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Original Research Article

An observational study of dental abnormalities in the primary teeth

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Abstract

Introduction: Pregnancy and early childhood are the most critical phases with regard to biological, cognitive, emotional, and social development. Adverse events in these periods of life may be related to alterations in dental development, including alterations in size, shape and mineralization. **Objective:** To evaluate the frequency of dental abnormalities and the factors associated with the developmental defects of the enamel in primary teeth. **Material and methods:** Information about family income, maternal education level, preterm birth, and hospitalization history up to 11 months of age were collected from the dental records of 544 children. Clinical examination of the children was performed to investigate abnormalities of tooth number, form, size, and developmental defects of the enamel (DDE). Data were analyzed using χ^2 test and Poisson regression. **Results:** In all, 544 children were evaluated. Sixty children (11.0%) presented some alterations in the primary teeth; and 7.5% showed DDE. Children born preterm were 3.17 times more likely to develop DDE in primary teeth (prevalence ratio – PR = 3.17, 95% confidence interval – 95%CI 1.26–7.98, p = 0.014). Among the alterations of number, 1.7% was hypodontia, and among the abnormalities of shape, 1.7% was fused teeth. **Conclusion:** The prevalence of dental anomalies in this sample was, in general, expressive. Children born preterm were more vulnerable to present developmental defects of the enamel.

Introduction

Pregnancy and early childhood are the most critical phases with regard to biological, cognitive, emotional, and social development [1]. Adverse events in these periods of life may be related to alterations in dental development. Mineralization of the primary teeth starts in the gestational period and is completed by approximately 12 months after birth [2]. Since the primary teeth are formed during the intra- and extra-uterine life (up till 1 year of age), they can serve as markers for adverse events occurring during mineralization, such as developmental defects of the enamel (DDE) [3].

The developmental abnormalities of the teeth usually reflect the stage of development in which the malformation occurred [4]. Disruptions in tooth initiation result in hypodontia or hyperdontia, whereas disruption during the morphodifferentiation stage leads to alterations of size and shape [5]. Moreover, disruptions during the stages of histodifferentiation, apposition, and mineralization result in development defects of the enamel (DDE) [6, 7].

Abnormalities in the primary dentition frequently lead to problems related to oral and general health. About oral health, dental abnormalities lead to orthodontic and esthetic problems have been described as predisposing factors for dental caries [8-11]. Referring to general health, children with tooth abnormalities may experience anxiety and difficulty in social interaction, since the impact of dental aesthetics reflects on their quality of life [12]. In addition, a close correlation between dental anomalies in the primary and permanent dentition has been also reported [9, 10, 13].

Prematurity and low birth weight, intensive care due to health complications after birth, physiological immaturity, and infectious diseases could affect ameloblastic function during tooth development and lead to DDE [2, 14, 15]. Moreover, early identification of tooth alterations, followed by intervention at the appropriate time, could minimize the need of complex treatments in future [16]. However, most studies on tooth abnormalities are case reports, making it difficult to estimate the exact prevalence of tooth abnormalities in the primary dentition [17-19]. A large variation in prevalence of tooth abnormalities is found in the literature [11, 16, 20, 21], but the data are still inconsistent.

The purpose of this study was to evaluate the frequency of tooth abnormalities and factors associated in the primary teeth of children attending at the Maternal and Child Oral Health Program at a School of Dentistry in southern Brazil.

Material and methods

Study design and setting

For this observational cross-sectional study, data were obtained from the dental clinical records of a Prenatal Oral Health Program (Portuguese acronym: AOMI), a spin-off of a program that promotes oral health in infants, in which the dental treatment is also focused on the expectant mothers.

This service is connected to the Pediatric Dentistry Clinic of the Federal University of Pelotas. The clinic provides access, treatment, and follow-up assistance to mothers during pregnancy and to their children. Continuous dental care is provided from birth up to the age of 36 months.

Participants

The study population consisted of children who entered the program before completing 2 years of age and maintained compliance to the program until they were 36 months of age. Data were collected from the follow-ups of the children in the last 15 years (2000 to 2015).

Data collection

The independent variables used in this study were obtained from the dental records. Family income was recorded in terms of Brazilian minimum wage (US$ 212) and divided in tertiles. Maternal education was recorded in terms of years of study and dichotomized in ≤ 8 years (elementary education) and > 8 years (middle education or higher). Data was also recorded regarding whether the child was born before the 37th week (no/yes) and whether the child needed hospitalization before 11 months of age (no/yes).

