

Relationship between the Eruption Time of First Primary Tooth and Developmental Parameters in Infants Aged 2-15 Months

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Abstract

Objectives: One of the important indicators of growth and development is tooth eruption timing, which is influenced by various genetic and environmental factors. This study aimed to assess the relationship between different developmental parameters and eruption time of first primary tooth in infants aged 2-15 months.

Methods: This cohort study was conducted on 873 infants aged 2-15 months in eastern health centers of Tehran, Iran. The height, weight, head circumference, breastfeeding/bottle-feeding practices, vitamin AD supplementation, and maternal age at birth of the infants were recorded. The eruption time of first primary tooth was recorded by monthly examination of infants at the health centers. The effects of qualitative and quantitative variables were analyzed using the independent t-test and Chi-square test, respectively. Linear regression analysis was performed to investigate the simultaneous effects of growth parameters on tooth eruption time at a significance level of 0.05.

Results: The eruption time of first primary tooth had an inverse relationship with the weight ($P<0.001$), height ($P=0.003$), and head circumference ($P=0.01$) of the infants. The mean eruption time of the first primary tooth was 7.6 ± 1.7 months in normal birth weight infants (above 2500 g) and 9.7 ± 1.9 months in low birth weight infants (below 2500 g). There was no significant correlation between gender and the eruption time of the first primary tooth ($P=0.16$). However, the eruption time had significant relationships with maternal age, breastfeeding, and vitamin AD supplementation ($P=0.001$).

Conclusion: higher birth weight, height, and head circumference, as well as breastfeeding and receiving vitamin AD supplements are correlated with earlier eruption of first primary tooth.

Keywords: Developmental Parameters; Tooth Eruption; Primary Tooth, weight, height, head circumference

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Introduction

Primary tooth eruption is an important event in development of infants.¹ Eruption times may vary, with most teeth showing a 1- to 4-month deviation from the average eruption time.² Many factors may delay or accelerate tooth eruption.^{3,4} Delayed tooth eruption may be a primary manifestation of some local conditions or systemic diseases.⁵ The sequence of eruption is more important than its timing. In normally developing children without any deficiencies, a delay in eruption can be observed. However, no specific treatment is typically performed to accelerate the eruption of primary teeth.^{6,7} Various factors may affect post-term development in children, such as fetal age, nutritional status at birth, and intake of nutritional supplements, among others.⁸

Primary teeth are essential for achieving an optimal dental occlusion in permanent dentition.⁴ Delayed eruption of primary teeth can cause numerous problems for children and concerns for parents; therefore, assessing the possible causes of this delay is of particular importance.^{9,10} Factors such as thyroid and pituitary growth hormone alterations, family history, calcium deficiency, type of delivery, infant's height and head circumference, and low birth weight (below 2500 g) have all been shown to affect tooth eruption.^{9,10} Delayed tooth eruption is more common in Infants with low birth weight and premature infants.¹¹ Low birth weight infants

often have nutritional problems such as calcium and phosphorus deficiencies. Low birth weight can also lead to a reduction in calcium reserves and cause abnormalities in its metabolites. A higher frequency of enamel defects has also been reported in children with low birth weight.¹² It has been reported that earlier eruption of the first primary tooth is more common in girls.¹³ The available studies on this topic, however, have been conducted on different races and have reported conflicting results.^{8,11,14,15}

Since the timing of first primary tooth eruption is important, this study aimed to assess the relationship between first primary tooth eruption time in infants aged 2-15 months and their developmental criteria, including head circumference, height, and weight at birth, breastfeeding/bottle feeding, maternal age, and gender.

Methods

This longitudinal cohort study was conducted from June 2015 to June 2016 after being approved by the Ethics Committee in Research Affairs, School of Dentistry, Shahid Beheshti University of Medical Sciences (code: IR.SBMU.DRC.REC.1394.129).

A total number of 1,000 samples were considered based on random sampling. Five health care centers in Tehran were selected. Two hundred forms were prepared for each center,

with parental consent obtained for children aged 2-4 months to assess their stages of growth and development. The infants' information was recorded on the forms. A total of 873 infants aged 2 months were selected and monitored monthly. Infants without any previous significant medical history were included. Infants with congenital anomalies, infectious diseases, endocrine disorders, syndromic diseases, familial and systemic conditions, or a history of hospitalization were excluded.

