DOI: 10.1111/j.1365-263X.2008.00918.x

Dental anomalies and associated factors in 2- to 5-year-old Brazilian children

PAULO FLORIANI KRAMER, CARLOS ALBERTO FELDENS, SIMONE HELENA FERREIRA, MÔNICA HERMANN SPIGUEL & ELIANE GERSON FELDENS

Department of Paediatric Dentistry, Lutheran University of Brazil, Canoas, Brazil

International Journal of Paediatric Dentistry 2008; 18: 434–440

Background. Dental anomalies in primary teeth may lead to functional and aesthetic disorders, and their recognition contributes to early diagnosis and long-term treatment planning.

Objective. This study investigated the prevalence of dental anomalies in primary dentition and associated factors in Brazilian preschoolers.

Methods. The study population of this cross-sectional study comprised 1260 2- to 5-year-old children from public nurseries in Canoas, southern Brazil. Dental anomalies were recorded by five trained examiners according to Kreiborg criteria; classification included double teeth, hypodontia, supernumerary, and microdontia.

Results. Dental anomalies as a group were found in 2.5% of children, although no significant difference occurred between genders and races. All the anomalies were observed in the anterior region, with no significant differences between the arches. However, supernumerary teeth were significantly more frequent among the non-white racial group (Fisher; $P = 0.025$) and double teeth on the lower arch (McNemar; $P = 0.020$). Individual anomaly frequencies were: double teeth, 1.3%; hypodontia, 0.6%; supernumerary, 0.3%; and microdontia, 0.3%.

Conclusions. The frequency of primary dentition anomalies as a group was greater than that reported in other populations; the findings of this study provide a clear vision of the distribution of this oral condition and may well contribute to early detection and treatment planning.

Introduction

Dental anomalies in primary dentition are frequently observed during routine dental examination, leading to orthodontic problems, including spacing or crowding of teeth, loss of arch length, deviation of the midline, increased caries risk, and esthetic problems in preschool children[1–9]. Moreover, a close correlation has been reported between dental anomalies in the primary and permanent dentition[2,4,6,8,9]. Although variations have been described in several studies, in more than 50% of these cases, a marked effect occurs on the permanent successors and the developing occlusion[4–8].

Correspondence to:
Carlos Alberto Feldens, Rua João Telles 185/1301, Pôrto Alegre, Brazil RS 90 035 121, Brazil. E-mail: cafeldens@terra.com.br

A composite picture of the magnitude of dental anomalies in primary dentition has been difficult to formulate, because most published articles are case reports[2,6,10–12]. Only a few frequency studies have been published and considerable variation exists in their findings, with prevalence ranging from 0.5% to 7%. This may reflect not only differences in study methodologies, but variations in demographic and environmental susceptibilities[9,13,14].

Dental anomalies in the primary dentition are conditions that should be taken into account when considering the need for oral health care in young children[15]. Early diagnosis should allow for more comprehensive long-term treatment planning, more favourable prognosis and, in certain instances, less extensive interception[3–5]. Furthermore, knowledge of the prevalence of dental anomalies is also of interest to anthropologists, geneticists, and others concerned with comparisons among different

ethnic groups[3–16]. Race has been used extensively in the medical and public health literature to measure social differences in health outcomes and treatment, and its use has increased in recent decades[17,18].

The purpose of this study was to evaluate the prevalence of dental anomalies (supernumerary, hypodontia, double teeth, and microdontia) and associated factors in the primary dentition of children aged 2–5 years old attending government nurseries in an urban centre in southern Brazil.

Methods

This cross-sectional study comprised 1260 preschool children aged 2–5 years old attending the 28 nurseries maintained by the municipal government of Canoas, in the state of Rio Grande do Sul, southern Brazil. The city of Canoas has an approximate population of 300 000, and all households have access to public water supply (fluoride level: 0.8 p.p.m). Children attending public nurseries in this region are usually from low socioeconomic backgrounds.

This study is part of a larger study which evaluated caries, gingivitis, and traumatic dental injuries. Children with systemic disease and chronic use of medication were excluded. Full details of the methodology were published previously[19,20].

