

Original Article

## Assessment of Oral Hygiene Level and Periodontal Condition in Brazilian Adolescents

Fábio Gomes dos Santos<sup>1</sup>, Yêska Paola Costa Aguiar<sup>2</sup>, Alidianne Fábria Cabral Cavalcanti<sup>2</sup>, Liege Helena Freitas Fernandes<sup>3</sup>, Rodrigo Feliciano Macedo<sup>4</sup>, Douglas Pereira de Sousa<sup>4</sup>, Alessandro Leite Cavalcanti<sup>5</sup>

<sup>1</sup>DDS, MSc in Dentistry, State University of Paraíba, Campina Grande, PB, Brazil.

<sup>2</sup>PhD student, Post-Graduate Program in Dentistry, State University of Paraíba, Campina Grande, PB, Brazil.

<sup>3</sup>Master's student, Post-Graduate Program in Dentistry, State University of Paraíba, Campina Grande, PB, Brazil.

<sup>4</sup>DDS, State University of Paraíba, Campina Grande, PB, Brazil.

<sup>5</sup>Professor, State University of Paraíba, Campina Grande, PB, Brazil.

Author to whom correspondence should be addressed: Fábio Gomes dos Santos, Rua Valdemar Chianca, 380, apto 401, Bairro: Jardim Oceania. 58037-255 João Pessoa, Paraíba. Phone: +55 83 9.87023866. E-mail: [fabiogomes\\_ca@outlook.com](mailto:fabiogomes_ca@outlook.com).

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### Abstract

**Objective:** To evaluate the oral hygiene level and periodontal condition of adolescents aged 15-19 years and socioeconomic factors. **Material and Methods:** Cross-sectional study with 630 adolescents from public schools randomly selected in the city of Campina Grande, Brazil. For data collection, a form containing socioeconomic variables and those related to oral hygiene was used. The oral hygiene level was measured through the Simplified Oral Hygiene Index (OHI-S) and periodontal condition was evaluated by the Community Periodontal Index (CPI). Data were descriptively and inferentially analyzed using the chi-square test, adopting significance level of 5%. **Results:** Adolescents were mostly females (59.5%), aged 16 years (32.4%), non-white (77.8%), with family income lower than US \$ 612.00 (55.1%), with parental schooling of up to high school (50%). Periodontal condition showed no significant association with any of the socioeconomic factors ( $p > 0.05$ ). All participants reported using toothbrush; however, the control of interproximal plaque with flossing was reported by only 44.1%, being higher among females ( $p = 0.028$ ), and its use has been associated with periodontal status ( $p = 0.026$ ). The oral hygiene level was satisfactory for 59.7% of adolescents, while CPI showed that only 1.6% of them had healthy periodontium and gingival bleeding (34.4%) and presence of dental calculus (37, 8%) were the most prevalent alterations. **Conclusion:** Adolescents showed satisfactory oral hygiene condition; however, there was a high prevalence of gingival bleeding and dental calculus. Periodontal condition was associated with flossing; however, association with socioeconomic factors was not observed.

**Keywords:** Periodontal Diseases, Oral Hygiene, Adolescent.

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## Introduction

Periodontal diseases and other diseases of the oral cavity are a public health problem worldwide [1], which may have a great impact on overall health and quality of life of individuals [2].

Biofilm accumulation leads to an inflammatory response in the marginal gingiva, characterizing gingivitis [1], which is the most prevalent form of periodontal disease, being common both in young individuals and in older age groups [3]. In young individuals, this condition usually remains chronic for a prolonged period of time without causing any damage to the periodontal ligament or bone [3].

Despite being reversible, when the etiologic agent is only biofilm [4], a change in the balance between biofilm and host [3] can cause gingivitis to develop into periodontitis [5], which is a destructive process of connective tissue attached to the bone, whose clinical signs include progressive development of periodontal pockets and clinical attachment loss, culminating in tooth loss [1].

The severity of periodontal diseases depends on the level of accumulated biofilm, virulence of its microorganisms and humoral and cell immune responses of the individual to the microbial biofilm [3]. The daily control of biofilm by individuals by means of mechanical methods is the best way to ensure the maintenance of periodontal health [4,5].

Advancing age behaves as a risk factor for the progression of periodontal diseases [6]. However, its development, including in the aggressive forms, occurs not only in adults but also in children and adolescents [4].

