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Prevalence of oral mucosal alterations in children from 0 to 12 years old

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BACKGROUND: As the exact prevalence of oral alterations in children is still not known and the findings are controversial, other studies about this subject are necessary.
METHODS: A cross-sectional survey was carried out on 1211 Brazilian children divided in two age groups: 0–4 and 5–12 years. The patients were economically classified and data of medical history were obtained from medical records.
RESULTS: The frequency of children presenting alterations was 27.0%, and it was higher in older children. The most common lesions were geographic tongue, cheek biting, and melanotic macule. Candidiasis was associated with antibiotic therapy and use of pacifiers. Fissured tongue was associated with congenital anomalies, allergy; age from 5 to 12 years. There was a lack of association of patient's economic status and prevalence of oral mucosal alterations.
CONCLUSIONS: The frequency of mucosal alterations in children is high and increases with age, and some of them are associated with habits and medical history of the patients.
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Dental caries, periodontal diseases, craniofacial defects, and oral cancer have been considered disorders of primary concern regarding oral health (1). Studies have been conducted mainly in adults and in populations at high risk of specific lesions (2), or they have attempted to document a single condition or a few selected alterations with similar clinical appearance like recurrent aphthous ulcerations and recurrent herpes (3–5). Moreover, other authors studied only alterations of specific anatomic regions like tongue lesions (6).

Many studies report a low prevalence of oral alterations in children, but this exact prevalence remains obscure because of the lack of standardized methodology, different profiles of the population studied, and diverse diagnostic criteria (2, 7–11). Furthermore, as numerous oral mucosal alterations can be found in children, health professionals should be able to detect them for establishing the correct diagnosis and the appropriate treatment (12).

Thus, the purpose of this study was to verify the prevalence and the associated factors of alterations on the oral mucosa in children from 0 to 12 years old, who were attended by the pediatric outpatient service of the Hospital das Clínicas of Minas Gerais Federal University (UFMG).

Materials and methods

A cross-sectional survey was carried out on 1211 children from 0 to 12 years old, attended by the outpatient pediatric service of the Hospital das Clínicas of UFMG, Brazil, from both sexes, divided into two age groups: 0–4 and 5–12 years old.

The size of the sample was calculated with a standard error of 1%, 95% confidence interval level, and an expected prevalence of 4% of alterations of the oral mucosa (2). A pilot study was carried out previously to test examination procedures and questionnaires, when a prevalence of 28.2% of oral mucosal alterations was found, which was used to recalculate the sample size (13).

Oral examinations were performed on children at the outpatient service on the day of their routine pediatric/physician appointment. The patients were examined under artificial light, using disposable retractors, and universal biohazard safety procedures were observed (14). Oral examination was performed by two examiners (CFNB and MAVC), and the Kappa-statistic test presented 85% of inter-examiner agreement, after a pilot study, where 133 patients were examined.

Clinical diagnostic criteria for oral mucosal alterations, proposed by the World Health Organization (15) and by Axéll (16), and utilized by Kleinman et al. (2), were used. Visual inspection of the oral cavity was done in a sequential procedure modified from the original sequence proposed by WHO (17), as indicated in Fig. 1. Lesions caused by dental caries and endodontic and inflammatory periodontal lesions were excluded from this study. The diagnosis of alveolar and

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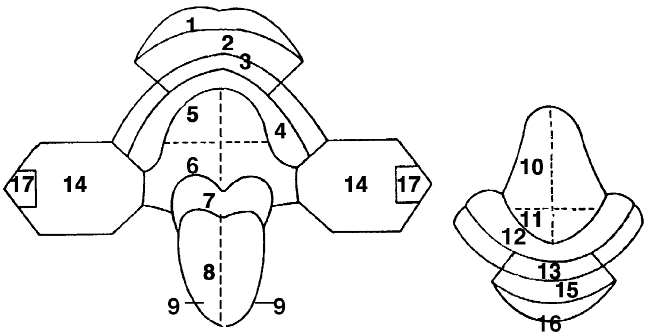

Figure 1 Sequence of clinical examination of oral mucosa. 1: upper lip (vermilion); 2: upper labial mucosa; 3: upper alveolar mucosa; 4: upper gingival/alveolar ridge; 5: hard palate; 6: soft palate; 7: oropharynx; 8: dorsum of the tongue; 9: lateral borders of the tongue; 10: ventral tongue; 11: floor of the mouth; 12: lower gingival/alveolar ridge; 13: lower alveolar mucosa; 14: right and left buccal mucosa; 15: lower labial mucosa; 16: lower lip (vermilion); 17: labial commissures.

palatal cysts in neonates was performed according to Flinck et al. (18), and gingival fibrous nodules were diagnosed according to Giunta (19). Geographic tongue was diagnosed based on Hume's criteria (20). The oral mucosal alterations identified by the examiners involved pathologic processes and variations of normality.

