INFLUENCE OF BODY MASS INDEX ON DENTAL DEVELOPMENT AND GINGIVAL INFLAMMATION IN CHILDREN OF 6-12 YEARS OLD

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INFLUENCE OF BODY MASS INDEX ON DENTAL DEVELOPMENT AND GINGIVAL INFLAMMATION IN CHILDREN OF 6-12 YEARS OLD (Abstract): Aim: Our study aims to assess the influence of BMI (Body Mass Index) on dental development and gingival inflammation in children aged 6-12 years old. Material and methods: The study was conducted on a group of 153 children aged 6 to 12 years, which were divided into three categories: normal weight, overweight and obese patients. Dental development estimation was performed using the Demirjian method, by using orthopantomographies. For each patient, chronological age, BMI, plaque index (PI) and gingival index (GI) were recorded. Results: The mean difference between chronological and dental age for the whole study group was 0.66±0.5 years. The mean value of the difference between chronological age and dental age for overweight and obese subjects was 0.81±0.43 years and 1.1±0.45 years, respectively. A significant correlation between BMI and GI was observed for male subjects. No correlations were found between BMI and chronological age, or between BMI and dental age. It was found correlation between BMI and the difference between chronological age and dental age. Conclusions: In the group of obese children there was a greater difference between chronological age and dental age compared to overweight and normal weight children, indicating that permanent teeth are likely to erupt at a younger age among obese and overweight pediatric patients. Keywords: GINGIVAL INFLAMMATION, DENTAL DEVELOPMENT, OBESITY.

Dental development is a complex biological process, studies showing that obesity can be associated in many cases with an acceleration of odontogenesis, regardless of gender or socioeconomic status (1-4). Obese pediatric patients have been shown to have low levels of growth hormone and, at the same time, increased lev-
Body Mass Index (BMI) is the most widely used indicator of obesity (National Institute for Clinical Excellence, 2006) (7). The Body Mass Index could be calculated dividing the weight in kilograms by the square of height in meters.

Recent studies also suggest that obese adolescents exhibit early development of craniofacial massif (8), which may lead to worsening of the existing dento-maxillary anomaly, requiring orthodontic intervention through interceptive therapeutic methods (9).

Numerous methods have been developed to assess dental age in children and adolescents. The method described by Demirjian in 1973 (10) is the most widely used method of dental age assessment due to its accuracy and feasibility. The effectiveness of the Demirjian method has been evaluated among different ethnicities (11-14). The correlation between dental development, height and weight has also been assessed and found to be a significant correlation in many of the studies (2, 15-18).

Our study aims to assess the influence of BMI on dental development and gingival inflammation in children aged 6-12 years.

MATERIAL AND METHODS

The study was conducted on a group of 153 children aged 6 to 12 years, 70 male and 83 female patients who presented to the dental office for routine dental treatments. For the study to be carried out, the approval of the Ethics Committee of University of Medicine and Pharmacy from Craiova, Romania was obtained (No.14/21.01.2019) and the informed consent was signed by the tutors.

Inclusion criteria: pediatric patients with no history of systemic disease, who had not received orthodontic treatment in the past and whose panoramic radiological investigations provided good quality images. Exclusion criteria: patients with an incomplete medical history, congenital malformations such as cleft lip and palate (whether they were surgically corrected or not), developmental dental anomalies or patients with previous extractions of permanent teeth, and radiological investigations of poor quality.

Dental age estimation was performed on the 153 orthopantomographies using the Demirjian method (10) based on the eight stages of development of the tooth, starting with mineralization from the cusp tip to apex closure. As the method involves a degree of subjectivity, the analysis of each orthopantomography was performed by an examiner who transformed the scores that have been obtained using gender-specific conversion tables.

Chronological age was determined according to the date of birth of each patient.

The BMI was calculated as the ratio of weight to height (expressed in kg/m²). Patients’ weight status was assessed using the International Obesity Task Force (IOTF) recommended classification system for childhood obesity (19). The study group was divided into three categories: normal weight, overweight and obese patients.

The clinical examination was performed by a single well-trained dentist.

The bacterial plaque index (PI) (20) was used to assess supragingival plaque deposits, which has a grading scale with values...
from 0 to 3. The Gingival Index (GI) scores on a scale of 0 to 3, where 0 - normal appearance to 3 - severe inflammation characterized by oedema, redness and spontaneous bleeding (21).

