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Prevalence and risk indicators for chronic periodontitis in adolescents and young adults in south Brazil

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Abstract

Aim: To describe the distribution of clinical attachment loss (CAL) and to study risk indicators for chronic periodontitis in a large population-based sample of adolescents and young adults from south Brazil.

Material and methods: This cross-sectional study used a subset of data from a larger survey representative of Porto Alegre, Brazil. The sample consisted of 612 individuals (291 males/321 females) aged 14–29 years. Full-mouth, six sites per tooth clinical examinations were performed by calibrated periodontists. Chronic periodontitis was defined as CAL $\geqslant$3 mm affecting two or more teeth. Aggressive periodontitis cases were excluded from the analysis.

Results: CAL $\geqslant$3 and $\geqslant$5 mm affected 50.4% and 17.4% of subjects and 9.7% and 1.1% of teeth, respectively. Prevalence of chronic periodontitis ranged between 18.2% and 72.0% among subjects 14–19 and 24–29 years old, respectively. In the multivariable logistic regression analysis, older age [odds ratio (OR) = 2.6, 95% confidence interval (CI) = 1.7–3.9 and OR = 7.2, 95% CI = 3.7–14.0 for 20–24 and 25–29 years old, respectively], low socioeconomic status (OR = 1.9, 95% CI = 1.4–2.7), heavy smoking (OR = 1.7, 95% CI = 1.1–2.7) and larger amounts of calculus (OR = 2.0, 95% CI = 1.2–3.2) were significantly associated with chronic periodontitis.

Conclusion: This population of adolescents and young adults had a high prevalence of chronic periodontitis, and its presence was associated with age, socioeconomic status, smoking and calculus.

Key words: adolescents; periodontal attachment loss; periodontitis; risk factors; smoking; young adults

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Chronic periodontitis is a common form of destructive periodontal disease in adults, and its epidemiology and risk factors have been extensively investigated (Albandar 2002, Albandar & Rams 2002, Burt 2005). On the other hand, studies in young subjects often focus on aggressive forms of periodontitis (Jenkins & Papapanou 2001, Albandar & Tinoco 2002), and hence, limited epidemiologic data exist on the epidemiology of chronic periodontitis in young age groups. It has been estimated that the prevalence of chronic periodontitis in the age group 11–25 years is in the range of 1–3% in West Europe, 2–5% in North America, 4–8% in South America, 5–8% in Asia and 10–20% in Africa (Albandar & Tinoco 2002).

Studies suggest that race–ethnicity (Aass et al. 1988, Löe & Brown 1991, Albandar et al. 1997a, b), gender (Löe & Brown 1991, Lopez et al. 2001, Van der Velden et al. 2006) and socioeconomic status (Aass et al. 1988, Lopez et al. 2001, 2006) are important risk indicators of chronic periodontitis in adolescents and young individuals. In a national survey of US adolescents, Albandar et al. (1997a) found that African Americans had the highest prevalence of chronic periodontitis (7.5%) followed by Hispanics (4.4%) and whites (1.2%). Lopez et al. (2006) found that periodontitis in Chilean adolescents was associated with having parents who

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had low income and fewer years of education. There is also evidence that chronic periodontitis in young subjects is associated with smoking (Linden & Mullally 1994, Mullally et al. 1999, Machuca et al. 2000, Hashim et al. 2001, Al-Wahadni & Linden 2003, Rosa et al. 2008) and diabetes (Novaes Junior et al. 1991, Lalla et al. 2007, Silvestre et al. 2009).

Few population studies (Löe & Brown 1991, Albandar et al. 1997b, Hashim et al. 2001, Lopez et al. 2001) of the epidemiology and risk factors of chronic periodontitis have been conducted in young age groups, and data from South America are scarce. In this study, we describe a large survey in south Brazil and report the epidemiology of clinical attachment loss (CAL) in adolescent and young adults, and the association of chronic periodontitis with sociodemographic, behavioural and environmental risk indicators.