Records of the physical and radiographic examinations of children were used to collect information about alterations in dental development. During the dental appointments of AOMI, clinical examinations were performed under artificial light using dental mirrors and dental probe. Cotton rolls and gauze were used to control moisture and remove dental plaque when necessary. Every clinical examination and dental intervention were performed by a trained team comprising an experienced dentist (specialist in pediatric dentistry), who was responsible for the examinations, an undergraduate student, and a trainee student. To standardize the procedures, calibration was performed after every six months.

Tooth abnormalities representing variations in tooth number, shape, and size were recorded according to the criteria described by Neville *et al*. [22]: hypodontia, absence of teeth; hyperdontia, presence of a supernumerary tooth; fusion, union of dentin and/or enamel between two or more separately developed normal teeth; gemination, incomplete division of a tooth germ; and microdontia, single tooth smaller than normal. The DDE modified index [23] was used for diagnosing DDE, excluding diffuse opacity, and considering only demarcated opacity, hypoplasia, or both. For specific analysis, DDE was dichotomized as present or absent. The presence of multiple alterations was recorded to assess the individual frequency of each alteration.

Statistical analysis

Independent double entry verification was performed to ensure the accuracy of dates. The software Stata version 12.0 was used for the analyses. Descriptive analysis was performed to assess the frequency of dental alterations and sex, and χ^2 test was used to evaluate dental alterations (dichotomized as present or absent) and independent variables. Moreover, χ^2 test and multivariable analysis by Poisson regression with robust variance were performed for DDE, to estimate the prevalence ratio (PR) and 95% confidence interval (95%CI). All variables that did not present empty cells in the bivariate analysis were tested in the crude analysis. All variables that presented $p < 0.20$ in the crude analysis were included in the adjusted multivariable analysis.

Ethics aspects

This study was approved by the Research Ethics Committee of the School of Dentistry, Federal University of Pelotas, Brazil (protocol number 57/2013). All mothers provided written informed consent before participating in the study.

Results

Out of 544 children, 60 (11.0%) had some alterations in the primary teeth. Table I exhibits the percentage and observations on the different development changes tooth found. Analyzing tooth abnormalities separately, alterations of number showed prevalence of 2.1% (11). Most of the cases presented hypodontia (1.7%; 9). Among the abnormalities of shape, the prevalence of fused teeth was 1.7% (9), while, among abnormalities of size, microdontia had prevalence of 0.4% (2). The prevalence of DDE was 7.5% (40) in total sample, representing 66.7% of dental abnormalities. Figure 1 indicates the frequency and distribution of DDE according to tooth type. The maxillary central incisors were the most affected teeth. A total of 14 maxillary right central incisors and 18 maxillary left central incisors presented DDE, followed by maxillary right lateral incisor (6) and maxillary left lateral incisor (11). In the lower arch, the right central incisor (9) and the left central incisor (7) were the most affected teeth.

Table I – Percentage and observations of the different development changes tooth found in children assisted at an Oral Health Public Program, Pelotas, Brazil, 2016 (n = 60)

Tooth abnormalities	Male	Female	%
Hypodontia	2	7*	1.7%
Hyperdontia	1	1	0.4%
Fusion (double teeth)	5	4	1.7%
Microdontia	-	2	0.4%
Opacity demarked	11	5	2.9%
Hypoplasia	9	12	3.9%
Hypoplasia and opacity demarked	-	3	0.6%

* Two children with hypodontia and other changes (62 cases of 60 children).