All clinical data were recorded in a form specially developed for this survey, and information about medical history, use of medications, and presence of oral habits were also computed. The parents of the children received information about the aim, characteristics, and the importance of the study, and their signatures were requested on a consent form. For economic classification, criteria of National Association of Business Research (ANEP) were used (21). Children who needed treatment of oral mucosal lesions were conducted to the Department of Oral Pathology, School of Dentistry of Minas Gerais Federal University.

Simple descriptive statistic was performed using Chi-square and Fisher's tests. The results were considered statistically significant when $P < 0.05$. Multiple logistic regression analysis were used to elucidate the relation between the prevalence of oral mucosal alterations, medical history of the patients, and the presence of oral habits. Four models of logistic regression were constructed based on the results of univariate analysis. All independent variables, where P-values were less than 0.25 in the univariate statistical tests, were included in the logistic regression model. The effect of each independent variable was assessed adjusting for that of all others in the model. Analysis was performed with the software Epi2000 version 1.02 developed by Centers for Disease Control and Prevention (EUA, 2000).

This study was approved by the Ethical Committee in Surveys of Minas Gerais Federal University.

Results

A total of 1211 children were examined: 571 (47.2%) boys and 640 (52.8%) girls. The children were divided in two age groups: 0–4 years old with 746 (61.6%) children and 5–12 years old with 465 (38.4%) children. Most of the children (836) examined were non-white (69%) and 375 (31%) were white. Sixty-eight per cent of parents had less than 8 years of education, 17% were analphabets, and 93% of the families received less than 812 dollars per month.

The results of this survey showed that 27% of the patients examined had oral mucosal alterations without significant differences related to sex, and there were children with two or more alterations at the same time. The frequency of children with mucosal alterations was higher in the group of children from 5 to 12 years old, and this difference was significant (Table 1).

Twenty-five different mucosal alterations were diagnosed, and the most common lesions were geographic tongue, cheek biting, and melanotic macule. Table 2 shows the alterations found and the prevalence findings by age and sex groups. Geographic tongue, pseudomembranous candidiasis, and alveolar cyst were more prevalent in children from 0 to 4 years old, while melanotic macule, fissured tongue, and recurrent herpes were more frequent in older children. These differences were statistically significant ($P < 0.05$).

In this study, cheek biting was diagnosed when erosions, petechias, or ulcerations of 1–3 mm were seen on the buccal mucosa near occlusal plane, unilaterally or bilaterally, in close relationship to the etiological agent. There were no statistical differences between age or sex groups among the 74 cases observed. Morsicatio buccarrum, which is a similar lesion, can occur in the same anatomic site as a consequence of the habit of chewing, biting, and sucking the cheeks. It appears clinically as macerated gray-white lesion of the buccal mucosa with small loose tags or fragments of epithelium on this surface. This lesion was observed only in two

Table 1 Frequency of children presenting oral mucosal alterations, according to age group and sex

	Age group					*Sex*						
	0–4 years		*5–12 years*			*Male*		*Female*			*Total*	
Mucosal alteration	*n*	*%*	*n*	*%*	*P*	*n*	*%*	*n*	*%*	*P*	*n*	*%*
Present	186	24.9	141	30.3	0.040*	164	28.7	163	25.5	0.203**	327	27.0
Absent	560	75.1	324	69.7		407	71.3	477	74.5		884	73.0
Total	746	100.0	465	100.0		571	100.0	640	100.0		1211	100.0

n: absolute frequency; %: relative frequency; *P*: *P*-value.
*$\chi^2 = 4.22$.
**$\chi^2 = 1.62$.

