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ORIGINAL ARTICLE

# Shame from Smiling and Speaking Due to Oral Health Problems in Brazilian Adolescents: A Nationwide Population-Based Study

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**ABSTRACT**

**Objective:** To investigate the association between oral health problems and being ashamed of smiling or speaking among Brazilian adolescents. **Material and Methods:** This was a population-based cross-sectional study carried out with secondary data from 7,328 12-year-old Brazilian adolescents from the latest Brazilian national oral health survey (*SB Brasil* 2010). The question "In the previous 6 months, have you been ashamed of smiling or speaking due to your teeth?" was the outcome variable. Calibrated examiners performed clinical examinations on adolescents for the diagnosis of dental caries (DMF-T), dental trauma, dental fluorosis and occlusal alterations. Data were analyzed descriptively and by Poisson unadjusted and adjusted Poisson regression analysis ($p<0.05$). The final model was controlled by family income. **Results:** The prevalence of being ashamed of smiling or speaking was 13.6%. The following variables were associated with the outcome: female sex (PR=1.33; 95% CI: 1.17-1.53), cavitated dental caries on upper incisors (PR=1.81; 95% CI: 1.51-2.15), dental trauma (PR=1.36; 95% CI:1.16-1.60), increased maxillary overjet (PR=1.36; 95% CI:1.18-1.57), dental crowding (PR=1.60; 95% CI:1.40-1.83), midline diastema (PR=1.30; 95% CI:1.11-1.44), tooth loss (PR=1.45; 95% CI:1.16-1.80), mild/questionable dental fluorosis (PR=1.23; 95% CI:1.06-1.44) and moderate/severe dental fluorosis (PR=1.67; 95% CI:1.15-2.44). **Conclusion:** Oral health problems that impact dental aesthetics were predisposing factors for being ashamed of smiling or speaking in Brazilian adolescents.

**Keywords:** Dental Caries; Fluorosis, Dental; Quality of Life; Tooth Injuries; Oral Health.

## Introduction

Oral health-related quality of life (OHRQoL) is a multidimensional construct related to the extent to which oral health problems negatively influence individuals' well-being, daily activities, and quality of life [1]. Measures evaluating these factors are increasingly being employed since they can supplement clinical indicators and provide a broader understanding of the health of populations [2].

Notably, this construct has been the focus of a growing number of investigations [3-6]. In general, most studies found that oral health problems such as dental caries, traumatic dental injuries, occlusal alterations, and dental fluorosis negatively affected the well-being of children and adolescents [3-6]. However, while the outcome impacted the OHRQoL among most studies, few studies have evaluated the extent to which oral health problems interfere with specific daily activities [4,7].

Adolescence is a critical phase in which appearance, especially of the face, is of pivotal importance [8]. During this phase, social life and interpersonal relationships are intense and appearance may influence self-acceptance and the development of friendships. Individuals with more attractive physical characteristics tend to experience greater social acceptance [9,10]. Moreover, an unpleasant dental appearance may stigmatize, hinder professional achievement, encourage negative stereotypes and diminish self-esteem [11,12]. Thus, it is possible that adolescents with oral health problems impairing aesthetics are more likely to be ashamed of smiling, speaking, or showing their teeth.

Although previous studies have investigated the influence of oral conditions on daily activities such as smiling or speaking [3,4,6], the literature is still scarce in studies specifically exploring the association between oral health problems and the avoidance of smiling as the main outcome. A previous investigation conducted in this line focused on preschool children only [7]. Furthermore, no study has examined the association between specific occlusal abnormalities—such as increased overjet or mandibular incisal crowding—and specific limitations on the daily life of adolescents. Additional studies are important to obtain an in-depth understanding of this subject as well as to guide the planning and allocation of resources and public health policies.

The aim of the present study was to investigate the factors associated with being ashamed of smiling or speaking due to oral health problems in a nationwide representative sample of 12-year-old adolescents.

## Material and Methods

The present study is reported according to the recommendations of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE Statement) [13].

