ORIGINAL ARTICLE

Influence of Birth Characteristics and Feeding Practices on Eruption of Primary Teeth in Children: A Preliminary Cross-sectional Observational Study

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Abstract

Background: The eruption process is under strong genetic control, external environmental factors also significantly contribute to this process. Therefore the present study was undertaken to identify the influence of birth characteristics and feeding practices on the eruption of the first primary tooth among healthy children in Pune, Maharashtra, India.

Materials and methods: The study was undertaken among 200 children aged 3–24 months. Children with any underlying conditions, those not accompanied by their mother and with neonatal teeth/natal teeth were excluded. The birth weight, gestational age, and type of delivery were obtained from medical records of the child. Data on feeding practices and the age of eruption of the first primary tooth was recorded after a structured interview of the mother followed by oral examination of the child. Gestational age was categorized into >37 weeks and <37 weeks, birth weight was divided into three groups—<1500, 1500–2500, and >2500 gm and four groups according to feeding practice during the first 6 months of life (exclusively breastfed, exclusively bottle fed, combination of breastfeeding and bottle feeding, and spoon-feeding).

Results: The mean age of eruption in the study population was 9.17 months. A9.05 months in males and 9.44 in females. A statistically significant correlation was noted with gestational age, birth weight, and feeding practices. Infants with a gestational age of >37 weeks, higher birth weight and those who were exclusively breastfed for the first 6 months had an earlier eruption of first primary teeth.

Conclusion: External factors seem to influence the eruption of the primary tooth. More longitudinal studies with larger sample sizes and matching confounders are needed to clearly understand the factors affecting the primary tooth eruption.

Keywords: Birth weight, Eruption timing, Feeding practices, Gestational age.

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Introduction

Primary tooth emergence is a complex and highly regulated process. The onset of tooth emergence is a very important stage in human ontogenetic development. Although the eruption process is under strong genetic control, external environmental factors also contribute significantly to this process. The eruption and exfoliation of primary teeth, followed by eruption of the permanent successors is a chronological and age-specific event which is of great significance not only in child healthcare planning but also in the diagnosis of certain growth disturbances.[1]

An integral part of the development of the child's body is the development of the stomatognathic system which responds to both the prenatal environment and postnatal environment, the former which programs the rate of development and the later which modifies this rate in the 1st year of life.[2] Dental emergence is known to be affected by conditions like low socioeconomic status, malnutrition, low birth weight, and prenatal diseases and syndromes.[3,4] Mothers often cite the presence of primary teeth as a developmental indicator which shapes their infant feeding decisions. Thus, the timing of primary tooth emergence not only reflects the developmental variation; but also contributes to it.

Neurobehavioral mechanisms associated with feeding are shaped by the emergence of primary teeth which coincides with the development of the immune system in infants. Thus implying a synchronized developmental program which includes the primary dentition. Infant feeding practices have been shown to affect the eruption timings of primary teeth.[5] Feeding practices in the first 6 months of life of infants are considered a significant factor influencing dental development and eruption timing of deciduous teeth according to various researchers.[6,7]

The birth weight reflects the overall prenatal nutritional environment and is used as a marker to assess the intrauterine environment. A relationship between birth weight and the time of eruption of the first tooth has also been observed. However, reports among studies have been inconsistent and conflicting. Preterm infants typically have a low birth weight which may be linked to a shorter gestational period or to the mother's malnutrition. A shorter

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gestational period has been associated with an older age at first tooth emergence and fewer teeth at 1–2 years.[8]

Limited studies exist on factors affecting the eruption of deciduous teeth in healthy infants. The present study was undertaken to identify the influence of birth characteristics and feeding habits on the eruption of the first primary tooth among healthy children in Pune.

Materials and Methods

This cross-sectional study was conducted among 216 healthy children aged 3–24 months reporting to the Department of Pedodontics and Preventive Dentistry, Dr DY Patil Dental College & Hospital, Dr DY Patil Vidyapeeth (Deemed to be University), Pune, Maharashtra, India. The minimum sample size for this study was calculated to be 216 using G*Power. Permission to conduct the study was obtained from the Institutional Scientific and Ethics Committee (DYPDCH/IEC/123/88/19). Children with no underlying medical condition and with at least one primary tooth erupted were included in the study. Neonatal and natal teeth were excluded from the study to avoid discrepancies related to tooth emergence.

