Importance of Dental Clinic Recalls for Caries Prevention in Children: Practice-Based Research

Renato Barcellos Rédua*/ Paulo César Barbosa Rédua**/ Adriana de Oliveira Lira Ortega***

***Objective**: to investigate the association between caries incidence in children and the number of clinical preventive visits and follow-up period (intervals). **Study Design:** a 30-year cohort composed of the dental records of 600 children who were 12-23 months old at their first dental appointment and who were followed up to 12 years of age (200 followed since 1981, Group 1; 200 followed since 1991, Group 2; and 200 followed since 2001, Group 3) was analytically and quantitatively evaluated. Random sample calculation was performed with 95% confidence, a maximum error of 2.95% and a ratio of 50%. **Results:** association was found between caries incidence and the number of dental visits and consultation intervals. Children who attended a smaller number of preventive visits had a higher incidence of the disease. Children who had an interval between returns greater than 12 months had an 18.7-times greater caries risk compared to children who had intervals no longer than 8 months between return visits. **Conclusions:** preventive consultations with an average interval of up to 8 months seemed to increase family adherence to preventive procedures and acted as a protective factor against caries incidence in children.*

***Keywords:** Recall visits, prevention, caries*

INTRODUCTION

Caries is a behavioral disorder modulated by the frequency and quality of diet, quality and frequency of oral hygiene procedures to remove dental biofilm, and by the presence of fluoride in the oral cavity, which reduces the minerals lost at each demineralization event and activates dental remineralization when neutral conditions return.[1]

Although children all over the world are affected by caries, the distribution of this disease is not equal within populations. People with low socioeconomic status are usually more affected by this disease, while families with greater access to information and professional dental care, mainly in the first years of life, have a lower risk of developing caries.[2]

The scientific literature demonstrates the importance of follow-up for dental caries prevention and the importance of a child having access to dental care as early as possible.[3-5] Thus, considering the importance of the development of strategies for caries prevention in pediatric dentistry and the lack of studies with children included in controlled prevention programs for more than 10 years, we proposed this 30-year historical cohort. The study objective was to verify if there is association between caries incidence and the number of clinical preventive visits and follow-up periods, in children followed up for 11 years during a 30-year period. This study is important because there is very low quality evidence to support or refute the practice of encouraging patients to attend dental check-ups at six-monthly intervals.[4]

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MATERIALS AND METHOD

Before data collection, this research project was approved by the institutional review board under number 195/2014.

A convenience sample of 600 patients was defined. Data were collected by a PhD student in pediatric dentistry. A total of 1,323 dental records of children who first visited the dentist in the 1980s, 1990s or 2000s were analyzed. Among these, 771 records from children whose first dental visit occurred between 12 and 23 months of age were included (271 in Group 1, 258 in Group 2 and 242 in Group 3), while 552 records of children in which the first visit occurred at different ages were excluded. Children with neuropsychomotor alterations reported at the first anamnesis or diagnosed later were excluded, as well as incomplete or illegible records, children who abandoned follow-up before 12 years old, and children attending another pediatric dentist during the follow-up period (71 in Group 1, 58 in Group 2 and 42 in Group 3). All children were followed for 11 years by the same professional, who was a specialist and professor of pediatric dentistry, in a private practice in the city of Vitória, ES, Brazil.

The sample was verified by ratio error and the expected maximum error was 2.96%. The error was verified by calculating the sample size for proportion estimators, considering the 95% confidence level and 50% ratio, which maximizes the variability and results in the highest possible value for the sample. The correction factor for finite population was used.

Statistical analysis was done by descriptive analysis of the research data. The logistic regression test was applied to verify the association between caries incidence and the number of consultations performed and the interval between consultations. The linear regression test was applied to verify the association between the number of caries lesions and the number of consultations and interval between these consultations. The significance level was 5% with a 95% confidence interval. Statistical analyses were performed on the SPSS Statistics version IMB 21 (SPSS Inc, Chicago, USA).

In data collection, caries lesions were considered as cavitated lesions recorded in the records according to the WHO criteria[6] and lesions observed on radiographs at the time of dental visits and registered on the records. The radiographs were not analyzed during data collection for this study.

