Clinical attachment loss and its association with risk indicators in Brazilian adolescents and young adults

Perda de inserção clínica e sua associação com indicadores de risco em adolescentes e jovens brasileiros

José Roberto CORTELLI
Sheila Cavalca CORTELLI
DDS, MS, PhD Department of Dentistry, Periodontics Research Division – University of Taubaté – UNITAU – Taubaté – SP – Brazil

Davi Romeiro AQUINO
Caio Vinícius Gonçalves ROMAN-TORRES
DDS, MS. Department of Dentistry, Periodontics Research Division – University of Taubaté – UNITAU – Taubaté – SP – Brazil

Abstract

Purpose: This cross-sectional study aimed to determine the prevalence of periodontal clinical attachment loss in 622 Brazilian adolescents and young adults (15 to 25 years) and its correlation with age, gender and smoking habits. In addition, to evaluate the influence of different cut-off points on the prevalence data. Materials and Methods: full-mouth periodontal examination was conducted by two trained and calibrated examiners to measure periodontal probing depth (PPD) and clinical attachment level (CAL) at 6 sites per tooth using a manual periodontal probe. The data analysis was performed in a subject level according to three cut-off points (CAL ≥ 1mm, 2mm or 3mm). Statistical analysis was conducted using Wilcoxon, Student-t and Mann Whitney tests ($p < 0.05$). The association between age and CAL was also analyzed by OR calculation. Results 454 subjects presented CAL of 1mm, 341 of 2mm and 251 of 3mm. In each cut-off point it was not observed significant differences between males and females, neither between smokers and non-smokers. Only age was associated with CAL. Subjects aged 20-25 years were 2.92 times more likely to have 2mm of CAL than subjects 15-19 years old. Conclusions:In this young population gender and smoking habits did not show association with CAL instead-off, age revealed an association with both presence and severity of CAL. Different cut-off points of periodontal disease influenced prevalence data in a significant way.

Uniterms

Periodontal attachment loss; periodontics; epidemiology; adolescent health.

Introduction

The immune-inflammatory process associated with periodontitis lead to an apical migration of the epithelial attachment and loss of periodontal soft and hard tissues[22]. For this reason, the clinical attachment level is an important measurement since it represents a clinical approximation of the loss of connective tissue attachment from the root surface. Dental biofilm has long been recognized as the initiator of periodontal disease and its main risk factor. However, the manifestation and progression of periodontitis is influenced by a wide variety of determinants and factors. Risk can be identified in terms of risk factors, risk indicators,

or risk predictors[7]. A risk factor is any characteristic, behavior, or exposure with an association to a particular disease, and the relationship is not necessarily causal in nature, instead-off risk indicator describes a possible factor associated with a disease, which is identified from case-control or cross-sectional studies. Finally, "risk marker" usually refers to risk factor which is predictive, i.e., associated with an increased probability of disease in the future[12].

Associations between gender and periodontal disease have been tested. Large bodies of evidence exits showing that among adults, males are at higher risk of developing chronic periodontitis than females[2,4,31]. Adult males also present a higher risk for clinical attachment loss[20,8]. However, the prevalence of clinical attachment loss in adolescents has been shown to be less consistent with a lack of agreement on whether or not gender is a risk factor for the occurrence of periodontitis among youngsters[23,11].

Several studies reported smoking habit as a very important risk factor, which contributes to a higher prevalence and severity of periodontitis in adults[33,3,32]. Significant associations between cigarette smoking and both clinical attachment loss and alveolar bone loss have been demonstrated[15,16,20,28].

Aging is commonly associated with periodontal disease, although this relationship is thought to be more related to the cumulative periodontal breakdown over time than to an age-related, intrinsic deficiency that contributes to susceptibility to periodontal disease [12.] Epidemiological studies have shown more severe periodontal disease in terms of attachment loss, as well as bone loss, among older age groups compared to younger groups[15,16,23,11,28,8].

