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Dental erosion and its association with eating disorders and gastroesophageal reflux disease in adolescent students

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ABSTRACT

Introduction: Dental erosion is a common problem in adolescents and may be associated with eating disorders and Gastroesophageal Reflux Disease. **Objective:** To determine the prevalence of dental erosion and its association with the risk of eating disorders and symptoms of gastroesophageal reflux disease in adolescent students. **Methods:** This cross-sectional, analytical, school-based study had a sample of 430 students of both sexes, aged 10 to 19 years, from public schools in inland Brazil. Adolescents undergoing orthodontic treatment and those who had some type of disability that prevented their participation were excluded. A self-administered questionnaire was applied to the participants, consisting of sociodemographic characteristics, food attitudes test, and symptoms of gastroesophageal reflux disease, followed by the Basic Erosive Wear Examination (BEWE) for clinical diagnosis of dental erosion. Data were analyzed with Pearson's chi-square test, Fisher's exact test, and Mann-Whitney test, with a margin of error set at 5%. **Results:** Dental erosion was found in 46.3% of adolescents, and 24.7% were at risk for eating disorders. As for gastroesophageal reflux disease, the mean (5.38±6.68) and median (4.59±5.34) were higher in students with dental erosion, without a significant association. **Conclusion:** This study showed a high prevalence of dental erosion among adolescents, predominantly on enamel.

Keywords: tooth erosion; Adolescent; gastroesophageal reflux; binge-eating disorder.

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INTRODUCTION

Eating disorders (ED) are psychopathological disorders that impact the patient's relationship with food and their own body image. They are manifested through altered eating behaviour and mental disorders with psychological and social damage[1,2].

These are persistent disorders that result in altered consumption or absorption of food, the main ones being Anorexia Nervosa (AN), characterized by low body weight and food restriction, and Bulimia Nervosa (BN), characterized by binge eating and inappropriate compensatory behaviors[3].

The prevalence of ED is 36.5% in the population, and females are the most affected ones[4]. These inappropriate eating behaviors can result in dental issues such as sensitivity, fractures, increased caries risk, tooth loss, and dental erosion, with the latter being the most frequently reported in the literature. Especially in bulimia, after episodes of binge-eating, self-induced vomiting occurs, and the acid produced in the mouth promotes the demineralization of tooth enamel to different degrees[5].

The impact of ED on oral health was initially reported by Hellstrom in the late 1970s[6]. Studies have indicated that the particularities of ED are noticeable mainly in the oral cavity during the first 6 months of development of the disorders[7].

Gastroesophageal reflux disease is defined as the reflux of gastric contents to the esophagus. Such a phenomenon can occur in physiological or pathological circumstances and in any individual, whether child or adult[8]. Gastroesophageal reflux disease (GERD) affects about 10 to 20% of the population worldwide. In Brazil, it affects approximately 12% of the population and can vary according to the region[9].

The direct contact of acids of intrinsic origin is regarded as the primary mechanism of damage to dental structures, leading to the dissolution of the teeth's inorganic material (hydroxyapatite crystals in the enamel), which occurs below the critical pH level of 5.55, and

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consequent irreversible loss of the dental substance calcified by the chemical action without bacterial involvement, that is, dental erosion[10]. It is the most observed oral alteration in both patients with ED and those with GERD[7].

The multidisciplinary approach with psychiatric, psychological, nutritional, and dental care is essential for prevention and treatment. Early diagnosis, combined with the suppression of refluxed acid through lifestyle modifications, has been reported as an effective method to prevent further damage and potential tooth loss; however, if the disease is already established, it is important to be monitored by a specialized team to prevent its progression[11,12].

Given the above, this study aimed to determine the prevalence of dental erosion and its association with the risk of eating disorders and symptoms of gastroesophageal reflux disease in adolescent students.

METHODS

This was a cross-sectional, analytical, and school-based study carried out in 12 state public schools in Pernambuco, Brazil, from August to October 2019. This study was conducted in accordance with the principles of the Declaration of Helsinki, approved under protocol number 3,202,773 and CAAE: 09036919.4.0000.5203.