The first primary tooth eruption time was the dependent variable, while weight, gender, head circumference, height breastfeeding/bottle feeding practices, vitamin AD supplementation, and maternal age of the infants were explanatory variables. Information about height, weight, head circumference, breastfeeding/bottle feeding practices, vitamin AD supplementation, and maternal age was collected through questioning the parents and from their existing files. Examination of the infants was performed by a dentist in a "knee-to-knee" position under adequate lighting, using disposable tongue blades and gloves. The infants were examined at 2, 4, 6, 7, 12, and 15 months. Part of crown emergence through gingiva indicated that the tooth had started to erupt.

If the first primary tooth did not erupt during the specified time period, the mother was contacted the following month. If there was a sign of eruption, she was asked to bring the child for a visit.

Statistical analysis was performed using SPSS version 24. Absolute and relative frequency values (number and percentage) were reported for variables such as age, gender, and vitamin AD supplementation. Moreover, measures of central dispersion were reported for the first primary tooth eruption time, same as head circumference, height, and weight of the infants at birth. Quantitative variables were analyzed using an independent t-test. Linear regression analysis was performed to assess the simultaneous effects of growth parameters on the eruption time of primary teeth. The significance level was set at 0.05. Assumptions of linear regression, including normality, homoscedasticity, and absence of multicollinearity, were checked and met.

Results

418 (47.8%) of the 873 children examined in this study, were girls, and 455 (52.1%) were boys. The maximum eruption age of the first primary tooth (often the mandibular primary central incisor) was 15 months. The mean eruption age was 8.1 ± 1.9 and 7.9 ± 1.9 months in girls and boys respectively. Table 1 shows the mean eruption age of the first primary tooth in the infants considering their developmental parameters. The higher birth weight was correlated with earlier first primary tooth eruption in children. A comparison of 162 infants with low birth weight (case group) and 165 infants with normal birth weight (control group) confirmed this result.

Table 1- Mean eruption time of first primary tooth in children according to their developmental parameters

Developmental parameters		Sample size	Mean±standard deviation (months)
Birth weight	Weight < 2500 g	162	9.7 ± 1.9
	Weight > 2500 g	711	7.7 ± 1.7
Height at birth	Height < 50 cm	389	8.7 ± 2
	Height > 50 cm	483	7.6 ± 1.7
Head circumference	head circumference < 35 cm	413	8.6 ± 2.1
	head circumference > 35 cm	459	7.6 ± 1.7
Infant's nutrition	Breast feeding	635	7.8 ± 1.7
	Bottle feeding	98	8.2 ± 2.1
Vitamin AD intake	Both	139	8.9 ± 2.1
	Yes	827	8 ± 1.8
Gender	No	45	9.4 ± 2.3
	Male	453	8.1 ± 1.9
	Female	418	7.9 ± 1.9

A significant inverse relationship was observed between the eruption time of the first primary tooth and infants' height at birth ($P=0.003$). In addition, a larger head circumference was correlated with earlier eruption of the first primary tooth ($P=0.01$). Moreover, earlier eruption was observed in

breastfed infants. A significant association was found between vitamin AD supplementation and the eruption time. However, there was no significant correlation between gender and the first primary tooth eruption time ($P=0.16$). Maternal age at birth also had a significant relationship with

the first primary tooth eruption time. The results of the linear regression analysis has been presented in Table 2.

		B	95% CI		P-value
			Upper	Lower	
Gender	Female	0.16	0.41	- 0.06	0.16
	Male	-			
Vitamin AD intake	Yes	-			<0.001
	No	1.54	2.06	1.03	
Infant's nutrition	Breast feeding	-			0.21
	Bottle feeding	0.22	0.6	- 0.13	
	Both	0.58	0.9	0.25	
Birth weight (g)	<2500	-			<0.001
	>2500	-1.6	-1.3	-1.9	
Maternal age		0.25	0.05	- 0.001	0.06
Height at birth (cm)	<50	-			0.003
	>50	-1.6	-0.13	-0.7	
Head circumference (cm)	<35	-			0.01
	>35	-0.4	-0.07	-0.6	

Discussion

Delayed tooth eruption can be a sign of undiagnosed genetic disorders or may concern parents; thus, the present study aimed to identify determinants of delayed tooth eruption. The primary teeth development is a complicated process that is controlled by genetics.¹⁶ Deviations from the normal eruption time have been observed in some children.¹⁷

The current study showed that weight, height, and head circumference at birth were significantly correlated with the first primary tooth eruption time. Preterm birth, low birth weight, and low head circumference at birth delayed the eruption time of first primary tooth. The mean age of eruption for first primary tooth in low birth weight infants was 9.7 ± 1.9 months and in normal birth weight infants was 7.6 ± 1.7 months.

