ORIGINAL RESEARCH

Effect of Neonatal Factors on the Eruption of Primary Teeth in Children: A Longitudinal Prospective Cohort Study

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Abstract

Introduction: Eruption of first primary teeth is a normal physiological process. Antenatal nutritional deficiency and prenatal and neonatal factors play an important role in eruption of primary teeth. Neonatal factors, such as gestational age (GA), degree of prematurity, severity of neonatal illness, and birth weight are primarily related to eruption of primary teeth. The relation between neonatal factors and the timing of eruption of primary teeth has not been studied prospectively among Indian preterm infants.

Aims: To evaluate the influence of neonatal factors on the eruption of primary teeth in children born preterm.

Materials and methods: A prospective longitudinal cohort study design was adopted. A total of 150 subjects were recruited by simple random sampling. Each child was followed up from birth up to 36 months. Intraoral examination was done and the teeth present in each visit were recorded. Data were statistically analyzed and interpreted.

Statistical analysis used: Descriptive statistics, *t*-tests for independent sample, and Pearson's chi-squared tests were applied. Tooth showing statistically significant difference in mean age of eruption between term and preterm categories was studied for the effect of maternal and neonatal characteristics on eruption using multivariate regression analysis.

Results: The mandibular central incisor was the first tooth to erupt. Significant determinant of eruption of mandibular incisor in term children was found to be parity, weight for GA, and complementary feeding, whereas for preterm children, significant determinants were parity, birth weight birth length, weight for GA, and complementary feeding.

Conclusion: Neonatal factors, such as birth weight, birth length, weight for GA, and introduction of complementary feeding have a strong significant association with the eruption of primary teeth.

Clinical significance: The findings of this study will guide in the preventive management of oral health in preterm children.

Keywords: Eruption, Longitudinal study, Neonatal factors, Preterm, Primary teeth, Term.

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Introduction

Eruption of first primary teeth, often referred as teething, is a normal physiological process, where primary teeth pierce through the gingiva from their developmental position within the bone to their occlusal position in the oral cavity.[1] The process of tooth eruption is highly regulated sequential process with the interplay of genetic and environmental factors.[2] Antenatal nutritional deficiency and prenatal and neonatal factors play an important role in growth and development and eruption of primary teeth. Neonatal factors such as GA, degree of prematurity, severity of neonatal illness, and birth weight are primarily related to eruption of primary teeth.[2,3–6]

Studies have reported that nutritional deficiency during early postnatal life can also lead to defective development of teeth or delayed eruption of teeth.[3] Low birth weight, infant weight gain in the first 3 months, maternal childbearing age, and ethnicity have been the significant determinants of eruption of first primary teeth.[2,5]

The timing of initiation of calcification and eruption of primary teeth has several individual variations.[7,8] However, under normal conditions, the sequence and timing of primary teeth follow a regular pattern. This process may be disturbed in infants born preterm due to nutritional deficiency, exposure to medication, and traumatic oral manipulation.[3,5] The relation between neonatal factors and the timing of eruption of primary teeth has not been studied prospectively among Indian preterm infants. Hence, this study was aimed to evaluate the influence of neonatal factors on the eruption of primary teeth in children born preterm.

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Materials and Methods

The strengthening the reporting of observational studies in epidemiology statement for reporting observational studies is used to report this study.

Study Design and Setting

A prospective longitudinal cohort study design was conducted that was approved by the Institutional Ethical Committee (JSS/ACP/Ethical/13). The study was conducted at "Baby Oral Health Promotion Clinic" an extension clinic of the Department of Pediatric and Preventive Dentistry at the Department of Pediatrics, Tertiary Care Hospital.

Participants

Sample Size

Sample size estimation was done with two means considering the mean age of eruption of the first tooth in full-term and preterm children. As this study required 36 months of follow-up, 10–20% attrition was anticipated. After considering the attrition rate, sample size was increased to 150 (75 in each group).