For sample size calculation, it was considered the total number of students in the last school census, which was 21,147 adolescents enrolled in public schools located in urban areas. The minimum sample size required was 378 adolescents, with an increase of 20% for eventual losses, so the estimated value of the sample was 454 students. During the data collection, 24 subjects were excluded from the sample due to incorrect/incomplete completion of the questionnaire and absence of dental elements in three or more sextants. The final sample was 430 adolescents; the schools were selected by random sampling, and the sample was defined by simple random sampling without replacement. Both genders of students, aged from 10 to 19

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years, were included in the sample. The exclusion criteria were students with some disability or dysfunction that prevented their participation.

The calibration of the examiners occurred in two stages, through photographs and calibration with 20 students, who did not participate in the sample. The examiners were dentists properly trained for the research. To validate the process, the inter- and intra-examiner kappa test was performed, with 0.81 and 0.92, respectively. Visits were made to the schools at the times provided by the management, and after a brief explanation of the research, the adolescents answered a form consisting of sociodemographic data, the Eating Attitudes Test (EAT-26), and the symptom questionnaire for gastroesophageal reflux disease, the SQ-GERD.

To assess the risk of eating disorders, the Eating Attitudes Test (EAT-26) was translated and validated for adolescents in Brazil[13] The purpose of this test is to primarily measure restrictive eating behaviours, such as diet and fasting, and bulimic behaviours, such as excessive food intake and induced vomiting. It has 26 items and six response options in Likert format, ranging from 0 to 3 points (always = 3; often =2; sometimes =1; rarely, almost never, and never =0). A score greater than or equal to 21 on the EAT identifies the individual at risk for eating disorders, and a score less than 21 classifies him/her as an out-of-risk group[13].

For gastroesophageal reflux disease, the Symptom Questionnaire for gastroesophageal reflux disease (SQ-GERD) was used. This questionnaire has excellent reproducibility, is easy to understand, and can be answered quickly. The questionnaire was translated and validated in Brazil[14]. The score is calculated by the sum of the digits marked by the patients and can vary between 0 and 50 (0 being the best response, absence of GERD symptoms, and 50 the worst, presence of GERD symptoms). The last question assesses the patient's perception of their current health status at six levels of satisfaction[14].

The patients were submitted to clinical examination under natural light, using sterile gauze for cleaning teeth, a flat oral mirror without augmentation, by the examiner using PPE

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(cap, mask, and gloves). The instrument used to assess the presence of dental erosion was the Basic Erosive Wear Examination (BEWE), the four level score grades the appearance or severity of wear on the teeth from no surface loss (0), initial loss of enamel surface texture (1), distinct defect, hard tissue loss (dentine) less than 50% of the surface area (2) or hard tissue loss more than 50% of the surface area (3). According to this scoring system, all teeth are examined and then a score from 0 to 3 is assigned to the most affected surface of each sextant, at the end, these scores are summed and according to the final score, which ranges from 0 to 18, it is classified as: No erosive wear (less than or equal to 2), “low” erosive wear (between 3 and 8), “medium” erosive wear (between 9 and 13) and “high” erosive wear (above 14).

Statistical Analysis

The data were categorized in a spreadsheet in the Excel Software (Microsoft, USA) and analyzed in SPSS version 23 (IBM, USA). The margin of error used in the decision of the statistical tests was 5%.

Data were descriptively analyzed by absolute and percentage frequencies for categorical variables and measurements: mean, standard deviation, minimum value, P25, median, P75, and maximum value for the numerical variable, gastroesophageal reflux. To evaluate the association between two categorical variables, Pearson's Chi-Square Test or Fisher's Exact Test was used when the condition for use of the chi-square test was not verified, and for comparison between two categories in relation to numerical variables Mann-Whitney test was used.

The choice of the Mann-Whitney test was due to the absence of normality in the numerical variable in both categories. The verification of normality was performed by the Shapiro-Wilk test. The odds ratio (OR) and its respective 95% confidence intervals were calculated using univariate logistic regression.