A recent study showed that gingivitis affects 34.7% of Latin American adolescents and the average periodontitis rate in this population was less than 10% [3]. In Brazil, the national epidemiological survey on oral health - SB Brasil 2010 - showed that 49.1% of adolescents aged 15-19 years showed some periodontal change, and gingival bleeding and presence of dental calculus were the most prevalent conditions [7]. In a city in northeastern Brazil, gingival bleeding, calculus, shallow periodontal pockets were present, respectively, in 49.6%, 48% and 5.4% of adolescents in this age group [8].

Periodontal disease is, therefore, a highly prevalent problem in the population [5]. Estimates of its prevalence and identification of risk factors from cross-sectional studies in young adults have been the focus of most studies conducted in developed countries, but there is lack of data regarding adolescents and young adults in developing countries [3,9], such as Brazil.

Obtaining data on the oral health of a population and the prediction of future care can be made through descriptive epidemiological surveys [10]. Thus, considering the cumulative nature of periodontal diseases [6], there is a need to know the periodontal health of the young population and its oral hygiene level to determine effective public policies that meet the actual deficiency of this age group and minimize the consequences caused by periodontal diseases, thus obtaining an adult population with good oral health and without early tooth loss.

Given the above, this study aimed to assess the oral hygiene level and periodontal condition of public school students aged 15-19 years and to assess the association between periodontal condition and socioeconomic aspects.

## **Material and Methods**

### **Study Design and Sample Selection**

An epidemiological, cross-sectional, descriptive and analytical survey was conducted between October 2012 and April 2013 in the city of Campina Grande, Paraíba, a municipality located in northeastern Brazil with about 405,072 inhabitants, human development index of 0.720 and a total of 53 high schools, 32 public and 21 private, with 9,367 students enrolled in the public school network [11].

The universe comprised a total of 6,514 students enrolled in the day shift of twenty state schools located in the urban area of the city. The parameters used to determine the minimum sample size for a finite population were: estimated prevalence of 50% of the outcome (periodontal disease), alpha error of up to 5% and a 20% increase for losses or refusals. The value obtained was multiplied by a drawing effect (Deff) of 1.6.

A total of 697 individuals aged 15-19 years were randomly selected through a stratified sampling plan for two-stage cluster (schools and classes). The number of randomly selected students was proportional to the size of each school in order to obtain a sample (n) representative of the population per health district [12].

The following exclusion criteria were adopted: patients who reported being hypertensive and / or diabetic, smokers, edentulous, fixed orthodontic appliance carriers that would prevent the application of periodontal indexes and individuals who had performed scaling and root planing procedures three months prior to dental examination.

### **Training and Calibration**

The calibration process of examiners occurred with 10 volunteers in two stages: initially in lux and subsequently in vivo. The intra-examiner agreement (Kappa = 0.784 and 0.679) and inter-examiner values (Kappa = 0.603) were considered significant [13].

### **Pilot Study and Data Collection**

A group of eighteen students aged 15-19 years from a public school was selected to participate in the pilot study. Data obtained in this phase were not included in the final results.

Data were collected through the application of a form containing identification data and socioeconomic information, as well as issues related to oral hygiene habits. Then, dental clinical examinations were performed with the aid of mouth mirror and periodontal probe OMS (Trinity Ind. Com. Ltda., São Paulo, SP, Brazil), with participants sitting in a chair with back and examiners

sitting in front of them or standing behind them, making use of standardized artificial light coupled to the head, inside the school, in special spaces and respecting biosecurity standards.

The oral hygiene level was measured through the Simplified Oral Hygiene Index (OHI-S), with the help of Replak biofilm disclosing solution (Dentsply Ind. Com. Ltda., Petropolis, RJ, Brazil) and the periodontal condition was evaluated by the Community Periodontal Index (CPI).

OHI-S evaluates the amount of biofilm attached to the surfaces of six index teeth (16, 11, 26, 36, 31 and 46) [14]. For this study, the oral hygiene level was considered satisfactory when biofilm was present in up to  $\frac{1}{3}$  of the tooth surface, regular when it was present in up to  $\frac{2}{3}$  of the tooth surface and unsatisfactory when biofilm was present in over  $\frac{2}{3}$  of the tooth surface. The oral hygiene level was calculated by adding the scores of each index tooth, dividing them by the number of examined teeth.