Vejdani et al. showed a significant association between the eruption time of first primary tooth and weight in girls and boys. The correlation of the primary incisor eruption time with head circumference and height was significant in boys. The difference between their study and the present study is that they measured the head circumference, height, and weight of children at the time of referral, while the present study assessed the weight, height, and head circumference of infants at birth.¹⁸ Bastos et al. showed that infants with shorter height at birth had fewer erupted teeth at 6 months of age. Their results were similar to the present findings.¹⁹ Haddad et al. examined the correlation between the erupted teeth and age, gender, weight, and height, and showed that

the age and height of children affected the primary teeth eruption time.²⁰

In the present study, the correlation between breastfeeding and eruption time of the first primary tooth was statistically significant, as it was earlier in breastfed children than in bottle-fed children. The way the sucking mechanism operates differs between these two feeding patterns. In breastfeeding, The newborn applies pressure to the nipple by thrusting the tongue against the hard palate, using a motion similar to peristalsis to suckle the milk. In bottle feeding, the infant pushes the tip against the hard palate in a rhythmic, piston-like manner, intensifying the sucking action of the lips and cheeks while exerting greater pressure on the palate. It's interesting to note that the tip of a nursing bottle is more rigid than a mother's nipple. As a result, babies have to push their tongues up with more force to draw milk from the bottle than they would need to when breastfeeding. Evidence shows that the act of breastfeeding significantly promotes the physiological advancement of muscle tone and the orofacial area. Bottle feeding plays a significant role in shaping the growth of anterior segment.²¹

Folayan and Oziegbe observed no correlation between the timing of tooth eruption and duration of breastfeeding.^{22,23} conversely, Kuhl et al. revealed that breastfeeding significantly impacts both the timing and the sequence of tooth emergence. They indicated that breastfeeding notably influenced when and how the first primary tooth emerged.²⁴ These controversies between the studies could be attributed to the ethnicity of participants.

Evidence shows that it is important to monitor tooth eruption patterns for clues about nutritional status. In children with severe malnutrition, there is a marked decrease in head circumference and brain development, which can affect the eruption process of primary teeth. Delayed eruption of primary teeth can partly indicate a developmental delay due to severe nutritional problems.²⁵ According to the literature, vitamin D deficiency leads to a delay in the eruption time of primary and permanent teeth.^{26, 27}

Backstrom et al. evaluated the effect of calcium, phosphorus, and vitamin D supplementation in low birth weight infants on their dental development. The results showed that children who received higher doses of vitamin D had better development of permanent teeth. Mineral consumption did not affect the development of permanent teeth.²⁸

The differences in the results of studies can be due to variations in the age of children, sample size, sampling methods, incidence and severity of diseases, and study methodologies. Most studies that examined the relationship between developmental parameters at birth and the eruption time of first primary tooth used case-control and cohort designs, and the cause-and-effect relationship between the variables could not be evaluated. However, there is no doubt that the eruption time of first primary tooth is affected by various environmental and genetic factors.

Conclusion

1. There were significant inverse correlations between the eruption time of the first primary tooth and the weight, height, and head circumference of infants at birth.
2. The eruption of the first primary tooth occurred earlier in breastfed children and in those consuming vitamin AD.
3. No significant correlation was found between gender and the eruption time of the first primary tooth.

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Informed Consent Statement: Informed consent was obtained from all participants involved in the study.

Data Availability Statement: No new data were created or analyzed in this study.

