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Original Article

Quantification of Dental Biofilm in Children with Dental Erosion

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Abstract

Objective: To quantify dental biofilm through the simplified oral hygiene index (OHI-S) proposed by Greene and Vermillion in children with dental erosion comparing them to children without this oral health problem. **Material and Methods:** The study included 48 children aged 4-9 years treated at the Clinic of Pediatric Dentistry of the Cruzeiro do Sul University, examined by a single trained and calibrated examiner according to O'Brien index for the diagnosis of dental erosion, in which 24 children had erosion lesions in teeth and 24 children did not have this oral health problem. Later, children received guidance and standardization for the OHI-S evaluation. Data were analyzed by the Poisson univariate logistic regression. Prevalence ratio (PR) values and 95% confidence intervals (CI 95%) were calculated. **Results:** The mean (standard deviation) of the OHI-S of children who had dental erosion was 1.19 (0.38), lower than children in the group without dental erosion 1.73 (0.44). The amount of biofilm on teeth was associated with the presence of dental erosion (OR 95% CI = 0.393; 0.188-0.822) and p-value = 0.013. Regarding the reduction in the WSL dimension, no significant difference between groups was observed (p = 0.931). **Conclusion:** Children with dental erosion showed a significantly lower amount of biofilm compared to children without this oral health problem, and dental biofilm can be a possible protective factor against acid attacks and development of dental erosion.

Keywords: Tooth Erosion; Dental Plaque; Biofilms.

Introduction

Considered an oral health problem [1], dental erosion has been studied for centuries [2,3], but in recent years, it has been observed that its prevalence is increasing, making it one of the leading oral health problems especially in children and adolescents [4,7] due to recent changes in lifestyle [8,9].

Dental erosion is caused by a chemical process of irreversible loss of mineral and surface structure of the teeth, arising from an acid aggression without bacterial involvement [10,11]. Its etiology is complex and multifactorial, in which acids that come into the oral cavity can be of intrinsic or extrinsic origin [12-14].

Erosive lesions resulting from acid attack affect specific regions of the teeth, but the enamel portions located near the gingival margin remain intact, possibly due to the presence of biofilm accumulated in the region that can act as a mechanical barrier against acid attack and possibly be a protective factor [5,11,13,15].

Both dental caries and periodontal disease are directly related to the biofilm, since changes in these micro-colonies of bacteria attached by a matrix and adhered to dental surfaces may make them become ill [16], which may also be related to dental erosion.

Although some authors suggest that dental biofilm is possibly a factor of protection against acids challenges, there are few studies relating the protective potential of biofilm with dental erosion. This study aimed to quantify the presence of biofilm on the dental surfaces of children with dental erosion comparing them to children without the disease and establish a possible relationship between the presence of biofilm and a protective factor against dental erosion.

Material and Methods

A cross-sectional study with a sample of 48 children aged 4-9 years of both sexes treated at the Clinic of Pediatric Dentistry of the Cruzeiro do Sul University was conducted.

Upon acceptance and completion of the Informed Consent Form by legal guardians, children were sent to the dental chair where clinical examinations were performed by a single graduate student, trained and calibrated for the diagnosis of dental erosion with images and clinical cases of this health problem and submitted to the Kappa test for intra-examiner reliability with values of 0.89 and 0.84. A questionnaire with information on diet and quality of daily oral hygiene was also applied.

Clinical examination was performed under good lighting from reflector attached to the equipment, dental surfaces were cleaned with gauze soaked in water, teeth were relatively isolated with cotton rolls and dried with the help of an air syringe and for better visualization, dental mirror # 5 was used.

Children with dental erosion were classified according to O'Brien index [17] due to its application and easy use in several previous studies with children [18-21]. This index uses scores from 1 to 3 to classify the severity of the disease.

After checking the presence or absence of the disease, children were divided into 2 groups, 24 children in the group without erosion and another 24 children composed the group with dental erosion.

