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ARQUIVOS EM ODONTOLOGIA

Association between dental caries lesion presence and previous restorative treatment: epidemiological survey

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Aim: Dental caries is a biofilm- and sugar-induced disease; therefore, the management of this condition should consider its etiologic factors. Although most clinical trials have focused on operative/restorative techniques to treat dental caries, this approach only addresses the consequences of the disease: the lesions. Thus, this study aimed to evaluate the association between the presence of dental caries lesions as cavities and the presence of previous tooth restorative treatments among adults.

Methods: A cross-sectional survey using a database of adults aged 35 – 44 years was conducted. Dental caries lesions were evaluated using the DMFT index (decayed, missing, and filled teeth). The following variables regarding restorative treatment were considered: filled teeth with caries and filled teeth without caries. Multilevel Poisson regression models (fixed effects and random intercepts) were conducted.

Results: 9,564 adults were included. The average number of teeth with untreated dental caries (crown) was 1.47. ¼ of adults had one or more filled teeth with dental caries. The presence of one or more teeth with cavitated dental caries lesions (crown) was significantly higher among adults with at least one filled tooth with caries ($p < 0.05$). This finding was also observed for root caries.

Conclusion: The prevalence of teeth with cavitated dental caries lesions (crown and root) was higher among adults who had filled teeth with caries. These findings suggest that patients may have been treated by dentists with a focus on restorative and invasive treatments rather than on addressing the underlying disease, thereby continuing to develop new caries lesions.

Uniterms: dental caries; therapeutics; oral health; disease.

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INTRODUCTION

Dental caries is an important and prevalent public health problem worldwide which seriously impair health systems and economic parameters of the countries. In 2010, untreated dental caries in permanent teeth was considered the most prevalent condition affecting people globally (≈ 35%), which represented more than 2.4 billion of people in the world affected by the disease[1,2]. This disease remained as the main health condition affecting people in the world in

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2015[3], affecting mainly adolescents and adults[2]. Interestingly, the dental caries prevalence in the world for deciduous and permanent teeth has persisted relatively unchanged over the past almost 30 years (1990-2017)[2], which suggest a challenge health condition to be defeated or controlled. Data from the National Health and Nutrition Examination Survey (NHANES / 2017 - 2020) conducted among US population estimated the prevalence of untreated active caries in more than 1 in 5 adults (21.3%)[4] and a higher burden of this condition is expected among people living in lower and middle-income countries, such as Brazil[1,3].

The current and evidence-based concept of dental caries consider it as a non-communicable biofilm and sugar-induced disease[5,6]. Although the disease has been described as a multifactorial condition[7], since biochemical, biological, behavioral, and environmental factors indirectly affects its occurrence, these factors modulate the mediating factors (biofilm and diet). When certain oral microorganisms accumulated on dental surfaces are exposed to sugars from the diet, there is a disruption in the physiologic and chemical equilibrium between tooth mineral and ions concentration in the biofilm fluid. It occurs due the sugar metabolism that changes the biofilm fluid pH, leading to an increase in hydrogen ions concentration. Hence, a chemical imbalance between the acidic biofilm fluid and the tooth is generated, resulting in tooth mineral loss, which can be clinically noticed as tooth structure loss, porosity and cavitations[5]. Therefore, dental caries management focusing on the disease treatment needs to consider the etiologic factors – biofilm accumulation and diet – to control lesion progression and prevent new lesions.

Most of evidence dealing with dental caries treatment has focused mainly on restorative and esthetics approaches[8-10]. Moreover, the evidence has widely described the use of fluoride products, the main positive determinant factor to control the progression and prevent or delay dental caries lesions arising[11-13]. Although clinical trials have suggested different therapeutic approaches to repair functions and esthetics of teeth affected by dental caries[8-10], these restorative techniques have focused only on the dental caries consequence, the lesion – cavitation. Therefore, tooth restoration does not treat the disease, only the lesions, and it is not enough to prevent new lesions. Current dental caries lesions management consider the caries activity and minimal intervention[14]. However, besides the lesion management the disease treatment should consider the inducing factors (biofilm and diet) to control the disease progression and prevent the occurrence of new lesions. Therefore, it is expected that patients attended by dentists for tooth restoration due to dental caries lesion also receive instructions focusing on oral hygiene and diet to treat the disease and do not present new or recurrent lesions. However, this outcome has not been previously explored in the literature.

Therefore, this study aimed to evaluate the association between the presence of untreated dental caries in adults with previous restorative treatment, as an indicator of previous dental treatment focusing only on lesions, the clinical sign of dental caries disease.