Table 2 Prevalence of oral mucosal alterations according to age group and sex

	Age group							*Sex*									
	0–4 years			*5–12 years*				*Male*			*Female*				*Total*		
Mucosal alteration	*n*	*%*	*Prev. (%)*	*n*	*%*	*Prev. (%)*	*P*	*n*	*%*	*Prev. (%)*	*n*	*%*	*Prev. (%)*	*P*	*n*	*%*	*Prev. (%)*
Geographic tongue	74	36.46	9.92	36	22.09	7.74	0.003	55	29.89	9.63	55	30.22	8.59	0.945	110	30.05	9.08
Cheek biting	35	17.24	4.69	39	23.93	8.39	0.114	35	19.02	6.13	39	21.43	6.09	0.566	74	20.22	6.11
Melanotic macule	8	3.94	1.21	23	14.11	4.95	0.001	18	9.78	3.15	13	7.14	2.03	0.364	31	8.47	2.56
Traumatic lesion	15	7.39	2.01	12	7.36	2.58	0.992	12	6.53	2.10	15	8.24	2.34	0.529	27	7.38	2.23
Fissured tongue	5	2.47	0.54	13	7.98	2.80	0.014	10	5.44	1.75	8	4.39	1.25	0.646	18	4.92	1.49
Recurrent aphthous ulcerations	11	5.42	1.47	8	4.91	1.72	0.827	8	4.35	1.40	11	6.04	1.72	0.465	19	5.19	1.57
Pseudo-membranous candidiasis	15	7.39	0.99	0	0.00	0.00	0.001	7	3.80	1.23	8	4.39	1.25	0.775	15	4.10	1.24
Alveolar cyst	10	4.93	1.34	0	0.00	0.00	0.002	5	2.72	0.88	5	2.75	0.78	0.618	10	2.73	0.82
Recurrent herpes	2	0.99	0.27	8	4.91	1.72	0.024	4	2.18	0.70	6	3.30	0.94	0.368	10	2.73	0.82
Commissural lip pits	4	1.97	0.54	5	3.07	1.07	0.366	6	3.26	1.05	3	1.65	0.47	0.257	9	2.46	0.74
Gingival fibrous nodule	1	0.49	0.13	7	4.30	1.51	0.016	2	1.09	0.35	6	3.30	9.94	0.138	8	2.19	0.66
Atrophic candidiasis	6	2.96	0.80	1	0.61	0.21	0.100	7	3.80	1.23	0	0.00	0.00	0.008	7	1.92	0.58
Ankyloglossia	5	2.47	0.67	1	0.61	0.21	0.167	5	2.72	0.88	1	0.55	0.16	0.110	6	1.64	0.50
Primary herpetic gingivostomatitis	3	1.48	0.40	1	0.61	0.21	0.398	3	1.63	0.53	1	0.55	0.16	0.316	4	1.09	0.33
Fordyce granules	1	0.49	0.07	3	1.84	0.65	0.234	2	1.09	0.35	2	1.10	0.31	0.684	4	1.09	0.33
Eruption cyst	1	0.49	0.07	1	0.61	0.21	0.693	1	0.54	0.18	1	0.55	0.16	0.748	2	0.55	0.17
Impetigo	2	0.99	0.27	0	0.00	0.00	0.307	1	0.54	0.18	1	0.55	0.16	0.748	2	0.55	0.17
Vascular lesion	2	0.99	0.27	0	0.00	0.00	0.307	1	0.54	0.18	1	0.55	0.16	0.748	2	0.55	0.17
Morsicatio buccarrum	0	0.00	0.00	2	1.23	0.43	0.198	0	0.00	0.00	2	1.10	0.31	0.247	2	0.55	0.17
Leukoedema	1	0.48	0.07	0	0.00	0.00	0.555	0	0.00	0.00	1	0.55	0.16	0.497	1	0.27	0.08
Mucocele	0	0.00	0.00	1	0.61	0.21	0.445	0	0.00	0.00	1	0.55	0.16	0.497	1	0.27	0.08
Exfoliative cheilitis	1	0.48	0.40	0	0.00	0.00	0.555	1	0.54	0.18	0	0.00	0.00	0.503	1	0.27	0.08
Mucosal burns	1	0.48	0.40	0	0.00	0.00	0.555	1	0.54	0.18	0	0.00	0.00	0.503	1	0.27	0.08
Oral warts	0	0.00	0.00	1	0.61	0.21	0.455	0	0.00	0.00	1	0.55	0.16	0.497	1	0.27	0.08
Cleft palate	0	0.00	0.00	1	0.61	0.21	0.455	0	0.00	0.00	1	0.55	0.16	0.497	1	0.27	0.08
Total	203	100.0	26.5	163	100.0	35.0		184	100.0	32.3	182	100.0	37.5		366	100.0	–

n: absolute frequency; %: relative frequency; Prev.: prevalence.

