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A study on neonatal factors and eruption time of primary teeth

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Objective: The purpose of this study was to determine the time of the eruption of the first primary tooth (FPT) in infants and to assess the effects of neonatal factors on the timing of the eruption. ***Basic research design:*** The dental and medical records of healthy infants were reviewed to gather data on birth weight (BW), gestational age (GA), prenatal history, and the time of the eruption of the FPT. Additionally, the mothers of these infants were asked to identify their smoking habits and/or caffeine consumption during pregnancy through face-to-face interviews. The resulting data were statistically analysed with the Student's t,Tukey, and Pearson correlation tests. ***Results:*** The mean eruption times (MET) for girls and boys were 7.25±2.47 and 7.07±1.66 months respectively ($p>0.05$). The MET of the FPT in infants with a GA of less than 34 weeks, 34 to 37 weeks, or over 37 weeks were 8.0±2.0, 8.29±2.97, 6.93±1.87 months, respectively. The MET in infants with a BW of 1500 to 2500g was 8.28 ±2.28 months, while the MET for the infants with a BW of over 2500g was 6.99±1.94 ($p=0.014$). ***Conclusion:*** A significant difference was found in the METs of infants with low and normal BWs. No significant differences were observed in the MET as related to other neonatal factors.

Keywords: Eruption time, neonatal factors, primary teeth.

Introduction

Primary tooth eruption, which is a part of the general somatic growth and development of infants, may be influenced by genetic and exogenous factors. Various factors and nutritional deficiences during pregnancy, which are known as the neonatal factors, may play a role in the development and emergence of deciduous teeth (Delgado *et al*., 1975; Hatton, 1955; Infante and Owen, 1973; Seow *et al*., 1988; Tanguay *et al*., 1984; Viscardi *et al*., 1994). The effects of general growth and development on the emergence of primary teeth have been studied by several investigators; however, limited studies describing the effect of various neonatal factors on the timing of primary tooth eruption have been reported (Baykan *et al*., 2004; Golden *et al*., 1981; Seow *et al*., 1988; Trupkin, 1974; Viscardi *et al*., 1994).

The eruption time of the primary teeth is of clinical importance in child health care planning and in the diagnosis of certain growth disturbances. Various populations were investigated regarding primary teeth eruption (Al-Jasser and Bello, 2003; Baykan *et al*., 2004; Choi and Yang, 2001). Studies have shown that the timing of eruption could vary between and within populations and that gender differences could affect primary teeth eruption (Baykan *et al*., 2004; Choi and Yang, 2001, Lunt and Law, 1974; Lysell *et al*., 1962).

The purpose of this study was to determine the eruption time of the first primary tooth in a sample group of Turkish infants and to determine the existence of any relationship between the neonatal factors and the eruption time of first primary tooth.

Methods

This retrospective study was conducted by the Institute of Child Health of Istanbul Medical Faculty and the Department of Pedodontics at Istanbul University. The study involved a total of 178 healthy infants who were periodically observed in the follow-up clinics. The subjects, 6 to 39 months of age, were randomly selected from Turkish urban children as part of an interdisciplinary prospective study of growth and development. None of the infants had any systemic medical problems or specific syndromes.

The medical and dental records of the subjects were reviewed for birth weight, gestational age, prenatal history of maternal diseases, and the time of the eruption of the first primary tooth. The mothers of the infants were asked to participate in the study and to note down the date of primary teeth eruption on a specially designed form at three months of age. The mothers were given clear instructions to mark the teeth as they emerged when any part of the crown was visible in the oral cavity. In addition, the mothers were asked about their cigarette smoking and caffeine (coffee, cola) consumption during the first trimester of pregnancy in a face-to-face interview; and the data were recorded. Informed consent from the subjects' mothers and ethical approval was obtained prior to the investigation.

The data were assessed according to Logan and Kronfeld's and Lunt and Law's chronology for the formation of the human dentition; the possible eruption stages for the first primary tooth were defined as early stage (less than six months of age), normal stage (six to eight months of age), and late stage (greather than eight months of age) (Logan and Kronfeld, 1933; Lunt and Law, 1974).

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The statistical analysis was conducted using the GraphPad Prism (V 3.0) software. The percentages, means, and standard deviations for the groups were computed separately. The comparison of the means was performed using the Student's t test. The Tukey test was used to assess the significance of the differences between the risk factors and the eruption times. Additionally, odds ratios (ORs) were calculated. The Pearson's Correlation Coefficient was used to analyse the relationship between the risk factors and the emergence of the first primary tooth. The statistical significance level was established at $p<0.05$.