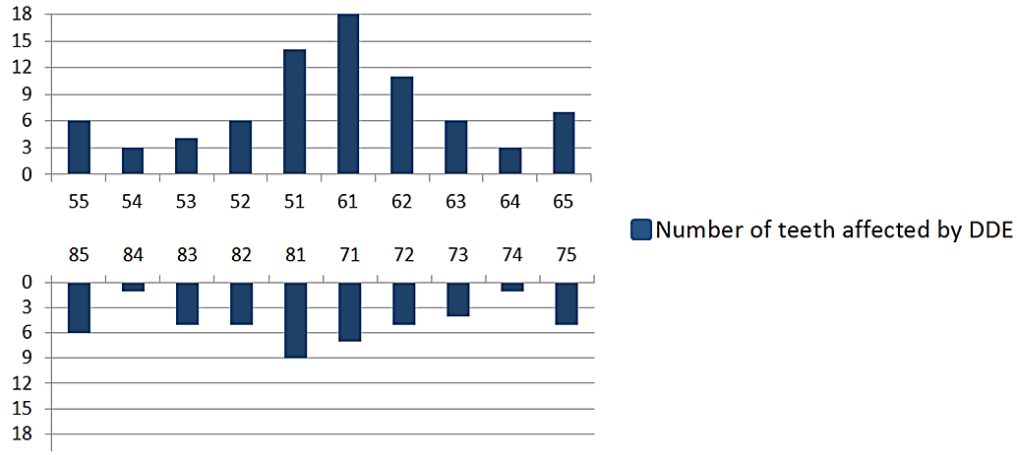

Figure 1 – Frequency of developmental defects of the enamel (DDE) according to tooth type

Table II shows the sample distribution, crude, and adjusted analysis between DDE and independent variables. There is an association between the presence of DDE and preterm birth (p = 0.001), as well as the occurrence of hospitalization before 11 months of age (p = 0.04). The crude analysis indicates that children born preterm and those who required hospitalization before 11 months of age were more likely to develop DDE in primary teeth. The adjusted analysis demonstrates that children born preterm were 3.17 times more likely to develop DDE in the primary teeth (PR = 3.17, 95%CI 1.26–7.98, p = 0.014).

Table II – Sample distribution, crude (c) and adjusted (a) analysis between developmental defects of the enamel (DDE) and independent variables, Pelotas, Brazil, 2016 (n=544)

Variable	DDE Present			ORc 95%CI			ORa 95%CI		
	n	(%)	p**			p			p
Sex			0.856			0.856	-		
Male (279)	20	(7.2)		1					
Female (265)	20	(7.6)		1.00	(0.96–1.05)				
Family income#			0.710			0.562	-		
2.6–22 MW (160)	11	(6.9)		1					
1.6–2.5 MW (160)	12	(7.5)		1.47	(0.58–3.70)				
0.5–1.5 MW (153)	8	(5.2)		1.34	(0.52–3.42)				
Maternal education#			0.460			0.460	-		
≤ 8 years (204)	13	(6.4)		1					
> 8 years (308)	25	(8.1)		1.30	(0.65–2.60)				
Preterm birth			0.001*			0.002*			0.014*
No (505)	32	(6.3)		1	(1.62–8.97)		1		
Yes (39)	8	(20.5)		3.81			3.17	(1.26–7.98)	
Hospitalization before 11 months#			0.040*			0.005*			
No (445)	29	(6.4)		1			1		0.280
Yes (83)	11	(12.5)		2.10	(1.01–4.39)		1.56	(0.70–3.47)	

OR: odds ratio; 95% CI: 95% confidence interval; ** χ^2 test; # missing data; -variables with p > 0.2; * statistically significant differences

Discussion

This study investigated the frequency of tooth alterations and associated factors in primary teeth of children less than 36 months of age. Few studies have investigated the frequency of dental alterations in primary dentition in this age group. The prevalence reported in the literature ranges from 1.4 to 7.2% [11, 16, 20, 21]. This high variation in the rate of dental alterations is likely due to some demographic factors, population characteristics, and methodological variations [21]. It is relevant to note that most studies do not include DDE as a dental alteration and consider it separately [15, 24, 25]. In addition, population-based studies do not make use of radiographic images to support the diagnosis [20, 21], overestimating or underestimating its prevalence.

In the present study, the abnormalities of number were present in 2.1% of the cases, and hypodontia was the most prevalent alteration (1.7%). Similar prevalence was found in a study conducted in Japan, which reported a 2.5% prevalence among 3-year-old children [11]. Other studies report range of prevalence of abnormalities from 0.5 to 0.9% [16, 20, 21]. The high prevalence found in this study can be explained by the composition of the sample, which comprised children participating in an oral health program. It is noteworthy that the children often sought dental care due to the presence of these dental alterations, especially in cases of oligodontia, which represents 0.8% of the cases. Oligodontia may lead to complex problems that affect tooth function, and may have negative impact on the child's quality of life [26].

In this study, fusion (double teeth) showed prevalence of 1.7%. This value is similar to the one found in other studies, which reported prevalence of 1.3% in children aged 2–5 years old [20, 21]. All cases of double teeth recorded in the present study were in the maxillary region, corroborating another Brazilian study [21]. The percentage of microdontia found in this study was 0.4%, which is consistent with previous reports of values ranging between 0.3 to 0.6% [16, 20, 21].