Sampling Method

Nonprobability sampling (simple random) was done to recruit the subjects. Parents willing to participate in the study were recruited and requested to sign a written informed consent form, which was in the local language of Kannada.

Inclusion Criteria

Babies of Indian origin born at term (≥37 weeks of gestation) and at preterm (born before 37 completed weeks of gestation, that is, 32 0/7 weeks through 36 6/7 weeks of gestation) between 1 January and 30 June 2016 and parents of Indian origin residing in Mysuru for at least three generations and belonging to upper middle and lower middle socioeconomic status [Kuppuswamy's socioeconomic status scale (SES) scale 2014] are included.

Exclusion Criteria

Children with genetic diseases, infectious systemic diseases, nutritional and endocrinal disturbances, recognized syndromes, and developmental disturbances, such as cleft lip and palate, and mothers with systemic illnesses, such as endocrinal disorders, blood disorders, and hypertension were excluded from the study.

Follow-up

Each child was followed up from birth up to 36 months or till the eruption of the last tooth, whichever was earlier. During the first 6 months, follow-up was as per the standard immunization schedule, that is, at birth and 6, 10, 14, and 18 weeks. After 6 months and up to 12 months, monthly follow-up was done. From 13 to 36 months, follow-up was done at 3-month intervals. To determine socioeconomic status of parents, modified Kuppuswamy's SES was used. For nutritional status of individual, weight, height, and head circumference of the child were determined at each visit using a standard protocol.

Oral examination was performed using knee-to-knee (lap-to-lap) positioning technique. Intraoral examination was done using disposable mouth mirror and tongue depressor under natural light. For the study purpose, a tooth was considered erupted if any part of the tooth penetrated the gingival mucosa, which can be seen or felt.

Eruption chart was specially designed for the study purpose and was calibrated by conducting a pilot study on 30 mothers. Specially designed eruption chart was given along with the child's immunization book brought to the pediatrician regularly, and the mother was instructed to frequently observe the infant's mouth and record the exact date of tooth eruption in this specially designed eruption chart. Eruption charts were cross-checked during the follow-up visits. All the mothers also received information regarding brushing technique, diet, and other preventive care through specially designed pamphlets.

For preterm children along with chronological age, corrected age was also considered. Chronological age is the number of years/months from his/her actual date of birth. In the present study, chronological age in months was calculated for every child from hospital records/birth certificates. For preterm subjects, both chronological and corrected age was recorded. Corrected age was recorded using the formula as follows:

Corrected age = chronological age in weeks – (40 – GA at birth in weeks)[7]

For example, for a child born prematurely at 32 weeks of gestation visits at 9 months, we know that the child is 8 weeks premature (term pregnancy is 40 weeks; subtract the child's GA from 40 weeks; 40 − 32 = 8 weeks). The chronological age of the child is 9 months.

To know the corrected age, use the following formula as follows:

Corrected age = $9 \times 4 - (40 - 32) = 36 - 8 = 28$ weeks = 7 months

At the end of every visit, data were entered into the Excel sheet by the investigator. The data were verified and scrutinized. To maintain the data quality, 10% of the observations were randomly selected and cross-checked to detect any error and to validate the data entry.

Statistical Methods

Statistical analysis was done using Statistical Package for the Social Sciences software. Descriptive statistics were applied for demographic data. Continuous variables were compared using *t*-test for independent samples. Variables on nominal scale were compared using Pearson's chi-squared test. Mean age (in months) at eruption of each tooth in term and preterm babies was derived and compared the respective mean ages of tooth using *t*-test for independent samples. The difference in the mean age of eruption of each tooth between term and preterm categories was assessed using independent samples *t*-test. Continuous variables, such as birth weight, length, head circumference, duration of feeding, and complementary feeding were compared between two groups as well as across times using two-way mixed analysis of variance. Tooth showing statistically significant difference in mean age of eruption between term and preterm categories was studied for the effect of maternal and neonatal characteristics on eruption using multivariate regression analysis.