In the first visit, information was given about the rational use of sugar, preferably at predetermined feeding times, and oral hygiene instructions with toothbrushing two to three times a day, carried out by parents in the first years of life and then by the child after six or seven years, according to the ability of each child.

After 1988, fluoride toothpaste was introduced in Brazil[7], and then the use of a small amount of fluoride dentifrice was recommended after eruption of the first deciduous teeth. All children in this study were exposed to fluoridated water, because the city of Vitória has fluoridated water since 1982.

During the first visit, a liability term was provided for parents ensuring that, if the child returned at every 6 months for preventive visits, in the case of carious lesions, the dental professional would perform the treatment without financial costs for the family.

After the first dental visit, follow-up visits were scheduled by sending letters for periodic clinical evaluations at every six months. When the child did not show up, two additional letters were sent, at seven months after the last visit and at 11 months after the last visit.

Biofilm control evaluation, presence or absence of gingival alterations, presence of carious lesions, risk of developing caries and treatment needs were assessed and recorded during each dental consultation. Topical application of high-concentration fluoride, using varnish or gel, was performed during each session.

RESULTS

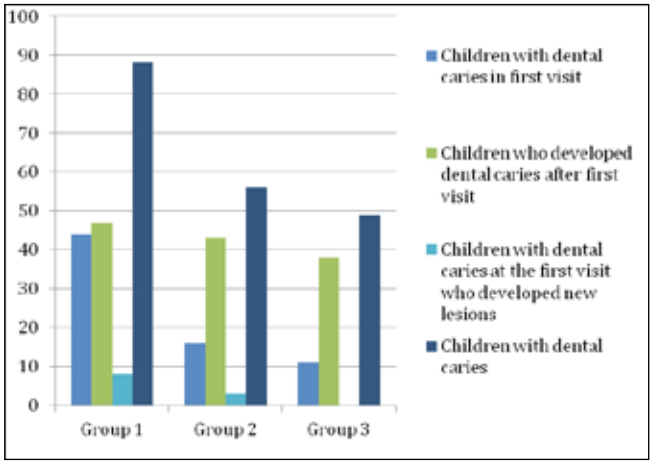
The mean age of children in the cohort at the first office visit was 18.8 months, with 20.4 months in Group 1, 19 months in Group 2 and 17.1 months in Group 3. Overall there were 307 boys and 293 girls in the cohort, with 106 and 94 in Group 1, 103 and 97 in Group 2 and 98 and 102 in Group 3, respectively.

Dental caries prevalence in children at the first visit was 11.8% (71 children). Among these, 44 children (22%) were in Group 1, 16 (8%) in Group 2 and 11 (5.5%) in Group 3 (Figure 1).

Dental caries incidence (after the first visit to a pediatric dentist) during 11 years of follow-up for these children was 21.3% (128 children): 47 children (23.5%) in Group 1, 43 (21.5%) in Group 2 and 38 (19%) in Group 3. Only 11 children (1.83% of sample) with carious lesions at the first visit developed new lesions during the follow-up period: 8 children (4%) in Group 1 and 3 (1. 5%) in Group 2 (Figure 1).

Combining the number of carious lesions observed at the first visit and the new lesions identified during 11 years of follow-up, the prevalence of disease was 31.3% (188 children): 88 children (44%) in Group 1, 56 (28%) in Group 2, and 49 (24.5%) in Group 3 (Figure 1).

Figure 1: Prevalence of dental caries before and after first visit



Caries prevalence in deciduous teeth, including lesions identified at the first visit and during 11 years of follow-up, was 30% (180 children): 82 children (41%) in Group 1, 57 (28.5%) in Group 2 and 41 (20.5%) in Group 3. The DMF index in deciduous teeth was 4.03, 3.64 and 2.64 in Groups 1, 2 and 3, respectively (Table 1).

Caries incidence in deciduous teeth (after the first visit) and during 11 years of follow-up was 18.1% (109 children): 38 children (19%) in Group 1, 41 (20.5%) in Group 2 and 30 (15%) in Group 3. The DMFT index in deciduous teeth after the first visit was 2.05, 1.97 and 1.68 in Groups 1, 2 and 3, respectively (Table 1).