Material and Methods

Study design

This was a cross-sectional study that used a subset of data from a larger survey representative of the population of Porto Alegre, the capital of the state of Rio Grande do Sul which is located in the southern part of Brazil (Susin et al. 2004, 2006). Briefly, the present survey included 14 major municipalities in the Porto Alegre metropolitan area, with a total population of approximately 3 million. This household-based survey used a multistage probability sample using primary sampling units that were selected randomly from geographic areas that had been stratified by income level. In general, only subjects with serious neurologic or psychiatric conditions were excluded. Individuals requiring pre-medication were provided with suitable medication approximately 1 h before the clinical examination.

Study subjects

The present sample consisted of 612 individuals aged 14–29 years, and comprised 291 (47.5%) males and 321 (52.5%) females, 507 (82.8%) whites and 105 (17.2%) non-whites. None of the study subjects were completely edentulous (Susin et al. 2006).

Interview and clinical examination

Eligible study subjects who consented to participation were interviewed to gather demographic, socioeconomic status, oral health and other health-related data using a structured written questionnaire. Participants were clinically examined in a mobile examination centre consisting of a trailer equipped with a complete dental unit, comprising a dental chair, dental light and basic amenities. Four periodontists performed the clinical examinations, and the data entry was performed by two dental assistants.

All permanent fully erupted teeth, excluding third molars, were examined with a manual periodontal probe (PCP10-SE, Hu-Friedy Mfg. Co. Inc., Chicago, IL, USA) colour coded at 1, 2, 3, 5, 7, 8, 9 and 10 mm. Six sites per tooth were assessed, the mesiobuccal, mid-buccal, distobuccal, distolingual, mid-lingual and mesiolingual sites. Teeth of each quadrant were dried with a blast of air, and presence of visible dental plaque and supragingival calculus was recorded. The periodontal probe was inserted 1–2 mm into the gingival sulcus starting at one inter-proximal area and moving to the other. Presence of gingival bleeding was scored after the sites of a single quadrant were probed. CAL was defined as the distance from the CEJ to the bottom of the pocket/sulcus, and was calculated as the sum of the probing depth and gingival recession measurements. Measurements were made in mm and were rounded to the lower whole mm.

Ethical considerations

The study protocol was reviewed and approved by the following committees: Research Ethics Committee, Federal University of Rio Grande do Sul, Porto Alegre, Brazil, and the National Commission on Ethics in Research, Ministry of Health, Brasilia, Brazil; Ethics in Medical Research Committee, University of Bergen, Bergen, Norway. Subjects who agreed to participate signed an informed consent form. At the conclusion of the study, the participants were provided with a written report detailing their oral status and any diagnosed mucosal lesions. Patients with diagnosed pathological conditions were advised to seek specialist consultation and treatment.

Measurement reproducibility

The examiners were trained and calibrated in performing the clinical measurements before and during the field examinations. Measurement reproducibility was assessed using replicate periodontal measurements in 57 subjects, with one examiner (C. S.) with the most clinical experience serving as the ''gold standard'' examiner. Measurement reproducibility was assessed at the site and subject levels and it has been thoroughly reported elsewhere (Susin et al. 2004, 2006). At the site level, the weighted κ ($\pm$ 1 mm) ranged between 0.65 and 0.87 for CAL, and the intra-class correlation coefficients ranged between 0.64 and 0.82 for dental plaque, and between 0.73 and 0.98 for supragingival calculus.

Data analysis

Chronic periodontitis was defined as CAL $\geqslant$3 mm affecting the inter-proximal sites of two or more teeth. A total of 220 cases were identified in this young population. Twenty-eight subjects previously diagnosed with aggressive periodontitis were excluded from the present analysis (Susin & Albandar 2005). Three hundred and sixty-four subjects did not meet the criteria of cases and were used as the reference group (no periodontitis). Because CAL at the mid-buccal surface of teeth can also be caused by factors not related to periodontal inflammation, measurements at mid-buccal sites were excluded from the present analysis.

Race was scored as white or non-white. Socioeconomic status was scored by combining information about household economy using a standard Brazilian economy classification (CCEB) (ANEP Task Force 1997) and the level of education of the individual. High socioeconomic status was defined as having $\geqslant$9 years of education and being in the upper two tertiles of the CCEB economy classification, or having 5–8 years of education and being in the highest tertile of the CCEB classification. Low socioeconomic status was defined as having 1–4 years of education, and being in the lowest two tertiles of the CCEB classification, or having 5–8 years of education and being in the lowest tertile of the CCEB classification. Individuals who had higher economy and education than the low socioeconomic status group, but less than the high group, were classified as having medium socioeconomic status.