Results

Among 105 subjects, 53 were term children (62.26% males and 37.74% females) and 52 were preterm children (59.62% males and 40.38% females). The mean birth weights were 2.84 ± 0.34 kg and 2.02 ± 0.51 kg; in the study population, 94.34% were exclusively breastfed, whereas in preterm children, only 61.54% were exclusively breastfed. A total of 81.31% of term children and 23.08% of preterm children were introduced to complementary feeding at 6–9 months, whereas 18.87% of term and 76.92% of preterm children were introduced to complementary feeding at 10–12 months (Tables 1 and 2).

Determinants of Eruption

Mandibular central incisor showed statistically significant difference in mean age of eruption between term and preterm subjects (Table 3). This was studied for the effect of maternal and neonatal characteristics on eruption of primary teeth using multivariate regression analysis. Significant determinants of eruption of mandibular incisor in term children were found to be parity, weight for GA, and complementary feeding, whereas for preterm children, significant determinants were parity, birth weight birth length, weight for GA, and complementary feeding.

In term children, mothers with the second child had a coefficient of 1.340 (0.619) compared to mothers with the first child, which indicates that the eruption was delayed in the second child as compared to first child. This effect was statistically significant, as indicated by p-value of 0.036. When weight for GA was considered, the children who were small for GA had coefficient value of 1.132 (0.838) compared to children who were appropriate for GA, which indicates that the eruption was delayed in children who were small for GA as compared to children who were appropriate for GA, and this effect was statistically significant ($p = 0.05$). Children who were introduced to complementary feeding after 9 months had delayed eruption compared to children to whom the complementary feeding was started before 9 months as indicated by the coefficient value of 0.881 (0.721). This effect was statistically significant, as indicated by p-value of 0.027 (Table 4).

In preterm children, mothers with the second child had a coefficient of 0.155 (0.457) compared to mothers with the first child. This indicated that the eruption was delayed in the second

Table 1: Descriptive statistics for mother characteristics

Characteristics	*Levels*	*Term (≥37 weeks), n = 53*	*Preterm (<37 weeks), n = 52*
Mother's age (years)		27.28 ± 4.95	24.94 ± 4.39
GA (weeks)		37.00 ± 0.00	34.28 ± 1.57
Mode of delivery	Vaginal	23 (43.4)	25 (48.08)
	Cesarean	30 (56.6)	27 (51.92)
Parity	First	34 (64.15)	29 (55.77)
	Second	19 (35.84)	23 (44.23)
Socioeconomic class	Upper middle	48 (90.57)	25 (48.08)
	Lower middle	5 (9.43)	27 (51.92)

Table 2: Descriptive statistics for children characteristics

Characteristics	*Levels*	*Term (≥37 weeks), n = 53 (%)*	*Preterm (<37 weeks), n = 52 (%)*
Gender	Male	33 (62.26)	31 (59.62)
	Female	20 (37.74)	21 (40.38)
Birth weight (kg)		2.84 ± 0.34	2.02 ± 0.51
Birth length (cm)		55.49 ± 6.44	44.43 ± 2.88
Birth head circumference (cm)		33.33 ± 1.11	31.32 ± 2.20
Weight for GA	Small for GA	16 (30.19)	14 (26.92)
	Appropriate GA	37 (69.81)	38 (73.08)
Feeding practice	Exclusively breastfed	50 (94.34)	32 (61.54)
	Mixed feeding	3 (5.66)	20 (38.46)
Introduction of complementary feeding	<9 months (6–9 months)	43 (81.13)	12 (23.08)
	>9 months (10–12 months)	10 (18.87)	40 (76.92)

Table 3: Comparison of mean age at eruption (*corrected age* for preterm) of maxillary and mandibular teeth in term and preterm children