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RESULTS

The age of the participants ranged from 10 to 19 years, with an average of 15.9 years. Most (88.1%) were in the age group between 15 and 19 years, and were female (51.9%). Regarding the family income, 43.5% of the respondents stated that it was up to one minimum wage; the level of education of the parents was a higher percentage in those who had incomplete middle school (41.4%).

Low erosive wear was observed in 199 adolescents examined (46%), and sextant 2 was the most affected site with score 1 (63.3%), whilst for the other sextants, score 0 was predominantly observed. In relation to eating disorders, approximately one quarter of the adolescents (24.7%) were in the risk group for eating disorders; the majority were female (60.4%). Table 1 shows the association between eating disorders and dental erosion.

Gastroesophageal reflux disease symptoms had a median of 4.96 ± 6.00 among the adolescents. In the GERD questionnaire, the adolescents rated the degree of satisfaction with their current health situation. 50% of the adolescents said they were satisfied, 33.3% indifferent, while 16.7% were very dissatisfied or disabled.

In table 2, observed in the total group according to the presence or absence of erosion, the mean and median of those surveyed with wear were correspondingly higher among those who had dental erosion; however, there was no significant difference ($p>0.05$) between the two subgroups in relation to gastroesophageal reflux disease.

DISCUSSION

Understanding the association between eating disorders and oral health has been a recent concern in Dentistry. Adolescents have been exposed to inadequate eating habits, such as consuming acidic foods, fast foods, spices, and sauces. It causes behavioural and somatic

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diseases which lead to serious repercussions, such as eating disorders and gastroesophageal reflux disease, for example[5].

In this study, the prevalence of dental erosion was high among the adolescents surveyed, corroborating the findings in the literature[10,15,16], which report this condition as a public health problem, as it is increasingly common in this age group from 10 to 19 years, with greater exposure to risk factors and less health care, due to lifestyle[10]. Thus, it is considered the most common chronic disease among adolescents[17].

Chronic regurgitation and self-induced vomiting promote the influx of gastric juice into the oral cavity, resulting in tooth erosion. Direct contact of the acid with the teeth is the main mechanism of the injury, by the dissolution of the inorganic material (hydroxyapatite crystals in the enamel), due to the low pH, without bacterial involvement[18]. Erosion can still be caused by factors such as poor oral hygiene, nutritional deficiency, chronic carbohydrate intake, dry mouth, and anxiety. It is also important to consider bruxism as a potential factor for dental wear, especially in incisors. While not the focus of the present study, future research should explore the interrelation of these factors.

In this study, half of the participants stated that they were satisfied with their current state of health, but it is noteworthy that almost one-fifth of the adolescents answered that they are dissatisfied with their appearance (16.7%). Another study found a 37% prevalence of body dissatisfaction among adolescents with symptoms of bulimia[19]. The overvaluation of thinness as a standard of beauty contributes to the development of eating disorders, resulting in an overestimation of the importance of eating habits, body shape, and weight, as well as the ability to control them, which can potentially influence both general health and oral health[3].

According to the answers obtained in the survey, about a quarter of the adolescents were at risk for ED, mostly females. Studies state that female adolescents with ED have a higher chance of dental erosion[4,5,18]. Due to episodes of recurrent vomiting, as well as long periods of

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fasting resulting from diets, there is a change in the quantity and quality of saliva[20]. The findings corroborate the observed data in the literature, which scores the highest incidence in females in a ratio of 10:1 when compared to males, since women tend to have a greater concern with their own image and their weight[4,18]. Additionally, studies indicate that the average age for the occurrence of this type of disorder would be between 17 and 25 years.

Regarding the teeth, it was found that the upper incisors were the most affected by dental erosion, as observed in the literature[21,22]. The presence of them longer in the mouth, considering that they are one of the first teeth to erupt, causes them to become more exposed to aggressive, extrinsic, and intrinsic agents, such as gastric acid present at reflux and episodes of vomiting[22]. The lingual surfaces of the mandibular teeth are often preserved, as they are protected by the tongue and saliva of the sublingual and submandibular glands[21,22].

