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Araştırma/ Research Article

INVESTIGATION OF DENTAL AGE AND SKELETAL AGE IN OBESE AND NORMAL-WEIGHT CHILDREN: AN ARCHIVE STUDY

OBEZ VE NORMAL KILOLU ÇOCUKLARDA DIŞ YAŞI VE İSKELET YAŞININ ARAŞTIRILMASI: BIR ARŞIV ÇALIŞMASI

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ABSTRACT

Aim: The aim of this study was to assess dental and skeletal development in obese and normal-weight pediatric patients.
Materials and Methods: A sample of 65 patients (33 boys, 32 girls aged between 9 and 15) was selected. Dental panoramic radiographies were used for determining the dental age. Dental age was evaluated using the Demirjian Method scoring system. Skeletal age was measured by hand wrist radiographies using Greulich and Pyle method. The data were analyzed by Mann-Whitney U and Independent t-tests.
Results: There was no statistically significant difference between the obese and normal-weight groups in terms of dental age (P> 0.05). Skeletal age was significantly increased in obese boys (P <0.05); however, there was no significant difference in girls(P> 0.05).
Conclusions: Paediatric dentists should consider body mass index percentile when assessing growing children because it can affect dental and skeletal development.
Keywords: Dental Age, Skeletal Age, Obesity, Panoramic Radiography

ÖZ

Amaç: Bu çalışmanın amacı,obez ve normal kilolu çocuk hastalarda, diş ve iskelet gelişimini değerlendirmektir.
Gereç ve Yöntem: 65 hastadan (9 -15 yaşları arasında, 33 oğlan, 32 kız) oluşan bir örneklem seçildi. Diş yaşını belirlemek için panoramic radyografiler kullanıldı. Diş yaşı Demirjian yöntemi puanlama sistemi kullanılarak değerlendirildi. İskelet yaşı Greulich ve Pyle yöntemi kullanılarak el bileği radyografisi ile ölçüldü. Veriler Mann- Whitney U ve Independent t-testleri tarafından analiz edildi.
Bulgular: Diş yaşı açısından obez ve normal kilolu gruplar arasında istatistiksel olarak anlamlı farklılık yoktur. (p> 0.05)
Sonuç: Çocuk diş hekimleri, diş ve iskelet sisteminin gelişimi etkilenebileceğinden, çocukların büyümesini değerlendirirken vücut kitle indeksi yüzdeliğini göz önünde bulundurmalıdır.
Anahtar Kelimeler: Diş yaşı, iskelet yaşı ,obezite, panoramik radyografi

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INTRODUCTION

Skeletal and dental age in pediatric patients is used with chronological age in the evaluation of growth and development [1]. In the field of pediatric dentistry and orthodontics, estimation of dental age is important to make correct diagnosis and treatment planning. Dental development is a useful indicator due to its high reliability, low coefficient of variation and resistance to environmental effects [2].

Different methods have been used to predict dental age from past to present. Many methods have

been described to estimate the dental age according to the calcification degree of the tooth with radiographies[3]. These methods make scoring according to the degree of mineralization of the teeth observed[4]. Demirjian et al. is the most commonly used method. Together with crown and root calcification, it presents root tip closure with eight stages (A-H)[5].

Some skeletal developmental stages of the hand and wrist are closely related to pubertal growth[6]. Skeletal age and skeletal maturity stages are grouped by atlases using wrist radiographs. The Greulich and Pyle atlas formed a skeletal age database by comparing wrist radioscopy with standard plaques[7].

Obesity rates have recently increased in the world[8]. Lifestyles that cause children to move less and the low level of school activities increased this rate[9, 10]. There are some points to consider when planning treatment in orthodontics and pedodontics in obese patients[11].

The aim of this study is to investigate whether there is a significant relationship between the teeth development and the skeletal development of the children in the group of normal weight and obese patients.