### Study Design and Sample Characteristics

A population-based cross-sectional study was developed using secondary data from the latest Brazilian national oral health survey (*SB Brasil* 2010). The *SB Brasil* 2010 dataset was provided upon request to the National Coordination of Oral Health, Ministry of Health of Brazil.

The *SB Brasil* 2010 project followed the World Health Organization (WHO) criteria [14] and was developed by the Brazilian Ministry of Health to gather epidemiological information concerning the oral health conditions of the Brazilian population from all state capitals as well as 150 municipalities from the interior of the five regions of Brazil (north, northeast, southeast, south and mid-west). Participants were randomly selected using a probabilistic cluster sampling technique with two stages (census tract and domicile) for the 27 capitals and three stages (municipality, census tract and domicile) for the 150 municipalities from the interior.

The sample size was calculated based on the number of decayed, missed and filled teeth (DMF-T) from the previous national oral health survey and considering a design effect of two.

A total of 37,519 subjects of the following ages were interviewed and examined: 5, 12, 15 to 19, 34 to 45, and 65 to 74 years old [15]. In the present study, only 12-year-old adolescents were included (n = 7,328). The sample is representative of the five geographic regions of Brazil.

Training and Calibration of Examiners

Prior to data collection, oral health teams were trained and instructed regarding the logistics of the study. Subsequently, a calibration exercise was also performed to ensure diagnostic accuracy. Teams consisted of an examiner (dentist) and an annotator who were trained in a 32-hour workshop. The training comprised the operational details of the research as well as a discussion of diagnostic criteria. Calibration was performed to simulate the oral conditions to be found in field research and involved the calculation of agreement coefficients (Cohen's kappa coefficient). Only dentists who obtained a kappa statistic of 0.65 or above participated as examiners in the study, as recommended by the WHO [14,15].

Clinical Data Collection

Data collection took place at the subjects' domiciles. Clinical exams were performed to diagnose the following conditions: dental caries, dental trauma, occlusal alterations and dental fluorosis.

Dental caries was diagnosed according to the WHO criteria (DMF-T) [14]. For the diagnosis of dental trauma, clinical signs of coronary fracture and dental avulsion in the permanent incisors were considered.

The following occlusal alterations were accounted for: anterior open bite, maxillary overjet, mandibular incisal crowding, and midline diastema. The absence of vertical overlap of the maxillary incisors over the mandibular incisors was recorded as an anterior open bite (measured with a millimetric probe). Increased overjet was recorded when greater than 2mm (measured with a millimetric probe) [16]. Occlusal abnormalities were diagnosed according to WHO recommendations [14].

Dean's index [17] was employed to diagnose dental fluorosis as follows: normal (glossy, smooth, even enamel surface, and white or pale creamy white in colour), questionable (altered glossiness with few white spots on enamel surface), very mild (irregular white opaque flecks on < 25% of enamel surface), mild (white opaque flecks on < 50% but > 25% of enamel surface), moderate (distinctive enamel attrition such as wear with brown staining) and severe (distinctive enamel attrition such as wear with brown staining).

Non-clinical Data Collection

Adolescents answered the following question addressing their self-perception of the impact of oral conditions on smiling and speaking: "In the previous 6 months, have you been ashamed of smiling or speaking due to your teeth?", which was the outcome variable in the present study. Additionally, the parent/caregiver of the child responded to a questionnaire addressing socio-economic data.

Data Analysis

Statistical analysis involved both descriptive and inferential statistics. Descriptive statistics were used to characterize the sample, while unadjusted and adjusted Poisson regression analysis with robust variance tested associations between being ashamed of smiling and speaking and the independent variables ($p<0.05$). The stepwise backward method was employed to select variables with a p-value ≤ 0,20 at the unadjusted level.

Variables with a p-value < 0.05 in the adjusted analysis were considered to be associated with the outcome. Data organization and statistical analyses were performed using the Statistical Package for Social Sciences (IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.).

Ethical Issues

The *SB Brasil* 2010 project was conducted in accordance with the determinations of the Declaration of Helsinki and received approval from the National Council of Health (certificate number: 15.948). All parents/caregivers received clarification regarding the objectives of the study and signed a statement of informed consent.