Results

A total of 85 females and 93 males were enrolled. The age ranges of the infants were as follows: 22 infants (12.36%) were between six and 12 months, 70 infants (39.33%) were between 12.1 and 24 months, 61 infants (34.27%) were between 24.1 and 36 months and 25 infants (14.04%) were older than 36 months of age (Table 1). The mean age of the children was 14.11 ± 5.99 months.

The data regarding the timing on a monthly basis of the eruption of the first primary tooth are summarized in Table 2. Two subjects were excluded from the study due to missing data. The mean eruption time of the first primary tooth was 7.25 ± 2.47 months for the females and 7.07 ± 1.66 months for the males (t=0.549, p=0.584).

When the data were analysed in relation to eruption time stages, 62.5% of males and 37.5% of females experienced their first tooth eruption at six to eight months of age. Early eruption was observed in 69.2% of girls and 30.8% of boys, while late eruption was observed in 65.8% of girls and 34.2% of boys. A significant difference was identified in early (p=0.006) and late (p=0.004) eruption between boys and girls. ORs for early and late eruption were calculated at a 95% level of confidence as 3.7 (confidence interval of 1.49-9.37) and 3.02 (confidence interval of 2.48-6.93) for early and late eruption, respectively; early eruption in girls was observed 3.7 times more than for boys, and late eruption in girls occurred 3.02 times more than for boys.

The first tooth erupted was the lower central primary incisor in the 155 infants (87.08%) and upper central primary incisors in 19 infants (10.67%), and lateral primary incisors in four infants (2.25%). No significant difference was found between sequence of the tooth eruption and gender.

The gestational age was divided into the following three stages; less than 34 weeks, 34 to 37 weeks and greater than 37 weeks gestation. The births of infants who were less than 37 weeks gestation were considered preterm births. Three subjects were excluded from the gestational age group due to missing data on medical records. The percentages of children with a gestational age less than 34 weeks, 34 to 37 weeks, or greater than 37 weeks were 1.73%, 12.14% and 86.13%, respectively. The mean eruption times of the first primary tooth for infants of gestational age less than 34 weeks, 34 to 37 weeks, and greater than 37 weeks were 8.00±2, 8.29±2.97, and 6.93±1.87 months of age, respectively. The data regarding the gestational age and eruption time stages are shown in Table 3. Only three subjects were born prior to 34 weeks and these were not included in the analysis of the relationship between gestational age and eruption time. A significant difference (p=0.012) was found in late eruption time between the group of 34 to 37 weeks gestation and the group of greater than 37 weeks gestation. Late eruption was seen 3.67 times more in infants who were born at less than 37 weeks gestation [i.e., the OR was 3.67, and the 95% CI was 1.14-9.61].

Birth weight

The birth weights were divided into the following three groups: less than 1500g (very low birth weight), 1500g to 2500g (low birth weight), and more than 2500g (normal birth weight). Within the entire study group, the percentage of infants in each group, i.e., less than 1500g, 1500 to 2500g, and greater than 2500g, were 0.57%, 9.09%, and 90.34%, respectively. The group of infants with a birth weight under 1500g was excluded from further analysis in the study since only one subject fell into this group. The mean eruption time in infants with a birth weight of 1500-2500g was 8.28 ±2.28 months of age, and the mean value for the infants with a birth weight of more than 2500g was determined as 6.99±1.94 months of age. A significant difference in the mean age for eruption was found between the infants with low and normal birth weights (p=0.014). Upon further analysis according to eruption time stages (Table 4), no significant difference in mean eruption age was found between the birth weight groups regarding early (p=0.747) or late eruption (p=0.36). Children with a birth weight of less than 2500g demonstrated late eruption 2.58 times more than infants with a birth weight of more than 2500g [OR 2.58, 95% CI (0.88-7.5)]. OR and 95% CI values for early eruption were calculated as 0.45 and (0.05-3.78), respectively.

Maternal Diseases

12.5% (n=22) of mothers reported that they had a systemic disease (i.e., infectious and/or metabolic) during the first trimester of their pregnancy (Table 5). No significant correlation (p>0.05) was found between first trimester maternal diseases and the time of eruption for the first primary tooth. Correlation between early or late eruption times and maternal diseases were not significant (p=0.09, p=0.415). Infants with mothers who experienced a systemic disease during the first trimester demonstrated early eruption 2.8 times more than infants with mothers who did not experience a systemic disease during the first trimester [OR 2.8, 95% CI(0.99-7.95)]. OR and 95% CI values for late eruption were 0.42 and (0.09-1.96), respectively.

