Original Research

The Relationship between Birth Weight, Birth Height, and Dental Development by Demirjian's Method

Najmeh Anbiaee[1], Anousheh Rashed Mohassel[2], Shakiba Afzalinasab[1]

[1] Oral & Maxillofacial Diseases Research Center, Faculty of Dentistry, Mashhad University of Medical Sciences, Mashhad, Iran

[2] Dental Research Center, Department of Pedodontics, Faulty of Dentistry, Birjand University of Medical Sciences, Birjand, Iran

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Abstract

Introduction: Like other measures of human development, dental development is not in complete accordance to chronological age. Investigations show that dental age can be affected by gender, race, systemic conditions, and some other factors and consequently, be different in people of the same chronological age. A correct estimation of dental age and its development in children is of great importance to design the appropriate dental treatment plan. One of the factors predicted to influence dental development is the physical status of newborn, of which, the most common indices are birth weight and height. The aim of this study was to evaluate the effects of these two factors on the dental development of permanent teeth in children of both genders. **Methods:** The dental ages of 211 of 4-14 year old healthy children were calculated using their panoramic radiographs according to Demirjian's method. Birth weight, height, and date were recorded from the vaccination certificate. The dental development rate was obtained by subtracting chronological age from dental age. Pearson correlation tests and regression analysis were conducted in both genders. **Results:** the correlation between dental development and birth weight and birth height was positive, when separated by gender; this correlation was only significant among females. **Conclusion:** There is a positive relationship between physical status of newborn and the development of permanent teeth. This should be taken into consideration when designing dental treatment plans for children.

Key words: Birth weight, dental development, panoramic.

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Introduction

Dental development is an interesting procedure, which includes a series of complicated epithelial-mesenchymal interactions (1). Many factors can influence dental development, whether to slow it down or accelerate it. Such factors can be either genetic or environmental (2). The effect of certain genetic factors like race and gender is quite proven, so it is recommended that each nation use a different dental age estimation chart. In these charts, estimation values are generally different for boys and girls (1).

As for environmental factors some of these mentioned in studies include premature birth, nutrition, and body mass index (2-4).

Dental development is of great importance in pediatric dentistry and orthodontics because these include a wide range of interventional practices such as applying space maintainers, space retainers, and serial extractions. Also at times decisions should be made whether to extract a primary tooth or to survive it at the expense of complicated, time consuming, questionable treatments. Such interventions necessitate a rationale for treatment plan timing. Treatment plan timings should be made according to the estimated remaining life-span of the teeth, which is determined by prognosis and the stage of development of primary teeth.

Shedding and eruption of teeth happen in an age range versus an exact time (5,6); but not knowing that, parents are sometimes concerned about delays in their child's dental development.

One of the best methods used to estimate the dental age is the Demirjian method. This method is highly accurate and is widely accepted (7-9). In the Demirjian method, the developmental stage of 7 permanent teeth in the left mandibular quadrant (central incisor to second molar) are estimated according to panoramic radiographs. Each tooth is classified into one of 9 stages (0,A,B,C,D,E,F,G,H) according to the degree of mineralization. Each stage receives a score. The 7 scores are totaled and a dental age is assigned to the sum. There are separate tables for the scores and dental ages for each gender. The Demirjian method allows age estimation for children between 3.5 to 16 years of dental age (10).

A good knowledge of factors influencing dental development helps a dentist satisfy parents, and more importantly, to design an appropriate treatment plan by predicting the dental development rate.

Birth height and birth weight, are two factors which have been assumed to be related to dental development rate. There have been a few studies where in most, the effect of these factors on dental development in early childhood has been evaluated (3,5,6). Whether these effects will continue to the later years of active dental development has not yet been clarified.

The aim of this study is to find out if there is a relationship between birth weight, birth height, and dental development.

Materials and Methods

This cross sectional study contained children from 4 to 15 years of age who were referred to a private dental radiography clinic in Mashhad, Iran for a panoramic radiograph prescribed by a pedodontist or orthodontist. Mashhad is the state capital of Khorasan Razavi, located in the north-eastern region of Iran. A total of 211 children were participated in the study. 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 informed consent was obtained. The study was approved by the Ethics Committee of Mashhad University of Medical Sciences.

Our inclusion criteria were patients referred for panoramic radiographs ranging from 4 to 15, while our exclusion criteria were those with systemic diseases affecting calcification and dental development, clefts, and missing of teeth on both jaw sides (except for third molars). The panoramic radiographs of the participants were made by a digital PSP sensor (AGFA, Berlin, Germany), Promax 2007 system (Promax, PlanMeca, Finland). The dental ages were estimated by using these radiographs as per Demirjian's method by an assistant professor of dental and maxillofacial radiography. The exact birth date, birth height, and birth weight were recorded from the child's vaccination certificate.

Dental development was calculated by subtracting chronological age from dental age. Positive values demonstrated acceleration while negative values demonstrated delay in dental development.

The data were saved in SPSS version 15, and analyzed by the Pearson correlation test and regression analysis.