The Community Periodontal Index (CPI) has been widely used to determine the periodontal health profile of individuals and plan prevention programs to control periodontal diseases in developed and developing countries [1]. It evaluates the periodontal condition of individuals regarding healthiness, bleeding on probing, presence of dental calculus and shallow (probing depth between 3.5 - 5.5mm) and deep periodontal pocket (probing depth > 5.5mm), dividing the mouth into six sextants, where each is represented by an index tooth that, for individuals aged up to 19 years, are the following elements: 16, 11, 26, 36, 31 and 46 [15]. Participants who presented healthiness in all surveyed sites were classified as healthy, and those showing sites with any periodontal changes (bleeding, calculus or pocket) were classified as with periodontal changes [16].

#### Ethical Aspects

This study was approved by the Ethics Research Committee of the State University of Paraiba, under CAEE number: 03263612.4.0000.5187 and participants (or legal guardians) signed the Informed Consent Form authorizing their participation in this study, as recommended by Resolution 466/12 of the National Health Council / MS [17].

#### Statistical Analysis

After being tabulated (double entry), data were descriptively and inferentially analyzed (Chi-square, significance level  $p < 0.05$ ), using the SPSS statistical software (Statistical Package for Social Sciences, version 18.0).

#### Results

A total of 630 adolescents agreed to participate in the survey, and the sample loss was 9.6%, which main reasons were lack of interest in participating, not being present at the examination day and no parental consent for participation.

There was a predominance of females (59.5%), aged 16 years (32.4%), non-white (77.8%), with family income lower than US \$ 612.00 (55.1 %) with parental schooling of up to high school

(50%). Periodontal condition showed no significant association with any of the socioeconomic factors (Table 1).

**Table 1. Distribution of adolescents according to socioeconomic characteristics and according to the periodontal condition.**

Variables	Periodontal Condition		Total n (%)	P-value*
	Health (CPI=0) n (%)	Periodontal Change (CPI≥1) n (%)		
Sex				
Male	6 (1,0%)	249 (39,5%)	255 (40,5%)	0,330
Female	4 (0,6%)	371 (58,9%)	375 (59,5%)	
Age (in years)				
15	4 (0,6%)	156 (24,8%)	160 (25,4%)	0,348
16	5 (0,8%)	199 (31,6%)	204 (32,4%)	
17	1 (0,2%)	172 (27,3%)	173 (27,5%)	
18	0 (0%)	74 (11,7%)	74 (11,7%)	
19	0 (0%)	19 (3%)	19 (3%)	
Race (self-reported)				
White	3 (0,5%)	137 (21,7%)	140 (22,2%)	0,713
Non-white**	7 (1,1%)	483 (76,7%)	490 (77,8%)	
Family income***				
< US\$ 612,00	6 (1,0%)	341 (54,1%)	347 (55,1%)	1,000
≥ US\$ 612,00	4 (0,6%)	279 (44,3%)	283 (44,9%)	
Schooling (Family Head)				
Illiterate	0 (0%)	9 (1,4%)	9 (1,4%)	0,693
Elementary school	6 (1,0%)	246 (39,0%)	252 (40,0%)	
High school	4 (0,6%)	311 (49,4%)	315 (50,0%)	
Higher education	0 (0%)	50 (7,9%)	50 (7,9%)	
Not informed	0 (0%)	4 (0,6%)	4 (0,6%)	

\*Chi-square test. \*\*Includes yellow, brown, black and indigenous races. \*\*\*According to the current minimum wage value in Brazil in October 2012.

Regarding oral hygiene habits, all participants reported using toothbrush and toothpaste (Table 2). However, control of interproximal plaque with flossing was reported by only 44.1% of the sample, being significantly higher in females ( $p = 0.028$ ). Other hygiene resources (mouthwash, tongue cleaner or other devices) showed no statistically significant results regarding gender ( $p > 0.05$ ). Association between periodontal condition and flossing was observed ( $p = 0.026$ ), with no association between periodontal condition and other oral hygiene devices (Table 2). The oral hygiene level was satisfactory in 59.7% (376) of adolescents, while CPI showed that 58.4% (368) had at least one periodontal condition change (Table 2).