MATERIALS AND METHODS

Subjects

The Atatürk University Faculty approved this retrospective archive scan study of the Medicine Ethics Committee. Children who previously applied to the endocrinology clinic and whose birth dates, height, and weights were recorded were included in the study. Obese children who a hand wrist X-ray is taken for fractures, growth, etc., were included in the study. Then it was checked whether the orthopantographies of these children were recorded in the telemedicine system. Orthopantographies were taken beforehand due to caries, pain, or control. We were able to reach 30 obese patients who hand wrist radiography and OPT. Dates of birth and x-ray dates were available in the telemedicine system. For the control group, patients who applied to the dentistry faculty and had dates of birth, height, and weight were selected. An attempt was made to reach children who had an OPT record and hand wrist radiography in telemedicine. We arrived at 35 children with normal weight. X-rays (hand wrist and OPT) were selected from those previously recorded in telemedicine.

This study was carried out on 30 (15 girls-15 boys) obese patients, 35 (17 girls-18 boys) normal-weight patients aged between 8-15 who applied to Atatürk University Faculty of Dentistry. The weight, height, date of birth, race, and gender of each patient were obtained from the patient's records. All orthopantomograms and hand-wrist radiographs were categorized by gender and chronological age.

Inclusion criteria

-All patients were of Turkish origin.
- There was no serious systemic diseases in the patients.
- Patients did not receive any orthodontic treatment.
- There was no trauma history in the face and jaw area of the patients

Exclusion criteria

Patients with image defects in their radiographs were excluded from the group.
- Patients with growth and developmental disorders were excluded.
- Patients with any congenital anomaly in hand and wrist were separated.
- Patients with any permanent tooth extraction were excluded.

Body mass indexes were performed based on the weight and height of the patients. In the study, two groups were divided into normal healthy individuals and obese individuals. The obesity of the patients was determined according to the BMI percentile criteria. According to this;

- 0-5 percentile underweight,
- Between 5-85 percentile normal weight,
- Between 85-95 percentile over-weight,
- Above 95 percentile obese group[12]

Evaluation of dental calcification stage

Dental calcification was evaluated in conformity with the method described by Demirjian et al. and 8-stage calcification was given, to A, H for each tooth. Dental age was determined according to the Demirjian's gender differentiate tables. The scores taken from the tables were calculated separately for boys and girls 100 points for girls correspond to a 16 years old dental age and in boys, 98.4 points correspond to 16 years of age[5]

Evaluation of skeletal maturity stage

Skeletal age was attempted to be estimated using the ossification stages in the Atlas of Hand and Wrist Skeletal Development Radiography (Greulich and Pyle).[7]

Skeletal stages of ossification in wrist radiographs were determined by using the Fishman method[13]:

1.MP3: In the middle phalanx of the third finger, the epiphysis is equal to the diaphysis.

2.S phase: Ulnar sesamoid bone mineralization has started.

3.MP3cap: The epiphysis in the middle phalanx of the third finger involves diaphysis.

4.DP3u: Full epiphysis fusion is seen in the distal phalanx of the third finger.

5.MP3u: The middle phalanx of the third finger fuses full epiphysis.

All assessments were performed in a viewing box illuminated in a dark room and by the same observer. Interpretations of both panoramic radiographs and hand-wrist were discussed until agreement was reached. In order to clarify the accuracy of each method, the difference between chronological age and dental age was calculated. The chronological ages of the patient were confirmed according to the date of birth of the patien

Statistical analysis

Data analysis was conducted in IBM SPSS V20.0 (SPSS Inc., Chicago, IL, USA) software package program on the computer. Normal distribution (Shapiro-Wilks) test was applied to the data before performing statistical tests. While independent t test is applied to the parameters that are normally distributed; Mann-Whitney U test was used for parameters that did not show normal distribution. The statistical significance of the difference was accepted as $p < 0.05$.

Twenty cases were randomly selected after 2 weeks, and panoramic films and wrist radiographs were re-evaluated. A weighted kappa score was used to measure control reliability. The weighted kappa values varied from 0.66 (for the first molar) to 0.94 (for the second premolar).

RESULTS

Our study was performed on a total of 65 individuals, 30 obese (15 girls, 15 boys), 35 normal weight individuals (18 boys, 17 girls).