The prevalence of DDE found in the present study was lower than those ones reported in previous cross-sectional studies, which ranged between 24.4 and 33.3% [15, 24, 25]. However, slightly lesser prevalence (5.3%) of DDE (including diffuse opacities) was reported by a similar birth cohort study on a sample of German children aged 3, who were followed-up by an oral health program [27]. It should be noted that the diffuse opacities, although registered in some dental records, were not included in this study due to the difficulty of standardization of clinical examinations and the observational characteristic of this study.

Evaluating specifically for DDE, this study showed that children with a history of preterm birth have a significantly higher frequency of this defect compared to children without preterm birth. These findings corroborate several other studies showing that preterm birth is a predisposing factor for DDE [2, 12, 14, 25]. Amelogenesis in primary teeth starts in the 15th gestational week and is completed by approximately 12 months after birth, with the formation of the second primary molar [2].

Children born preterm can be affected by many adverse systemic conditions, such as calcium deficiency, cardiovascular defects, gastrointestinal disturbances, infections, anemia, respiratory diseases, orotracheal intubation, and ventilation, which are predisposing factors for DDE [2, 12, 14, 25]. The oxygen deprivation may affect ameloblastic function during tooth development [28]. Immature metabolic and mineralization systems, deficient vitamin D metabolism, inadequate mineral levels, and the inability of the gastrointestinal tract to absorb in children born preterm are other important contributors to the defective formation of the dental enamel [29].

In the crude analysis, the need of hospitalization before 11 months also showed significant association with DDE. However, in the multivariate analysis, it lost this association, probably due to the interaction with preterm birth. It is important to highlight that a recent German study found association between the need for hospitalization before 1 year of age and the development of DDE [27]. Hospitalization usually requires laryngoscopy and endotracheal intubation, both of which can cause local trauma, increasing the risk of DDE [2].

A relationship between social factors and DDE has been also suggested. However, this study did not find association between low family income and the presence of DDE, corroborating a Germany study [27]. Social and economic inequities are the main predictive factors for risk behaviors like lack of care during pregnancy and under-nutrition among children, both of which increase the risk of infectious diseases [26, 30]. Nevertheless, it is most probably that nutritional disturbances during the neonatal period cause enamel defects in the primary teeth [30].

Thus, it can be said that social inequalities may have an important impact on the quality of life, affecting both general health and tooth formation in children. Moreover, the literature shows that

socioeconomic factors act as negative confounders and attenuate the association between maternal age of pregnancy and preterm birth [31]. This can be explained by the fact that mothers with better socioeconomic status tend to have children at older ages due to commitment with jobs, and at older ages women are more likely to have problems during pregnancy, leading to premature birth.

The defects were more common in the maxillary central incisors, followed by the maxillary lateral incisors. These results are supported by the findings of previous studies [15]. Site-specific factors such as the slower calcification of the primary teeth in the maxilla as compared to the mandible can be the cause of the greater prevalence of these defects in the maxillary teeth [32].

This study has a few limitations. First, it was limited to a relatively small geographic location and to the children who participated in AOMI. Consequently, the findings were restricted to this population group. Some important highlights of this study were close examinations of each child, use of radiographic investigations for differential diagnosis, and routine monitoring of the patients, with return visits booked according to the individual's needs. Another point of this study is that the monitoring can prevent sequelae of dental alterations, such as the risk of caries development related to the presence of DDE. Nevertheless, the early identification of dental anomalies in the anterior region is of great relevance for esthetic and orthodontic treatment planning. Studies have provided useful information regarding the prevalence, location, and distribution of anomalies of the primary teeth, contributing to the formulation of public health policies adequately informed by the specificities of each population [20].

Thus, early diagnosis of dental alterations is of great interest for treatment planning and reestablishment of oral health in children. Understanding the process of development and the etiological factors is also significant in view of discussing the oral condition, including the etiology and the possible treatment, with the patients and their families. Our data shows the importance of encouraging parents to plan early dental visits for their children. We also highlight the need for a detailed and careful clinical examination by the dentist. All these factors have long-term benefits, according to the individual's requirements.

Conclusion

The prevalence of dental anomalies in this sample was, in general, expressive. There were several cases of dental fusion and hypodontia, which affect the oral functions the most, among developmental anomalies of the teeth. This reinforces the importance of the professional's preparedness to diagnose anomalies. DDE also had high prevalence, *i.e.*, children born preterm are more vulnerable to present this enamel defects.

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