In periodontal research, prevalence of periodontal conditions is often determined by the proportion of the population having at least one tooth with values of periodontal clinical attachment loss (CAL) above a set cut-off point[19]. Greene[13] (1959) reported that 80% of all adults were affected by periodontal disease; the cut-off point for disease definition was at least one site with CAL ≥ 2mm. When the cut-off point was changed to CAL ≥4mm, prevalence decreased to 64% overall. CAL ≥ 1mm was seen in 69.2% of 9,203 high school students aged 12 to 21 years. For CAL ≥ 2mm the prevalence decrease to 16% while only 4.5% of those students showed CAL ≥ 3mm 23. Similar finds were reported by Collins et al.[11] (2005) in a random sample of adolescents, i.e., a decrease in the prevalence of disease considering CAL ≥ 1mm, CAL ≥ 2mm and CAL ≥ 3mm as the cut-off points. Moreover, Albandar et al.[4] (2002) classified early onset periodontitis subjects as having CAL ≥ 4mm at approximal surfaces of one or more teeth, and using this criteria the authors found a prevalence of 28.8% of disease among 690 students aged 12-25 years. In addition, most research efforts in periodontal epidemiology have focused on middle-aged or older people. And, understanding the epidemiology of the periodontal status earlier in the disease course may enable more appropriate interventions.

Therefore, the primary aim of the present cross-sectional study was to determine the prevalence of periodontal clinical attachment loss in Brazilian adolescents and young adults and its correlation with established determinants and indicators of risk. In addition, to evaluate the influence of different cut-off points on the prevalence data.

Materials and Methods

The subjects in this survey were recruited from the Dental clinic of the University of Taubaté, Vale do Paraíba – São Paulo, Brazil, following a verbal and written explanation of the study and signing a consent form previously approved by the Institutional Committee on Research Involving Human Subjects (106/00). The study population included 622 untreated periodontal individuals (249 males and 373 females) aged 15 to 25 years (19.57 ± 3.12). Clinical measurements, demographic information, and smoking histories were recorded. Each subject was classified as current-smoker, never smoker or former-smoker (at least 3 years without tobacco use).

All participants had not received any dental therapy during the previous 12 months and no periodontal therapy during the previous 24 months. In addition, subjects who wore fixed orthodontic appliances or who had systemic condition requiring antibiotic coverage for periodontal examination were also excluded from this study. Subjects that leave smoking habits in the previous 35 months were not included in this survey.

During the full-mouth periodontal examination, two trained and calibrated examiners measured periodontal probing depth (PPD) and clinical attachment level (CAL) at 6 sites per tooth (mesial-buccal, mid-buccal, distal-buccal, mesial-lingual, mid-lingual, and distal-lingual) using a manual periodontal probe (PQWBR – Hu Friedy Mfg. Inc. Chicago, IL, USA). Third molars were not included in the clinical assessment due to their large variation in anatomy and po-

sition in the oral cavity. Care was taken to assure that measurements were made with the probe tip parallel to the tooth axis at the mid-buccal, mid-lingual and as close as possible to the mid-interproximal area from the buccal and lingual aspects, and the same angulations were carried on through all the sites.

The calibration protocol followed similar methods described previously by Araujo et al.[6] (2003). The data analysis was performed to determine the reliability using standard error of measurement (s.e.m) for the continuous variables, such as PPD and CAL, and Kappa-statistics (K) for the categorical variables. It was considered calibrated the examiner who reached a s.e.m ≤ 0.8 and a K between 0.8 and 0.95.

The data analysis was performed in a subject level according to three cut-off points (1mm, 2mm, 3mm). The prevalence of periodontal disease at different levels of severity was calculated considering the presence of at least one periodontal site/subject in a given cut-off point.

To establish the association between periodontal disease (using CAL as indicator), gender, smoking habits (smokers = current smokers; non-smokers = never smokers plus former-smokers) and age we use the Wilcoxon, Student-t and Mann Whitney tests according to the characteristic of the sample distribution, considering $p < 0.05$. In addition, for the 3 cut-off points, it was calculated odds-ratio (OR) for the oldest group in relation to the youngest group.

All participants enrolled in this study received oral hygiene instruction, professional supragingival plaque control, and if indicated scaling and root planning.

Results

Table 1 shows the distribution of the study population according to gender, age and smoking habits.

Due to the low number of former-smokers (15 subjects) for statistical analysis we considered them together with the never smokers. In each cut-off point it was not observed significant differences ($p<0.05$) between males and females, neither between smokers and non-smokers (Table 2). However, the oldest age group showed higher percentages of subjects with CAL considering each one of the 3 cut-off points (Figure 1). This same profile was found when it was considered gender and smoking habits (Figure 2).

OR confirmed these preliminary findings which related age with CAL. Figure 3 shows that older subjects presented high levels of CAL. It was demonstrated that subjects aged 20-25 years were 2.92 times more likely to have 2mm of CAL than subjects 15-19 years old.