		Term (≥37 weeks), n = 53	*Preterm (<37 weeks), n = 52*		
Primary teeth		*Age in months, mean ± SD*		*t-value*	*p-value**
Maxilla	Central incisor	11.25 ± 1.99	12.39 ± 1.58	−3.24	0.002*
	Lateral incisor	13.10 ± 2.75	14.16 ± 1.54	−2.45	0.016*
	Canine	20.12 ± 2.98	20.93 ± 2.00	−1.63	0.106
	First molar	16.75 ± 2.54	17.93 ± 2.13	−2.57	0.012*
	Second molar	27.59 ± 3.38	30.49 ± 2.69	−4.88	<0.001*
Mandible	Central incisor	10.55 ± 1.87	11.46 ± 1.25	−2.93	0.004*
	Lateral incisor	15.97 ± 3.40	16.62 ± 2.17	−1.17	0.246
	Canine	21.10 ± 2.93	21.69 ± 2.94	−1.02	0.309
	First molar	16.87 ± 2.38	17.56 ± 3.02	−1.29	0.202
	Second molar	26.83 ± 3.18	28.57 ± 2.17	−3.28	0.001*

SD, standard deviation; *significant

Table 4: Multivariate analysis of pre, peri, and postnatal factors affecting eruption timing of mandibular central incisor in term babies

Factor	*Levels*	*Number (%)*	*Mean (SD)*	*B (SE)*	*p-value*
Constant		Total = 53		11.12 (1.71)	<0.001
Mothers age (years)		53 (100)	10.55 (1.87)	−0.004 (0.061)	0.948
Socioeconomic status	Upper class	48 (90.57)	10.50 (1.94)	−0.536 (0.957)	0.579
	Lower class[a]	5 (9.43)	10.99 (0.77)		
Mode of delivery	Cesarean	30 (56.60)	10.25 (1.73)	−0.944 (0.529)	0.082
	Vaginal[a]	23 (43.40)	10.93 (2.01)		
Parity	Second	19 (35.85)	11.01 (1.72)	1.340 (0.619)	0.036*
	First[a]	34 (64.15)	10.29 (1.92)		
Gender	Male	33 (62.26)	10.44 (1.89)	−0.160 (0.550)	0.772
	Female[a]	20 (37.74)	10.72 (1.86)		
Birth weight	Extreme	9 (16.98)	10.64 (1.40)	1.599 (0.956)	0.102
	Normal[a]	44 (83.02)	10.53 (1.96)		
Birth length	Extreme	29 (54.72)	10.93 (1.85)	1.026 (0.556)	0.072
	Normal[a]	24 (45.28)	10.08 (1.81)		
Birth head circumference	Extreme	32 (60.38)	10.27 (1.81)	−0.764 (0.538)	0.163
	Normal[a]	21 (39.62)	10.97 (1.93)		
Weight for GA	Small for GA	16 (30.19)	11.23 (1.69)	1.132 (0.838)	0.051*
	Appropriate GA[a]	37 (69.81)	10.68 (1.95)		
Feeding practice	Combination	3 (5.66)	9.86 (0.52)	−0.371 (1.124)	0.743
	Breastfed[a]	50 (94.34)	10.59 (1.91)		
Complementary feeding	>9 months	10 (18.87)	11.04 (1.40)	0.881 (0.721)	0.027*
	≤9 months[a]	43 (81.13)	10.43 (1.96)		

Reference group, [a]R-square = 0.290; SD, standard deviation; B(SE), regression coefficient (standard error); * significant

child as compared to first child, and the effect was statistically significant ($p = 0.043$). With regard to neonatal factors, compared to normal birth weight (10–90th percentile), the extreme category (<10th percentile or >90th percentile) had longer eruption time [B = 0.140 (0.547)], and this effect was statistically significant ($p = 0.029$). Babies with extreme cases of birth lengths had longer eruption time as indicated by positive coefficients [B = 0.263 (0.721)] compared to normal category; this effect was also statistically significant as indicated by p-value of 0.034. When weight for GA was considered, the children who were small for GA had coefficient value of 0.328 (0.461) compared to children who were appropriate for GA. This indicated that the eruption was delayed in children who were small for GA as compared to children who were appropriate for GA and this effect was statistically significant ($p = 0.050$). Children who were introduced to complementary feeding after 9 months had delayed eruption compared to children to whom the complementary feeding was started before 9 months as indicated by the coefficient value of 0.575 (0.540). This effect was statistically significant, as indicated by p-value of 0.029 (Table 5).

