EXPLORING MOUTH OPENING IN 3 TO 14-YEAR-OLD CHILDREN IN A TERTIARY CARE CENTRE OF NEPAL

Priyanka Shah, Sanskriti Khanal

[1]Department of Pedodontics and Preventive Dentistry, Nepal Medical College and Teaching Hospital, Attarkhel, Gokarneshwor-8, Kathmandu, Nepal

ABSTRACT

Mouth opening plays a crucial role in our daily lives. Maximum mouth opening is an important parameter in the assessment of several clinical situations and its value is documented to have variations with gender, age and individual's physical characteristics. This cross-sectional study was carried out to measure the clinical maximum mouth opening in children and its correlation with age, gender, height and weight. A total of 301 children of 3 to 14 years old were included in the study. Data was analyzed using SPSS-16. The mean maximum mouth opening seen in male was 43.17 ± 6.09 mm and in female was 42.55 ± 6.13 mm. Mouth opening differences among different gender was not significant. The mean maximum mouth opening in 3 to 5 years age group was 35.71 ± 4.88 mm, 6 to 8 years age group was 41.71 ± 4.86 mm, 9 to 11 years age group was 44.82 ± 4.61 mm, and 12 to 14 years age group was 47.73 ± 5.84 mm. There was significant difference in the mouth opening of different age groups. There was a positive significant correlation between MMO and weight (Pearson's correlation coefficient r = 0.592; P <0.0001) as well as between MMO and height (r = 0.616; P <0.0001).

KEYWORDS

Age, gender, height, maximal mouth opening, weight

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CORRESPONDING AUTHOR

Dr. Priyanka Shah,
Assistant Professor,
Department of Pedodontics and Preventive Dentistry,
Nepal Medical College Teaching Hospital,
Attarkhel, Gokarneshwor-8, Kathmandu, Nepal
Email: picu.shah@gmail.com
Orcid No: https://orcid.org/0000-0003-3167-0595
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INTRODUCTION

The ability to open the mouth plays a crucial role in various activities such as feeding, speech, and overall oral health. Measurement of maximal mouth opening (MMO) capacity reflects mandibular range of motion. It is described as the greatest distance between the upper and lower incisors or the inter-incisal distance when mouth is opened wide painlessly.[1] A reduced mouth opening capacity may be one of the first clinical signs of pathological changes in the masticatory system.[2]

Dental infections, craniofacial malignancies, fractures and myopathies in the head and neck region and many other reasons may contribute to the cause of reduced mouth opening. All clinicians dealing with the oral cavity face various problems when there is a limited mouth opening.[3] Furthermore, expected MMO serves as a reference for managing individuals with maxillofacial trauma and/or pathologies, aiding in treatment aimed at restoring mouth opening to levels deemed 'normal'. An excessive or reduced range of mandibular movement could indicate signs and symptoms of muscular and/or temporomandibular joint (TMJ) dysfunction.[4] Thus, mandibular range of motion (ROM) measurement becomes a useful parameter in diagnosis and treatment planning, and is therefore recommended in clinical examinations of patients with temporo-mandibular disorders (TMD) signs and symptoms. MMO can also be helpful in providing necessary information for designing of dental instruments/prosthesis.[5]

Most of the studies has revealed as age increases, MMO increases as well.[6,7] Moreover, girls have a decreased MMO compared to boys.[8-12] 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.[13]

However, the developmental trajectory of mouth opening in children and the factors influencing it remains understudied in our population. This research aims to fill this gap by investigating the patterns of mouth opening in children and identifying potential determinants. Therefore, this study was done to measure the clinical maximum mouth opening in children and its correlation with age, gender, height and weight.

MATERIALS AND METHODS

This cross-sectional study was done among children visiting Department of Pedodontics at Nepal Medical College Teaching Hospital from 26th April to 31st May 2024. The study was conducted after obtaining the Ethical clearance from the Institutional Review Committee (IRC) of Nepal Medical College (Ref. No.: 62-080/81). Informed consent and assent were taken both from parents and children.

Measurement of maximum mouth opening was carried out in the department using digital Vernier caliper. The children were seated upright and in relaxed position in the dental chair with their heads well rested in the head rest and looking straight ahead. They were encouraged to open the mouth as far as possible, while the examiner measured the maximum distance from the incisal edge of maxillary central incisor to the incisal edge of mandibular central incisor at the midline. For each child, the examiner took three readings of MMO in millimeters and the mean value was considered. All the measurements were be performed by a single examiner to avoid intra-examiner variations.