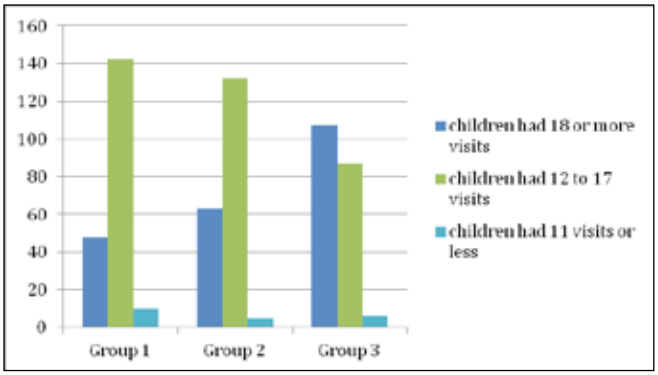
Caries incidence in permanent teeth was 8.16% (49 children): 28 (14%) children in Group 1, 13 (6.5%) in Group 2 and 8 (4%) in Group 3. The DMFT index for permanent teeth was 2.39, 3.07 and 1.37 in Groups 1, 2 and 3, respectively (Table 1).

Table 1: Number and percentage of children with carious lesions in deciduous and permanent teeth and the DMFT index during 11 years of follow-up over a 30-year period

	Group 1	Group 2	Group 3	Total
Children with caries in deciduous teeth	82 (41%)	57 (28.5%)	41 (20.5%)	180 (30%)
DMFT index in deciduous teeth	4.03	3.64	2.64	
Children with caries in deciduous teeth after the first visit	38 (19%)	41 (20.5%)	30 (15%)	109 (18%)
DMFT index in deciduous teeth after the first visit (new lesions)	2.05	1.97	1.68	
Children with caries in permanent teeth	28 (14%)	13 (6.5%)	8 (4%)	49 (8.16%)
DMFT index in permanent teeth	2.39	3.07	1.37	

Regarding the number of dental visits for each child during 11 years of follow-up, a mean of 15.7, 16.6 and 17.1 visits were performed in Groups 1, 2 and 3, respectively. In Group 1, 48 children (24%) had 18 or more visits, 142 (71%) had 12 to 17 visits, and 10 (5%) had 11 visits or less. In Group 2, 63 children (31.5%) had 18 or more visits, 132 (66%) had 12 to 17 visits, and 5 (2.5%) had 11 visits or less. In Group 3, 107 patients (53.5%) had 18 or more visits, 87 (43.5%) had 12 to 17 visits, and only 6 (3%) had 11 visits or less (Figure 2).

Figure 2: Number of dental visits for children during 11 years of follow-up over 3 decades



Among the 218 children who had 18 or more dental visits, 18 (8.25%) presented lesions after the first visit. Among 361 children who had 12 to 17 consultations, 95 (26.3%) suffered injuries; and among 21 children who had 11 or fewer consultations, 15 (71.4%) had carious lesions after the initial consultation.

Dental caries incidence could have been influenced by the number of preventive visits. The logistic regression test showed that the number of dental visits was a predictive factor to determine the risk of developing caries and had a statistically significant value. In patients who attended less than 12 visits, the risk of caries lesions was 25.4 times greater compared to those who attended 18 or more visits. In those children who had only 12 to 17 consultations, this risk was 3.1 times greater compared to children who had 18 or more consultations. Children with carious lesions before the first visit were not included (Table 2).

The number of carious lesions could also have been influenced by the number of visits as determined by linear regression, with statistical significance. Children who attended fewer than 12 visits had increase in the number of carious lesions compared to children who attended 18 or more visits. Among patients who attended 12 to 17 preventive visits, there was increase in the number of carious lesions: however, this increase was not statistically significant when compared to the number of carious lesions for those who attended 18 or more visits. Children with carious lesions before their first visit were not included (Table 3).