Discussion

Sociodemographic factors, such as mothers age, education level, and socioeconomic status; prenatal factors, such as maternal illness, plasma vitamin D level, and alcohol or tobacco consumption during pregnancy; perinatal factors, such as mode of delivery, birth weight, height, and weight for GA; and postnatal factors, such as feeding patterns may be the determinants of timing of eruption of first primary teeth in otherwise healthy children.[4,5] Birth event itself is considered to be a stimulus for eruption of teeth.[9] Eruption of teeth at the molecular level is a series of metabolic changes occurring in the alveolar bone controlled by the dental follicle.[10] Studies related to metabolic evidence of eruption in primary teeth are very scarce. Hence, we attempted to correlate the peri and postnatal factors that affect the metabolic functions for the eruption of primary teeth in both term and preterm children. Only those teeth that showed statistically significant differences in the eruption timing after the correction of prematurity were regressed to correlate with neonatal factors.

Mother's age had a poor relationship with the eruption of primary teeth in both term and preterm children. Negative correlations were observed in the previous studies.[4] A total of 56.6% of term and 51.92% of preterm children were delivered through cesarean section. Children born through cesarean section experienced early eruption of all primary teeth except maxillary lateral incisor, first molar, and second molar in preterm group. However, the effect was statistically insignificant. Lam et al. reported a similar finding with the eruption of first primary tooth.[5]

A total of 64.1% of term and 55.77% of preterm children were delivered as first child. Children born second had delay in the eruption of all primary teeth compared to the first child in both the groups. This effect was statistically significant for mandibular incisors in both term and preterm groups and statistically insignificant for all the other teeth suggesting that parity affects only the eruption of first primary teeth. However, no data were available in the literature to compare the effect of this factor on eruption.

Table 5: Multivariate analysis of pre, peri, and postnatal factors affecting eruption timing of mandibular central incisor in preterm babies

Factor	*Levels*	*Number (%)*	*Mean (SD)*	*B (SE)*	*p-value*
Constant		Total = 52		12.061 (1.349)	<0.001
Mother's age (year)		52 (100)	11.46 (1.25)	–0.019 (0.051)	0.714
Socioeconomic status	Upper class	25 (48.08)	11.27 (1.37)	–0.379 (0.444)	0.398
	Lower class[a]	27 (51.92)	11.62 (1.13)		
Mode of delivery	Cesarean	27 (51.92)	11.16 (1.31)	–0.398 (0.450)	0.382
	Vaginal[a]	25 (48.08)	11.77 (1.13)		
Parity	Second	23 (44.23)	12.27 (1.26)	0.155 (0.457)	0.043*
	First[a]	29 (55.77)	11.60 (1.24)		
Gender	Male	31 (59.62)	11.42 (1.22)	–0.434 (0.424)	0.312
	Female[a]	21 (40.38)	11.51 (1.33)		
Birth weight	Extreme	42 (80.77)	12.50 (1.36)	0.140 (0.547)	0.029*
	Normal[a]	10 (19.23)	11.26 (0.66)		
Birth length	Extreme	11 (21.15)	11.47 (1.14)	0.263 (0.721)	0.034*
	Normal[a]	41 (78.85)	10.45 (1.29)		
Birth head circumference	Extreme	12 (23.08)	11.68 (1.26)	0.668 (0.708)	0.351
	Normal[a]	40 (76.92)	11.39 (1.26)		
Weight for GA	Small for GA	14 (26.92)	12.33 (1.06)	0.328 (0.461)	0.050*
	Appropriate GA[a]	38 (73.08)	11.50 (1.33)		
Feeding practice	Combination	20 (38.46)	11.40 (1.28)	–0.107 (0.523)	0.838
	Breastfed[a]	32 (61.54)	11.45 (1.25)		
Complementary feeding	>9 months	40 (76.92)	11.56 (1.33)	0.575 (0.540)	0.029*
	≤9 months[a]	12 (23.08)	10.12 (0.89)		