Age, gender, height, and weight were recorded for each participant. The height and weight of participating children were determined, with children being dressed in light clothing. Standing height (in centimeters) was measured and weight was determined in kilograms using analog weighing machine. Children having fully erupted maxillary and mandibular central incisors and able to understand and cooperate with the investigators were included in the study. Children with dental prosthesis on anterior teeth, with missing maxillary or mandibular incisors, fractured, crowned or attrited incisors and children with history of bruxism, severe orthodontic problems, with signs and symptoms of temporomandibular joint disorders, odontogenic infections affecting mouth opening were excluded from the study. Based on the study by Joshi *et al*,[14] taking σ=3.99, E=0.5 at 95% confidence interval and using formula $n=Z^2\ \sigma^2\ /E^2$, the minimum sample size was 244. In this study total 301 subjects were included. The convenience sampling method was used to collect the study samples.

Data was entered, coded in SPSS-16 for analysis. Mouth opening differences among different gender was compared using independent "t" test and among different age groups was compared using one-way ANOVA. The differences between individual age groups were compared using post hoc test. Pearson correlation was used to determine the relationship between the different parameters. P-value <0.05 was the bench mark for statistical significance in the analysis.

RESULTS

Among the 301 participants, 157 (52.2%) were male while 144 (47.8%) were female. Among them, 46 (15.3%) fall under 3-5 years, 96 (31.9%) were 6-8 years, 114 (37.9%) fall under 9-11 years, and 45 (15.0%) fall under 12-14 years old group. The mean maximum mouth opening seen in male was 43.17 ± 6.09 mm and in female was 42.55 ± 6.13 mm. Mouth opening differences among different gender was not significant (Table 1).

Table 1: Mean MMO in different gender

Gender	n (%)	MMO (mean ± SD)	p-value
Male	157 (52.2)	43.17±6.09	0.37 (not significant)
Female	144 (47.8)	42.55±6.13	
Total	**301**		

Table 2: Mean MMO in different age groups

Age group	n (%)	MMO (mean ± SD)
3-5	46 (15.3)	35.71±4.88
6-8	96 (31.9)	41.71±4.86
9-11	114 (37.9)	44.82±4.61
12-14	45 (15)	47.73±5.84
Total	**301**	

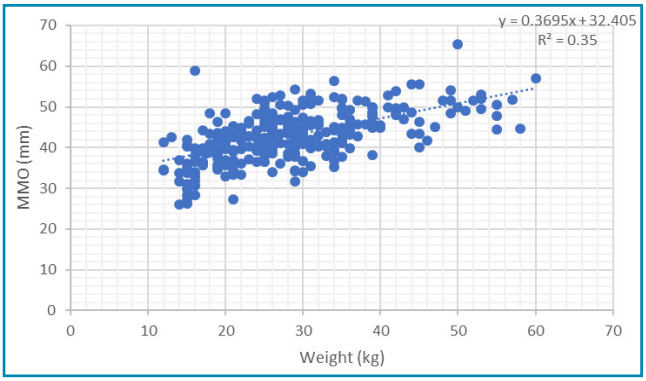

Fig. 1: Scatter and linear regression diagrams of MMO associated with weight. MMO: Maximum mouth opening

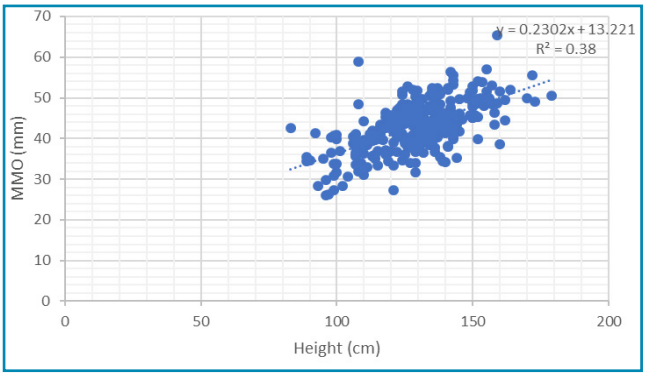

Fig. 2: Scatter and linear regression diagrams of MMO associated with height. MMO: Maximum mouth opening

Table 3: Difference in mouth opening in different age group using one-way ANOVA

	Sum of squares	df	Mean square	F	Sig.
Between groups	3984.736	3	1328.245	54.596	**0.000** (p<0.05)
Within groups	7225.570	297	24.329		
Total	**11210.306**	**300**			