The longest mean period between sessions was 11.1 months in Group 1, 10.4 months in Group 2 and 10.1 months in Group 3. Intervals between sessions of up to 8 months or less were observed in 41 children (20.5%) in Group 1, 78 (39%) in Group 2 and 92 (46%) in Group 3. A maximum interval between sessions of approximately 9 to 12 months was observed in 123 children (61.5%) in Group 1, 93 (46.5%) in Group 2, and 74 (37%) in Group 3. A period exceeding 12 months between sessions was observed in 36 children (18%) in Group 1, 29 (14.5%) in Group 2 and 34 (17%) in Group 3 (Figure 3).

Among the 211 children who had a maximum follow-up interval of up to 8 months, 14 children (6.6%) suffered carious lesions after the first visit; among 290 children whose maximum interval between visits was 9 to 12 months, 54 children (18.6%) presented lesions. For 99 children whose longest consultation interval was over 12 months, 60 (60.6%) presented lesions after the first consultation.

The maximum interval between consultations may influence the caries incidence. Considering that the child was affected by dental caries, regardless of the number of lesions, the logistic regression test showed that the maximum interval between consultations

Table 2: Logistic regression model for the association between caries incidence and number of preventative visits attended

		p value	OR Inferior limit	95.0% confidence interval for OR		*Pseudo*-R²
				Upper limit		
Number of dental visits attended	Less than 12 visits	**< 0.001**	25.429	7.925	81.592	0.131
	12 to 17 visits	**< 0.001**	3.133	1.973	4.976	

OR: *odds ratio*.

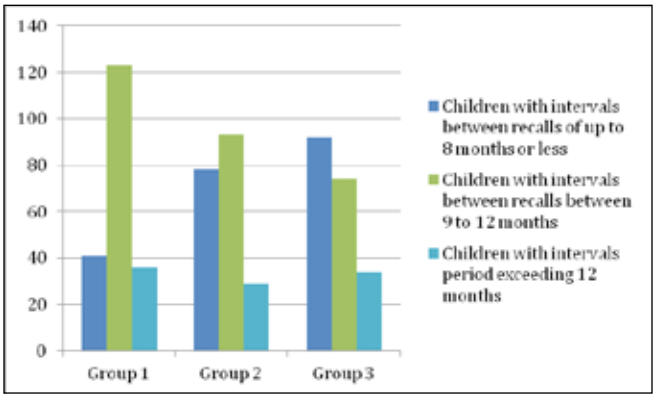
Pseudo-R² = similar to the fit of the model
Note: reference value = 18 visits or more

Table 3: Linear regression model for the association between the amount of carious lesions and the number of preventative visits

		B	t	p value	95.0% confidence interval for B		R^2 Adjusted
					Inferior limit	Upper limit	
Number of dental visits performed	Less than 12 visits	2.127	3.184	**< 0.01**	0.807	3.447	0.052
	12 to 17 visits	0.852	1.892	0.060	-0.038	1.741	

R^2: coefficient of determination (adjustment measure).
Note: reference value = 18 visits or more.

Figure 3: Interval period between recalls for children during 11 years



increased the risk of developing caries and was statistically significant. The risk of developing caries was 2.7 times greater for children returning between 9 and 12 months compared to children returning during maximum intervals of up to 8 months. Intervals greater than 12 months increased this risk by 18.7 times in comparison with a maximum interval of up to 8 months. Children with carious lesions before the first visit were not included (Table 4).

The number of carious lesions may also be influenced by the maximum interval between sessions, and the result was statistically significant ($p < 0.005$). When the interval was greater than 12 months, there was a mean increase in the number of lesions compared to the number of lesions in children who had a maximum interval of 8 months. There was no statistically significant difference in the number of lesions between children with a maximum interval between 9-12 months and children with a maximum interval of up to 8 months. Children with carious lesions before the first visit were not included (Table 5).

DISCUSSION

A search of the available literature indicates that this appears to be the first 30-year historical cohort study investigating the association between caries incidence in patients attending a private practice and the number of preventive dental visits and the interval between these visits.