METHODS

DESIGN AND SAMPLE

The epidemiological survey was conducted respecting the ethical principles of the Resolution of the National Council of Health n° 196 / 96, according to the Declaration of Helsinki, and was approved and registered by the National Research Ethics Commission (protocol no. 15,498 / 2010).

Databases of the 2010 National Survey of Oral Health Conditions from Brazil (*SB Brasil*) was used for data extraction. The survey was conducted according to World Health Organization (WHO) criteria (1997)[15,16]. Representative samples of the Brazilian population within particular age categories (5, 12, 35 - 44, 65 - 74 years) were interviewed and clinically examined by trained and calibrated examiners in their homes regarding their oral health status, dental service use and socioeconomic conditions. After selection through multi-stage probability cluster sampling, with probability proportional to the size and considering a design effect (*deff*) of 2, people living in 177 municipalities from the five Brazilian macro-regions (North, Northeast, Central – West, Southeast, and South) were interviewed and examined. Dentists were trained and calibrated using the consensus technique to conduct the examinations and interviews, with a minimal acceptable kappa value of 0.65 for each examiner. In the present study, data from adults (35 - 44 years old) who were evaluated for dental caries were included.

DENTAL CARIES EVALUATION

The dependent variable — dental caries lesion — was constructed by the DMFT index (decayed, missing, and filled teeth), and only the component 'decayed – D' which evaluate dental caries as cavitation was used to estimate the presence of untreated dental caries in the crown and root. Clinical examinations were performed using a clinical mirror and CPI probe under natural light. A tooth was considered decayed when presenting a cavity, softened tissue at the base, or enamel discoloration, according to WHO criteria[15]. For construction of the dependent variables, tooth with dental caries (crown) or root with dental caries was dichotomized as "0" (without cavities) and "1 or more" (1 or more teeth with caries lesion - cavities). Therefore, missing and filled teeth were not considered in the construction of dependent variables, only the decayed component. Although the same person can have cavities, filled or filled tooth with cavities in the oral cavity, each dental element is categorized with one code. Therefore, if the element was considered as "with cavity", it can not be assigned to "filled with cavity", but other element in the same cavity can be assigned as "filled with cavity". It allows to evaluate the association between tooth with cavities and filled tooth (or filled with cavity).

RESTORATIVE TREATMENT EVALUATION

The following variables regarding restorative treatment was considered as the main independent variable: filled tooth with caries and filled tooth. The variables were constructed by the DMFT index. Each tooth received just one classification (code) and, therefore, a tooth evaluated as filled tooth with caries (cavitation) is a different tooth than that evaluated with only dental caries (cavitation). Filled tooth with caries and filled tooth were used as indicator of previous restorative treatment at the time of clinical evaluation. Tooth lost due to dental caries was also used as independent variable as indicator of previous consequence of dental caries disease. Each variable was dichotomized as "0" no tooth affected or "1 or more" tooth affected (filled tooth with caries, filled tooth and tooth lost).

DENTAL SERVICE USE

As an indicator of adults who were previously attended by dental services, the variable "time passed since the last dental visit" was considered as one of the main independent variables and it was dichotomized as "1 year or less" and "More than 1 year".

CONTEXTUAL AND INDIVIDUAL VARIABLES

To adjust the models, the following individual variables were included: age and sex. Moreover, contextual variables were considered: Human Development Index (HDI), Gini index, Coverage for oral health in primary care, Dentists per 1000 inhabitants. Contextual information was extracted from public databases available online. The HDI and GINI index were obtained from Atlas Brazil. The HDI is an indicator obtained by the arithmetic mean of 3 subsections: longevity, education, and income. The GINI coefficient of income measures the deviation of income distribution (or consumption) among individuals or families, internally in the municipality, which ranges from 0 (absolute equality) to 1 (absolute inequality). The coverage for oral health in primary care, composed of professionals related to dentistry, is part of a primary health care program in the Brazilian Health System. Coverage of oral health in primary care and dentists per 1000 inhabitants were extracted from the database of the Brazilian Health Unified System (DATA - SUS / *Dados do Sistema Único de Saúde*). All individual and contextual variables were considered as collected.

STATISTICAL ANALYSIS

STATA version 15.1 software was used for data analysis. The command svy was used for consideration of the complexity and sampling of stages (sample weight). Initially, the variables were described according to the proportion (categorical) and average (numerical) and 95% confidence interval. Multilevel Poisson regression (fixed-effect and random intercept) models were conducted. Dental caries (crown) and root caries were separately used as dependent variable.