**Table 2. Use of oral hygiene devices and oral hygiene level of participants according to gender and periodontal condition of adolescents.**

Variables	Sex		P-value	Periodontal Condition		P-value
	Male n (%)	Female n (%)		Health (CPI =0)	Periodontal Change (CPI≥1)	
Toothbrush and toothpaste						
Yes	255 (40,5%)	375 (59,5%)		10 (1,6%)	620 (98,4%)	

Dental floss						
Yes	99 (15,7%)	179 (28,4%)	0,028	8 (1,3%)	270 (42,8%)	0,026
No	156 (24,8%)	196 (31,1%)		2 (0,3%)	350 (55,6%)	
Mouthwash						
Yes	75 (11,9%)	123 (19,5%)	0,383	2 (0,3%)	196 (31,1%)	0,732
No	180 (28,6%)	252 (40%)		8 (1,3%)	424 (67,3%)	
Tongue cleaner						
Yes	40 (6,3%)	55 (8,7%)	0,735	0 (0%)	95 (15,1%)	0,373
No	215 (34,1%)	320 (50,8%)		10 (1,6%)	525 (83,3%)	
Another devices						
Yes	7 (1,1%)	6 (1%)	0,395	0 (0%)	13 (2,1%)	1,000
No	248 (39,4%)	369 (58,6%)		10 (1,6%)	607 (96,3%)	
OHI-S						
Satisfactory	157 (24,9%)	219 (34,8%)	0,457	8 (1,3%)	368 (58,4%)	0,330
Unsatisfactory	98 (15,6%)	156 (24,8%)		2 (0,3%)	252 (40,0%)	

Regarding the periodontal condition, the prevalence of healthiness was only 1.6%, and gingival bleeding and presence of calculus were the most frequent changes, 34.4% and 37.8%, respectively (Table 3). None of the individuals aged 18-19 showed satisfactory periodontal health.

**Table 3. Prevalence of healthiness, bleeding, calculus, shallow pocket and deep pocket of individuals according to the maximum CPI score.**

Variables	Healthiness	Bleeding	Calculus	SP	DP	P-value	CI (95%)	
	n (%)	n (%)	n (%)	n (%)	n (%)		L.L.	U.L.
Sex								
Male	6 (1%)	87 (13,8%)	88 (14%)	69 (11%)	5 (0,8%)	0,383	0,381	0,458
Female	4 (0,6%)	130 (20,6%)	150 (23,8%)	84 (13,3%)	7 (1,1%)			
Age (in years)								
15	4 (0,6)	69 (11%)	47 (7,5%)	38 (6%)	2 (0,3%)	0,013	0,010	0,032
16	5 (0,8%)	67 (10,6%)	86 (13,7%)	45 (7,1%)	1 (0,2%)			
17	1 (0,2%)	50 (7,9%)	71 (11,3%)	48 (7,6%)	3 (0,5%)			
18	0	25 (4%)	26 (4,1%)	19 (3%)	4 (0,6%)			
19	0	6 (1%)	8 (1,3%)	3 (0,5%)	2 (0,3%)			
<b>Total</b>	<b>10 (1,6%)</b>	<b>217 (34,4%)</b>	<b>238 (37,8%)</b>	<b>153 (24,3%)</b>	<b>12 (1,9%)</b>			

Regarding the severity of conditions assessed by CPI, each adolescent showed, on average, more than one sextant with dental calculus and two bleeding sextants, regardless of sex or age (Table 4).

**Table 4. Average value of sextants per individual according to the presence of healthiness, bleeding, calculus, shallow and deep pocket.**

Variables	n	Healthiness	Bleeding	Calculus	Shallow pocket	Deep pocket
Sex						
Male	255	2,36	1,976	1,141	0,478	0,035
Female	375	2,07	2,101	1,378	0,418	0,024
Age (in years)						
15	160	2,25	2,287	1,056	0,381	0,018
16	204	2,30	2,088	1,225	0,367	0,004

17	173	2,12	1,803	1,502	0,543	0,023
18	74	2,01	2,027	1,270	0,567	0,108
19	19	1,68	2	1,842	0,368	0,105

Central sextants (upper and lower) were the regions showing greater periodontal health percentage in both sexes, while in posterior sextants (upper and lower), bleeding on probing was the most prevalent. The presence of dental calculus was virtually associated with sextants represented by molars (maxillary and mandibular) and lower central incisor (Table 5).