patients. Other traumatic lesions on the oral mucosa were caused by physical injuries such as external trauma or strange objects placed in the mouth. Lesions occurred mainly on the lips, tongue, hard palate, and gingiva. These data are summarized in Table 2.

There was similarity in distribution of alterations in both sexes, except atrophic candidiasis, which was more frequent in males ($P = 0.008$). Fissured tongue was more prevalent in Blacks ($P = 0.042$) and aphthous ulcerations mainly affected White children ($P = 0.03$). Three children presented combination of both geographic and fissured tongue in oral examination, but this occurrence was not statistically significant (χ^2-test, $P = 0.204$).

The frequency of children with oral habits by age group is shown in Table 3. Habits of use of nursing bottle and pacifier were more frequent in children from 0 to 4 years old, while the habits of gnawing fingernails and bruxism were more prevalent in children from 5 to 12 years old. Some children were reported to have more than one habit, simultaneously. There were no differences in frequency of children presenting oral mucosal alterations according to the presence of oral habits, in general ($P = 0.398$).

No association between economic status and frequency of children presenting oral mucosal alterations was found in this study ($P = 0.729$).

The history of use of medications was investigated, and 26.3% of children reported this use at the moment of the oral examination. The medications used more were nutritional supplements, antibiotics, bronchodilators, and analgesics. Considering the total prevalence of alterations observed,

Table 3 Frequency of children with oral habits according to age group and type of habit

	Age-group				*Total*		
	0–4 years old		*5–12 years old*				
Prevalence of habits	*n*	*%*	*n*	*%*	*n*	*%*	*P*
Nursing bottle	436	45.94	26	8.39	462	36.70	<0.001
Use of pacifier	336	35.40	25	8.06	361	28.67	<0.001
Gnaw fingernails	68	7.17	167	53.87	235	18.67	<0.001
Bruxism	47	4.95	56	18.07	103	8.18	<0.001
Suction of fingers	55	5.80	25	8.06	80	6.35	0.155
Others	7	0.74	11	3.55	18	1.43	<0.001
Total	949	100.00	310	100.00	1259*	100.00	–

n: absolute frequency; %: relative frequency.
*Some children presented more than one habit.

Table 4 Factors associated with candidiasis, geographic tongue, and fissured tongue among children – multiple logistic regression (final model), Odds ratio (OR), and 95% confidence intervals

Factors associated with each alteration	*B*	*SE*	*Wald*	*P*	*OR*	*CI*
Candidiasis						
Use of antibiotic (present)[a]	1.67	0.54	3.07	0.002	5.30	1.82–15.39
Use of pacifier (present)[b]	1.22	0.46	2.68	0.007	3.39	1.39–8.27
Geographic tongue						
Age group (0–4 years old)[c]	0.63	0.24	2.61	0.009	1.89	1.17–3.04
Fissured tongue						
Congenital anomalies (present)[d]	1.75	0.72	2.43	0.015	5.73	1.40–23.49
History of allergy (present)[e]	1.16	0.59	1.98	0.047	3.20	1.01–10.14
Age group (5–12 years old)[f]	1.12	0.55	2.02	0.043	3.07	1.04–9.06

B: coefficient; SE: standard error; Wald: *Z*-Statistic; *P*: *P*-value; OR: Odds ratio; CI: confidence interval (95%).
The cut-point utilized was 1. Each model was adjusted with all variables that showed significance ($P < 0.25$) in the Chi-square test (χ^2) or Fisher's test.
[a]0 = absent; 1 = present ($\chi^2 = 13.56$; $P = 0.0002$).
[b]0 = absent; 1 = present ($\chi^2 = 9.45$; $P = 0.002$).
[c]0 = 5–12 years; 1 = 0–4 years ($\chi^2 = 9.70$; $P = 0.0018$).
[d]0 = absent; 1 = present (Fisher's test, $P = 0.0508$).
[e]0 = absent; 1 = present (Fisher's test, $P = 0.0308$).
[f]0 = 0–4 years; 2 = 5–12 years (Fisher's test; $P = 0.0066$).

there were no statistical differences in the frequency of children with and without oral mucosal alterations and the use of medications ($P = 0.673$).