Research assessment questionnaires

A questionnaire assessing demographic data (age, gender, race) and general health conditions was completed by the parents. In relation to race, this study used the classification 'white' and 'non-white'[17]. Trained researchers were available to provide assistance to parents who were unable to read or write.

Clinical dental examination

Collection of the clinical data was realized in the nurseries by five dental surgeons specially trained in evaluating primary dentition anomalies. The examinations were carried out with the children lying on ordinary desks. First, the teeth were cleaned and dried with gauze. The clinical examination was exclusively visual, aided by a tongue depressor. Children with permanent teeth were excluded from the analysis. Dental anomalies were recorded according to the criteria described by Kreiborg *et al.*[21]: (i) fusion: union in dentine and/or enamel between two or more separately developed normal teeth; (ii) gemination: incomplete division of a tooth germ; (iii) hypodontia: absence of one or more teeth; (iv) supernumerary: presence of an extra tooth; and (v) microdontia: a single tooth smaller than normal. Because of the difficulty in distinguishing fusion and gemination, both were grouped under the term 'double teeth', as suggested by Carvalho *et al.*[22] To avoid misclassification in relation to hypodontia (false positive), the possibility of premature loss because of traumatic dental injury or dental caries, and physiological mobility of the homologous teeth were taken into account.

Statistical analysis

The data obtained were described in relation to each anomaly and as a whole, by means of simple frequencies and percentages. To quantify the association between gender, age, race, and the presence of concurrent anomalies, the prevalence ratios (PRs) and 95% confidence interval (95% CI) were calculated. To verify whether differences occurred between the arches in relation to the presence of anomalies, the McNemar test was realized, and to compare gender and race categories in relation to the occurrence of each anomaly, the chi-squared or Fisher exact tests were used, depending on the frequencies observed. A significance level of $P < 0.05$ was adopted. To allow for comparison between the results obtained in other populations, the results of the present and previous studies were summarized in Table 1.

Ethical aspects

This study was approved by the Ethics in Research Committee of Lutheran University of Brazil, Canoas, Brazil. The procedures, possible discomforts, and risks were fully explained to the children and their parents or guardians, and written consent was obtained prior to investigation.

Table 1. Prevalence surveys of dental anomalies in primary dentition in different countries.

Study	Country	Sample size	Prevalence of dental anomalies			
			Supernumerary teeth (%)	Hypodontia (%)	Double teeth (%)	Microdontia (%)
Menczer, 1955[1]	USA	2209	0.2	0.1	0.1	–
Clayton, 1956[10]	USA	1795	1.8	4.6	0.8	0.2
Grahnen and Granath, 1961[23]	Sweden	1173	0.3	0.4	0.5	–
Ravn, 1971[2]	Denmark	4564	0.6	0.6	0.9	–
Brook, 1974[3]*	England	741	0.8	0.3	1.6	0.5
Magnusson, 1984[16]*	Iceland	572	0.5	0.5	0.7	–
Jones *et al*., 1993[24]	USA	493	0.2	0.0	0.4	–
Whittington and Durward, 1996[4]*	New Zealand	1680	0.2	0.4	0.8	–
Yonezu *et al*., 1997[5]	Japan	2733	0.1	2.4	4.1	0.6
Carvalho *et al*., 1998[22]*	Belgium	750	0.8	0.4	0.6	0.1
This study*	Brazil	1260	0.3	0.6	1.3	0.3

*Studies undertaken with population samples; in the remaining studies, the samples were recruited in clinical services.

Table 2. Prevalence ratio (PR) and 95% confidence intervals (95% CI) for associations between demographic variables and dental anomalies.