**Table 5. Prevalence of healthiness, bleeding, calculus, shallow and deep pocket of individuals according to sex and sextant.**

Sex	Sextant	n	Healthy %	Bleeding %	Calculus %	Shallow pocket %	Deep pocket %
Male	Upper Right	255	14,8	11,4	9	4,8	3
	Upper center		26,3	11	2,9	0,2	0,2
	Upper Left		11,6	15,1	8,7	4,8	0,3
	Lower Left		12,5	15,4	7,5	4,6	0,3
	Lower center		19,4	10,5	10,2	0,5	0
	Lower right		11	16,7	7,9	4,8	0,2
Female	Upper Right	375	16,7	21,4	14,3	6,5	0,6
	Upper center		38,4	16,2	4,3	0,5	0
	Upper Left		15,1	21,3	15,9	7	0,3
	Lower Left		13,3	25,2	15,4	5,6	0
	Lower center		24,9	16,2	17,8	0,3	0,3
	Lower right		14,9	24,9	14,4	5,1	0,3

## Discussion

Periodontal diseases are among the most common oral pathologies, have multifactorial etiology, are characterized by numerous risk factors and can affect all populations throughout life [18], being related to poor oral hygiene [1].

Detection and treatment of these disorders at an early age before the disease progression to more severe stages is desirable not only due to the better prognosis and response to treatment but also for prevention in adulthood, avoiding tooth loss [19], which directly affects the quality of life in terms of reduced functional capacity, self-esteem and social relationships [1].

Some researchers have shown that women have better health-related attitudes and behaviors, with a higher frequency in dental care services [20] and better oral hygiene performance [18]. In addition, in a study with adolescents aged 15-19 years, it was observed that most of those who have never been to the dentist were male [20]. However, although sex may affect the oral care level of individuals [21], periodontal conditions evaluated in this study were similar, regardless of sex.

In this study, it was observed that the frequency of periodontal change decreased with increasing age, suggesting a greater oral health awareness and better manual dexterity at late adolescence [22]. The impact of the disease and the need for care are greater individuals from developing countries [2] compared to those from developed countries, where people seek dental care on a regular basis [21]. Oral health problems are significantly influenced by socioeconomic and environmental conditions in which individuals are inserted [23]. In addition, low education level has

also been associated with worse oral health conditions [18], being considered vulnerable and of low attitude in relation to oral hygiene in general.

As expected, there was no statistically significant association between family income and education level of the household head and periodontal condition ( $p = 1.000$  and  $p = 0.693$ , respectively). However, as this was a population with relatively homogeneous socioeconomic status (adolescents enrolled in public schools in the urban area) [8], the significance of these relationships has possibly been masked.

Brushing is a habit widely implemented by the population, but most individuals cannot completely remove the biofilm attached to the surfaces of teeth [24,25] which, when maintained for prolonged periods of time, leads to the development of periodontal disease [21]. This explains the fact that all study participants reported using toothbrush and toothpaste; however, only 1.6% of them did not have periodontal changes. This fact can be attributed to poor brushing; however, it is noteworthy that the type of toothbrush, brushing technique and patient's ability and skill are factors that contribute to biofilm control [5], but these aspects have not been evaluated, being thus a study limitation. Nevertheless, there is need for a more effective oral hygiene instruction in adolescence, given that periodontal diseases can be prevented through proper removal of dental plaque [5,26] and that health education is able to promote changes in life habits, having an impact on the improvement of periodontal indexes [27].

Brushing is the most common method used to control biofilm [28]. Toothbrush bristles are effective in the cleaning of free tooth surfaces, or buccal, lingual and occlusal faces [5,24], but do not reach interproximal areas [28], requiring the use of dental floss for periodontal health maintenance [25]. Only 44.1% of adolescents reported the use of flossing, being statistically higher in females. This fact strengthens the hypothesis that women are more self-conscious and prone to greater self-care with their oral health, being less tolerant to changes in relation to oral health status [18].

A systematic review showed that the use of dental floss does not provide additional benefit in removing bacterial biofilm and reducing the clinical signs of gingival inflammation [28]. However, flossing deficiency by adolescents was associated with the presence of periodontal changes ( $p = 0.026$ ), corroborating previous findings in which regular interdental cleaning was associated with lower plaque levels, dental calculus, gingivitis and periodontal pockets [26].