Reference group, [a]R-square = 0.144; SD, standard deviation; B(SE), regression coefficient (standard error); * significant

Birth weight and height have an influence on the primary tooth eruption. Various studies have reported that in children above 1 year with poor somatic growth or inadequate nutritional status, there is a delay in the tooth eruption.[6,11–14] Lam et al.[5] reported delay in the eruption of first primary teeth in children below 1 year with poor nutritional status. From these studies, we can conclude that adequate nutrition is required during the early childhood period for normal tooth eruption. One of the methods for nutritional assessment for a child from birth to 3 years is by recording the anthropometric measurements, such as weight, length/height, and head circumference. Hence, to balance the confounding effect of these factors, we included only those children who were falling between 5th and 95th percentiles in Centers for Disease Control and Prevention growth chart. Among them, all the children with weight, length, and head circumference <10th percentile or >90th percentile were grouped as extreme cases and children between 10th and 90th percentiles were categorized as normal.

Children with extreme birth weight and birth length (<10th or >90th percentile) had delay in the eruption of maxillary and mandibular central incisors and maxillary lateral incisors in both term and preterm groups. However, the effect was statistically significant only among preterm children. Similar finding was observed by Lam et al.[5] Children with extreme head circumference showed early eruption of all primary teeth in term and delayed eruption of all primary teeth in preterm. The reason for this variation could not be traced in literature. However, Infante and Owen[15] reported a strong association of primary tooth eruption with head circumference, especially in males.

Among the study population, 30.19% of term and 26.92% of preterm children were small for GA. Those children who were small for GA showed delayed eruption of all primary teeth regressed in both term and preterm groups. However, statistically significant delay was observed only with respect to maxillary and mandibular central incisors in both groups. Similar finding was observed in the study conducted by Lam et al.[5] Delayed eruption was seen in low birth weight children. The delay in eruption was significant even after correcting the child's age for prematurity. These results were in concordance with that of Neto and Falcão[16] and Pavičin et al.[17]

Seow et al.[9] compared eruption time in low and normal birth weight children and concluded that the first tooth eruption occurred significantly earlier in the normal birth weight group. The present study results support that the delayed emergence time in low birth weight children could be related to reduced GA.

In the present study, 5.66% of term and 38.46% of preterm children were mixed fed probably due to frequent medical complications in the neonatal period. Breastfeeding and bottle-feeding involve different mechanisms and orofacial muscle activity, which might be one of the possible reasons for the different growth patterns of jaws, dental arch development, and tooth eruption. In the present study, compared to breastfeeding, those on mixed feeding had earlier eruption, but the finding was statistically insignificant. Similar results were shown in a study by Folayan et al.,[18] who concluded that breastfeeding and its duration did not affect the timing of eruption of the first deciduous teeth. Sahin et al.[19] reported that there was no delay in the eruption of first primary teeth whether they were formula fed/cow's milk fed in addition to breastfeeding. Contrary to our results, few studies have reported delayed eruption of upper incisor in infants who were not breastfed.[18,19]

Conclusion

Preterm children have a delay in the eruption of all primary teeth compared with term children; however, when the prematurity is corrected, only central incisors showed a delay, suggesting that the delay in the eruption is because of prematurity. Neonatal factors, such as birth weight, birth length, weight for GA, and introduction of complementary feeding have strong significant association with the eruption of primary teeth. The findings of this study will guide in the preventive management of oral health in preterm children.