Discussion

The present cross-sectional investigation primary evaluated the prevalence of clinical attachment loss, adjustment cut-off points, and its association with established risk factors for disease including gender, smoking habit and age in Brazilian adolescents and young adults.

In current clinical practice, the clinical attachment level is an important measurement since it represents a clinical approximation of the loss of connective tissue

Table 1 – Distribution of the study population according to gender, age and smoking habits

	15-19 years of age	20-25 years of age	Total
	n (M ± SD)	n (M ± SD)	n (M ± SD)
Male	134 (16.81±1.28)	115 (22.16±1.63)	249 (20.41±4.01)
Female	184 (16.94±1.42)	189 (22.50±1.62)	373 (19.43±3.78)
Non-smokers	253 (16.83±1.37)	219 (22.41±1.65)	472 (20.26±3.50)
Smokers	65 (17.12±1.31)	85 (22.53±1.57)	150 (20.13±4.13)
Total	318 (16.89±1.36)	304 (22.37±1.63)	622 (19.57±3.12)

n- number of subjects; M – media; SD- standard deviation

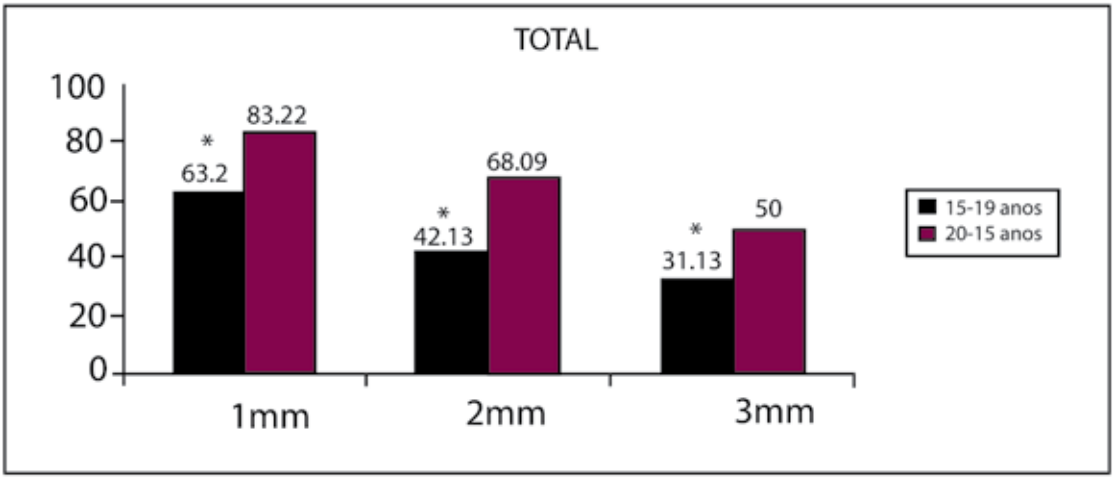
Table 2 – Percentage of subjects with clinical attachment level – CAL (1, 2 and 3 mm) according to gender, age and smoking habits

	15-19 years of age			20-25 years of age		
	CAL			CAL		
	1mm	2mm	3mm	1mm	2mm	3mm
Male	60.44	39.55	26.11	85.21	67.82	49.56
Female	62.5	44.02	34.78	82.01	68.25	50.26
Non-smokers	64.03	43.47	32.20	81.73	67.57	49.31
Smokers	60.00	36.92	23.07	87.05	69.41	51.76
Total	63.20	42.13	31.13	83.22	68.09	50.00

attachment from the root surface. Indeed, the clinical attachment level is considered the "gold standard" against each other diagnostic test to assess progression of periodontitis. However, the bias in the assessment of attachment loss is influenced by the partial recording design, type and number of sites assessed [6, 27].