The clinical manifestations of GERD can be divided into three main categories: the first one is composed by the most frequent and typical symptoms such as heartburn and regurgitation that worsen after meals and when the patient lies down and/or bends over; the second is related to the complications of GERD (mild dysphagia in the absence of any narrowing; odynophagia; hematemesis and melena); the third category, in turn, includes oropharyngeal dysphagia, asthma, recurrent chest pain and pharyngitis[23].

Studies indicate that the presence of reflux is associated with dental erosion and almost triples its occurrence; when gastroesophageal reflux disease episodes become more frequent, these chances are even higher[20,24-26]. Holbrook et al.[27] state that GERD is associated with the presence of dental erosion, and that the dental surgeon should alert the patient about this condition. A systematic review revealed that the prevalence of GERD increases with age and body mass index, which explains the lack of correlation, since the participants were on average 15 years old[28].

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Although the present study did not find a significant association between the variables, high rates of dental erosion were observed in individuals at risk for developing eating disorders. Pace et al.[18], when comparing studies of the association between GERD and dental erosion, found that the different diagnostic instruments, types of study, patient identification schemes, age of research participants, and results could not allow a correlation of conditions. In the present study, the instruments used to collect the data, referring to GERD and ED, were filled out by the participants themselves, which, depending on age and intellectual maturity, may have resulted in a bias in the interpretation/understanding of any question, leading to an incorrect answer[18,21,23].

Although we acknowledge that having the research team administer the questionnaires could have reduced potential biases related to the maturity and truthfulness of the responses, the self-administered format was chosen to ensure the privacy of the participants and to prevent any potential examiner bias. This methodology is also common in studies involving sensitive topics with adolescents, as it can encourage more candid answers. This limitation, along with the recall bias, will be considered in future research. The Basic Erosive Wear Examination (BEWE) evaluates all teeth and is therefore considered a simple and convenient index with sufficient sensitivity and specificity for diagnosis and use in adolescents[18].

Thus, more studies, with an adequate design, are necessary to elucidate the relationship between ED and GERD and oral diseases, considering their impact on oral health.

As for the limitations observed in the study, recall bias can be considered because it is a cross-sectional study. The age of the adolescents participating in the research may also have an influence on the low incidence of ED and high incidence of risk for the development of ED, since the average age in the literature for the development of ED is between 17 and 25 years, and the participants were up to 19 years. In addition, studies carried out with adolescents in the school environment may cause discomfort in responding reliably to the questions on the form,

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despite all efforts to avoid this type of bias. Another factor to be considered is the index used for the diagnosis of erosion. Although the BEWE is a simple and applicable index, the researchers, during calibration, need to define the parameters to standardize the diagnosis.

Conclusion

This study showed a high prevalence of dental erosion among adolescents, predominantly at the enamel level. The dental erosion was especially identified among the participants who composed the group at risk for developing eating disorders. There was no statistically significant association between dental erosion and gastroesophageal reflux disease. Furthermore, the findings highlight the need for nutritional and psychological follow-up for adolescents at risk, through consultations, lectures, and guidance on lifestyle changes.

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Table 1: Risk evaluation for eating disorders and degree of personal satisfaction and dental erosion.

Variable	Dental erosion				OR (95%)	p-Value*
	Yes		No			
	n	%	n	%		
Risk of eating disorders						0.990
Present	49	46.2	57	53.8	0.20	
Absent	150	46.3	174	53.7	1.00 (0.65 to 1.56)	

* Pearson's Chi-Square Test.

Table 2: Gastroesophageal reflux statistics according to the occurrence of dental erosion.

Dental erosion			
Yes	**No**	**Total Group**	**p-Value***
Mean ±SD Median (P25; P75)	Mean ±SD Median (P25; P75)	Mean ±SD Median (P25; P75)	
5.38 ± 6.68 4.00 (1.00; 8.00)	4.59 ± 5.34 3.00 (1.00; 7.00)	4.96 ± 6.00 3.00 (1.00; 7.25)	$p^* = 0.289$

*Mann-Whitney Test.

SD = standard deviation

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