Conflict of Interest: No Conflict of Interest Declared. ■

References

1. Moorrees CFA, Fanning EA, Hunt EEJ. Age variation of formation stages for ten permanent teeth. *J Dent Res.* 1963;42:1490-502.
2. Psoter W, Gebrian B, Prophete S, Reid B, Katz R. Effect of early childhood malnutrition on tooth eruption in Haitian adolescents. *Community Dent Oral Epidemiol.* 2008;36: 179-89.
3. Lunt RC, Schroeder HE. Tooth eruption: theories and facts. *Anat Res.* 1996; 245:374-3.
4. McDonald RE, Avery DR, Dean JA. *Dentistry for the Child and adolescent.* 9th ed. Philadelphia: Elsevier; 2016:92-4.
5. Paulsson L, Bondemark L, Söderfeldt B. A systematic review of the consequences of premature birth on palatal morphology, dental occlusion, tooth-crown dimensions, and tooth maturity and eruption. *Angle Orthod.* 2004;269:74-9.
6. Kardos TB. The mechanism of tooth eruption. *Br Dent J* 1997;181:91-5.
7. Dally A. The anct and the gum-lancet: 400 years of teething babies. *Lancet.* 1996;384:1710-11.
8. Seow WK, Effects of preterm birth on oral growth and development, *Aust Dent J.* 1997;42(2):85-91.
9. Ounsted M, Moar V, Scott A. A longitudinal study of tooth emergence and somatic growth in 697 children from birth to three years. *Arch Oral Biol.* 1987; 32:787-91.
10. Harris EF, Barcroft BD, Haydar S, Haydar B. Delayed tooth formation in low-birth-weight African – American children. *Pediatr Dent.* 1993; 15:30-1.
11. Duarte ME, Andraade MA, Faria PC, Marques LS, Jorge ML. Factors associated with chronology of eruption of deciduous teeth literature review: eruption of deciduous teeth and associated factors. *Rev Univ Vale Rio Verde.* 2011;9:139-51.
12. Seow WK. Enamel hypoplasia in the primary dentition: a review. *J ASDC Dent child.* 1991;58:441-51.
13. Koch G. *Pediatric dentistry: A clinical approach.* John Wiley& Sons. 2017; 4:19-26.
14. Fadavi SH, Punwani I, adeni S, Vidyasagar D. Development. Eruption pattern in the primary dentition of premature low-birth-weight children. *ASDC J Dent Child.* 1992; 59:120-22.
15. Ramos SR, Gugishi RC, Fraiz FC. The influence of gestational age and birth weight of the newborn on tooth eruption. *J Appl Oral Sci.* 2006;14:228-32.
16. Kochhar R, Richardson A. The chronology and sequence of eruption of human permanent teeth in Northern Ireland. *Int J Paediatr Dent.* 1998;8:243-52.
17. Vejdani J, Naemi V. Relationship between birth weight and eruption time of first deciduous tooth. *Res s Dent Sci.* 2015;7:31-5.
18. Vejdani J, Naemi V. Relationship between birth weight and eruption time of first deciduous tooth. *Res s Dent Sci.* 2015; 7:31-

- 5.
19. Bastos JL, Peres MA, Peres KG, Barros AJ. Infant growth, development and tooth emergence patterns: a longitudinal study from birth to 6 years of age. *Arch Oral Biol* 2007; 52:598-606
20. Haddad AE, Correa MS. The relationship between the number of erupted primary teeth and the child's height and weight: a cross-sectional study. *J Clin Pediatr Dent* 2005;29:357-362.
21. Viggiano D, Fasano D, Monaco G, Strohmenger L. Breast feeding, bottle feeding, and non-nutritive sucking; effects on occlusion in deciduous dentition. *Arch Dis Child*. 2004 Dec;89(12):1121-3.
22. Oziegbe EO, Adekoya-Sofowora, Esan TA, Owotade FJ, Folayan MO. Breast feeding pattern and eruption of primary teeth in Nigerian children. *Ped Dent J*.2010;20:1-6.
23. Folayan M, Owotade F, Adejuyigbe E, Sen S, Lawal B, Ndukwe K. The timing of eruption of the primary dentition in Nigerian children. *Am J Phys Anthropol*.2007;134:443-8.
24. Kohli MV, Patil GB, Kulkarni NB, Bagalkot K, et al. A changing trend in eruption age and pattern of first deciduous tooth: correlation to feeding pattern. *J Clin Diagn Res* 2014; 8:199-201.
25. Infante PF, Owen GM: Relation of chronology of deciduous tooth-emergence to height, weight and head circumference in children. *Arch Oral Biol*. 1973;18:1411-17.
26. Folayan M, Owotade F, Adejuyigbe E, Sen S, Lawal B, Ndukwe K. The timing of eruption of the primary dentition in Nigerian children. *Am J Phys Anthropol*. 2007;134:443-8.
27. Maurice Edward Shils MS. *Modern Nutrition in Health and Disease*, Lippincott Williams & Wilkins, 2006;1155–63.
28. Backstrom MC, Aine L, Maki R, Kuusela AL, Sievanen H, Koiuisto Am, IKonen RS, Maturation of primary and permanent teeth in preterm infants. *Arch Dis Child Fetal Neonatal Ed*. 2000;83:104-8.