences in MMO relative to sex and age groups. The statistical analyses were performed using the Student's t-test for independent samples of males and females. P < 0.05 values were considered statistically significant.

Results

Descriptive statistics of the subjects are shown in Table 2. The study population comprised of 1059 (569 males, 490 females), 3- to 15-year-old (mean age 8.82±3.06) children. The MMO in relation to gender and age is shown in Table 2. The maximal inter-incisal distance was observed with the mean score of 33.24±5.54 for the female group and 33.32±5.71 for the male group. Statistically significant difference was not found according to sex (p=0.815; p>0.05). There were significant rises in MMO with increasing age, regardless of sex. The highest mean MMO according to age was in those aged 12-15 years. The mean score of maximal inter-incisal distance was found 28.63±4.34 for 3-5 years; 33.52±4.84 for 6-11 years; 37.35±5.52 for 12-15 years children (Table 2, Figure 1, Figure 2). Statistically significant differences were found between age groups (p: 0.001; p<0.01) (Table 2).

The maximal inter-incisal distance was observed with the mean score of 32.9±5.6 for class I; 34.92±5.51 for class II; 35.2±5.36 for class III malocclusions (Figure 3). Statistically significant differences were found between malocclusion groups (p: 0.001; p<0.01) (Table 2).

Discussion

MMO has been described as the inter- incisal distance or as overbite added inter-incisal distance [3,16–18]. To measure overbite added inter-incisal distance, the distance that mandible travels vertically should be measured, but, as pointed out by Mezitis et al. [16], the functional opening of the mouth is more important, because this is the value that actually affects chewing and dental treatment. Therefore, the MMO in this study was defined as

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the maximal inter-incisal distance (MID) [5].

There are various methods to measure MMO like directly by using a calibrated fiber ruler [9,14,19–21], simple ruler [7,22,23], scale and divider [20], vernier caliper or wiley's bite gauge [12,13,24–26], Boley gauge [27,28], calibrated Boley gauge [8], modified vernier calliper [6], subject's finger [4,10], optoelectric jaw- tracking system [29,30], Jaw Motion Analyzer System [31] and Therabite range of motion scales [4,32]. Wood and Branco [33] compared different measurement types and suggested that direct measurements using a ruler or calliper were more accurate and precise. The present study was done using metallic calliper.

The most important factor in measuring MMO is the head position [30,34]. Higbie et al. [34] described short-term alterations in head position have a significant effect on the amount of MMO in a normal population. In this study, all subjects were placed in a vertical position for measuring in order to eliminate the possible influence of different head positions.

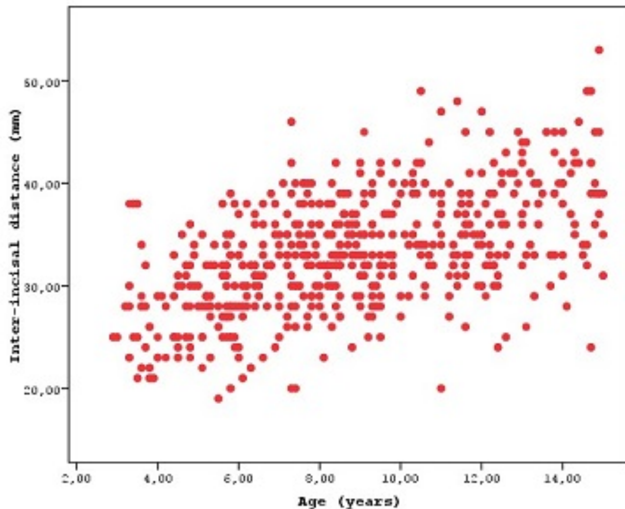

Figure 1. Scatterplot of the correlation between inter-incisal distance and age of all children (girls and boys).

A wide range of MMO has been reported from all over the world in different studies. Studies of MMO values of children and adolescents from different countries with different age range are described in Table 1. We could not compare our study with them about racial differences because of the wide age range. Longitudinal studies are required to compare racial differences with same age. The only study done on Turkish children in this regard [35]; TMJ movements were examined with the Temporomandibular Opening Index (TOI) and its own formula in all dentition types with and without temporomandibular joint dysfunction syndrome. TOI showed that there were no significant differences between different dentitions or genders.