Results

Our study sample included 211 children (94 boys and 117 girls) ranging from 4 to 15 years-old with an average of 9.43 ±2.32 years. Since the data on vaccination certificates was not recorded completely in all cases, we obtained in total 192 birth weights (86 boys and 106 girls) and 157 birth heights (75 boys and 82 girls). Table 1 demonstrates the descriptive of the data.

Table 1. Descriptive datain boys and girls

	Mean dental development (yrs±SD)	Mean birth weight (kg±SD)	Mean birth height (cm±SD)
Girls	-0.09±1.13 N=117	3.15±0.52* N=106 p=0.002 r=0.296	50.20±2.20* N=82 p=0.001 r=0.356
Boys	0.07±1.12 N=94	3.40±0.52 N=86 p>0.05	50.96±1.90 N=75 p>0.05

* The content of cells with the star mark, have a significant relationship with dental development.

According to the Pearson correlation analysis of the total sample, there was a significant direct relationship between both birth weight and dental development (p=0.000, r=0.270) and also birth height and dental development (p=0.003, r=0.242). This means that the increased values of birth weight and height are supposed to be associated with acceleration in dental development. However, when separated by gender, this significant relationship was only found among girls (birth weight: p=0.002, r=0.296, birth height: p=0.001, r=0.356) and not boys (birth weight: p=0.056, birth height: p=0.610).

According to linear multiple regression analysis (backward method), no formula could be obtained for estimating dental development containing both birth weight and height. For this analysis, the following formula is capable of estimating dental development according to birth weight:

Dental age-dental development=-1.59+(0.48× weight).

Discussion

As mentioned before, a few studies have found a relationship between primary tooth eruption and birth weight. Moreover, there could be seen that weight gaining after birth has a significant relationship to primary tooth eruption time (4). In a study by Seow et al. (11) regarding low birth weight and very low birth weight children, in the range of 6 to 11 months and 12 to 17 months, fewer erupted teeth were found compared with normal birth weight children. However, in the range of 18 to 23 months and after 24 months, no significant difference was reported. This shows that after the second year of life, growth catch-up causes the eruption time to return to normal. Seow et al. (11) studied the eruption time of tooth but in our study the development was important. This fact mentioned in the study of Ramos et al. (12) claiming the delayed eruption may be related to premature birth and not to a delay in dental development.

Regarding permanent teeth, in a study by Harris EF et al., in children from 4 to 7 years of age with the histories of low birth weight, only early forming teeth (incisors and first molars) showed delays in their formation. Older children were more delayed because proportionately they had a greater opportunity for dental age to diverge from chronological age (13). Seow (14) in 1996 reported that with children of very low birth weight, dental development is most delayed less than 6 years of age, but after age 9, there is no significant difference from the normal birth weight group. This maybe true that effects of the birth weight on teeth is more severe on younger children; another studies mentioned that the low birth weight is a risk factor for enamel defects and hypoplasia in incisors and first molars (15,16). Also in a study by Bruce and Cynthia (17), the relationship between birth weight and caries development was investigated. They found that increased birth at weight was associated with caries presence at 61 months of age. They concluded that further research is needed because the weak relationship they found cannot be casual. Development and calcification occur during a critical within the intrauterine developmental period and affect deferent types of teeth differently. The significant relationships we found were in the wide age range of 4 to 15 years of age. We did not have enough samples to look for the relationship in separate shorter age ranges. On the other hand, we calculated dental development by Demirjian's method, which was applicable in our sample range and which has been a subject of many studies about dental maturity (18,19). Other studies may use from another methods.

There have been fewer studies on the relationship between birth height and dental development.

Bostos et al. (20) found fewer erupted teeth in 6 month old children who had a birth height of less than 49 cm. They also reported that girls with birth heights of less than 49 cm had fewer erupted teeth at age 1, but these findings were not reported in boys.

Martin Moreno et al. (21) found that girls, who were taller and heavier at 1 month old, had more erupted teeth at 9 months old. We know that the birth height is relationship with the birth weight.

In this study when samples were separated by gender, a significant relationship was found only among girls. This could be due tothe puberty age of girls that lies in the age range of our samples. The puberty can influence the eruption of teeth. Earlier eruption of permanent teeth in females is attributed to earlier onset of maturation (2). In the studies by Bostos et al. (20) and Martin Moreno et al. (21), similar results regarding genders have been reported as previously mentioned.

Finally, we recommend further studies in larger calculated sample sizes as a large sample size allows for dividing the samples into smaller age ranges with enough samples in each group, and therefore the effects of birth weight/height can be evaluated in all stages and on each tooth separately (early forming and late forming teeth may be differently affected).

Conclusion

In this study, a significant relationship was found between birth weight/height and dental development in females. To support our findings further a well-designed, controlled as well as longitudinal studies with a larger sample size is required.

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Corresponding Author:
Anousheh Rashed Mohassel
Dental Research Center
Department of Pedodontics
Faculty of Dentistry, Birjand, Iran
Tel: +98-561-8825526
E-mail: arashedmhl@yahoo.com