Table 4: Inter group comparison using post-hoc Tukey HD

Age group (I)	Age group (J)	Mean difference (I-J)	Std. error	Sig.	95% confidence interval	
					Lower bound	Upper bound
3-5 years	6-8 years	-6.00453*	0.88	0.00	-8.28	-3.71
	9-11 years	-9.11613*	0.86	0.00	-11.34	-6.89
	12-14 years	-12.01830*	1.03	0.00	-14.69	-9.34
6-8 years	3-5 years	6.00453*	0.88	0.00	3.71	8.28
	9-11years	-3.11160*	0.68	0.00	-4.87	-1.34
	12-14 years	-6.01377*	0.89	0.00	-8.31	-3.71
9-11 years	3-5 years	9.11613*	0.86	0.00	6.8902	11.3421
	6-8 years	3.11160*	0.68	0.00	1.3463	4.8769
	12-14 years	-2.90218*	0.86	.005	-5.1457	-.6587
12-14 years	3-5 years	12.01830*	1.03417	.000	9.3464	14.6902
	6-8 years	6.01377*	.89110	.000	3.7115	8.3160
	9-11 years	2.90218*	.86836	.005	.6587	5.1457

**The mean difference is significant at the p<0.05 level.*

The mean maximum mouth opening in 3 to 5 years age group was 35.71 ± 4.88 mm, 6 to 8 years age group was 41.71 ± 4.86 mm, 9 to 11 years age group was 44.82 ± 4.61 mm, and 12 to 14 years age group was 47.73 ± 5.84 mm (Table 2). There was significant difference in the mouth opening of different age groups (Table 3 and 4).

There was a positive significant correlation between MMO and weight (Pearson's correlation coefficient r = 0.592; P <0.0001) as well as between MMO and height (r = 0.616; P <0.0001). Data are shown in Fig. 1 and 2. Fig. 1 shows scatter and linear regression diagrams of MMO associated with weight. Fig. 2 shows scatter and linear regression diagrams of MMO associated with height.

DISCUSSION

Assessing the standard mouth opening range in children within a specific population is a vital indicator for detecting various conditions that may result in reduced mouth opening within that community. It serves as an indicator for several pathological conditions impacting the masticatory system. Like with any other ailment, the objective of treating disorders affecting mouth opening is to return it to its normal range.[6]

Position of head also plays a very crucial role in determining MMO. Values of MMO were seen to vary in forward, natural or retracted head positions in a study conducted by Higbie *et al*.[15] Thus, in the present study, MMO was measured with the head of the subjects in an upright position and rested against a firm surface, so as to disregard the possible impact of different head positions on values of MMO. Studies have indicated considerable variation in mouth opening measurements based on factors such as age, gender, stature, weight, facial morphology as well as geographical and ethnic backgrounds.

Various probing has been done concerning normal values of MMO in boys and girls of different ages. In a study done in *Newari* children, the mean maximum mouth opening seen in male was 41.61 ± 6.21 mm and in female was 40.22 ± 5.85 mm, these results were comparable with our study probably because of same age groups taken in both these studies.[14] Another study conducted in Nepal among normal subjects and in patients with oral submucous fibrosis, the authors documented the mean value of interincisal distance of 47.1 ± 6.7 mm in normal subjects.[16] This is higher in comparison with our study as the age group taken in this study was 18-68 years. Another study done Nepal in Bachelor level students also had the mean inter-incisal distance of male and female as 48.69 ± 6.92 mm and 46.51 ± 6.24 mm respectively.[17]

In this study MMO was not statistically significant between gender. Our findings resonated with the finding of the study done by Abou- atme *et al*.[18] done in children of age 4-15 years which revealed that no gender difference was correlated to MMO.A number of studies have been conducted in Indian, Saudi and Irish population which have documented that the maximum mouth opening was higher in males than in females.[9,19,20] This gender difference observed in these studies may be explained as the anatomical structure of the male head and face bones are generally larger than those of females.[11] The reason for gender difference could also be attributed to the difference in the facial morphology and the orofacial musculature of males and females.[1]

The mean MMO in the present study showed a gradual increase with age with a mean MMO of 35.71 mm at 3–5 years to a mean MMO of 47.73 mm at 12-14 years. This is in agreement with the findings of previous studies conducted in pediatric population.[8,14,18,21,22] A study done in Jordanian population[23] revealed a trend of increasing MMO from 3 to 42 years old which was explained by the development of temporomandibular eminence. After that, MMO gradually decreases with the aging process as explained by skeletal muscle atrophy, declining strength, and degenerative changes as patient ages.

A positive correlation of MMO with height and weight was noted in the present study which was consistent with the findings of study done in Indian, Chinese and Jordanian population.[8,11,22,23] A study done in an Indian population revealed an indefinitive correlation of MMO with height and weight.[3] Similar findings were also obtained in a study conducted by Agerberg[24] who found a weak correlation of MMO with height and weight.

In our study MMO was seen to increase with age in a statistically significant manner. Both height and weight had positive correlation with MMO of children. Normal MMO from this study can serve as a baseline data for children for comparison and future references for a pediatric population. This can assist in identifying any pathologic or non-pathologic conditions which usually goes unnoticed in a child with restricted mouth opening. Moreover,

it will be helpful for pediatric dentist to easily identify the child with retarded mouth opening and it's underlying cause.

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