The study subjects were classified according to the self-reported pattern

of dental visits during the last 5 years. Individuals who had visited a dentist on a regular basis for maintenance care were classified as having regular dental visits. Subjects who had visited a dentist during the last 5 years only for emergency dental treatment, or had not visited a dentist were classified in the irregular dental visits group. Most participants in this study claimed they used a toothbrush regularly at least once a day, and this variable was therefore not included in the present analysis.

Lifetime exposure to cigarette smoking was estimated for current and former smokers, and it was calculated as the total number of packs consumed during the participants' lifetime. Individuals were classified by their smoking habit into four groups: non-smokers (<1 pack of cigarettes in a lifetime), light (1–499 packs), moderate (500–1499 packs) and heavy smokers ($\geqslant 1500$ packs). The percentage of sites per person with visible dental plaque, gingival bleeding or supragingival calculus were calculated by dividing the number of sites with each of these variables, by the total number of sites within the subject. Supragingival calculus was used as proxy for long-term dental plaque accumulation (Anerud et al. 1991) and individuals were classified into two groups: $<10\%$ and $\geqslant 10\%$ sites with supragingival calculus. No participants in this age group reported having diabetes; thus, this variable could not be included in the analysis.

Data analysis was performed by STATA software (Stata 9.2 for Windows, Stata Corporation, College Station, TX, USA) and using survey commands that take into account survey design including stratification, clustering and weighting and robust variance estimation. A weight variable was used to adjust for the probability of selection and deviations in the sample distributions from the target population distribution by age, gender and education (IBGE 1996, Korn & Graubard 1999). The chosen level of statistical significance was 5%. Standard errors (SE) and 95% confidence intervals (95% CI) were calculated.

Univariable and multivariable analyses were used to compare the percentage of sites with dental plaque, gingival bleeding and supragingival calculus between subjects with and without chronic periodontitis. No major departures from the normal distribution were observed for these variables. Pairwise comparisons of unadjusted estimates were carried out using the Wald test (Korn & Graubard 1999). Further comparisons were performed using linear regression analysis, adjusting for gender, race, age, socioeconomic status, smoking and dental visits.

Logistic regression analysis was used to model the relationship between chronic periodontitis and various risk indicators. Preliminary analyses were performed using univariable models. Next, a multivariable model was constructed and only exposures showing in the univariable analyses associations with $p \leqslant 0.25$ were included (Hosmer & Lemeshow 2000). Confounding and interaction effects were assessed. The multivariable analyses were performed in two stages. Demographic, socioeconomic and behavioural variables were entered first in the model, and supragingival calculus was entered next (full model). Gender, race and pattern of dental visits did not show significant associations with chronic periodontitis, and these variables were therefore removed from the final model (reduced model). Confounding and effect modification were assessed. There were no significant differences between the effects of medium and high levels of socioeconomic status, or between the effects of light and moderate smoking, and therefore these categories were pooled to simplify the final logistic model.

Results

Twenty-eight subjects diagnosed with aggressive periodontitis were not included in the present study, yielding a final sample size of 584 subjects. Overall, 50.4% and 17.4% of the subjects, respectively, had CAL $\geqslant 3$ and $\geqslant 5$ mm, affecting 9.7% and 1.1% of the teeth (Table 1). Presence of CAL increased steadily in the older age groups. Lower incisors and upper molars were the most affected teeth with CAL (Fig. 1). The percentages of subjects and teeth with CAL $\geqslant 3$ and $\geqslant 4$ mm were significantly higher among subjects of low socioeconomic status (Fig. 2), heavy smokers (Fig. 3) and individuals with larger amounts of calculus (Fig. 4).