The study procedure and protocols were explained to the parents and written informed consent was procured before the start of the study. Data on the age, gender, feeding practices, and age of eruption of first teeth was recorded by the examiner on the patient information sheet after a structured interview with the parent. The birth weight, gestational age, and type of delivery were retrieved from the child's medical records. The accompanying parent preferably the mother was asked about the timing related to the eruption of the first primary tooth. In case the child was not accompanied by the mother and the caregiver had doubts regarding the eruption timing of the first tooth and feeding practices, the child was dropped from the study. Li et al. noted that the validity and reliability of a mother's recalled information were high for the first 36 months after which the validity and reliability decreased. Hence, we only included children between the age-group 3 and 24 months.[9]

An oral examination of the child was done to assure the reliability of the collected data and to rule out any oral pathology. The infant was examined in the mother's lap using the knee-to-knee position.[10] The oral cavity was examined with a mouth mirror under natural light. An erupted tooth, visible in the oral cavity at any stage partial or completely extracted tooth was considered erupted.

Gestational age was categorized into >37 weeks (preterm) and <37 weeks (fullterm). The birth weight was divided into three groups according to the World Health Organization, <1500 gm (very low birth weight), 1500–2500 gm (low birth weight), and >2500 gm (adequate birth weight) and four groups according to feeding practice during the first 6 months of life (exclusively breastfed, exclusively bottle fed, a combination of breastfeeding and bottle feeding, and spoon-feeding). The data obtained was coded, entered and analyzed using descriptive analysis. Mean ± standard deviation was used to describe parametric continuous variables and frequency was used to describe categorical variables. The p-value < 0.05 was considered statistically significant.

Results

Population Characteristics

Out of a total of 216 participants, there were 116 males and 100 females, Only 12 children were preterm and 204 children were full-term. The mean age of eruption in the study population was 9.05 months in males and 9.44 in females (Table 1).

The mean eruption time in preterm infants was 9.12 and 11.16 months in full-term infants. When the eruption timing of the first primary tooth was compared with the two groups, a statistically significant difference was noted. Full-term infants with gestational age >37 weeks had the first tooth erupted comparatively earlier (p-value ≤ 0.001) (Table 2).

Out of the total sample, there were 28 children who were of very low birth weight, 121 of low birth weight, and 67 of adequate birth weight. When the eruption timing of the first primary tooth was compared with the three groups, a statistically significant difference was noted (p-value ≤ 0.001). The mean eruption time was 10.53 months in very low birth weight infants, 9.76 months in low birth weight infants, and 7.73 months in adequate birth weight infants (Table 3).

Out of the total number of children 142 were exclusively breastfed for the first 6 months, three were bottle-fed, 50 were bottle and breastfed (combination), and 15 were spoon-fed. When the eruption timing of the first primary tooth was compared within the four groups, a statistically significant difference was noted (p-value ≤ 0.001). The mean eruption time in breastfed infants was 8.95, 8.33 months in bottle-fed infants, 9.66 months in spoon-fed

Table 1: Table representing population characteristics

		Frequency	*Percent*
Gender	Male	116	53.7
	Female	100	46.1
	Total	216	100.0
Gestational age	Group A <37 weeks	12	5.5
	Group B >37 weeks	204	94.2055
	Total	216	100.0
Birth weight	Category A Very low birth weight	28	12.9
	Category B Low birth weight	121	56.0
	Category C Adequate birth weight	67	31.1
	Total	216	100

Table 2: Table representing relationship between gestational age and eruption timing of first tooth eruption

	Eruption timing of first primary tooth									
Gestational age	*6 months N (%)*	*7 months N (%)*	*8 months N (%)*	*9 months N (%)*	*10 months N (%)*	*11 months N (%)*	*12 months N (%)*	*13 months N (%)*	*Chi-square*	*p-value*
<37 weeks	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	11 (44.0%)	0 (0.0%)	1 (12.5%)	81.921	<0.001
>37 weeks	16 (100.0%)	31 (100.0%)	35 (100.0%)	37 (100.0%)	39 (100.0%)	14 (56.0%)	25 (100.0%)	7 (87.5%)		
Total *N* (%)	16 (100.0%)	31 (100.0%)	35 (100.0%)	37 (100.0%)	39 (100.0%)	25 (100.0%)	25 (100.0%)	8 (100.0%)		

infants, and 10.14 months in breastfed and bottle-fed (combination) infants (Table 4).