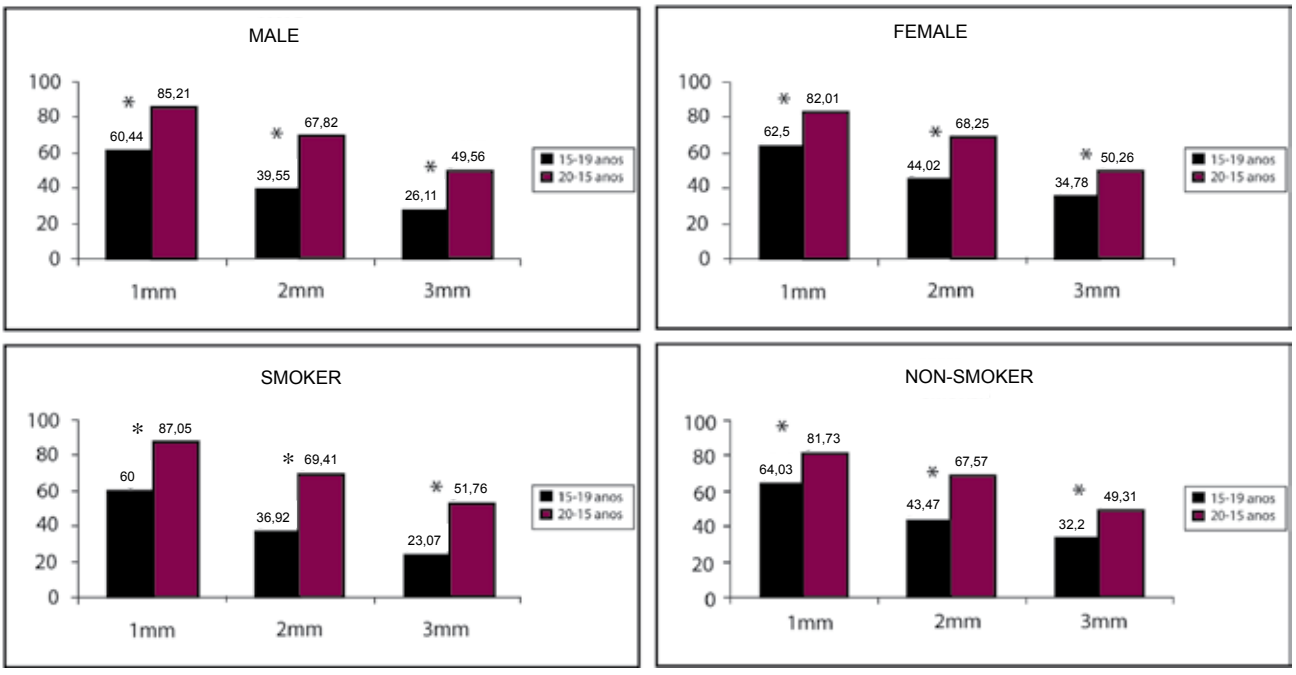
There are two dominant variables that affect the extent of periodontal probe penetration, insertion force 25 and inflammatory status of the tissues [17, 29]. In the present study, as we examined subjects with different periodontal status, including healthy and disease untreated sites, this specific bias were taken into consideration when 1mm, 2mm and 3mm cut-off points were applied to evaluate the different patterns of periodontal disease. However, the determination of an appropriate cut-off point and method of measurement to characterize the presence of disease may be difficult and reason for criticisms of the epidemiological studies.

According to the position paper of the American Academy of Periodontology [5] (1996) any measure of prevalence of periodontitis is dependent on how the disease is defined, i.e., the case-definition of periodontitis. It is interesting to mention that Lopez, Baelum [24] (2003) evaluated the performance of four clinical classification systems proposed to diagnosis periodontitis in young subjects when applied to epidemiological data on clinical attachment loss. After analysis of a large number of high school students the authors concluded that for epidemiological studies an approach based on simple definition of disease is appropriated and preferable. In our study we adopted



* Statistically significant difference ($p<0.05$).

Figure 1 – Comparison of subjects (%) presenting CAL in a given cut-off point between age groups.



* Statistically significant difference between age groups ($p<0.05$)

Figure 2 – Comparison of percentage of subjects presenting CAL in a given cut-off point between age groups among males, females, smokers and non-smokers