Chronic periodontitis, defined as CAL $\geqslant 3$ mm affecting two or more teeth, was diagnosed in 43% of the subjects. Subjects with chronic periodontitis had CAL $\geqslant 3$, $\geqslant 4$ and $\geqslant 5$ affecting, on average, 21.8%, 8.7% and 2.6% of their teeth (Table 1). Prevalence of chronic periodontitis was significantly higher among subjects of low socioeconomic status, heavy smokers and individuals with larger amounts of

Table 1. Percentage of subjects (prevalence) and affected teeth (extent) in adolescents and young adults, by threshold of clinical attachment loss (CAL) severity and age group

CAL	Subjects with chronic periodontitis								All subjects							
	age groups (years)						Total ($n = 220$)		age groups (years)						Total ($n = 584$)	
	14–19 ($n = 46$)		20–24 ($n = 70$)		25–29 ($n = 104$)				14–19 ($n = 256$)		20–24 ($n = 174$)		25–29 ($n = 154$)			
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Prevalence (mm)																
$\geqslant 3$	100.0	100.0–100.0	100.0	100.0–100.0	100.0	100.0–100.0	100.0	100.0–100.0	22.3	12.2–32.5	53.4	43.0–63.8	79.4	69.5–89.3	50.4	42.1–58.8
$\geqslant 4$	71.5	54.0–89.0	81.4	74.3–88.5	78.4	67.1–89.7	78.4	70.6–86.2	13.0	6.5–19.5	35.4	24.2–46.6	56.4	44.1–68.7	33.9	25.6–42.3
$\geqslant 5$	40.6	10.6–70.7	39.6	30.0–49.4	40.2	33.1–47.4	40.1	36.1–44.1	7.4	2.0–12.8	17.2	9.5–25.0	29.0	24.3–33.6	17.4	13.9–20.8
$\geqslant 6$	14.0	2.5–25.5	21.9	11.9–31.9	19.1	7.4–30.8	19.3	12.6–26.0	2.5	0.4–4.6	9.5	3.3–15.8	13.8	6.6–20.9	8.4	5.0–11.7
Extent (mm)																
$\geqslant 3$	15.4	2.7–28.1	18.0	13,5–22.4	26.3	19.7–32.9	21.8	15.8–27.8	3.0	0.7–6.6	8.2	5.1–11.2	19.2	12.8–25.6	9.7	5.5–13.9
$\geqslant 4$	4.1	3.5–4.6	7.6	5.0–10.1	10.8	8.8–12.7	8.7	7.6–9.8	0.7	0.4–1.1	3.3	1.5–5.0	7.8	5.7–9.8	3.8	2.7–4.8
$\geqslant 5$	1.7	0.5–3.0	2.4	1.6–3.3	3.0	1.9–4.2	2.6	2.0–3.3	0.3	0.1–0.5	1.1	0.5–1.7	2.2	1.4–3.0	1.1	0.8–1.5
$\geqslant 6$	0.5	0.1–0.9	1.0	0.5–1.5	1.0	0.3–1.6	0.9	0.6–1.3	0.1	0.1–0.2	0.4	0.1–0.7	0.7	0.3–1.1	0.4	0.2–0.6

CI, confidence interval.

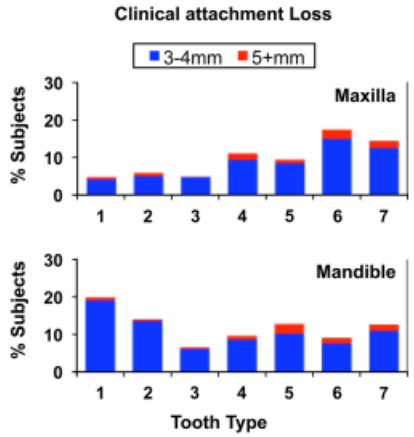

Fig. 1. Percentage of teeth by thresholds of clinical attachment loss, tooth type and arch. Central incisor, 1; second molar, 7.