## Results

A total of 7,328 12-year-old adolescents and their parents/caregivers participated in the present study (response rate = 91.6%). There was an even distribution of participants in terms of sex (50.3% female and 49.7% male). Most adolescents belonged to families with a monthly income higher than R$ 500 (79.8%), whereas 20.2% were from families with an income up to R$ 500.

The frequency of adolescents that were ashamed of smiling or speaking due to oral problems was 13.6%. Overall, only 8.5% of participants had cavitated dental caries in the upper incisors, while 21.7% presented dental trauma. The prevalence of occlusal abnormalities was: 14.4% for anterior open bite, 43.1% for mandibular incisal crowding and 34.0% for increased maxillary overjet. One-quarter of adolescents (25.1%) had midline diastema and approximately 15% of participants had dental fluorosis ranging between very mild and severe. The prevalence of tooth loss was 6.3% (Table 1).

**Table 1. Frequency of oral health problems and of being ashamed of smiling or speaking among 12-year-old Brazilian adolescents.**

| Variables | N | % |
|---|---|---|
| Ashamed of smiling or speaking | | |
| Yes | 991 | 13.6 |
| No | 6297 | 86.4 |
| Dental trauma | | |
| Present | 1589 | 21.7 |
| Absent | 5739 | 78.3 |
| Cavitated caries on upper incisors | | |
| Present | 558 | 8.5 |
| Absent | 5968 | 91.5 |
| Anterior open bite | | |
| Present | 1057 | 14.4 |
| Absent | 6271 | 85.6 |
| Maxillary overjet | | |
| Normal (≤ 2mm) | 4840 | 66.0 |
| Increased (≥ 3mm) | 2488 | 34.0 |
| Mandibular dental crowding | | |
| Present | 3053 | 43.1 |
| Absent | 4038 | 56.9 |
| Midline diastema | | |
| Present | 1839 | 25.1 |
| Absent | 5489 | 74.9 |
| Dental fluorosis | | |
| Normal/questionable | 6110 | 84.5 |
| Very mild/mild | 1004 | 13.9 |
| Moderate/severe | 118 | 1,6 |

| | | |
|---|---|---|
| Tooth loss | | |
| Yes | 460 | 6.3 |
| No | 6787 | 93.7 |

Table 2 displays the results of the bivariate and multivariate Poisson regression analyses. At the bivariate level, the prevalence rate of being ashamed of smiling or speaking was significantly higher among female adolescents. In addition, monthly family income of up to R$500, dental trauma, cavitated caries on the upper incisors, anterior open bite, increased maxillary overjet, mandibular incisal crowding, midline diastema, dental fluorosis and tooth loss were associated with the outcome (p<0.05). In the adjusted model, being ashamed of smiling or speaking was associated with the female sex (PR=1.33), cavitated caries in the upper incisors (PR=1.81), dental trauma (PR=1.36), increased maxillary overjet (PR=1.36), mandibular incisal crowding (PR=1.60), midline diastema (PR=1.30), higher severity of dental fluorosis (PR=1.20; PR=1.67) and tooth loss (PR=1.45).

**Table 2. Unadjusted and adjusted Poisson regression models of being ashamed of smiling and speaking and independent variables in 12-year-old adolescents.**