Variable	*N* (%)	With anomalies *n* (%)	PR (95% CI)	*P**
Gender				0.952
Male	676 (53.7)	17 (2.5)	1.00	
Female	584 (46.3)	15 (2.6)	1.02 (0.51–2.03)	
Age (years)				0.687
2	269 (21.3)	6 (2.2)	1.00	
3	340 (27.0)	8 (2.4)	1.05 (0.37–3.00)	
4	355 (28.2)	12 (3.4)	1.52 (0.58–3.99)	
5	296 (23.5)	6 (2.0)	0.91 (0.30–2.78)	
Race				0.436
White	1013 (80.4)	24 (2.4)	1.00	
Non-white	247 (19.6)	8 (3.2)	1.37 (0.62–3.01)	

N, number of children examined; *n*, number of children with dental anomalies.
**P* value: chi-squared test.

Results

The results on sample distribution and prevalence of dental anomalies according to gender, age, and race are presented in Table 2. Anomalies were observed in 32 children, representing an overall prevalence of 2.5%. Anomaly frequencies among the genders were 2.5% ($n = 17$) for boys and 2.6% ($n = 15$) for girls, showing no statistical difference (PR = 1.02; 95% CI = 0.51–2.03). In relation to anomaly frequencies at different ages, no difference was found between the frequencies observed: ($P = 0.687$) 2.2% at 2 years old, 2.4% at 3 years old, 3.4% at 4 years old, and 2.0% at 5 years old. Although anomaly prevalence was greater in the non-white racial group (3.2%) than among the white group (2.4%), this difference was not statistically significant (PR = 1.37; 95% CI = 0.62–3.01).

Distribution of the children according to location of the anomalies as a whole, demonstrated that 11 children presented anomalies exclusively on the upper arch, 20 presented exclusively on the lower arch, and one child presented anomalies on both arches. Analysis of these observations showed that no statistically significant difference occurred between the arches (McNemar; $P = 0.150$). In relation to dental segment, all the anomalies were observed in the anterior region.

Table 3 presents the distribution of children for each individual anomaly according to

Table 3. Dental anomalies distribution according to gender, race (unit of analysis: children), and dental arch (unit of analysis: teeth).

Unit of analysis and variables	*N*	Double teeth *n* (%)	Hypodontia *n* (%)	Supernumerary *n* (%)	Microdontia *n* (%)
Children: overall	**1260**	**16 (1.3)**	**8 (0.6)**	**4 (0.3)**	**4 (0.3)**
Gender					
Male	676	8 (1.2)	4 (0.6)	3 (0.4)	2 (0.3)
Female	584	8 (1.4)	4 (0.7)	1 (0.2)	2 (0.3)
Race					
White	1013	12 (1.2)	7 (0.7)	1 (0.1)	4 (0.4)
Non-white	247	4 (1.6)	1 (0.4)	3 (1.2)*	0 (0.0)
Teeth		**16**	**14**	**4**	**6**
Arch					
Upper		3	5	3	5
Lower		13†	9	1	1

N, number of children examined; *n*, number of children or teeth with dental anomalies.
*Fisher exact test: $P = 0.025$.
†McNemar test: $P = 0.020$.

gender, race, and location on the upper or lower arch. Sixteen children presented double teeth (1.3%); eight children presented hypodontia (0.6%), with six presenting unilateral hypodontia and two presenting bilateral hypodontia (total = 14 teeth: five upper lateral incisors, seven lower lateral incisors, and two central incisors); four presented supernumerary teeth (0.3%); and four children presented microdontia, two children presenting unilateral microdontia and two presenting bilateral microdontia (total = 6 teeth: five upper canines and one lower canine). The low frequencies observed make it difficult to describe statistical inferences regarding these data. A similar distribution was observed between genders and racial groups, with the exception of the occurrence of supernumerary teeth, which was significantly greater in the non-white group ($P = 0.025$). None of the non-white children presented microdontia, making it impossible to compare these frequencies. Regarding anomaly distribution according to location, verification revealed a statistically significant difference only in relation to double teeth ($P = 0.02$), with predominance of the lower arch (13 of 16) over the upper arch (3 of 16).