However, the use of antibiotics and pacifiers were the independent variables considered in logistic regression final model of candidiasis. The cases of pseudomembranous and atrophic candidiasis were analyzed together. Candidiasis was more than five times more likely to occur in children who recently used antibiotics (OR = 5.30) and it was more than three times more likely to be present in children who had the pacifier habit (OR = 3.39; Table 4).

The only statistically significant variable associated with the occurrence of geographic tongue was the age group 0–4 years old (Table 4). Geographic tongue was almost two times (OR = 1.89) more likely to occur in younger children (0–4 years old) than in the older age group.

Fissured tongue was significantly more common in children presenting extra-oral congenital abnormalities (OR = 5.73) in children with history of allergy (OR = 3.20) and in older age group (5–12 years old; OR = 3.07). The main congenital anomalies in children were cardiac deformities, encephalopathy, and urologic defects.

Discussion

This survey was a cross-sectional study designed for children attended by outpatient pediatric service of the Hospital das Clínicas of UFMG, Brazil. In this study, the oral mucosal alterations were diagnosed in a single examination of each child. Thus, the true prevalence of recurrent alterations like herpes labialis and aphthous ulcerations may have been underestimated (1).

The population examined in this study was composed predominantly of children aged between 0–4 years (61.6%), and this difference may be attributed to the profile of children attending this hospital according to its preventive medicine program.

The frequency of children presenting oral mucosal alterations in the present work (27.2%) was similar to other reports in Argentina (10) and in South Africa (9). However, Kleinman et al. (2) showed that only about 4% of the US schoolchildren aged 5–17 years had one or more oral mucosal lesions at the time of examination. In a survey based on record reviews, Bezerra & Costa (12) found only 2.3% of children aged 0–5 years with oral mucosal conditions. The frequency of children with oral mucosal alterations and the prevalence of each lesion show a wide range in the literature, and this may be as a result of the differences of geographic areas, sociodemographic characteristics of the population studied, methodology, and clinical diagnosis criteria. Some authors also included periodontal abnormalities and periapical abscess in the diagnosis of the oral mucosal lesions, which may influence the overall prevalence of oral mucosal alterations and difficult comparisons among studies (9, 10).

Our findings indicate a significant difference in frequency of children presenting oral mucosal alterations according to age group not related to sex. Higher frequency was found in children from 5 to 12 years old (30.3%) when compared with children from 0 to 4 years old (24.9%). This finding is in accordance with other studies, which also reported increase in prevalence of oral mucosal alterations with increase of age (2, 22). In our study, melanotic macule ($P = 0.001$), fissured tongue ($P = 0.014$), recurrent herpes ($P = 0.024$), and gingival fibrous nodule ($P = 0.0160$) were significantly more prevalent in the group of 5–12-year-olds.

Twenty-five different alterations were observed on the oral mucosa that emphasizes the importance of the systematic examination of children's mouth and the need of a broad knowledge of oral diagnosis for suitable assistance to the pediatric patients.

The most prevalent alterations found in this study were geographic tongue (30.05%), cheek biting (20.22%), and melanotic macule (8.47%).