| Variables | Ashamed of Smiling or Speaking | | Unadjusted PR* | | Adjusted PR*** | |
|---|---|---|---|---|---|---|
| | Yes N (%) | No N (%) | p-value | (95% IC) | p-value | (95% IC) |
| Sex | | | | | | |
| Male | 429 (11.9) | 3191 (88.1) | <0.001 | 1.00 | <0.001 | 1.00 |
| Female | 562 (15.3) | 3106 (84.7) | | 1.33 (1.16-1.52) | | 1.33 (1.17-1.53) |
| Monthly family income | | | | | | |
| > R$ 500 | 720 (13.1) | 4797 (86.9) | 0.013 | 1.00 | - | - |
| ≤ R$ 500 | 21 (15.2) | 1181 (84.8) | | 1.21 (1.04-1.42) | | - |
| Cavitated caries on upper incisors | | | | | | |
| Present | 129 (23.2) | 428 (76.8) | <0.001 | 1.97 (1.66-2.34) | <0.001 | 1.81 (1.51-2.15) |
| Absent | 721 (12.1) | 5241 (87.9) | | 1.00 | | 1.00 |
| Dental trauma | | | | | | |
| Absent | 727 (12.3) | 5176 (87.7) | <0.001 | 1.00 | <0.001 | 1.00 |
| Present | 283 (17.9) | 1298 (82.1) | | 1.47 (1.25-1.72) | | 1.36 (1.16-1.60) |
| Anterior open bite | | | | | | |
| Present | 183 (17.4) | 866 (82.6) | 0.018 | 1.26 (1.04-1.53) | - | - |
| Absent | 808 (13.0) | 5431 (87.0) | | 1.00 | | - |
| Maxillary overjet | | | | | | |
| Normal (≤ 2mm) | 634 (10.6) | 5358 (89.4) | <0.001 | 1.00 | <0.001 | 1.00 |
| Increased (> 3mm) | 978 (15.4) | 5353 (84.6) | | 1.44 (1.25-1.65) | | 1.36 (1.18-1.57) |
| Mandibular crowding | | | | | | |
| Present | 523 (17.2) | 2517 (82.8) | <0.001 | 1.68 (1.47-1.92) | <0.001 | 1.60 (1.40-1.83) |
| Absent | 425 (10.6) | 3592 (89.4) | | 1.00 | | 1.00 |
| Midline diastema | | | | | | |
| Present | 279 (15.3) | 1543 (84.7) | 0.013 | 1.17 (1.03-1.33) | 0.001 | 1.30 (1.11-1.51) |
| Absent | 712 (13.0) | 4754 (87.0) | | 1.00 | | 1.00 |
| Dental fluorosis | | | | | | |
| Normal/questionable | 791 (13.0) | 5289 (87.0) | | 1.00 | | 1.00 |
| Very mild/mild | 161 (16.1) | 839 (83.9) | 0.007 | 1.23 (1.06-1.44) | 0.040 | 1.20 (1.01-1.44) |
| Moderate/severe | 25 (21.2) | 93 (78.8) | 0.007 | 1.62 (1.14-2.32) | 0.006 | 1.67 (1.15-2.44) |
| Tooth loss | | | | | | |
| Yes | 89 (19.4) | 370 (80.6) | <0.001 | 1.56 (1.26-1.94) | 0.001 | 1.45 (1.16-1.80) |
| No | 889 (13.2) | 5865 (86.8) | | 1.00 | | 1.00 |

*Unadjusted Poisson regression of independent variables and being ashamed of smiling or speaking; **Variables incorporated in the multivariate model (p<0.20): sex, monthly family income, cavitated caries on upper incisors, dental trauma, anterior open bite, maxillary overjet, mandibular crowding, midline diastema, dental fluorosis and tooth loss; ***Adjusted Poisson regression for independent variables and being ashamed of smiling or speaking.

## Discussion

The percentage of adolescents ashamed of smiling or speaking due to oral health problems was lower than reports from previous investigations [18-21]. Previous studies also conducted in Brazil reported prevalence rates of being ashamed of smiling due to oral conditions of between 26.5% and 32.3% among children and adolescents [18,20,21]. Notably, the divergent results between the present and previous studies are likely a consequence of methodological differences. In addition to the age of participants not being consistent across investigations, previous studies were school-based, whereas the adolescents in the present study were recruited in their domiciles. Moreover, the presence of the parent/caregiver during interviews with adolescents may have influenced their responses.

Adolescents with cavitated caries in the upper incisors were ashamed of smiling or speaking significantly more than those caries-free. Adolescents are more concerned with body image and self-esteem and are highly influenced by certain beauty standards [22]. Our findings showed that cavitated caries in the upper incisors may directly influence aesthetics, thereby impacting adolescents' self-esteem [23]. Moreover, it has been reported that adolescents' victims of criticism due to oral health issues have increased odds of experiencing bullying [24]. Thus, teenagers with oral conditions with aesthetic consequences may adopt behaviors such as avoiding smiling or speaking as a defense mechanism.