Discussion

The prevalence of dental anomalies observed in this study (2.5%) was greater than that reported by Menczer[1], Grahnen and Granath[23], Ravn[2], Magnusson[16], Jones *et al.*[24], Whittington and Durward[4], and Carvalho *et al.*[22], which varied between 0.4% and 2.1%. The frequencies reported by Clayton (7.4%)[10], Yonezu *et al.* (7.2%)[5], and Brook (3.2%)[3], however, were greater than the total observed in the present work. Despite that these results may be reflecting racial characteristics, the differences should be interpreted in accordance with the methodology used. Studies by Clayton[10] and Yonezu *et al.*[5], which reported a high proportion of children with dental anomalies, were undertaken in children who attended clinical services. This fact could have led to the overestimation of outcomes in relation to the general population.

Knowledge regarding the most prevalent location of anomalies in primary dentition could assist early diagnosis, which is important for the prevention of complications and the improvement of long-term prognoses[4,16]. The findings of this study confirm previous works, in which the anomalies only affected incisors and canines, and were located exclusively in the anterior segment[1–5,16,22–24]. These data demonstrate the importance of studying anomalies in primary dentition, given their aesthetic and psychological implications and consequent increased demands for treatment.

The observation that gender and anomalies were not associated, both for the overall

frequency and the individual anomalies, confirms the majority of previously published works[2–4,6,16] and demonstrates that gender does not constitute a risk factor for anomaly occurrence in primary teeth. The exception is one study that found a greater prevalence for double teeth among boys: Yonezu *et al.*[5]: 4.9% vs. 3.3%. Although the difference was not significant, boys showed higher prevalence of supernumerary in this study (0.4% vs. 0.2%). In the permanent dentition, Brook found that males more often presented supernumerary teeth and females more frequently presented hypodontia, and these differences were statistically significant[25].

In this population, there was no increase with age in the frequency of dental anomalies, as observed with dental caries[20]. Similar probabilities for anomalies at different ages of primary dentition have been observed previously[2,4,12,16,23] and demonstrate that diagnosis can be realized at a younger age, from 2 years old onwards.

Previous studies have suggested the possibility that race is a factor associated with the occurrence of anomalies in primary dentition[3,4,6,16,23,24]. In contrast, the findings of this study show that, with the exception of a greater prevalence for supernumerary teeth observed in the non-white group, no significant differences occurred between racial groups. Because the non-white individuals represent miscegenation between different races, no specific group was identified as presenting a greater risk of the occurrence of anomalies in this study. These results should be analysed, however, in the context within which the study was realized. It is generally recommended that self-assessment is the appropriate way to inquire about race[17]. However, there is a considerable variation across countries about definitions of racial categories. Brazilian activists argue in favour of using the dichotomous 'black'/'white' classification[17]. Lovell and Wood[18] used this procedure, justifying their choice by the fact that the category 'non-white' is more stable over time than 'pardo' and 'black', and that the category 'white' shows greater reliability. In Latin American countries, miscegenation constitutes part of the social and populational characteristics[17,18]. It is possible that different ethnic groups, not represented in the population studied here, present greater risks.

Primary dentition anomalies should also be described individually, because they are associated with distinct sequelae in permanent dentition. Analysis of the frequency and location of each anomaly demonstrated consistency with data from previous studies. The anomaly presenting greatest prevalence in this study was double teeth (1.3%), a previously reported predominance[3,5,16,23,24]. Although it has been suggested, this is the first study to detect a statistically significant preferential location for double teeth in the lower arch. The unilateral occurrence of this anomaly and its presence in the lateral incisor region coincide with the majority of previous studies[1,2,4,5,24].

Hypodontia, supernumerary, and microdontia presented values of less than 1%, similar to previously published works[1,3,4,16,22–24]. Frequencies above 1% have only been reported by Clayton (1956) among American children (hypodontia, 4.6%; supernumerary, 1.8%) and Yonezu *et al.* among Japanese children (hypodontia, 2.4%). Hypodontia was almost exclusively observed affecting the lateral incisors unilaterally, as found in previous studies[2,4,8,23,26]. Children with hypodontia in the primary dentition present corresponding missing permanent teeth[2,4,24], indicating the importance of early diagnosis with regard to adequate medium and long-term treatment planning.