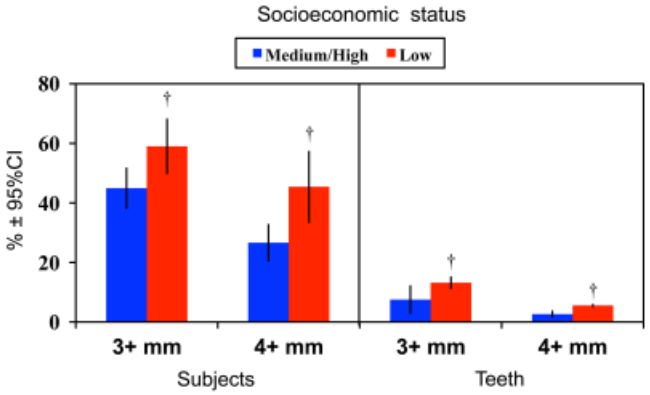

Fig. 2. Percentage of subjects and teeth with clinical attachment loss (CAL) by thresholds of CAL and socioeconomic status. ($^{\dagger}p<0.01$, Wald test, error bars represent 95% confidence intervals).

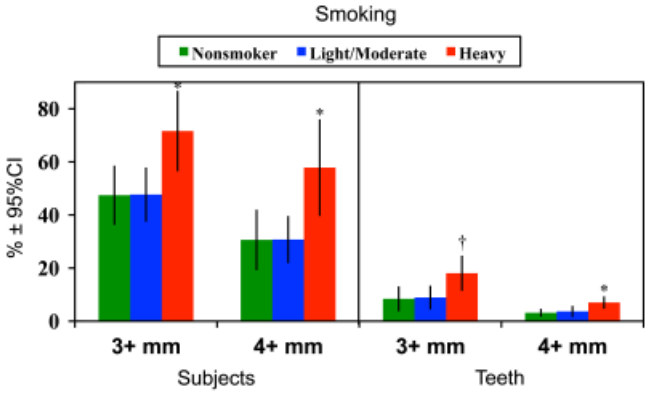

Fig. 3. Percentage of subjects and teeth with clinical attachment loss (CAL) by thresholds of CAL and smoking status ($^{*}p<0.05$; $^{\dagger}p<0.01$, Wald test, error bars represent 95% confidence intervals).

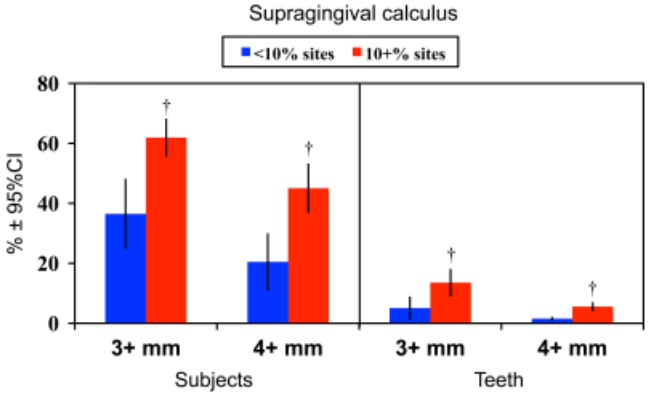

Fig. 4. Percentage of subjects and teeth with clinical attachment loss by percentage of teeth with supragingival dental calculus ($^{\dagger}p<0.01$, Wald test, error bars represent 95% confidence intervals).

calculus (Table 2). Subjects with chronic periodontitis had significantly higher percentages of sites with dental plaque, gingival bleeding and supragingival calculus than subjects without periodontitis (Table 3). These differences remained statistically significant after adjusting for the effects of age, race, gender, socioeconomic status, smoking and dental visits.

In the logistic regression analysis, similar results were observed in the univariable and multivariable models (Table 4). In the multivariable analysis, older age [odds ratio (OR) = 2.6 and 7.2 for 20–24 and 25–29 years old, respectively], low socioeconomic status (OR = 1.9), heavy smoking (OR = 1.7) and larger amounts of calculus (OR = 2.0) were significantly associated with chronic periodontitis (Table 4). Chronic periodontitis was not significantly associated with gender, race and dental visits.

Discussion

CAL was highly prevalent in this Brazilian population of adolescents and young adults. Approximately, half of the subjects had CAL $\geqslant$3 mm, and a fifth had CAL $\geqslant$5 mm. Mild CAL was widespread, whereas severe CAL was restricted to few teeth in the dentition. Lower incisors and upper molars were the most affected teeth with CAL. Prevalence of chronic periodontitis increased steadily with age and it was significantly associated with socioeconomic status, smoking and supragingival calculus.