A sequence of multilevel models was developed. Each sequence evaluated the association of the dependent variable with one of the main independent variables tested (filled tooth with caries or filled tooth or tooth lost or time since last dental visit) and it was adjusted by contextual and individual variables. The first model included only the dependent variables, as the empty model (Model 1). The second model (Model 2) included only one main independent variable. The third

model (Model 3) included the main independent variable and contextual variables. The following model (Model 4) included the main independent variable and contextual and individual variables. The final model (Model 5) considered the main independent variable, contextual and individual variables, and the time since the last dental visit. The variance among the models was estimated, the Prevalence Ratio and 95% confidence interval were described, and a significance level of 5% was adopted for analyses.

RESULTS

9,564 adults (35 - 44 years) evaluated for dental caries were included in the study. Almost the half of adults evaluated had at least one tooth affected by dental caries as cavitation (Table 1). The average of teeth with untreated dental caries (crown) was 1.47. Approximately ¼ of adults has 1 or more filled tooth with dental caries and most of them used the dental service less than a year (Table 1).

Table 1. Descriptive analysis of dental caries presence (crown and root), main independent variables, and individual and contextual variables among adults. n = 9,564.

	Proportion (95% CI) and/or average (95% CI)
Tooth with dental caries	1.47 (1.34 - 1.60)
0	0.54 (0.52 - 0.57)
1 or more	0.46 (0.42 - 0.47)
Root with dental caries	0.29 (0.24 - 0.35)
0	0.86 (0.84 - 0.88)
1 or more	0.13 (0.11 - 0.15)
MAIN INDEPENDENT VARIABLES	
Filled tooth with dental caries	0.45 (0.48 - 0.51)
0	0.76 (0.74 - 0.79)
1 or more	0.23 (0.20 - 0.25)
Filled tooth	7.35 (6.86 - 7.84)
0	0.17 (0.15 - 0.20)
1 or more	0.82 (0.79 - 0.84)
Tooth lost	7.43 (6.93 - 7.92)
0	0.19 (0.16 - 0.21)
1 or more	0.80 (0.78 - 0.83)
Time since last dental visit	
Less than a year	0.49 (0.46 - 0.52)
1 year or more	0.51 (0.47 - 0.53)
CONTEXTUAL	
Gini Index	0.53 (0.50 - 0.56)
HDI	0.75 (0.74 - 0.76)
Coverage for oral health in primary care	35.51 (24.86 - 46.17)
Dentists per 1000 inhabitants	0.84 (0.78 - 0.89)
INDIVIDUAL	
Age (years)	39.39 (39.23 - 39.54)
Sex	
Women	0.64 (0.60 - 0.66)
Men	0.36 (0.33 - 0.39)

HDI – Human Development Index. Proportion for categorical variables and average for numerical variables.

In the Poisson model, the presence of 1 or more tooth with dental caries as cavitation (crown) was higher among adults with filled tooth with caries (1 or more) ($p < 0.05$) (Table 2). It shows that there is a higher chance of the same individual having a tooth with cavitation lesion and other tooth filled and with cavitation. Therefore, there is a higher prevalence of dental caries lesions (cavitation) among adults that were already attended by dentists for restorative treatments and this association was significant ($p < 0.05$) even after adjustment by individual and contextual determinants and time since last dental visit. In contrast, dental caries lesions (1 or more tooth) prevalence was lower among adults with filled tooth (1 or more) (Table 2). However, this filled tooth had no cavitation. Higher prevalence of dental caries lesions (cavitation) was found for adults with tooth lost (1 or more) and that attended dental visit more than a year (Table 2).

Table 2. Prevalence ratio (95% Confidence Intervals in brackets) of 1 or more teeth with dental caries (crown) in multilevel models with random intercepts and fixed effects according to the each main independent variables and adjusted by contextual and individual determinants among 35 - to 44-year - olds adults. n = 9,564.

