Original Research

The Relationship between Body Mass Index and Dental Development by Demirjian's Method in 4- to 15-Year-Old Children in Mashhad

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Abstract

Introduction: The purpose of this study was to evaluate the relationship between the body mass index (BMI) and dental development. **Methods:** The dental ages of 196 children were calculated according to Demirjian's method. The chronological age, weight, and height were recorded. Dental development was defined as dental age minus chronological age. Children were classified into three groups according to their BMI: underweight, normal, or overweight and obese. We used One-way analysis of variance (ANOVA), and Pearson correlation tests to analyze the data (significance level of 0.05). **Results:** There was a significant correlation between BMI and dental development in the girls (P=0.03, r=0.205). There was not a significant correlation between BMI and dental development in the boys (P=0.08, r=0.18). There was not a significant difference between the mean dental development and BMI group in the girls (P=0.07). There was a significant difference between mean dental development in different BMI groups in the boys (P=0.018). **Conclusion:** Dental development in overweight and obese boys is significantly accelerated.

Key Words: Body mass index, Dental development, Panoramic

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Introduction

Dental age and dental development are important issues in pediatric dentistry and orthodontics. Delays in the appearance of permanent teeth, is a concern for many parents. Children are compared to their siblings, cousins, or peer friends in the permanent tooth eruption. From the professional point of view, dental development must be taken into account in serial extractions, space maintainers and space regainers, and many other interventions. According to previous studies, both genetic and environmental factors may affect dental development. BMI is one of the factors thought to be related to dental development, but few studies have been performed in this regard (1-6).

Both emergence and calcification of the teeth may be used to estimate dental age. Emergence is a transitory process and it is difficult to predict the exact time of its occurrence while calcification is a continuous process and can be traced by radiographs. Therefore, calcification is of greater validity (7). The most common method of estimating dental age based on tooth calcification, is suggested by Demirjian (8).

Body Mass Index (BMI) is calculated by dividing the body weight into the square of the height. BMI, is a reasonable measure by which to assess fatness in children, after considering their age and gender (3,9).

According to BMI curves of the Centers for Disease Control and Prevention (CDC), children are divided into four groups: underweight, normal, overweight, and obese (3).

Obesity is a major and common health concern. Its increasing prevalence is caused primarily by our modern lifestyles and dietary habits (10). Obesity is also a growing health problem among children and adolescents (11,12). The World Health Organization

(WHO) has also been concerned with the issue of underweight and malnutrition in underdeveloped nations. The aim of this study was to determine if there is a relationship between BMI and dental development.

Materials and Methods

The unit of observation in this cross sectional study was the 4- to 15-year-old children who referred to a private clinic of dental and maxillofacial radiology in Mashhad, to have a panoramic radiograph prescribed by dentists from November 1, 2008 to November 1, 2009. The exclusion criteria were patients who had a systemic disease, palatal cleft, hyperdontia, or bilateral missing of some teeth except for third molars. Of the 204 children in this age range who referred to the clinic, 8 were excluded.

This study was ethically approved by the Ethics Committee of Mashhad University of Medical Sciences. The method and objectives of our study were briefly and simply described to the parents. They were assured that their child would not receive an extra dose of radiation for the study, and the informed consent was obtained.

The panoramic radiographs of the participants were made by a digital PSP sensor (AGFA, Berlin, Germany), ProMax system (ProMax PlanMeca, Helsinki, Finland). Each child's birth date was recorded from his or her certificate document. The height and weight of all children were measured by one person; the weights were measured using a Mettler TE 120 digital scale. The reliability and validity of measurement tools were checked prior to taking the measurements. The accuracy of measurements was ± 0.01 kg for weight, ± 0.01 meter for height, and ± 0.01 year for chronological age.

With the BMI, age, and gender of each individual, and according to age- and gender-matched BMI tables published by the CDC, the samples were classified into three groups: normal, underweight, and overweight/obese.

The dental ages of the 196 participants were estimated by using these radiographs according to Demirjian's method, by an expert in dental and maxillofacial radiology. Dental development was calculated by subtracting the chronological age from the dental age.