Direct comparison of the present results with previous surveys performed in Brazil is not feasible because these studies are either based in the CPITN methodology (Flores-de-Jacoby et al. 1991, Dini et al. 1997, Ministerio da Saude 2004) or used specific samples (Gjermo et al. 1984, Albandar et al. 1991, Corraini et al. 2008, Silva-Boghossian et al. 2009). Nevertheless, a national survey conducted in Brazil found a prevalence of periodontal probing depths $\geqslant$4 mm in approximately 1.3% of the subjects 15–19 years old (Ministerio da

Table 2. Prevalence of chronic periodontitis according to the demographics, socioeconomic status, behavioural factors and supragingival calculus ($n = 584$)

Variables	Categories	*n*	Prevalence		*p*-Value*
			%	95% CI	
Gender	Female	307	43.7	32.7–53.0	Ref.
	Male	277	42.8	31.8–55.7	0.80
Race	White	481	42.9	32.7–53.2	Ref.
	Non-white	103	45.0	32.3–57.7	0.49
Age (years)	14–19	256	18.2	7.9–28.4	Ref.
	20–24	174	43.5	32.0–55.0	<0.001
	25–29	154	72.0	57.4–86.6	<0.001
Socioeconomic status	Medium/high	422	34.7	25.4–44.0	Ref.
	Low	162	56.7	46.4–67.0	<0.001
Smoking	Non-smokers	384	39.4	26.4–52.4	Ref.
	Light/moderate	141	41.2	29.1–53.4	0.73
	Heavy	59	67.6	53.2–82.0	0.009
Dental visits	Regular	159	38.6	34.4–55.2	Ref.
	Irregular	423	44.8	24.3–53.0	0.25
Supragingival calculus	<10% sites	291	28.6	15.8–41.4	Ref.
	⩾10% sites	293	55.5	46.9–64.0	<0.001
Total		584	43.3	32.9–53.7	

*Wald test.
CI, 95% confidence interval; Ref., reference category.

Table 3. Crude and adjusted percentage of sites per subject with dental plaque, gingival bleeding and supragingival calculus by chronic periodontitis status ($n = 584$)

Variables	No periodontitis ($n = 364$)		Chronic periodontitis ($n = 220$)		*p**
	Mean	95% CI	Mean	95% CI	
Crude estimates					
Dental plaque	50.0	45.3–54.6	58.7	50.3–67.2	0.01
Gingival bleeding	25.4	21.5–29.3	30.5	26.6–34.3	0.001
Supragingival calculus	11.1	9.8–12.4	23.7	19.8–27.7	0.0001
Adjusted estimates†					
Dental plaque	49.0	46.8–51.1	54.8	51.9–57.6	0.003
Gingival bleeding	24.5	22.8–26.1	30.4	28.2–32.6	0.0001
Supragingival calculus	11.9	10.5–13.4	19.4	17.5–21.3	0.0001

*Wald test.
†Adjusted for age, race, gender, socioeconomic status, smoking and dental visits.
CI, confidence interval.

Saude 2004). In contrast, Flores-de-Jacoby et al. (1991) observed a much higher prevalence of deep-probing depths (⩾6 mm) in a random sample from Rio de Janeiro, with estimates ranging between 2.7% and 8.4% for individuals 15–19 and 25–29 years old, respectively. Using radiographs, Gjermo et al. (1984) reported that the prevalence of bone loss >2 mm was 25% in adolescents of low socioeconomic status, whereas Albandar et al. (1991) observed bone loss ⩾3 mm in 4.1% of 13-year-old schoolchildren of a high socioeconomic status. Recent studies using non-representative samples also found high prevalence of CAL among young subjects (Corraini et al. 2008, Silva-Boghossian et al. 2009).