Other samples, such as other pediatric dental offices or dental schools, were not included in this study because they did not have a similar follow-up period. Furthermore, investigation of a sample from only one pediatric dental office allowed standardizing the study. All procedures were performed by the same professional,

Table 4: Logistic regression model for the association between caries incidence and the maximum interval between visits

		p value	OR Inferior limit	95.0% confidence interval for OR		*Pseudo*-R^2
				Upper limit		
Maximum interval between visits	9 to 12 months	**< 0.001**	2.734	1.600	4.672	0.255
	Greater than 12 months	**< 0.001**	18.678	9.951	35.058	

OR: *odds ratio.*

Pseudo-R^2 = similar to the fit of the model
Note: reference value = maximum recall interval of up to 8 months

Table 5: Linear regression model for the association between the amount of carious lesions and the maximum interval between visits

		B	t	p value	95.0% confidence interval for B		R^2 Adjusted
					Inferior limit	Upper limit	
Maximum interval between visits	9 to 12 months	0.528	1.650	0.101	-0.172	1.914	0.068
	Greater than 12 months	1.758	3.356	**< 0.01**	0.723	2.792	

R^2: Coefficient of determination (adjustment measure).
Note: reference value = maximum recall interval of up to 8 months

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who was a specialist and professor of pediatric dentistry, thus providing an accurate diagnosis, standardized data recording, planning and execution of clinical procedures and provision of prevention guidelines. Although caries diagnosis was performed only by a single professional, which could result in bias, on the other hand this design allowed standardization of the sample, considering more than 30 years of data collected.

The mean age of children at the first dental visit decreased along 30 years, from 20.48 months in the 1980s to 17.14 months in the 2000s, which is possibly related to the introduction of new dental care preventive concepts in Brazil from the mid-1980s onwards. The first Brazilian clinic for baby dental care that was registered was established in Londrina (PR) by Prof. Luiz Walter in 1984. Until then, it was not common for children under 3 years of age to attend a preventive visit. In Brazil, the importance of this care was only consolidated after the 1990s; therefore, parents were poorly informed and did not seek treatment for younger children.[8]

Currently, it is known that a child should have access to dental care as early as possible[9, 10] because the younger the child's age at the first visit, the lower the risk of developing caries.[11] In the initial study design, we tried to include the records of children whose first visit occurred during the first year of life. However, the number of children up to 11 months old who were in the database and started follow-up was small. Thus, we decided to include patients who received the first dental care between 12 and 23 months old, a period also recommended to initiate caries prevention programs.[12]

Considering the reduction in caries prevalence in some populations, some studies started to use indices that include initial caries lesions that are not cavitated, in addition to cavitated lesions, restored or lost teeth.[13-16] Initial caries lesions (white spots) have been reported in epidemiological surveys after 1989; before this period, these lesions were not identified and reported in the literature and were not routinely diagnosed in pediatric dentistry practice. There was no diagnosis or registry of white spot lesions in the records assessed until the mid-1990s in this study. Therefore, we considered only cavitated lesions recorded according to the WHO criteria as caries lesions.[6]

There was a considerable discrepancy in the number of children with carious lesions at the first visit in Group 1 (22%) compared to those in Groups 2 and 3 (8 and 5.5%); the number of children with carious lesions in the first months of life was higher in the 1980s. One possible explanation for this finding is that fluoride toothpaste was only introduced in the Brazilian market in 1988;[7] therefore, children in Groups 2 and 3 may have been exposed to fluoride dentifrice in the first months of life, which may represent an important factor for the lower caries prevalence at the first visit.

Regarding caries prevalence in permanent teeth, again, there was discrepancy between children in Group 1 (14%) and children in the other groups (6.5% and 4%). This discrepancy may also be related to the late introduction of fluoride toothpaste in the first group, considering that, in preventive pediatric dentistry programs, the use of fluoride dentifrice is extremely relevant, with wide benefits shown in the literature.[17-19]

The number of children affected by caries after the first visit showed a slight reduction in the 3 groups, suggesting that although Group 1 was not benefited by fluoride toothpaste, periodic consultations were a protective factor for the incidence of disease. Similar caries incidence after the first visit in the 3 groups shows that the behavioral factor of the interval between consultations was determinant for the occurrence of disease. Similarly, the percentage of children with permanent teeth affected by lesions decreased during the 30-year period, up to only 4% in Group 3. This encouraging result may be associated with a higher number of children with a maximum recall period of up to 8 months and a higher number of children who had more than 18 visits in 11 years of follow-up.