The patients selected for this study were properly instructed and rescheduled in another day for biofilm observation for the classification of the simplified oral hygiene index (OHI-S) [22]. Through the amount of biofilm found, the index measures the quality of oral hygiene. To prevent changes, this step was standardized: the examination occurred in all patients from 03.00 p.m. to 05.00 p.m., when they were instructed not to perform oral hygiene and keep fasting for a minimum of 2 hours before the test.

On return, patients were again conducted the dental chair for the OHI-S examination using 3% fuchsin as biofilm disclosing agent, which was applied to the tooth surfaces with the aid of swab soaked in this product and data were described in a spreadsheet.

The simplified oral hygiene index evaluates the oral (teeth 16, 11, 26, and 31) and lingual surfaces (teeth 36 and 46) or in the absence of these teeth, the use of an adjacent tooth by reference, in which the amount of biofilm receives a code of 0 to 3 on each surface. Code 0 means no biofilm, code 1 means that the biofilm does not cover more than 1/3 of the examined surface, code 2 means that the biofilm covers more than 1/3 and in code 3, biofilm covers more than 3/3 of the tooth surface. The sum of all surfaces evaluated is divided by the total number of teeth. The rating indicates scores from 0 to 0.9 as good condition (with little biofilm), from 1 to 1.9 regular condition and from 2 to 3 poor condition, when a larger amount of biofilm is accumulated in teeth [22].

Data were tabulated in Windows Excel 7 software. Whenever necessary, the Minitab R 14.2 version for the Poisson logistic regression test was used and prevalence ratio values (PR) and 95% confidence intervals (CI 95%) were calculated.

This research was approved by the Research Ethics Committee of the Cruzeiro do Sul University, according to the protocol number 015/2010.

Results

A total of 48 children (26 boys and 22 girls) participated in this study, and 24 of them had dental erosion and the other 24 did not show any clinical signs of this problem (Table 1). The mean age (standard deviation) of children with erosion was 6.5 (1.6) years and 7.2 (1.6) years was the mean age of children without dental erosion.

Table 1. Number of patients (%) with and without dental erosion by sex.

Sex	With dental erosion	Without dental erosion	Total
Males	12 (46.15%)	14 (53.85%)	26 (100%)
Females	12 (54.55%)	10 (45.45%)	24 (100%)
Total	24 (50.00%)	24 (50.00%)	48 (100%)

The mean OHI-S (standard deviation) of children with dental erosion was 1.19 (0.38), which is lower than that of children in the control group, 1.73 (0.44) (Figure 1).

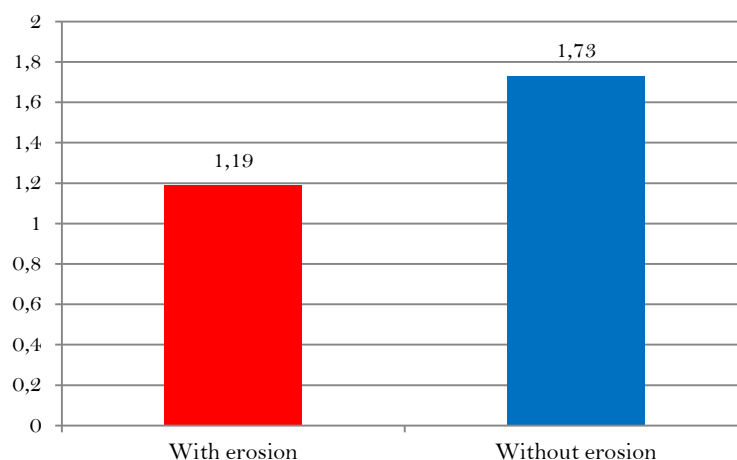


Figure 1. The mean of biofilm in children.

A Poisson regression analysis can be seen in Table 2, which showed an association between the amount of dental biofilm and dental erosion ($p = 0.013$).