Supernumerary teeth, defined as teeth additional to those of the normal series, have been reported as most prevalent in the maxillary anterior region, the lateral incisor being most frequently involved[2,6,8,23,26,27]. Data from this study further confirm the preferential location of this anomaly, but low frequencies made comparison between the arches difficult. Although considerable variation is reported in specific studies, between a third and two-thirds of children presenting supernumerary primary teeth, present the same condition in the permanent dentition[2,4,23].

Microdontia is an anomaly characterized by a marked reduction in crown diameter. The findings of this study confirm the low prevalence suggested by other studies, between 0.1% and 0.6%[3,5,10,22]. The occurrence of microdontia in canines has been previously

described[5], although not exclusively, as found in the present work. Only limited information exists regarding the occurrence of microdontia in primary dentition. In part, this is because of the fact that its diagnosis is based on the evaluation of crown size, which is a more subjective criteria and subject to error, in relation to the diagnosis of other anomalies.

Some methodological aspects of the study concerning anomalies in primary dentition that could challenge researchers should be highlighted. An exclusively visual examination is not the 'gold standard' for detecting anomalies. The subregistration of cases (false negatives), however, could only have occurred in relation to unerupted supernumerary teeth, a condition known to be rare in primary dentition[16,23]. Another aspect that should be considered is the validity of inference for the source population of study subjects. In this study, subjects were representative of the population, because the children were recruited from public nurseries. Because of the aesthetic repercussions of dental anomalies, data collection in clinical services could determine over-registration of cases, and this would probably represent a selection bias[28].

Finally, the detection of anomalies whose prevalences present frequencies close to 1% demands larger population samples in relation to studies traditionally performed in dentistry, such as caries and traumatic dental injuries. Given this fact, the possibility of random error increases significantly in population samples of less than 1000 children; this partially justifies the lower anomaly frequencies described in other studies.

Epidemiological studies have provided useful information regarding the prevalence, location, and distribution of primary tooth anomalies, contributing to the formulation of public health policies adequately informed by the specificities of each population. The current data support findings concerning the prevalence of dental anomalies in primary dentition, and emphasize the importance of encouraging parents to visit the dentist with their child at an early age. It also illustrates the need for a detailed and careful clinical examination by the dentist. This will permit effective, long-term treatment planning, according to the child's individual requirements.

What this paper adds

- There are few studies concerning dental anomalies in primary dentition with a large sample size.
- This paper provides a clearer picture of dental anomalies in preschool children to paediatric dentists, including the prevalence of supernumerary, hypodontia, double teeth, and microdontia.
- This confirms a wide variation in dental anomalies frequencies between different populations and races; this knowledge is also of interest to anthropologists, geneticists, and others concerned with comparisons among different ethnic groups.

Why this paper is important to paediatric dentists

- This paper helps paediatric dentists in clinical practice, contributing to current understanding of dental anomalies and their distribution according to age, gender, race, arch, and segment.
- These findings could contribute to early diagnosis, and long-term treatment planning, with the aim of diminishing functional and aesthetic disorders resulting from primary dentition anomalies.

References

1 Menczer LF. Anomalies of the primary dentition. *J Dent Child* 1955; **22**: 57–62.

2 Ravn JJ. Aplasia, supernumerary teeth and fused teeth in the primary dentition. An epidemiologic study. *Scand J Dent Res* 1971; **79**: 1–6.

3 Brook AH. Dental anomalies of number, form and size: their prevalence in British schoolchildren. *J Int Assoc Dent Child* 1974; **5**: 37–53.

4 Whittington BR, Durward CS. Survey of anomalies in primary teeth and their correlation with the permanent dentition. *N Z Dent J* 1996; **92**: 4–8.

5 Yonezu T, Hayashi Y, Sasaki J, Machida Y. Prevalence of congenital dental anomalies of the deciduous dentition in Japanese children. *Bull Tokyo Dent Coll* 1997; **38**: 27–32.

6 Hagman FT. Anomalies of form and number, fused primary teeth, a correlation of the dentitions. *ASDC J Dent Child* 1988; **55**: 359–361.

7 Buenviaje TM, Rapp R. Dental anomalies in children: a clinical and radiographic survey. *ASDC J Dent Child* 1984; **51**: 42–46.