	Model 1		Model 2		Model 3		Model 4		Model 5	
	PR (95% CI)	***P***	**PR (95% CI)**	***P***	**PR (95% CI)**	***P***	**PR (95% CI)**	***P***	**PR (95% CI)**	***P***
Filled tooth with caries (1 or more)	--	--	1.33 (1.25 - 1.41)	**< .0001**	1.35 (1.27 - 1.43)	**< .0001**	1.35 (1.27 - 1.44)	**< .0001**	1.35 (1.27 - 1.44)	**< .0001**
Variance	0.05		0.05		0.02		0.01		0.01	
Filled tooth (1 or more)	--	--	0.71 (0.66 - 0.75)	**< .0001**	0.73 (0.68 - 0.78)	**< .0001**	0.72 (0.68 - 0.77)	**< .0001**	0.73 (0.68 - 0.78)	**< .0001**
Variance	0.05		0.03		0.01		0.01		0.01	
Tooth Lost (1 or more)	--	--	1.76 (1.58 - 1.95)	**< .0001**	1.73 (1.56 - 1.96)	**< .0001**	1.79 (1.61 - 1.98)	**< .0001**	1.81 (1.63 - 2.01)	**< .0001**
Variance	0.05		0.04		0.01		0.01		0.01	
Time since last Dental visit (1 year or more)	--	--	1.03 (1.02 - 1.05)	**< .0001**	1.03 (1.01 - 1.04)	**< .0001**	1.03 (1.01 - 1.04)	**< .0001**	--	--
Variance	0.05		0.04		0.02		0.02			

Model 1 – empty.

Model 2 – only the main independent variable.

Model 3 – main independent variable + contextual variables.

Model 4 – main independent variable + contextual variables + individual variables.

Model 5 – main independent variable + contextual variables + individual variables + time since last visit

Contextual variables: HDI, Gini index, Coverage for oral health in primary care; Dentists per 1000 inhabitants; Individual variables: age and sex.

The same pattern found for the crown was found for root caries. Poisson model showed a higher prevalence of root caries among adults with 1 or more tooth filled and with caries (cavitation), tooth lost and the time since last dental visit of 1 year or more (Table 3).

Table 3. Prevalence ratio (95% Confidence Intervals in brackets) of 1 or more teeth with root caries in multilevel models with random intercepts and fixed effects according to the each main independent variables and adjusted by contextual and individual determinants among 35 - to 44-year - olds adults. n = 9,564.

	Model 1		Model 2		Model 3		Model 4		Model 5	
	PR (95% CI)	***P***	**PR (95% CI)**	***P***	**PR (95% CI)**	***P***	**PR (95% CI)**	***P***	**PR (95% CI)**	***P***
Filled tooth with caries (1 or more)	--	--	1.58 (1.41 - 1.77)	**< .0001**	1.60 (1.43 - 1.79)	**< .0001**	1.60 (1.43 - 1.80)	**< .0001**	1.61 (1.44 - 1.81)	**< .0001**
Variance	0.24		0.23		0.15		0.15		0.01	
Filled tooth (1 or more)	--	--	0.55 (0.49 - 0.62)	**< .0001**	0.57 (0.51 - 0.64)	**< .0001**	0.57 (0.51 - 0.65)	**< .0001**	0.60 (0.53 - 0.68)	**< .0001**
Variance	0.24		0.18		0.15		0.15		0.13	
Tooth Lost (1 or more)	--	--	1.93 (1.58 - 2.36)	**< .0001**	1.89 (1.54 - 2.31)	**< .0001**	1.88 (1.53 - 2.30)	**< .0001**	1.89 (1.54 - 2.32)	**< .0001**
Variance	0.24		0.23		0.17		0.17		0.14	
Time since last Dental visit (1 year or more)	--	--	1.08 (1.05 - 1.11)	**< .0001**	1.08 (1.05 - 1.10)	**< .0001**	1.07 (1.05 - 1.10)	**< .0001**	--	--

Model 1 – empty.

Model 2 – only the main independent variable.

Model 3 – main independent variable + contextual variables.

Model 4 – main independent variable + contextual variables + individual variables.

Model 5 – main independent variable + contextual variables + individual variables + time since last visit

Contextual variables: HDI, Gini index, Coverage by piped water; Coverage for oral health in primary care; Dentists per 1000 inhabitants; Individual variables: age and sex.

Since the dental caries prevalence was higher among adults that have used dental service 1 or more years ago (Table 2) and who have done restorative treatment (filled tooth) during dental visits, a Poisson model was done considering only adults that have used dental service less than a year before the survey (Table 4). The pattern of association was kept, with a higher prevalence of dental caries as cavitation (crown) among adults with 1 or more filled tooth with caries (Table 4). However, the prevalence ratio was higher considering adults with recent dental service use (PR: 1.49, 95% CI: 1.35 - 1.65 – Table 4), compared to the whole sample (PR: 1.35, 95% CI: 1.27 - 1.44 – Table 2).