The mean age was 12.73 ± 1.76 years (girls 12.66 ± 1.93, boys 12.74 ± 1.32), the mean dental maturation was 13.65 ± 1.98 years (girls 13.51 ± 2.09, boys 13.92 ± 1.73), the mean skeletal age was 13.23 ± 1.62 years (girls 13.19 ± 1.80 boys 13.32 ± 1.56) and the mean BMI percentile was 71.6 ± 50.2. (girls 68.2 ± 48.4, boys 73.4 ± 51.2). The sample distribution included 53.9% (n = 35) normal weight and 46.1% (n = 30) obese subjects.

There were no statistically significant differences between obese and normal-weight groups in terms of dental age ($P > 0.05$), skeletal age increased significantly in obese individuals in boys ($P < 0.05$) (Table 1).

There were no statistically significant differences between obese and normal-weight groups in terms of dental age and skeletal age in girls($P > 0.05$) (Table 2).

Table 1. Evaluation of dental age and skeletal age in normal weight and obese boys.

	N	**Chronological age**	**Dental age**	**Skeletal age**
		Mean±SD	Mean±SD	Mean±SD
Normal weight	18	12.81 ± 1.41	13.83 ± 1.95	12.63 ± 1.77
Obese	15	12.63 ± 1.20	14.02 ± 1.54	13.95 ± 1.32
***P* value**		0.710	0.890	0.041

Table 2. Evaluation of dental age and skeletal age in normal weight and obese girls.

	N	**Chronological age**	**Dental age**	**Skeletal age**
		Mean±SD	Mean±SD	Mean±SD
Normal weight	17	12.75 ± 1.86	13.37 ± 2.16	12.85 ± 1.78
Obese	15	12.58 ± 2.05	13.64 ± 2.01	13.63 ± 1.83
***P* value**		0.801	0.716	0.222

DISCUSSION

Obesity prevalence is rapidly increasing and is one of the common metabolic diseases in developed countries. The obesity is defined as the accumulation of abnormal or excess fat in the adiposis tissue to a level which can harm health. Excessive food consumption, poor nutrition and insufficient physical activity are some of the reasons for this. According to the World Health Organization (WHO), childhood obesity is one of the most important health problems due to its rapid increase rate. Childhood obesity development is closely related to obesity in adulthood [14].

Body mass index (BMI) is a convenient and easy way to classify obesity. It is formulated as divide the length (meter) into unit of weight (kilograms) [15]. However, BMI percentiles in children do not give safe results in childhood as they also increase the fat-free

tissues. For now, age and gender-specific BMI percentile is used to provide an accurate classification in childhood and is called BMI-age [16]. In this cross-sectional, epidemiological study, body mass was compared with various variables. Classifications according to the weight of the patients in this study was performed according to BMI percentile score.

Growth charts used in Disease Control Centers are based on 5 cross-sectional studies made from 1963 to 1994 [14]. In order to establish standards, more than 15% of children should be obese in a sample group consistent with the data. In our study, the observed prevalence of obesity (46%) indicates that the BMI percentile in the population is consistent with other publications[17]. In statistical modelling, we use the continuous measure of percentage of BMI rather than categorical classifications. Because there are more BMI percentage patients in the "normal weight" category. Recently, it has been reported that the prevalence of high BMI percentiles is slightly higher in boys than in girls[17]. However, if more work will be done on more samples, we can get better results. In our study, BMI percentile showed poor correlation with dental and skeletal development. There are other studies that support this [6, 18]. Groups from different geographical regions of the world as well as malnourished populations, would be more useful in assessing the accuracy of the findings. Individual ethnic variations related to body mass and development can enrich the database. Socioeconomic status information will also be useful in a future study.