For statistical analysis, Graph Pad Prism 9.4.0 was used. The data are described as mean ± standard deviation (SD) for continuous variables and as number (percentages) for discrete variables. The direction and magnitude of correlation were assessed with Pearson or Spearman correlation or 3-way ANOVA, depending on that values from variables are sampled from populations with a Gaussian distribution or not. Data were tested for normality using Shapiro-Wilk test.

RESULTS

The mean age of the study group was 9.22±1.69 (54.2% female and 45.8% male), while the background was predominantly urban. The mean weight with a value of 32.88±7.34 (72.5% of them with normal weight) (tab. I).

The mean difference between chronological and dental age for the whole study group was 0.66±0.5 years. The mean value of the difference between chronological age and dental age for overweight and obese subjects was 0.81±0.43 years and 1.1±0.45 years, respectively (tab. I). The differences between the two ages according to gender are shown in Table II.

A low correlation was identified between BMI and PI, on the limit of statistical significance for male patients (ρ=0.23, p=0.055), but the data could not be correlated for the female patients (ρ = -0.119, p=0.286).

A significant correlation between BMI and GI was observed for male subjects (ρ=0.398, p=0.001), while for the female group there was none (ρ=0.167, p=0.131). No statistically significant correlation was identified between GI and the difference between chronological age and dental age (ρ=0.059, p=0.468).

**TABLE I.**

Batch distribution according to variables analyzed

<table>
<thead>
<tr>
<th>Variables analyzed</th>
<th>Chronological age</th>
<th>Age category</th>
<th>Dental age Mean (±SD)</th>
<th>Difference between chronological age and dental age Mean (±SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (±SD)</td>
<td>Range</td>
<td></td>
<td>whole study group</td>
</tr>
<tr>
<td>Chronological age</td>
<td>9.22 (±1.69)</td>
<td>6-12</td>
<td></td>
<td>0.66 (±0.5)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>Urban</td>
<td>124 (81%)</td>
<td></td>
<td></td>
<td>Female</td>
</tr>
<tr>
<td>Rural</td>
<td>29 (19%)</td>
<td></td>
<td></td>
<td>Weight</td>
</tr>
<tr>
<td>Height</td>
<td>135.05 (±10.15)</td>
<td></td>
<td></td>
<td>BMI</td>
</tr>
<tr>
<td>Normal weight</td>
<td></td>
<td></td>
<td></td>
<td>Plaque Index (PI)</td>
</tr>
<tr>
<td>Overweight</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Obese</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Gingival Index (GI)</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
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<td>2</td>
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<tr>
<td>2</td>
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<td>3</td>
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</tbody>
</table>
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Also, no correlations were found between BMI and chronological age ($\rho=-0.101$, $p=0.213$), or between BMI and dental age ($\rho=-0.02$, $p=0.81$), but there was between BMI and the difference between chronological age and dental age ($\rho=0.281$, $p<0.001$). Thus, increased BMI is associated with accelerated dental development in children aged 6-12 years old.

### TABLE II.
Difference between chronological age and dental age by gender

<table>
<thead>
<tr>
<th>AGE</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n=70)</td>
<td>(n=83)</td>
</tr>
<tr>
<td>Chronological age Mean (±SD)</td>
<td>9.36 (±1.73)</td>
<td>9.1 (±1.66)</td>
</tr>
<tr>
<td>Dental age Mean (±SD)</td>
<td>9.97 (±1.82)</td>
<td>9.79 (±1.79)</td>
</tr>
<tr>
<td>Difference between the chronological age and the dental age Mean (±SD)</td>
<td>0.62 (±0.57)</td>
<td>0.69 (±0.42)</td>
</tr>
</tbody>
</table>

No statistically significant correlation was identified between age, gender and BMI. The distribution is normal with the mean=0.66 and SD=0.50. No possible outliers were detected for the dependent variable. Dental development was significantly accelerated with increasing BMI, but not after adjusting for age and gender ($p>0.05$). These three factors did not correlate in terms of acceleration of the dental development.

Accelerated dental development was observed to be correlated with BMI only in male patients ($\rho=0.363$, $p=0.002$), but for female patients the correlation was low and to the limit of statistical significance ($\rho=0.208$, $p=0.059$).