Table 4. Prevalence ratio (95% Confidence Intervals in brackets) of 1 or more teeth with dental caries (crown) in multilevel models with random intercepts and fixed effects according to the each main independent variables and adjusted by contextual and individual determinants among only 35 - to 44 – year - olds adults that used dental service less than a year.

	Model 1		Model 2		Model 3		Model 4	
	PR (95% CI)	*P*	PR (95% CI)	*P*	PR (95% CI)	*P*	PR (95% CI)	*P*
Filled tooth with caries (1 or more)	--	--	1.47 (1.33 - 1.62)	**< .0001**	1.49 (1.35 - 1.64)	**< .0001**	1.49 (1.35 - 1.65)	**< .0001**
Variance	0.04		0.04		0.009		0.008	
Filled tooth (1 or more)	--	--	0.60 (0.53 - 0.67)	**< .0001**	0.63 (0.56 - 0.71)	**< .0001**	0.63 (0.56 - 0.71)	**< .0001**
Variance	0.04		0.03		0.01		0.01	

Model 1 – empty.

Model 2 – only the main independent variable.

Model 3 – main independent variable + contextual variables.

Model 4 – main independent variable + contextual variables + individual variables.

Contextual variables: HDI, Gini index, Coverage for oral health in primary care; Dentists per 1000 inhabitants; Individual variables: age and sex.

DISCUSSION

Although the clinical evidence has suggested restorative treatments for dental caries lesions management according with the cavitation and activity[14,17], this approach only treat and control the consequence and sequelae of the disease (lesions). Since dental caries is a biofilm and sugar-induced disease,[5,6] the disease treatment should also consider the determinant factors to prevent new lesions. Therefore, when patients with dental caries are attended by dentists is expected that beyond the restorative treatments – when necessary – they should receive orientations and interventions regarding oral hygiene and diet to treat the disease and prevent new lesions. Our findings showed a significant association showing a higher prevalence of dental caries lesions as cavitation on the crown and root among adults with 1 or more filled tooth with caries. Tooth filled with caries represent an important negative oral health condition, since the same tooth element that has been treated still been affect by new lesions. Additionally, this patient may have new lesions in others tooth elements. These results suggest a higher dental caries prevalence among adults who were already attended dental services in the past (as showed by the filled tooth with caries). Interestingly, the tooth with only dental caries as cavitation is a different one that filled tooth with cavities. Moreover, the filled tooth with caries shows new cavities even in the same tooth that has already received a restorative treatment. Therefore, although it is a cross-sectional survey, the findings suggest that patients previously treated with restorative treatments are still presenting new lesions and only the lesions, not the disease, might have been the focus of the previous treatment.

In contrast to filled tooth with caries, the prevalence of dental caries lesions on the crown and root was lower among adults with filled tooth without caries. It may be explained by the quality of the restorative treatments and/or by the suitable control of the etiologic factors (biofilm formation and frequency of sugar intake). New caries lesions, commonly called as “secondary caries”, on filled tooth has been indicated as one of the main reasons for restoration failure[18]. Therefore, filled tooth with caries may represent a poor quality of dental services which might not consider a proper restorative technique and instructions regarding oral hygiene and diet to treat the disease. The evidence has suggested the combination of restorative techniques with fluoride products (i.e. varnish) to control and prevent dental caries lesions[19]. Interestingly, in situ study

showed that the use of fluoride toothpaste or resin-modified glass ionomer cement increase fluoride concentration in the biofilm and, consequently, controlling caries progression[20], which suggests the inclusion positive determinants of dental caries – fluoride – on caries lesion management to prevent new lesions.

The use of fluoride and its positive effect on caries control is attested in the literature[21,22] including by systematic reviews[13,23]. Nonetheless, the inclusion of fluoride has been suggested in dental materials used for restorative treatments to improve the local action of fluoride on dental caries lesions. Although the evidence has shown a positive effect of fluoride released from dental materials to control tooth demineralization[24,25], it has been based mainly on in vitro and in situ studies and needs more investigation. Recently, new restorative materials have been developed and suggested for dental caries treatment and control due to their bioactive properties and promising results[26,27]. However, it is necessary to improve and enhance their effectiveness as well as associate their use with the control of dental caries etiologic factors, since no improvement has been observed when clinical trial outcomes are observed[28,29].