Dental trauma was significantly associated with the outcome, even after controlling for confounding variables. Investigations conducted in Jordan [25] and Egypt [26] have also reported similar results. However, comparisons between the findings of the present study and of the cited studies should be made with caution due to methodological differences between investigations, such as the different diagnostic criteria employed for dental trauma. Nevertheless, this association highlights the importance of implementing measures to prevent dental trauma, such as promoting healthy leisure environments and using protective equipment during sports activities.

Except for the anterior open bite, all remaining occlusal abnormalities were associated with being ashamed of smiling or speaking. Notably, the literature has highlighted an association between bullying and occlusal alterations [27,28]. Thus, it is possible that an increased overjet, as well as the presence of midline diastemas and mandibular incisal crowding, increase the likelihood of adolescents being teased at school, which leads to them avoiding showing their teeth. Moreover, subjects with an increased overjet are more prone to mouth breathing and subsequent halitosis due to dryness of the oral mucosa [29,30], which also explains our results. Likewise, tooth loss was associated with the outcome, which reinforces the importance placed on aesthetics during adolescence. The association between anterior open bite and the outcome lost its statistically significant in the adjusted model. The majority of adolescents with this occlusal alteration presented an open bite measuring between 1m to 2 mm. It seems that anterior open bite was not so severe to cause an aesthetic impact, explaining our findings.

Severe stages of dental fluorosis have been linked to a negative self-perception of oral health [31]. The findings of the present study support such a statement, as there was a dose-response gradient in the strength of association between this condition and the outcome. An investigation conducted in Iran found a moderate correlation between avoiding smiling and the severity of fluorosis [32]. Very mild and mild levels of fluorosis were also associated with the outcome, which demonstrates that adolescents can identify even the slightest forms of this condition. This finding reinforces the high values that adolescents place in aesthetics and also shows that parents and dentists should not underestimate the potential negative impact of even mild levels of fluorosis in adolescents' OHRQoL. Instructing parents and patients regarding the rational use of fluorides

and the maintenance of surveillance policies for public water fluoridation to maintain fluoride at optimal concentrations are important strategies to reduce such consequences.

An interesting finding of the present study was that female adolescents were significantly more likely to be ashamed of smiling or speaking when compared to their male peers. Sex might exert an influence on the perception of the consequences of oral health problems on quality of life [33]. Indeed, girls are more critical of and worried about aesthetics and dentofacial appearance [18], which also explains our results.

While useful, the present study has the inherent limitations of a cross-sectional design, which prevents the determination of causality. Other limitations include relying on secondary data and restrictions in the diagnosis of dental trauma since only fractures and tooth avulsions were considered. On the other hand, a series of actions were undertaken to minimise other biases. The random selection of participants, as well as the robust and representative sample of the five regions of Brazil and state capitals, increase our confidence in the results of this investigation. Furthermore, examiner calibration and the use of multivariate analyses also contribute to the soundness of the data.

Extrapolating the results of the present study to the country population translates to approximately 480,000 12-year-old Brazilian adolescents that are ashamed of smiling or speaking due to oral health problems. This is an expressive figure that highlights the need to intensify oral health promotion and prevention actions while increasing the availability of dental services, especially for orthodontic treatment. Accessing orthodontic treatment in Brazil is difficult, as this treatment modality is rarely offered in the Brazilian public health system. Increasing the offer of this specialty may contribute to the early treatment of occlusal abnormalities, thereby avoiding negative consequences on social well-being among adolescents.

## Conclusion

The present study showed that the female sex and oral health problems that impact dental aesthetics, such as cavitated dental caries on upper incisors, dental trauma, increased maxillary overjet, dental crowding, midline diastema, tooth loss, and dental fluorosis, are predisposing factors for being ashamed of smiling or speaking in Brazilian adolescents.

## Authors' Contributions


| | | |
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All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.


## Financial Support

None.

## Conflict of Interest

The authors declare no conflicts of interest.

## Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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