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References

1. Ash MM, Nelson SJ. Chapter 2. “Development and Eruption of Teeth” Dental Anatomy, Physiology and Occlusion, 8th edition. St Louis: Elsevier; 2003. pp. 49–51.
2. Aktoren O, Tuna EB, Guven Y, et al. A study on neonatal factors and eruption time of primary teeth. Community Dental Health 2010;27(1):52–56.
3. Gatta EA, Al-Alousi WS, Diab BS. Primary teeth emergence in relation to nutritional status among 4–48 months old children in Baghdad city. Mustansiria Dental J 2008;5(1):62–70.
4. Khalifa AM, El Gendy RA, El-Mohsen MM, et al. Relationship between gestational age, birth weight and deciduous tooth eruption. Egypt Pediatr Assoc Gaz 2014;62(2):41–45. DOI: 10.1016/j.epag.2014.04.001
5. Lam CU, Hsu CS, Yee R, et al. Influence of metabolic-linked early life factors on the eruption timing of the first primary tooth. Clin Oral Investig 2016;20(8):1871–1879. DOI: 10.1007/s00784-015-1670-6
6. Viscardi RM, Romberg E, Abrams RG. Delayed primary tooth eruption in premature infants: relationship to neonatal factors. Pediatr Dent 1994;16:23–28.
7. Devraj IM, Nandlal B, Narayanappa. Polymorphism in the eruption sequence of primary dentition: a cross-sectional study. J Clin Diagn Res 2017;11(5):ZC72– ZC74. DOI: 10.7860/JCDR/2017/27668.9909
8. Ramirez O, Planells P, Barberia E. Age and order of eruption of primary teeth in Spanish children. Community Dent Oral Epidemiol 1994;22(1):56–59. DOI: 10.1111/j.1600-0528.1994.tb01570.x
9. Seow WK, Humphrys C, Mahanonda R, et al. Dental eruption in low birth-weight prematurely born children: a controlled study. Pediatr Dent 1988;10(1):39–42.
10. Wise GE, Frazier-Bowers S, D’souza RN. Cellular, molecular, and genetic determinants of tooth eruption. Crit Rev Oral Biol Med 2002;13(4):323–335.
11. Arvystas MG. Familial generalized delayed eruption of the dentition with short stature. Oral Surg Oral Med Oral Pathol 1876;41(2):235–243. DOI: 10.1177/154411130201300403
12. Rami Reddy V, Vijayalakshmi PB, Chndrasekhar Reddy BK. Deciduous tooth emergence and physique of Velama children of southeastern Andhra Pradesh, India. Acta Odontol Pediatr 1986;7(1):1–5.
13. Alvarez JO, Lewis CA, Saman C, et al. Chronic malnutrition, dental caries, and tooth exfoliation in Peruvian children aged 3–9 years. Am J Clin Nutr 1988;48(2):368–372. DOI: 10.1093/ajcn/48.2.368
14. Clements EM, Davies-Thomas E, Pickett KG. Time of eruption of permanent teeth in British children at independent, rural, and urban schools. Br Med J 2009;1:1511–1513. DOI: 10.1136/bmj.1.5034.1511
15. Infante PF, Owen GM. Relation of chronology of deciduous tooth emergence to height, weight and head circumference in children. Arch Oral Biol 1973;18(11):1411–1417. DOI: 10.1016/0003-9969(73)90115-5
16. Neto PGF, Falcão MC. Eruption chronology of the first deciduous teeth in children born prematurely with birth weight less than 1500 g. Rev Paul Pediatr 2014;32(1):17–23. DOI: 10.1590/s0103-05822014000100004
17. Pavičin IS, Dumančić J,Badel T, et al. Timing of emergence of the first primary tooth in preterm and full-term infants. Ann Anat 2016;203:19–23. DOI: 10.1016/j.aanat.2015.05.004
18. Folayan M, Owotade F, Adejuyigbe E, et al. The timing of eruption of the primary dentition in Nigerian children. Am J Phys Anthropol 2007;134(4):443–448. DOI: 10.1002/ajpa.20635
19. Sahin F, Camurdan AD, Camurdan MO, et al. Factors affecting the timing of teething in healthy Turkish infants: a prospective cohort study. Int J Paediatr Dent 2008;18(4):262–266. DOI: 10.1111/j.1365-263X.2007.00893.x