The focus on restorative approach to treat dental caries has been attributed to the previous misunderstanding of dental caries concept as infectious disease and the needed to contaminated tissue removal[14]. Paradigm changes led to the evidence-based and correct concept of the disease as biofilm and sugar-dependent[5], and hence new approaches to control, prevent and treat have emerged. Consensus statements by Delphi studies and systematic reviews have suggested how to intervene in the caries process at different ages and conditions[14,17,30-32]. These studies have suggested that the intervention needs to consider the activity, cavitation and cleansability of the lesion[14]. Noninvasive, microinvasive and invasive strategies has been discussed to intervene in the caries process mainly to control or reduce caries activity[17,32]. Since nowadays the current evidence shows that caries disease can be treated and controlled by modifying the patient's caries risk based on determinant factors, biofilm and sugar intake, and not only by operative techniques where the focus is mainly the lesion, these consensuses have also suggested the needed to induce patients to adhere to healthy behaviors[14,17,32,33]. Together with preventive and controlling strategies, such as toothbrushing and sugar intake reduction, the evidence is clear when recommending fluoride toothpaste (1,000 - 1,500 ppm of fluoride) to reduce caries incidence[23]. Therefore, although restorative/operative approach may be necessary to intervene in caries process, it needs to be applied with strategies to modify patient's caries risk reducing biofilm accumulation and sugar exposure to treat the disease and control caries progression, as well as prevent new lesions.

Interestingly, the prevalence of dental caries lesions on the crown and root was higher among adults that used dental service in the last year previously the survey. This finding may suggest that the caries lesions (cavitation) are either recent and/or new lesions that were not considered or correctly managed by the dentists. Previous studies have shown the importance of oral health education in enhancing healthy behaviors and preventing dental caries[34,35]. Therefore, it should be routinely applied during dental visits, mainly for patients with high risk for dental caries. However, previous study conducted among Brazilian dentists showed that in-office fluoride application was the main dental caries preventive measured used[36]. Preventive measures, such as oral hygiene instruction and dental service use for prevention may also reduce the inequalities related to caries prevalence, dental service use and the impact of the disease on daily life[37]. Considering these aspects, the healthy literacy of patients should be considered for disease management at both the patient and institutional levels.

Health literacy consider the knowledge, motivation and abilities of people to access, understanding, evaluate and apply health-related information to adopt healthy behaviors, prevent diseases and promote health conditions and quality of life[38,39,40]. Therefore, healthy literacy concept can be applied for professionals, institutions and peoples focusing in the autonomy of patients and abilities to prevent, control and treat diseases. Since dental caries can be prevented, controlled and treated by adopting health behaviors (oral hygiene and diet) focusing on determinants of disease (biofilm and sugar), the health literacy concept is a promising and important approach that needs to be considered on the disease management, mainly considering dental caries consequences, such as pain[41], but it has been commonly neglected in the Dental field.

Although the association between caries lesions and filled tooth with caries has been found, a cross-sectional database was used. Thus, we cannot determine whether the restorative treatment was conducted before the occurrence of new lesions or whether the individual was

under treatment during the service and lesions had been treated. Therefore, further studies need to evaluate in details dentist approach to treat the disease and lesions on clinical practice and its outcomes for caries treatment. Moreover, the survey considered only dental caries as cavitation, and other indexes evaluating caries activities should be considered. In addition, health literacy was not evaluated and considered in the survey.

CONCLUSION

In conclusion, the prevalence of tooth with dental caries lesions (cavity) was higher among adults with filled tooth with caries. This association shows that the same individual has at least a tooth with caries lesion and other one filled and with cavities, mainly among them that have recently used dental services (1 year or less before the survey). These findings suggest that the patient was attended by dentists for restorative and invasive treatments but are still presenting caries lesions, even in the same tooth previously treated (filled tooth with caries). Therefore, the treatment may have been focused on the lesions and not on the dental caries disease. Preventive and therapeutic approaches for dental caries disease management should include measures focusing on determinants of the disease, biofilm accumulation, and sugar intake. In addition, when restorative techniques for lesions treatment are necessary, the professional should also consider the use of fluoride products as a disease's positive determinant for assisting in caries control and health literacy strategies focusing on healthy behaviors.

AUTHOR CONTRIBUTIONS

Conceptualization: SAST, JGSS, AMEBLM; Data analysis: SAST, DCM, JT, BECO, ABA, MM, JGSS, AMEBLM. Manuscript writing: SAST, DCM, JT, BECO, ABA, MM, JGSS, AMEBLM; Critical review: SAST, RCF, JGSS, AMEBLM; Approved final version: all authors.

CONFLICT INTEREST

None.

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