Table 2. Poisson univariate regression analysis with some variables of children diagnosed with dental erosion.

Variables	PR	CI95%	p-value
Age	0.600	0.345-1.042	0.070
Sex Male	1.00	1.00	0.571
Female	0.844	0.469-1.516	
OHI-S	0.393	0.188-0.822	0.013

Table 3 shows the distribution of the OHI-S index and classifies the amount of biofilm found as good, regular or poor. The majority of children in both groups reported brushing teeth 3 times a day (Table 4).

Table 3. Distribution (%) of the OHI-S index between groups.

GROUP	Good	Regular	Poor
Erosion	5 (21%)	18 (75%)	1 (4%)
Control	2 (8%)	12 (50%)	10 (42%)

Table 3. Distribution of the daily frequency of oral hygiene of children.

Brushing	Without dental erosion n (%)	With dental erosion n (%)	Total
1x	1 (4%)	0 (0%)	1 (100%)
2x	5 (21%)	9 (38%)	14 (100%)
3x	13 (54%)	13 (54%)	26 (100%)
4x	2 (8%)	1 (4%)	3 (100%)
5x or more	3 (13%)	1 (4%)	4 (100%)
Total	24 (100%)	24 (100%)	48 (100%)

Discussion

Some studies have suggested that dental biofilm is possibly a protective factor against acids challenges, justifying that the regions of the tooth surface located close to the gingival margin are not affected by acid attack by a possible biofilm accumulation [11,13]. However, the potential protective effect of the biofilm with regard to dental erosion remains unknown. This study quantified the presence of biofilm on the dental surfaces of children with dental erosion comparing to those without the disease and establish a possible relationship between the presence of biofilm and a protective factor against dental erosion.

Data obtained in this study point that the small amount of biofilm on the dental surface of children with dental erosion (average of 1.19) compared to children with no dental erosion (average of 1.73) is statistically significant ($p = 0.013$), indicating that there is a protective effect of the biofilm, as expected. Due to its "selective barrier" property, the biofilm can be a possible protective factor against acid attacks and the development of dental erosion.

An in situ study observed to influence the biofilm on dental enamel, in which patients used dental braces for 14 days to induce biofilm formation with subsequent immersion in soft drink for acid attack, and the influence of biofilm in the dental erosion process was observed [23]. These findings showed that biofilm is a protective agent against acid attack, which is in agreement to results observed in the present study.

Several changes in the oral cavity such as changes in pH and temperature influence the oral microflora, which can change biofilm formation [24]. The findings of our study showed that patients with dental erosion have a smaller amount of biofilm, but It is not known whether this was due to the frequent arrival of acid to the oral cavity, which could modify some factors, thus influencing biofilm formation or the disease development occurred by smaller amount of biofilm.

Through the questionnaire applied, we tried to identify the brushing frequency reported by children, because excessive brushing could lead to a significant reduction in biofilm present on the dental surfaces, but the results showed no considerable difference in the brushing frequency pattern between groups (Table 4).

Most children reported brushing teeth 3 times a day, which represented a rate of 54% for both groups, if data are grouped by groups, the brushing frequency of 3 or more times per day was 69%. The results were similar to those found in another study [25] that assessed children aged 7-12 years and showed a high brushing frequency of 3 or more times per day of 70.5%.

The means used for the diagnosis of dental erosion and its classification have been the subject of recent studies and so far there is no universal index in literature accepted for the classification of these lesions [26]. The O'Brien index, which emerged in the UK, is one of the most widely used indexes for studies and surveys on the prevalence of dental erosion in children. In some of these studies, minor modifications were observed, but it could be considered a clear and comprehensive index, as it classifies the depth and extent of erosive lesions [6,27].

Further studies are still required to better understand this complex oral health problem, being a reality and concern among dentists.

Conclusion

Children with dental erosion showed significantly less biofilm compared to children without this oral health problem.

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