8 Gellin MF. The distribution of anomalies of primary anterior teeth and their effect on the permanent successors. *Dent Clin North Am* 1984; **28**: 69–80.

9 Yuen SW, Chan JC, Wei SH. Double primary teeth and their relationship with the permanent successors. A radiographic study of 376 cases. *Pediatr Dent* 1987; **9**: 42–48.

10 Clayton JM. Congenital dental anomalies occurring in 3557 children. *ASDC J Dent Child* 1956; **23**: 206–208.

11 Levitas TC. Gemination, fusion, twinning and concrescences. *ASDC J Dent Child* 1965; **32**: 93–100.

12 Brook AH, Winter GB. Double teeth. A retrospective study of 'geminated' and 'fused' teeth in children. *Br Dent J* 1970; **129**: 123–130.
13 Duncan WK, Helpin ML. Bilateral fusion and gemination: a literature analysis and case report. *Oral Surg Oral Med Oral Pathol* 1987; **64**: 82–87.
14 Davis PJ, Darvell BW. Congenitally missing permanent mandibular incisors and their association with missing primary teeth in the southern Chinese (Hong Kong). *Community Dent Oral Epidemiol* 1993; **21**: 162–164.
15 American Academy of Pediatric Dentistry Clinical Affairs Committee; American Academy of Pediatric Dentistry Council on Clinical Affairs. Policy on third-party reimbursement for oral health care services related to congenital orofacial anomalies. *Pediatr Dent* 2005–2006; **27**(7 Reference Manual): 187–188.
16 Magnusson TE. Hypodontia, hyperdontia, and double formation of primary teeth in Iceland. *Acta Odontol Scand* 1984; **42**: 137–139.
17 Travassos C, Williams DR. The concept and measurements of race and their relationship to public health: a review focused on Brazil and the United States. *Cad Saúde Pública* 2004; **20**: 660–679.
18 Lovell PA, Wood CH. Skin color, racial identity and life chances in Brazil. *Lat Am Perspect* 1998; **25**: 90–109.
19 Feldens EG, Kramer PF, Feldens CA, Ferreira SH. Distribution of plaque and gingivitis and associated factors in 3- to 5-year-old Brazilian children. *J Dent Child* 2006; **73**: 4–10.
20 Ferreira SH, Beria JU, Kramer PF, Feldens EG, Feldens CA. Dental caries in 0- to 5-year-old Brazilian children: prevalence, severity, and associated factors. *Int J Paediatr Dent* 2007; **17**: 289–296.
21 Kreiborg S, Egemark-Erickson I, Jensen BL, Nyström M. Disturbances of occlusal development and function. In: Koch G, Modéer T, Poulsen S, Rasmussen P (eds). *Pedodontics: A Clinical Approach*. Copenhagen: Munksgaard, 1994: 275–292.
22 Carvalho JC, Vinkler F, Declerck D. Malocclusion, dental injuries and dental anomalies in the primary dentition of Belgian children. *Int J Paediatr Dent* 1998; **8**: 137–141.
23 Grahnen H, Granath LE. Numerical variations in primary dentition and their correlation with the permanent dentition. *Odontol Revy* 1961; **12**: 348–357.
24 Jones ML, Mourino AP, Bowden TA. Evaluation of occlusion, trauma and dental anomalies in African-American children of metropolitan Headstart programs. *J Clin Pediatr Dent* 1993; **18**: 51–54.
25 Brook AH. A unifying aetiological explanation for anomalies of human tooth number and size. *Arch Oral Biol* 1984; **29**: 373–378.
26 Järvinen S, Lehtinen L. Supernumerary and congenitally missing primary teeth in Finnish children. *Acta Odontol Scand* 1981; **39**: 83–86.
27 Luten JR. The prevalence of supernumerary teeth in primary and mixed dentitions. *ASDC J Dent Child* 1967; **34**: 346–353.
28 Rothman KJ, Greenland S. *Modern Epidemiology*, 2nd edn. Philadelphia: Lippincott Williams & Wilkins, 1998.