Discussion

The age of eruption of the first primary teeth has a significant association with the growth and development of a child. It has been thought that the eruption of deciduous teeth plays an essential role in the proper alignment, spacing, and occlusion of permanent teeth.[11]

The mean age of eruption in our study was found to be earlier compared to Verma et al., Manjunatha et al.[12,13] Studies on Indian children have also shown variation in the eruption of first primary teeth from 10.4 to 14.5 months. When sexual dimorphism was considered we found that boys exhibited earlier eruptions similar to the results observed by GunaShekar et al.[14] Whereas Kaul et al. and Agarwal et al. reported that girls exhibited early eruption.[15,16]

Several authors have identified a significant positive association between gestational age or premature birth and the timing of primary tooth emergence. Some authors like Ramos et al., Ntani et al., and Pavičin et al. in their studies have corrected the chronological age for gestational age when the study sample comprised of preterm infants. This is usually estimated by adding up the chronological age (in weeks) to the number of postconception weeks.[8,17,18]

Ntani et al. noted that infants with a longer gestation period (>37 weeks) had earlier tooth eruption even when the gestational age was corrected.[8] Neto and Falcão found that extremely premature infants (gestational age >31 weeks) had later mean ages of first primary tooth emergence when compared to full-term infants.[19]

Similar results were found in our study where we found that infants who had a gestational age of >37 weeks or fullterm had their first tooth erupted significantly earlier compared to their counterparts with a shorter gestational age of <37 weeks. Pavičin et al. found contradictory results and noted no significant mean difference in corrected ages of first primary tooth emergence between full-term infants and preterm infants, although a short gestational age combined with extremely low birth weight (<1500 gm) emerged as an important predictor of later corrected age.[18] One complicating factor in our study could be the failure to correct for gestation length.

Generally adequate or more than adequate birth weight is a predictive of accelerated dental as well as somatic development since such conditions indicate more favorable pre and postnatal conditions. Some authors noted that very-low-birth-weight infants had their first tooth erupted much later even when gestational age was corrected compared to their heavier counterparts.[8,19]

Kaur and Singh noted that healthy girl infants who weighed around 3–4 kg at birth had notably more erupted teeth than girl infants who weighed around 2.5–3 kg at birth at 1 year of age.[20] Similar results were also observed by Ntani et al. and Aktoren et al. who found a significant positive association between birth weight and first tooth eruption.[8,21]

In our study, we found that when the eruption timing of the first primary tooth was compared with the three groups (according to birth weight), a statistically significant difference was noted and adequate birth weight infants demonstrated earlier eruption.

On the contrary, authors like Backström et al. and Ramos et al. found no significant association between deciduous tooth eruption and birth weight.[17,22] The former discovered that neither birth weight nor prematurity was associated with the corrected age of first primary tooth emergence and the later found no significant differences in the mean age of eruption of the first primary tooth among three birth weight groups in full-term and preterm infants when the age was adjusted for gestation length.[8,22]

When the eruption time of the first primary tooth was evaluated with respect to feeding pattern, we found that children who were exclusively breastfed for the first 6 months had significantly earlier eruptions compared to those infants who were not exclusively breastfed. This could be explained by the hypothesis that the act of breastfeeding itself encourages proper growth and development of the entire mouth and jaw. It also helps in the secretion of

Table 3: Table representing relationship between birth weight and eruption timing of first tooth eruption