Children and adolescents do not grow constantly and stably, their growth show different phases from birth to adulthood. Their body parts do not develop at the same speed. However, some studies have shown that MMO constantly rises after birth until adulthood, and then gradually decreases during aging. Our research has shown that MID has increased with age among the subjects. These measurements are similar to reported by many researchers that aged among 3 to 15 [6–10,14,15,27,31,32]. These results were divergent with Rothenberg [7], Sousa [8] and Ingervall [36]. Age may be an important predictor of MMO measurements, but the relationship between age and MMO has not yet been established. In our study, mean value of MMO was 28,63 ± 4,34 mm in primary dentition. These measurements are lower from to the ones reported by Choi et al [15]. Chen et al [12] and Ying et al [32] among two to six year-old children. The mean score of MMO was found 33.52±4.84 for 6-11 years; 37.35±5.52 for 12-15 years

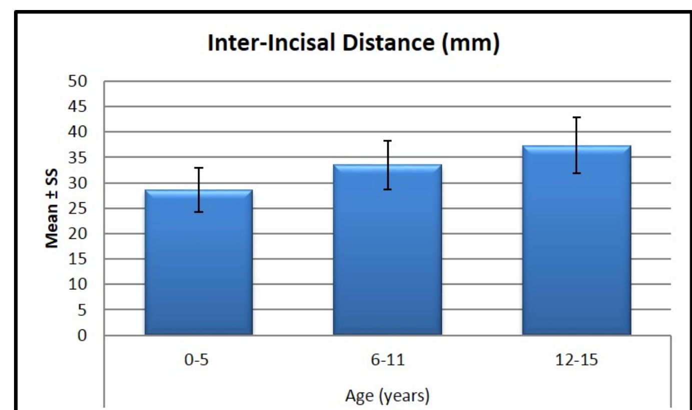

Figure 2. Mean maximum opening(mm) by age groups.

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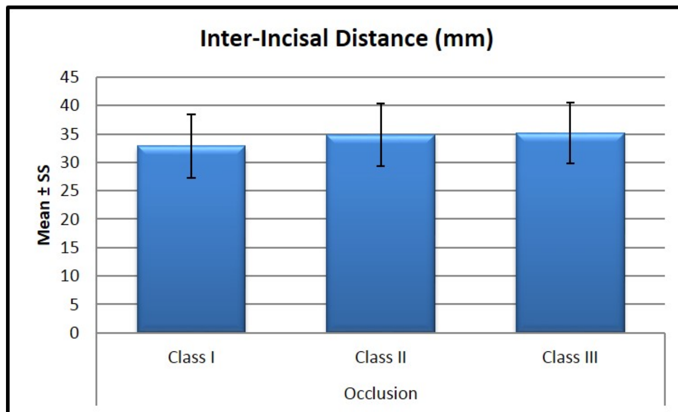

Figure 3. Mean maximum opening (mm) in different occlusion types.

children. These measurements are lower from to the many studies [6–11,13–15,28].

There was no statistically significant difference of MMO according to gender in this study. These results were compatible with many studies [6–10,32,37]. Only few researches report sex difference in MMO [7,24]. Therefore, it is suggested that the gender effect on MMO in adults is not observed in children and adolescents because of they have incomplete sexual maturity. However, Ingervall [36] observed MMO values of 10-year old females were similar to the adult females; but it was not similar to male adults.

In our study, the mean score of maximal inter-incisal distance was found 32.9±5.6 for class I; 34.92±5.51 for class II; 35.2±5.36 for class III malocclusions. Malocclusion groups showed statistically significant differences. We hypothesized like Ying [32], that a Class II molar relationship, due to a retrognathic mandible, would demonstrate a smaller MMO. But the largest MMO value was observed in class III malocclusion. We thought that reason of this situation was our study contained children adolescents who have not yet completed growth. But Ying et al [32] found occlusion type were statistically insignificant in affecting MMO. They found largest MMO value at class II in left molar classification.

In this study, we established basic standard values of MMO in Turkish children and adolescents for detect the mandibular and TMJ functions. In general, MMO was lower than that reported in similar studies that conducted in many countries all over the world. However, additional studies are needed to establish certain average values of MMO in Turkish population for all ages. The result of this study reported the positive relationship between the maximum mouth opening and age and malocclusion.

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