Therefore, not only the use of dental floss is important for periodontal health maintenance, but also its regular use, since ineffective cleaning can lead to increased risk for severe periodontal disease later in life [22].

Although 59.7% of the sample showed satisfactory oral hygiene level, most of these individuals had at least one periodontal change. Thus, biofilm accumulation evidenced by OHI-S did not reflect the true periodontal condition of individuals. The plaque index has the disadvantage of showing biofilm accumulation only during clinical examination and may not reflect the normal oral hygiene behavior of the individual [27], thus demonstrating the need for caution when using OHI-S alone and stressing the urgency of raising the awareness among dental professionals in making the

detailed periodontal examination a routine in clinical practice, since early diagnosis and treatment improve prognosis [4]; in addition, the presence of oral diseases is highly likely to have a negative impact on the quality of life of adolescents [8]. The underreporting of the periodontal condition of young adolescents due to the lack of early and detailed examinations results in diagnostics only in the advanced stages of the periodontal disease, when bone loss is already radiographically observed [19].

In literature, it is possible to observe discrepancies in the periodontal health of adolescents. The prevalence of adolescents with healthy periodontal tissue, that is, CPI = 0 reported in this study was 1.6%, a result close to that described in India [16], but much lower than results reported by Italian researchers, whose frequency of students with CPI = 0 was 27.2% [29]. These differences indicate that the country's state of development influences the development of periodontal changes in individuals [1], probably because the country's stage of development is linked to stronger awareness policies and greater accessibility to dental services.

In the SB Brasil 2010, 44.7% of adolescents aged 15-19 years living in northeastern Brazil showed periodontal healthiness, while gingival bleeding, calculus and shallow and deep pocket rates were 7.9%, 35.7%, 9.7% and 0.5% respectively [7]. In this study, 98.4% of adolescents had some periodontal changes and calculus was also the most prevalent periodontal change (37.8%); but very high rates for other changes were also found, especially for the presence of shallow pocket, which corresponded to 24.3% of the sample, indicating greater neglect regarding oral health in adolescents from Campina Grande, Brazil.

The late diagnosis of periodontal disease tends to reduce the treatment options and require interventions that may be inaccessible to the most vulnerable populations, such as bone grafts or extractions, followed by implants [19]. The percentage of individuals observed with periodontal pockets in such an early age is alarming, especially when one takes into account the cumulative nature of diseases affecting the periodontium [6]. Therefore, it is evident the importance of monitoring oral health in this age group.

Through separate analysis for each periodontal change, it was found that the state of periodontal disease was observed in several sextants in the mouth of examined individuals and the average values of sextants affected by bleeding, calculus, shallow and deep pocket found in this study were higher than values observed for adolescents living in the northeastern region of the SB Brasil 2010 [7]. Since it is an epidemiological survey conducted on a large scale, data on periodontal health may have been underestimated in the SB Brasil 2010, thus emphasizing the importance of local epidemiological studies, where collection times are generally shorter.

Tooth surfaces where there is large dental plaque accumulation are distolingual and mesiolingual surfaces of mandibular molars and premolars, followed by distolingual and mesiolingual surfaces of maxillary and mandibular molars [24]. This corroborates the results found in this study, where the periodontal health condition was predominantly higher in central sextants of the maxilla and mandible and therefore, calculus was less present in these regions.

The development of prevention and oral health education programs, attitudes of patients and dentists regarding oral health, as well as the availability, accessibility and quality of oral health care influence the prevalence and severity of oral diseases [22], and authorities should make the population aware of the importance of good oral health maintenance [1].

Oral health care represents a long-term commitment, requiring constant guidance throughout the different stages of life [5]. Therefore, epidemiological surveys are essential for the surveillance of oral diseases such as periodontal diseases through the diagnosis of these diseases, it is possible to guide decision making in the implementation of effective preventive and curative policies, so that adolescents can reach adulthood with periodontal health.

### Conclusion

Most participants presented satisfactory oral hygiene level; however, a high percentage of participants showed some periodontal alteration, and gingival bleeding and presence of dental calculus were the most prevalent. In addition, there was a significant presence of shallow pockets in the study sample. Socioeconomic factors and oral hygiene levels were not associated with periodontal conditions, which are rather associated with flossing.

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