The magnitude of the correlation between variables differs by gender without being statistically significant. A greater difference in dental development can be observed for female patients in the age group of 9-12 years old compared to the age group of 6-9 years old(figs. 1, 2)

![Estimated Marginal Means of DiffAge at Gender = Male](image)

**Fig. 1.** Correlation between BMI and difference between chronological age and dental age for male patients
DISCUSSION
Childhood obesity is frequently associated with accelerated dental development, an increased incidence of carious lesions located mainly on permanent molars, an increased risk of periodontitis in late adolescence and early adulthood (22). In the study by Hedayati Z et al., the dental age of normal weight children was found to be lower than the chronological age, while among obese children the dental age was higher than the chronological age and there was a direct correlation between BMI and the process of dental development (3), data which were not according to the study by Panchbhai A et al. in which a negative, non-significant correlation was observed between BMI and mean dental age (23).

Our study found a significant positive correlation between accelerated dental development and BMI values, results also found in other studies (3, 15, 17, 24-28). Also, studies have reported accelerated dental development/age in obese children compared to children with weight within normal values (2, 29, 30).

In contrast to the results of the present study, it was reported a negative correlation indicating delayed tooth eruption for the group of overweight and obese children of 6-7 years old compared to the group of children with normal weight, authors explaining these results through the differences in ethnicity, racially, and dietary habits between Indian and Western population (31). Also, Khan et al. observed that the dental eruption time of Pakistani children are different in many aspects with to other nationalities. (32).

The results of our study show that accelerated dental development correlated with the BMI in male patients. In some studies, it was shown that among female patients, the difference between chronicolog-
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ABSTRACT

The purpose of this study was to evaluate the relationship between body mass index (BMI) and dental development and gingival inflammation in children aged 6-12 years old. The study included 100 obese and overweight children and 100 normal weight children. The age of dental development and the presence of gingival inflammation were evaluated using radiographic and clinical methods. The results showed that obese and overweight children had a greater difference between age and dental age compared to normal weight children, suggesting that permanent teeth are likely to erupt at a younger age among obese and overweight pediatric patients. There was a significant correlation between gingival inflammation and BMI for male patients, possibly due to a combination of factors: not only to the inappropriate attitude toward dental hygiene but to the metabolic and inflammatory changes. Early onset of dental development refers to the importance of establishing and performing proper oral hygiene in children from an early age. Therefore, their poor oral hygiene will result in an increased frequency of carious lesions in the mixed and permanent dentition. In addition, the timing of eruption could affect the planning of orthodontic therapy. If interceptive orthodontic treatment is recommended, which may result in altered growth patterns, the timing of therapeutic intervention will involve a reassessment of the clinical case to consider gender and BMI.

CONCLUSIONS

In the group of obese children there was a greater difference between chronological age and dental age compared to overweight and normal weight children, indicating that permanent teeth are likely to erupt at a younger age among obese and overweight pediatric patients.

CONFLICTS OF INTEREST AND FUNDING

The authors declare that there is no conflict of interest to disclose, and they received no specific funding regarding this scientific research.

REFERENCES


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**NEWS**

**IS THE PATIENT WITH PSORIASIFORM SKIN LESIONS SUSCEPTIBLE TO PARADOXICAL REACTION UNDER THE TNF A ADMINISTRATION?**

Paradoxical reactions (PR) are immune-mediated disorders that would normally respond to the biologic therapy. The exacerbation of existing psoriasis after administration TNF-α antagonist is a well-described problem. This study analyzes, 125 patients during the therapy with a TNF antagonist. Of these, 14 patients experienced PR under TNF antagonist therapy (adalimumab, infliximab, certolizumab pegol, etanercept). Thirteen patients discontinued TNF antagonist therapy and only one patient continued the biologic therapy. The present study showed no improvement in patients who were switched to another TNF antagonist, except one patient who was switched to infliximab. In addition, this study suggests that focal infections in psoriasis patients may be a risk factor for the development of PR due to TNF antagonist administration. Our study demonstrates that there are some disease (acrodermatitis continua of Hallopeau and palmoplantar pustular psoriasis) which may predispose the patients to PR under TNF antagonist therapy. Finally, this finding has relevance for the physician to recognize these clinical problems and helps to identify the potential therapeutic targets (Miho Mori, Rie Tobita, Chizu Egusa, et al. Clinical background of patients with psoriasisform skin lesions due to tumor necrosis factor antagonist administration at a single center. *J Dermatol* 2021; 48(11): 1745-1753).