A national survey in the United States observed a prevalence of chronic periodontitis of 2.3% and 3.2% in individuals 13–15 and 16–17 years of age, respectively (Albandar et al. 1997a). In comparison, adolescents 14–17 years old in the present study would have a prevalence of 11.1% if a similar disease definition (CAL⩾3 mm) and partial recording protocol (mesiobuccal and mid-buccal sites of all permanent teeth) were applied in our sample. Also using a partial recording protocol, Thomson et al. (2000) found a prevalence of 68.6% for CAL ⩾3 mm in a cohort of New Zealanders who were 26 years old. In the present population, the prevalence of CAL ⩾3 mm would decrease from 50.4% to 35.8% if the same partial recording protocol (random half-mouth protocol including mesiobuccal, mid-buccal and distolingual sites) was used. Lopez et al. (2001), using a partial recording protocol that assessed six sites in molars and incisors, observed a prevalence of 4.5% and 8.2% of CAL ⩾3 mm among 15–17 and 18–21-year-old students in Chile. Similar disease estimates were observed among subjects 20–29 years old in West Pomerania, Germany, using a half-mouth four sites per tooth (mesiobuccal, mid-buccal, distobuccal and mid-lingual) protocol (Holtfreter et al. 2009). Prevalence and extent of CAL ⩾3 mm were, respectively, 64% and 22% for Pomerania and 66% and 13% for this Brazilian Population. The lack of consistency in case definition (Albandar et al. 1997a, Lopez & Baelum 2003), clinical examination protocols (Kingman & Albandar 2002, Susin et al. 2005) and differences in sample demographics limits comparisons of the present findings with the literature. Nevertheless, it seems reasonable to conclude that the present population had a higher prevalence of periodontitis than developed countries, and somewhat comparable results to other developing countries (Jenkins & Papapanou 2001, Albandar & Tinoco 2002).

In the present analysis, gender and race were not significantly associated with chronic periodontitis in young subjects. These observations are in agreement with our previous findings on young subjects with aggressive periodontitis (Susin & Albandar 2005); however, males were more likely to have severe CAL than females among adults (Susin et al. 2004). In contrast, Löe & Brown (1991) observed significant interactions between gender and race for the risk of having chronic periodontitis (incidental CAL). African Americans were more likely than whites to have CAL, and non-Hispanic males had higher odds of having CAL than non-Hispanic females (Löe & Brown 1991). Contradictory findings were observed in other studies with females having higher risk of having CAL ⩾3 mm among Chilean students (Lopez et al. 2001); whereas, males were more likely to experience progression of periodontal destruction among Western Java youngsters (Van der Velden et al. 2006). Holtfreter et al. (2009) did not observe any significant differences in the prevalence of CAL between males and females in Pomeranians. Using a

Table 4. Univariable and multivariate logistic regression analysis of the effect of demographics, socioeconomic status, behavioural factors and supragingival calculus on the presence of chronic periodontitis ($n = 584$)

Variables	Categories	*n*	Univariable analysis		Multivariable analysis			
					full model		reduced final model	
			OR	95% CI	OR	95% CI	OR	95% CI
Gender	Female	307	1.0		1.0		–	
	Male	277	0.9	0.7–1.1	1.1	0.8–1.4	–	
Race	White	481	1.0		1.0		–	
	Non-white	103	1.1	0.9–1.5	1.0	0.7–1.3	–	
Age (years)	14–19	256	1.0		1.0		1.0	
	20–24	174	3.1†	2.2–4.4	2.6†	1.8–3.9	2.6†	1.7–3.9
	25–29	154	9.5†	5.2–17.5	7.3†	3.7–14.1	7.2†	3.7–14.0
Socioeconomic status	Medium/high	422	1.0		1.0		1.0	
	Low	162	2.3†	1.7–3.0	2.0†	1.3–2.9	1.9†	1.4–2.7
Smoking	Non-smokers	384	1.0		1.0		1.0	
	Light/moderate	141	1.1	0.8–1.7	0.8	0.6–1.3	0.9	0.6–1.3
	Heavy	59	3.5†	2.1–5.9	1.7*	1.1–2.8	1.7*	1.1–2.7
Dental visits	Regular	159	1.0		1.0		–	
	Irregular	423	1.3	0.8–1.9	1.1	0.6–2.0	–	
Supragingival calculus	$<10\%$ sites	291	1.0		1.0		1.0	
	$\geqslant 10\%$ sites	293	2.9†	2.0–4.2	2.0†	1.3–3.3	2.0†	1.2–3.2

*$p < 0.05$;
†$p < 0.01$.
OR, odds ratio; CI, confidence intervals.

subsample of a national survey in Brazil, Peres et al. (2007) observed that the chance of having periodontitis was significantly higher among non-whites and males in subjects 35–44 years old.