Smoking during pregnancy

12.5% of the mothers smoked cigarettes during the first trimester (i.e., less than three per day) (Table 6). No significant correlation (p>0.05) was found between smoking and the infant's age of eruption. Correlation between early or late eruption times and smoking were not significant (p=0.561 and p=0.632). Early eruption was observed 1.66 times more in the children of mothers who smoked [OR 1.66, 95% CI(0.54-5.13)]. OR and 95% CI values for late eruption have been calculated as 0.6 and (0.16-2.21), respectively.

Table 1. Subject distribution according to age and gender

Age	*Girls*		*Boys*		*Total*	
	n	*%*	*n*	*%*	*n*	*%*
6-12 months	10	45.5	12	54.5	22	12.36
12.1-24 months	27	38.6	43	61.4	70	39.33
24.1- 36 months	39	63.9	22	36.1	61	34.27
> 36 months	9	36.0	16	64.0	25	14.04
Total	85	47.8	93	52.2	178	100

Table 2. Distribution of children according to first primary tooth eruption age

Months	*<6*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*>12*	*Total*
n (%)	26 (14.77)	56 (31.82)	32 (18.18)	27 (15.34)	19 (10.80)	4 (2.27)	3 (1.71)	5 (2.84)	4 (2.27)	176

Table 3. Data regarding gestational age and eruption stages

		Eruption stages of first primary teeth					
		Early stage (<6 month)		*Normal stage (6-8 month)*		*Late stage (>8 month)*	
Gestation Age	*n*	*n*	*%*	*n*	*%*	*n*	*%*
<34 weeks	3	0	0	2	1.79	1	2.86
34-37 weeks	21	3	11.54	9	8.04	9	25.71
>37 weeks	152	23	88.46	101	90.18	28	73.68
	176	26		112		38	

Table 4. Data regarding birth weight and eruption stages.

		Eruption stages of first primary teeth					
		Early stage (<6 month)		*Normal stage (6-8 month)*		*Late stage (>8 month)*	
Birth Weight	*n*	*n*	*%*	*n*	*%*	*n*	*%*
<1500 g	1	0	0	0	0	1	2.63
1500-2500 g	16	1	3.85	9	8.04	6	15.79
>2500 g	159	25	96.15	103	91.96	31	81.58
	176	26		112		38	

Table 5. Maternal diseases and eruption stages

		Eruption stages of first primary teeth					
		Early stage (<6 month)		*Normal stage (6-8 month)*		*Late stage (>8 month)*	
Maternal Diseases	*n*	*n*	*%*	*n*	*%*	*n*	*%*
No	154	19	73.08	99	88.39	36	94.74
Yes	22	7	26.92	13	11.61	2	5.26
	176	26		112		38	

Caffeine consumption during pregnancy

21.6% of the mothers in the study group used caffeine during the first trimester (i.e., more than three cups of coffee or cola per day) (Table 7). No significant difference ($p>0.05$) was determined between the stages of eruption time as related to the use of caffeine during pregnancy. Correlation between early or late eruption times and caffeine consumption were not significant ($p=0.674$ and $p=0.69$). Early eruption and late eruption were observed 0.66 and 1.31 times more in infants whose mothers had used caffeine during the first trimester of pregnancy, respectively. OR and 95% CI values for early and late eruption were calculated as OR 0.66, CI (0.20-2.12) and OR 1.31, CI (0.55-3.06), respectively.

Discussion

The timing of primary tooth eruption and the factors that may affect the timing of the eruption have been assessed in different populations and races. Numerous investigators have studied the timing and sequence of primary teeth eruption, and contradictory findings regarding the timing, sequence of eruption, and gender differences in the emergence of primary teeth have been reported (Choi and Yang, 2001; Demirjian and Levesque, 1980; Hagg and Taranger, 1986; Logan and Kronfeld, 1933; Lunt and Law, 1974). Lysell *et al*. (1962, 1964) have stated that no statistically significant differences were observed in the sexes with respect to eruption time. Demirjian and Levesque (1980) have found a similarity between boys and girls in the early stages of development and an advancement of girls over boys in later stages. Choi and Yang (2001), Hagg and Taranger (1986), and Infante (1974) have concluded that boys showed earlier tooth emergence in early stages. Girls are generally more advanced in somatic growth and development than boys up to the preadolescent years; however, studies have indicated that the eruption process could be independent of the growth process and that boys could show earlier tooth emergence compared to girls (Choi and Yang, 2001; Demirjian and Levesque, 1980).