	Eruption timing of first primary tooth									
Birth weight	*6 months N (%)*	*7 months N (%)*	*8 months N (%)*	*9 months N (%)*	*10 months N (%)*	*11 months N (%)*	*12 months N (%)*	*13 months N (%)*	*Chi-square*	*p-value*
Very low birth weight	0 (0.0%)	1 (3.2%)	0 (0.0%)	0 (0.0%)	11 (28.2%)	15 (60.0%)	0 (0.0%)	1 (12.5%)	148.85	<0.001
Low birth weight	8 (50.0%)	4 (12.9%)	21 (60.0%)	20 (54.1%)	28 (71.8%)	9 (36.0%)	24 (96.0%)	7 (87.5%)		
Adequate birth weight	8 (50.0%)	26 (83.9%)	14 (40.0%)	17 (45.9%)	0 (0.0%)	1 (4.0%)	1 (4.0%)	0 (0.0%)		
Total *N* (%)	16 (100.0%)	31 (100.0%)	35 (100.0%)	37 (100.0%)	39 (100.0%)	25 (100.0%)	25 (100.0%)	8 (100.0%)		

Table 4: Table representing relationship between feeding practices and eruption timing of first tooth

	Eruption of first primary tooth									
Feeding practice	*6 months N (%)*	*7 months N (%)*	*8 months N (%)*	*9 months N (%)*	*10 months N (%)*	*11 months N (%)*	*12 months N (%)*	*13 months N (%)*	*Chi square*	*p- value*
Breastfeeding	4 (25.0%)	24 (85.7%)	29 (87.9%)	33 (89.2%)	26 (68.4%)	23 (92.0%)	2 (8.0%)	1 (12.5%)	167.69	<0.001
Bottle feeding	0 (0.0%)	0 (0.0%)	2 (6.1%)	1 (2.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)		
Breast + bottle feeding	12 (75.0%)	3 (10.7%)	2 (6.1%)	0 (0.0%0	2 (5.3%)	1 (4.0%)	23 (92.0%)	7 (87.5%)		
Spoon feeding	0 (0.0%)	1 (3.6%)	0 (0.0%)	3 (8.1%)	10 (26.3%)	1 (4.0%)	0 (0.0%)	0 (0.0%)		
Total *N* (%)	16 (100.0%)	28 (100.0%)	33 (100.0%)	37 (100.0%)	38 (100.0%)	25 (100.0%)	25 (100.0%)	8 (100.0%)		

hormones for digestion.[3,23] Several authors have examined infant feeding practices and first primary tooth eruption with inconsistent findings. Similar results were noted by Oziegbe et al. and Folayan et al. found no effect on the average emergence timing of any deciduous teeth, in exclusively breastfed children and children breastfed with supplementary food (including water), during the first 6 months of life.[24,25] Sahin et al. also did not find any correlation between feeding practices (breast milk) and eruption timing of the first tooth, they observed that infants fed with cow's milk or formula, either exclusively or in addition to breast milk were less likely to have their first tooth erupted by 6 or 9 months.[5]

On the contrary, some authors have noted that in the first 6 months of life, children who were exclusively breastfed had a significantly later age of eruption of the first primary tooth than those who were fed formula.[26] The authors hypothesized that a characteristic of formula-fed infants, that is, accelerated head growth with low-fat body composition, maybe the cause of the observed earlier ages at first-tooth eruption.[26,27]

Conclusion

The study assessed the eruption timing of the first primary tooth in infants in Pune, India and the effects of gestational age, birth weight, and feeding practices. Within the limitations of the study, we found that infants with a gestational age of <37 weeks and with a birth weight <2500 gm demonstrated a significant delay in eruption of the first primary tooth. Whereas children who were exclusively breastfed for the first 6 months showed early eruption timing. Other healthcare professionals along with the general public should be made aware of the factors affecting the eruption time of deciduous teeth in Pune, India. More longitudinal studies with larger sample sizes and matching confounders are needed to clearly understand the factors affecting the primary tooth eruption.

Why This Paper is Important to Pediatric Dentists

- The dental development is an integral part of human growth. An understanding of the effects of environmental influences on dental growth processes is valuable when analyzing a child's development.
- This research has the potential to impact at a broader level for academic understanding.

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