ORIGINAL ARTICLE

Does Body Mass Index affect Tooth Eruption Sequence? A Study among 6–7 Years Old Schoolchildren in Chennai, India

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Abstract

Background: Changes in eruption pattern cause malocclusion and crowding, which lead to poor oral hygiene as well as periodontal disorders. Hence, it is important for the dentist to know the exact tooth eruption sequence to educate the parents. Tooth eruption sequence we follow is based on the Western population.

Aim: As Indian population differs from the Western population in ethnicity, racially, and dietary habits, etc., an attempt was undertaken to compare eruption sequence of Indian children in accordance with the Western population and also to correlate whether body mass index (BMI) affects tooth eruption.

Materials and methods: Body mass index and eruption status of permanent mandibular central incisors and first molars were recorded among 529 schoolchildren in Chennai. Eruption status was examined with the help of mouth mirrors and illumination under natural light. The recorded data were entered into Microsoft Excel 2007 and were analyzed using Chi-square test, *z* test, and Spearman's correlation test. Level of significance was set as 0.05.

Results: Eruption values attained from our study were not consistent with the eruption values reported by Logan and Kronfeld. The present study showed that girls have early tooth eruption than boys. Our findings showed negative correlation with respect to BMI and eruption sequence of 31 ($r = -0.133$), 41 ($r = -0.140$), 36 ($r = -0.08$), and 46 ($r = -0.076$).

Conclusion: Eruption values reported by Logan and Kronfeld are inappropriate for Indian population. It is also found that obese children had delayed tooth eruption when compared with underweight children who had early tooth eruption.

Keywords: Body mass index, Eruption status, Nutritional status, Sex factors, South Indian population, Tooth eruption.

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Introduction

Tooth eruption is defined as the natural physiological process by which a tooth moves from its site of development to its final functional position in the oral cavity.[1] The first set of teeth that erupts is called deciduous or milk teeth. After primary and permanent teeth erupts, variety of developmental anomalies is evident that can be related to systemic and local factors, which influence the formation and calcification of enamel matrix.[2] Thus, it is important that the parents should be educated about the time factors related to the early stages of tooth calcification.[3] The permanent teeth erupt following the shedding of the deciduous teeth, and each tooth has a particular age of eruption and follows an eruption sequence. The first permanent tooth to erupt is the central incisor at the age of 6 years followed by the first molars. The eruption sequence followed universally is the sequence observed in the western population.[4] Nutritional status of the child can be assessed using body mass index (BMI). As nutrition plays a significant role in tooth eruption and development, it is necessary to know whether BMI has influenced the chronology of tooth eruption pattern. According to BMI curves, centers for disease control and prevention, children are divided into four groups: underweight, normal, overweight, and obese.[5] Changes in eruption pattern cause malocclusion and crowding, which lead to poor oral hygiene as well as periodontal disorders. The subjects surveyed in almost all studies of dental development in the past[1,3,4] are essentially of Western derivation. Indian studies done by Tandon et al.[6], Patil et al.,[2] and Gupta et al.[7] showed differences in the eruption of primary dentition among the South Indian population when compared to the eruption sequence of western population given by Logan and Kronfeld.[4]

In children, increase or decrease in the amount of body fat can lead to weight-related diseases and other health-related issues. This increase or decrease in body weight can be measured directly by BMI. The literature shows that there is a significant relationship between BMI and oral hygiene status.[8,9] However, there is a scarcity of literature to show whether BMI has a role in tooth eruption. So, this study was carried out to find the correlation between the BMI and eruption status of permanent mandibular central incisors and first molars among children aged 6–7 years.

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Materials and Methods

Five hundred and twenty-nine school-going children aged 6–7 years from primary schools in Chennai were randomly selected with prior permission from school authorities and District Educational Officers to examine the children. Ethical clearance was obtained from the Institutional Human Ethical Committee of Sathyabama University Dental College and Hospital, Chennai. The demographic details and basic information about the children were obtained from school records. The weight of children was measured in kilograms using a weighing scale and height was measured using wall-mounted tailor tape. BMI was obtained from the recorded weight and height of each individual using the following formula:

$$\text{BMI} = \text{weight}\ (\text{kg}) \big/ \text{height}\ (\text{cm}^2).$$

In children, BMI category was derived by measuring the deviation of each observation from the sample mean as recommended by WHO.[6] Overweight >+1SD (equivalent to BMI 23 kg/m^2 at 19 years), obesity >+2SD (equivalent to BMI 30 kg/m^2 at 19 years), thinness <–2SD, and severe thinness <–3SD.