The prevalence of geographic tongue was significantly higher among children from 0 to 4 years old than in the older age group. Prevalence reports of this condition in children show a great variability in the literature from 0.37 to 14.3% and depend on the population studied (6, 20, 22–28). Sedano et al. (22) also reported a strong difference between age groups, showing higher prevalence in children aged 5–10.5 years compared with children aged 10.5–14.5 years. These authors suggested that the difference between age groups could indicate that non-genetic factors that participate in the multifactorial etiology of geographic tongue may not have been as influential for the older group as they were for the younger children. Rahamimoff & Muhsam (23), in a longitudinal study, reported a significant increase in prevalence of geographic tongue in children of more than 2 years. They observed 1246 cases of geographic tongue, and in 41, the transition to fissured tongue could be determined. They noted that 38% of the parents of these children had fissured tongue, 7% had geographic tongue, and in 8 children, there was simultaneous presence of both the tongue alterations. They suggested that these findings were a direct indication for the transition of geographic tongue to fissured tongue and a strong evidence for transmission through inheritance. Other studies also related the association of geographic and fissured tongue, and a genetic linkage between the two alterations has been suggested (6, 24, 26, 27). Although our results did not demonstrate significant relationship between these conditions, there were also an increase in prevalence of fissured tongue with age, which is clearly reported in the literature (6, 25, 26, 28). Children from 5 to 12 years old were three times more likely to present fissured tongue than younger children (OR = 3.07).

In our study, the prevalence rates of geographic tongue and fissured tongue show no significant difference related to sex. In the literature, the distribution of these alterations between sexes varies and does not show consistency in the reports (23, 25–27).

Our results show a statistically significant association of fissured tongue and allergy. Fissured tongue was more than three times more likely to occur in children with a history of allergy. This finding might be explained on the basis of the idea of genetic association of geographic tongue and fissured tongue, as geographic tongue is more prevalent in allergic patients, according to the literature (29, 30). As we could not find correlation between these two tongue conditions, we also considered that they might be independent alterations appearing simultaneously in the same patients. Further studies should be performed to elucidate this question.

In our study, fissured tongue was more prevalent in children with extra-oral congenital anomalies. According to some authors, fissured tongue is familial and it is linked with an autosomal, dominant gene with incomplete penetrance. This fact gives support to hypothesis that it is possible that children with extra-oral congenital anomalies have genetic abnormalities that could increase their susceptibility to fissured tongue (31).

Cheek biting was the second most prevalent alteration in the population studied. It was the main alteration in children from 5 to 12 years old. Although it was not the purpose of our study, we could note a large number of children with extensive caries, cavities, and cutting surfaces. We considered them as possible causes of this lesion on the buccal mucosa besides the lack of occlusal stability because of the period of eruption of permanent teeth and the use of orthodontic appliances.

Melanotic macule was the third most frequent lesion and it was diagnosed when solitary, flat, pigmented lesion was observed and could not be considered as physiologic pigmentation or manifestation of systemic diseases. Thus, the comparison of our finding regarding this alteration with the literature is difficult, as authors do not specify the diagnosis criteria used for this condition.

Our results show that candidiasis is more likely to occur in children who had used antibiotic recently (OR = 5.30) and in those who had the pacifier suction habit (OR = 3.39). Antibiotics, especially wide-spectrum agents, have long been associated with an increased occurrence of candidiasis because of their capacity to inhibit endogenous microorganisms. Thus, reduced environmental competition may happen, which favors the growth of *Candida* (32). The greater prevalence of candidiasis among pacifier users has also been well documented in literature. In one study, children who sucked dummies had clinical thrush and positive swabs for *Candida* more frequently than those who did not (33).

Comparison between the prevalence of oral mucosal alterations and the economic status of the children examined did not show significant differences. Crivelli et al. (11) reported different distribution of some lesions among children attended in schools with contrasting socioeconomic status. Aphthous ulcerations and fissured tongue were more prevalent among children of a higher economic status, while herpes labialis and angular cheilitis were more frequent in low-status group. Muniz et al. (8) reported that 60% of children from an orphanage school were affected with oral mucosal lesions and a significant predominance of the lesions of infectious etiology, which they attributed to the low economic condition of the population examined. The lack of association of economic status and prevalence of oral mucosal alterations found in our survey is probably because of the homogeneous economic distribution of the population studied.

Conclusions

The present survey describes a high frequency of Brazilian children presenting oral mucosal alterations. This frequency increases with age, and some mucosal alterations are associated with the medical history and the habits of the patients. The broad range of alterations diagnosed in this study should encourage practitioners to carefully investigate children's mouths in order to detect alterations, and to give them suitable care.

Our results also should be used as baseline data for future studies involving different children populations in order to obtain more information about the prevalence of oral mucosal alterations and the factors associated with them. This knowledge can be used to plan dental assistance to pediatric patients in better ways.

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