Although recent systematic reviews have shown limitations in accurately determining caries risk factors,[20, 21] this study demonstrated that caries incidence was related to the interval between consultations and the number of visits carried out during 11 years. The greater the period between visits, the greater the increase in disease, being 2.7 times greater for those with interval between 9 and 12 months and 18.7 times greater for those with interval longer than 12 months compared to those with interval up to 8 months. A fewer number of visits increased the chance of developing the disease, similar to the results suggested by Tomar[5], who assessed the importance of follow-up visits in caries control, and by Abanto *et al* [3] who verified the effectiveness of a prevention program based on caries risk assessment in 296 children aged 1 to 12 years in São Paulo, Brazil, by evaluating the gingival bleeding index, the amount of bacterial plaque adhered to teeth, early carious lesions and active carious lesions, implementing a follow-up program for new prevention consultations.

In this study, the percentage of children affected by caries in permanent teeth was quite low (8.16%), possibly because the parents and children had already received information about oral health care many times over the follow-up period and because they had more dental visits until eruption of the first permanent teeth. The higher frequency of preventive visits seems to be able to increase the parents' and children's adherence to guidance about caries prevention at each office visit, especially concerning the rational use of sucrose.[22]N.</author><author>Lozano, C.</author><author>-Giacaman, R. A.</author></authors></contributors><auth-address>Department of Oral Rehabilitation, Cariology Unit, University of Talca, Talca, Chile.
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Regarding fluoride topical application during dental visits in this study, although controlled clinical studies demonstrated that the regular application of fluoride gel to the teeth of children with low caries risk has no explicit benefit,[23-26] a meta-analysis including 14 randomized placebo-controlled clinical studies found a mean reduction in the development of caries of 21%, ranging from 14 to 28%, with the use of fluoride gel.[27] Another systematic review, including 23 randomized clinical trials, some with placebo control, showed a caries reduction of 28% on average, ranging from 19 to 37%, with the use of fluoride gel.[28] The literature also indicates that topical fluoride use has greater effectiveness for prevention in patients with high prevalence of caries than in patients with low prevalence, with a mean reduction of 22% considering patients with high and low prevalence.[29] The Cochrane Oral Health Group data, including 28 randomized clinical trials and evaluating a total of

9,140 children and adolescents, indicate that fluoride gel use is able to inhibit dental caries in permanent and deciduous teeth in children and adolescents.[30]

Considering the preventive procedures performed and information given since the first visit and subsequent consultations in this study, caries incidence was influenced by the number of visits and the interval between them, despite the absence of a control group; we suggest that the benefits of periodic fluoride gel application were effective in this sample because Group 1 was not benefited by the use of fluoride toothpaste.

The data obtained seem to be significant, and we suggest that a new study with similar design and a larger sample with follow-up visits, including other dental centers for comparison and verification of the findings reported in this research, should be conducted.

CONCLUSION

There was association between the number of dental visits and caries incidence. Children who had a smaller number of visits had higher incidence of disease during the 11 years of follow-up and 3 decades studied.

A higher incidence of dental caries was associated with a longer interval between dental visits. Children who had a follow-up interval greater than 12 months had an 18.7 times higher risk of caries compared to children with a maximum interval of 8 months.

Preventive consultations with an average interval of up to 8 months seemed to increase family adherence to preventive procedures and acted as a protective factor against caries incidence in children.

Why this paper is important to pediatric dentists?

- This study is important to support the practice of encouraging patients to attend for dental check-ups at every six to eight months.
- This study demonstrates the association between the number of dental visits and longer interval between these with caries incidence.
- It demonstrates that preventive consultations with an average interval of up to 8 months seemed to increase family adherence to preventive procedures and acted as a protective factor against caries incidence in children.

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