The effect of obesity on skeletal system has been the subject of literature. Mechanical loading due to increased body weight in overweight and obese people provides a beneficial effect on bone formation. This situation acts as a natural preservative that prevents the formation of osteoporosis[19]. Obesity is reported to increase bone mass and reduce fracture risk[20]. Many studies have shown that bone mineral density (BMD) and bone mineral content (BMC) are higher in overweight and obese children[21, 22]. In contrast, cases of increased risk of fracture in overweight patients have also been shown [22]. Unlike studies that define a positive relationship between obesity and bone mass, there are several studies in the literature that show a negative relationship between these two [22, 23]. Obesity influences bone metabolism with various mechanisms. These mechanisms include increased proinflammatory cytokines, changes in bone turnover, hormones and mechanical stress on the bone[24] Studies have shown that obesity affects cortical bone rather than trabecular bone[23]. Leonardo et al. [25]reported that body bone sizes and mass increase were associated with obesity during childhood and adolescence. In our study, skeletal age was more prominent especially in obese men. Although the numerical values of skeletal age were predominant in obese girls patient group, no statistically significant difference was found. When we look at the dental age in the obese girl and boy group, there was no statistically significant difference when compared with the normal patient group, although the values of the table were high. We thought that the reason for this situation may be that the girls' pubertal development attacks differ from men.

Demirjian et al. [5] made scoring according to the gender and the maturation stage of teeth and this has been beneficial to determine dental age more accurately. Although this method of detection is often used in predicting chronological age, several authors have shown that this method differs from ethnicity and needs to be adapted to populations[5, 26]. It has been previously reported that there are ethnic variations in the relationships between the calcification stages of teeth and skeletal development[26]. Therefore, this study was conducted to investigate the stages of calcification of various teeth and skeletal maturity among Turkish individuals.

The timing of dental eruption which is considered as the most obvious and easily detected indicator of dental maturation, was claimed to be much more variable than skeletal maturation [27]. Also, according to Nolla, dental eruption is more variable than the dental calcification [4]. Dental eruption is a temporary phenomenon which is under environmental factors[5]. In this study, the calcification stages of the teeth were preferred instead of the eruption time of the teeth[4]. Therefore, Demirjian et al., dental maturity evaluation stages were used [27]. The criterion of this method is to consider the degree of crown and root development rather than the length of crown and root [27]. Despite some criticisms about the accuracy of Demirjian et al. [5] method in the determination of dental age, there is no other widely accepted systematic method that is valid in different ethnic and geographical groups[28].

Some studies was reported that the clinician could more easily define the relationship between the dental calcification degrees and the stages of skeletal maturity by using panoramic films [27, 29, 30]. If there is a strong connection between the skeletal maturity and

dental calcification stages, the calcification stages of the tooth can also be used as a first status diagnostic tool to determine the timing of the pubertal growth increase. [31] Different imaging methods such as MRI can also be successful in determining the tooth age. Vertebrae can also be used for tooth age determination.[32, 33]

Skeletal maturation is an important factor in the planning of orthodontic treatment or Pediatric dental treatment[34]. Orthodontists relate to skeletal age rather than chronological age as an indication of when to start treatment[29]. Different methods have been defined to evaluate skeletal age. Hand-wrist radiographs are most commonly used by dentists in determining skeletal maturation[34]. With this method, we determined that skeletal development of obese boys is more predominant then normal children. When planning treatment as a dentist, the development of dental age or skeletal development in children should be considered. There are various methods to evaluate the dental and skeletal development. Good and reliable results can be obtained using the appropriate ones. In addition, pedodontists should consider the health problems associated with overweight and obesity and should direct the patients to the relevant health units.

This study has some limitations. The sample size is low because it is difficult to find children with wrist radiography and OPT. it is not classified according to the age groups of children. There is a need to support the results with alternative imaging methods for dental and skeletal maturity.

CONCLUSIONS

The increase in BMI percentile appears to be related to the increase in skeletal development in boys. Although there was a numerical increase in girls, no statistically significant difference was viewed. In the development of this condition, it is seen that ethnic origin is effective and it should be studied in larger patient groups. As health professionals, pedodontists may be helpful in collecting weight information for treatment planning purposes and health counselling.

Bu çalışma, çalışmayı yürüten tüm yazarlar tarafından okunmuş ve onaylanmış orijinal bir çalışmadır. Herhangi bir yazar, kurum ya da kuruluş ile çıkar çatışması olmadığını belirtilmek isteriz.

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