One-sample Kolmogorov test was done to define the distribution. Pearson correlation test, one-way analysis of variance (ANOVA) and post-hoc tests were conducted by SPSS software (SPSS for Windows, SPSS, Chicago, USA) to analyze the data.

Results

We ended up with 41 underweight (21%), 99 normal weight (50%), and 56 overweight and obese (29%) samples. This portion of the data was obtained by convenience sampling. 109 females (56%) and 87 males (44%) participated in this study, ranging in chronological age from 4.58 to 14.91 years with a mean value of 9.45 years. The dental age range was from 3.92 to 14.75 years with the mean value of 9.47 years. One-sample Kolmogorov test showed the distribution of dental development is normal in the boys (P>0.05) and the girls (P>0.05). The distribution of BMI groups was not normal (P=0.00).

Dental development, calculated by subtracting the chronological age from the dental age, had the minimum and maximum values of -4.3 and 3, respectively and the mean value of 0.016.

The girls were divided into two groups: group 1 who were younger than 10 years (67) and group 2 who were 10 years and older (42). Without grouping, the Correlation Coefficient between BMI category and dental development is significant in the girls (P=0.03, r=0.2). Considering the age grouping, this coefficient is also significant in group 2 (P=0.02, r=0.34) but insignificant in group 1 (P=0.52, r=0.08). There was no significant difference between mean dental development in BMI categories in neither group 1 (P=0.76) nor group 2 (P=0.12). Similarly, the boys were divided into two groups: group 3 who were younger than 12 years (75) and group 4 who were 12 years and older (12). Without grouping, the correlation coefficient between BMI and dental development is not significant in boys (P=0.08, r=0.18). Considering the age grouping, this Coefficient is not significant in neither group 3 (P=0.08, r=0.20) nor in group 4 (P=0.96, r=-0.01). There was a significant difference between mean dental development in BMI categories in boys (P=0.018). Post-hoc test revealed that boys in overweight and obese BMI category had a significantly accelerated dental development comparing with boys in normal BMI category which equals approximately to 0.7 years. When separated by age, the significant difference in dental development between BMI groups was only seen in group 3. As for the girls, there was no significant difference in dental development between BMI groups not in the whole female samples neither together nor in groups 3 and 4, separately.

Discussion

The Demirjian's method used in this study, has been studied in various populations (3,8,13-15) including Iranian population, and introduced as an appropriate method for estimating the dental age (16,17).

In the age range of this study, most children experience physical maturation. The girls tend to enter adolescent growth spurt at around 10 and boys at around 12. Growth spurt is accompanied by increase in mass of muscles, redistribution of body fat, and increase in rate of skeletal growth (18). These changes, obviously affect the BMI.

We found a significant correlation between BMI and dental development in the girls but the correlation coefficient was not high. To make the clinical prediction that increased pure BMI (regardless of age and sex which are required to CDC grouping) is related to accelerated dental development, the correlation coefficient needs to be at least 0.8 (18). The correlation coefficient was not significant in the boys.

There was a significant acceleration in dental development in the overweight and obese boys, whereas no significant differences were found in dental development of different BMI groups in the girls. When separated by age, only the overweight and obese boys who were younger than twelve years, had a significant acceleration in dental development, this may be related to fewer male samples who were older than twelve, or may indicate the intervention of maturation process on the complicated system of fat distribution, somatic growth, and dental development.

Our findings support in parts those of Hilgers et al. (3) who reported an acceleration of dental development in the overweight and obese children though this acceleration was observed in both boys and girls. Shantanulal et al. (20) also reported that diabetic patients in the two higher percentiles of BMI experience faster dental development.

In the study of Gaethofs et al. (18), the boys with delayed growth and maturation showed a delayed dental maturation as well. Such a relationship has not been mentioned in the girls. This result is along with the result of our study which identifies the effect of increased BMI on the boys in preadolescence years. Ultimately, this could be a guide to the relationship between gender, maturation, and dental development that requires more investigations for clarification. A bigger sample size is recommended for further studies to obtain a more definite result about male samples.

These results of this study indicate that when planning interventional dental treatments in the overweight and obese preadolescent boys, the possibility of accelerated dental development should be considered.

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