Socioeconomic status was an important risk indicator for the prevalence of CAL in this Brazilian population. Young individuals of low socioeconomic status had a twofold higher chance of having chronic periodontitis and this association remained after adjusting for potential confounders. This finding is in accordance with previous studies on this (Susin et al. 2004, Susin & Albandar 2005) and other populations (Aass et al. 1994, Drury et al. 1999, Lopez et al. 2001, Peres et al. 2007). However, in spite of this evidence, a recent systematic review concluded that other factors (i.e. smoking) were more important for the occurrence of periodontitis than socioeconomic status (Klinge & Norlund 2005).

Heavy smokers had a significantly higher chance of having chronic periodontitis than non-smokers. The role of smoking as a risk factor for chronic periodontitis in adults is well established (Albandar 2002, Burt 2005); however, limited data are available for young subjects. While some studies have shown associations (Linden & Mullally 1994, Mullally et al. 1999, Machuca et al. 2000, Hashim et al. 2001, Al-Wahadni & Linden 2003, Rosa et al. 2008), Lopez et al. (2001) did not observe any association between CAL and smoking in a large sample representative of Chilean students. Similar to the present findings, smoking was a risk indicator for aggressive periodontitis in young subjects (Susin & Albandar 2005) and chronic periodontitis in adults (Susin et al. 2004) in this Brazilian population. In our previous study with young subjects (Susin & Albandar 2005), a lower threshold for lifetime exposure to cigarette smoking (>912 packs *versus* $\geqslant 1500$ packs) was used to study the relationship between smoking and aggressive periodontitis due to sample constrains. If the same definition was applied to the present analysis, only marginal changes in the strength of the association between heavy smoking and chronic periodontitis would be observed (OR for >912 packs $= 1.6$ *versus* OR for $\geqslant 1500$ packs $= 1.7$). Collectively, these findings support the notion that smoking has a detrimental effect on periodontal health even at a young age.

The relationship between local factors (i.e. plaque, gingival inflammation and calculus) and periodontitis in young individuals is controversial in the literature due to the belief that moderate-to-severe periodontal destruction is often incommensurate with oral hygiene levels. In the present population, chronic as well as aggressive (Susin & Albandar 2005) periodontitis were strongly associated with supragingival calculus after adjusting for important co-factors. These findings are in agreement with Albandar et al. (1997b) who observed that young individuals with chronic periodontitis had a higher percentage of sites with gingival bleeding and subgingival calculus. Gingival bleeding and supragingival calculus have also been associated with presence (Lopez et al. 2009) and progression (Albandar et al. 1998, Suda et al. 2000, Griffiths et al. 2001, Van der Velden et al. 2006) of CAL in young subjects. Similarly, subgingival calculus has been associated with progression of CAL in youngsters (Clerehugh et al. 1995, Albandar et al. 1998, Griffiths et al. 2001). The present findings do not preclude the existence of severe periodontitis among young subjects without large amounts of plaque and calculus; nevertheless, it seems reasonable to postulate that local factors may increase the chances of young individuals developing periodontitis.

In conclusion, the present population of adolescents and young adults from South Brazil has a high prevalence of periodontal destruction. Age, socioeconomic status, smoking and supragingival calculus were significantly associated with chronic periodontitis. Specific measures of health promotion should be targeted to this population in order to prevent the deleterious consequences of periodontitis.

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Clinical Relevance

Scientific rationale for the study: Epidemiology and risk factors for chronic periodontitis have been widely studied in adult and senior populations. However, limited epidemiologic data exist on the prevalence and risk indicators of chronic periodontitis in adolescent and young adults.

Principal findings: Periodontal destruction was very prevalent in this southern Brazilian population of youngsters. The presence of chronic periodontitis was significantly associated with age, socioeconomic status, smoking and supragingival calculus.

Practical implications: Adolescents and young adults should be targeted for health promotion programmes aiming to reduce well-known periodontal risk factors in order to prevent further periodontal breakdown later in life.