In this study of urban children living in Istanbul, the age of the first eruption was determined as 7.25 ± 2.47 months of age for girls and 7.07 ± 1.66 months of age for boys. These mean values of eruption age are consistent with the results of Baykan *et al*.'s (2004) study of Turkish children (7.4±2.0 months of age for first eruption) and with the chronologies of normal eruption time for first primary tooth emergence (six to eight months), which were developed by Logan and Kronfeld (1933) and Lunt and Law (1974).

Logan and Kronfeld's chronology of the formation of the human dentition has been a standard for eruption times since 1940 and was revised by Lunt and Law in 1974; the standards for primary teeth eruption developed by Lunt and Law (1974) were at least two months later than those published by Logan and Kronfeld (1933). Therefore, the mean value found in this study with Turkish children is accepted within the limits of the normal timing range of first tooth emergence.

The data collected in this study revealed no significant differences in the mean eruption times between the genders. This finding is similar to that of Lysell *et al*. (1962). In this study, a further analysis of data was performed according to eruption stages. When the data were classified and assessed according to normal, early, and late eruption stages, boys (62.5%) showed a greater tendency for normal stage eruption than girls (37.5%);

Table 6. Data regarding smoking and eruption stages.

		Eruption stages of first primary teeth					
		Early stage (<6 month)		*Normal stage (6-8 month)*		*Late stage (>8 month)*	
Smoking	*n*	*n*	*%*	*n*	*%*	*n*	*%*
No	154	21	80.77	98	87.50	35	92.11
Yes	22	5	19.23	14	12.50	3	7.89
	176	26		112		38	

Table 7. Data regarding caffeine consumption and eruption stages

		Eruption stages of first primary teeth					
		Early stage (<6 month)		*Normal stage (6-8 month)*		*Late stage (>8 month)*	
Caffeine Consumption	*n*	*n*	*%*	*n*	*%*	*n*	*%*
No	138	22	84.62	88	78.57	28	73.68
Yes	38	4	15.38	24	21.43	10	26.32
	176	26		112		38	

irregular timing, both early and late eruption, was mostly seen in girls rather than boys. In view of the significant number of late eruptions seen in girls (65.8%), these findings partly reflect the results of investigators indicating that boys showed earlier tooth emergence than girls.

The findings in this study regarding the relationship between gestational period, birth and eruption times are consistent with the findings of other investigators who indicated that preterm children and children with low birth weight showed significant delays in many areas of physical growth and development in early childhood (Haddad and Correa, 2005; Seow *et al.,* 1988; Trupkin 1974). Catch-up growth in later childhood or, in some cases, long-term delays into adolescence have been reported. Golden *et al*. (1981), Seow *et al*. (1988), and Trupkin (1974) have determined that oral structures and the eruption process in primary and permanent dentitions have been affected for preterm and low birth weight children. They stated that delays in the eruption of the primary dentition and in growth of the permanent dentition had been observed in those children. Seow (1997) has shown that after 18 months of age (i.e. by 18 to 23 months of age and 24 months of age and beyond), no significant differences in three birthweight groups regarding delayed eruption was observed since catch-up development had occurred. The results of this study were confirmed by the data from other studies, which indicated that the teething age was delayed in preterm and low-birth children in early childhood; those findings confirm that the complications of prematurity and nutritional factors during the neonatal period contribute to the delayed eruption of the first primary tooth (Golden *et al*., 1981; Hadad and Correa, 2005).

No significant differences in eruption times were recorded in infants whose mothers experienced illness in the first trimester versus infants whose mothers did not; and infants have shown no significant differences in eruption times as related to smoking and the use of caffeine during pregnancy.

On the basis of these data, the timing of tooth eruption in infants can be affected by developmental problems, gestational age, and low birth weight, and the severity of the neonatal factors have an important role in the timing of primary tooth eruption. Further studies are required for the comprehensive assessment of the effects of both neonatal and postnatal factors on the timing of primary tooth emergence.

Conclusion

This study assessed the eruption time of the first primary tooth in Turkish infants and the effects of neonatal factors on the timing of the primary tooth eruption. Eruption time for girls and boys were determined to be 7.25 ± 2.47 months of age and 7.07 ± 1.66 months of age, respectively; no significant difference was found in the total mean eruption times between boys and girls. Irregularities in eruption times were observed mostly in girls. A significant relationship has been found between the gestational age, birth weight of infants, and primary tooth emergence. Infants with a gestational age of less than 37 weeks and infants with a birth weight lower than 2500g demonstrated significant delayed eruption of the first primary tooth. No significant differences were determined in eruption times as related to other neonatal factors.

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