With the help of sterilized mouth mirrors and natural light, the subjects were examined for eruption of permanent mandibular first molar and central incisor. A tooth was considered erupted, when any part of the crown was seen in the oral mucosa. The permanent tooth was recorded using the two-digit system of the Federation Dentaire Internationale notation.[7]

The recorded data were gathered and entered into Microsoft Excel 2007 and were analyzed using the SPSS (Statistical Package for Social Science), version 16. The Chi-square test was used to study the association between gender and eruption status of permanent mandibular central incisors 31/41 and permanent mandibular molar 36/46. The data obtained from our study were then compared with the eruption value reported by Logan and cornfield using a *z* test. The level of significance was set as 0.05. The independent sample '*t*' test was used to compare the BMI between genders; Spearman correlation and Chi-square test were used to find the comparison of BMI and eruption status.

Results

The study population consists of 529 school-going children out of which 266 were boys and 263 were girls. Table 1 shows that the eruption values obtained from the present study slightly deviated from the reported eruption values by Logan and Kronfeld.[4] Table 2 shows that there is no significant relation between gender and tooth eruption.

From Table 3, it is evident that there is a statistically significant association between BMI and central incisor teeth eruption status. However, there is no association between BMI and molar teeth eruption status. From Table 4, we observe that BMI and central incisor (31 and 41) negatively correlate with the accepted level of statistical significance. However, the molar (36 and 46) has no relationship with the BMI.

Discussion

The eruption age is determined usually by specific statistical methods based on the data collected from a population. This eruption process varies physiologically among individuals

Table 2: Eruption of permanent mandibular central incisors and permanent mandibular first molars in boys and girls

Age groups years/ (gender)	*Permanent mandibular central incisors erupted (n%)*		*Permanent mandibular first molars erupted (n%)*	
	31	*41*	*36*	*46*
6–7 years (boys)	157 (59.0%)	151 (56.8%)	201 (75.6%)	199 (74.8%)
6–7 years (girls)	164 (62.4%)	153 (58.2%)	216 (82.1%)	205 (77.9%)
Pearson Chi-square value	0.616	0.107	3.416	0.720
D_f	1	1	1	1
p value	0.432	0.743	0.065	0.396

Table 3: Eruption of permanent mandibular central incisors and permanent mandibular first molars based on body mass index

	Permanent mandibular central incisors erupted (n%)		*Permanent mandibular first molars erupted (n%)*	
BMI	*31*	*41*	*36*	*46*
Severe thinness	0	0	0	0
Thinness	17	15	20	19
Optimal	261	248	353	343
Overweight	30	28	5	29
Obesity	13	13	13	13
Pearson Chi-square value	19.745	12.446	7.610	6.689
D_f	5	4	4	4
p value	0.01	0.014	0.107	0.153

Table 4: Correlation between body mass index and eruption status

	Permanent mandibular central incisor (31)	*Permanent mandibular central incisor (41)*	*Permanent mandibular molar (36)*	*Permanent mandibular molar (46)*
Pearson correlation	–0.133	–0.140	–0.08	–0.076
Sig. (2-tailed)	0.002	0.001	0.066	0.081

Table 1: Comparison of the values observed in the present study with the values reported by Logan and Kronfeld

	Permanent mandibular central incisor (31)	*Permanent mandibular central incisor (41)*	*Permanent mandibular molar (36)*	*Permanent mandibular molar (46)*
Eruption values observed	60.7%	57.5%	78.8%	76.4%
Eruption values reported by Logan and Kronfeld	65%	65%	75%	75%
Z statistic	–2.031977908	–3.50120255	2.153103714	0.74132608
p value	0.042155892	0.000463164	0.031310528	0.458495752

based on heredity, geographic factors, gender, nutrition, and urbanization, etc.

Eruption of teeth is often presumed based on a study done by Logan and Kronfeld[4] among Western populations. Scarcity of literature to explain the exact eruption sequence in Chennai, South India had led to the need to carry out the study. This study also highlights whether BMI plays a role in affecting tooth eruption sequence in Chennai population.

The present study showed that eruption sequence in our study population varied significantly from that of Logan and Kronfeld[4] with regards to mandibular central incisors. There was no significant relation between the mean eruption time and the gender of the children. However, it should be noted that girls have early eruption of teeth than the boys. Indian studies conducted by Sivapathasundharam et al.[7] and Bagewadi[10] in Indian population also support our findings that girls have an early tooth eruption than boys. Conversely, studies done by Liverside[11] and Romo-pinales[12] in the Western population showed tooth eruption is earlier in boys than girls.

Nutrition plays a major role is overall growth and development of the human body. Body mass index helps in indicating the nutritional status of an individual. According to WHO, BMI is categorized as severely underweight, underweight, optimal, overweight, and obese. Our study showed negative correlation with respect to BMI and an eruption sequence of 31, 41, 36, and 46. This is in accordance with another Indian study conducted by Sabharwal[13] in Uttar Pradesh, India.

The findings in this study highlights that the tooth eruption sequence of Logan and Kronfeld[4] is not applicable for Indian population. As dentists rely on tooth eruption sequence for early prevention and treatment of dental diseases and conditions, this study recommends the need for larger survey to estimate the exact eruption sequelae for Indian population based on BMI, as tooth eruption is delayed with an increase in BMI.

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