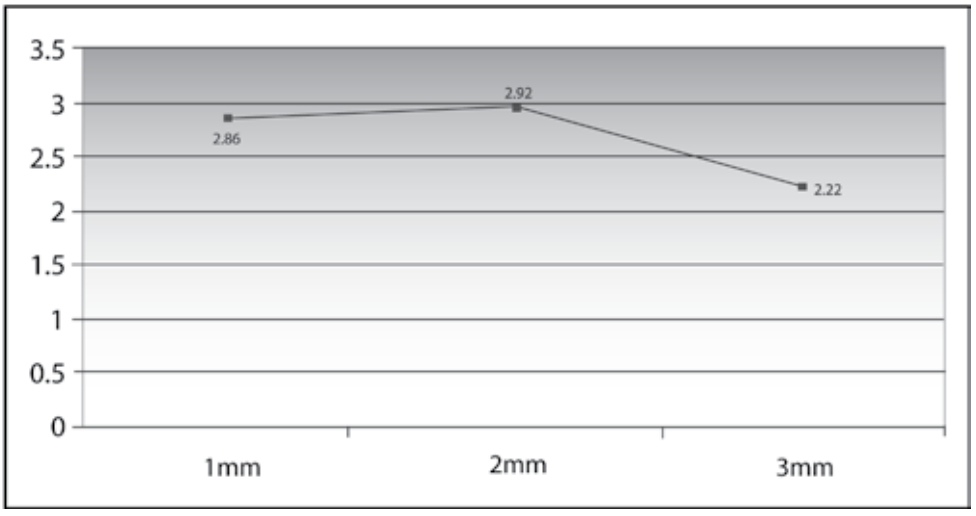


Figure 3 – Odds-ratio (OR) for the oldest group in relation to the youngest group in each cut-off point

at least one site with clinical attachment loss of 1mm, 2mm or 3mm to determine the periodontal status.

In this survey 72 subjects showed only incidental attachment loss, i.e. no more than one periodontal site with CAL. According to Ranney [26] (1993), clinical attachment loss, including gingival recessions, detected in few teeth could be consider related to hard brushing, tooth-level factors and also related to systemic condition. Thomson et al. [30] (2000) reported that over 70% of the participants at age 26 (n=914) had at least one tooth with CAL ≥ 1mm revealed by gingival recessions.

In our study 83.22% of subjects between 20-25 years old presented at least one periodontal site with CAL ≥ 1mm. Lifetime CAL > 1mm have been pre-

viously considered to be an early sign of periodontal disease in epidemiological studies of early-onset periodontitis 21 or early periodontitis 9, 10. In addition, Griffiths et al.[14] (2001) reported that the proportion of sites with lifetime CAL > 1mm exhibited prediction for both lifetime CAL and periodontal disease, which was not previously observed.

Besides the high prevalence of CAL ≥ 1mm, when the disease was defined as the identification of at least one site with CAL ≥ 2mm, in our survey around 42% in 15 to 19 years and 68% in 20 to 25 years old were affected. Studies conducted in young populations usually found lower prevalence of CAL ≥ 2mm. Lopez et al. [23] (2001) found 16% of the high school students with CAL ≥ 2mm while Collins et al. [11] (2005) observed 15% of prevalence among adolescents applying that same cut-off point. Our data is just close with adult population. A study carried out in 1987 by United States Public Health Service 34 using the same method found clinical attachment loss ≥ 2mm around 80% of aim population. In 2000, the Surgeon General of United States Public Health Service released the first official report to state that mild forms of periodontitis are common in adults. When a cut-off point for disease determination of 2mm of attachment loss was used, 60.5% of subjects between 25 to 34 years of age were classified as diseased.

Generally, males show high prevalence of different levels of clinical attachment loss than females [20, 8.] In contrast, Albandar et al. [1] (1997) using data from more than 14,000 subjects aged 13-19 years, examined in the National Survey of the Oral Health of United States, demonstrated that periodontitis was slightly more prevalent in males. Moreover, the logistic regression model adopted by Collins et al. [11] (2005) did not reveal that gender significantly increase the probability of having clinical attachment loss. Similarly, in our study it was not observed an association between gender and clinical attachment loss.

Smoking habit represent an risk factor for periodontal disease, since there are a number of biologically plausible explanations for it as a causative agent for periodontal disease, and prospective clinical studies have shown that smokers are more likely to develop periodontitis than nonsmokers [28.] Although, Hashim et al. [18] (2001) suggested that the effect of smoking on the prevalence of periodontitis in young populations is similar to that observed for adults, there are only a few studies that have investigated the effect of smoking on the periodontal status in young age cohorts. However it seems that this hypothesis will be confirmed. Susin et al. [27] (2005) and Tanner et al. [28] (2005) also reported an association between cigarette smoking and clinical attachment loss in adolescents and young adults. For the other hand, in our present study it was not observed an association between cigarette smoking and periodontal status. Probably, for our population the short time of exposure could not reveal the effect of tobacco on periodontal status. Furthermore, our population was made up of light smokers (mean of 2 ±1.2 cigarretes/day).

As age increase, clinical attachment loss and alveolar bone destruction become more prevalent, extensive, and severe [2, 28]. However, aging per se is not likely to be a predisposing factor for periodontal disease. The strong association between age and periodontal destruction is mostly due to the effect of age as surrogate for the length of exposure to etiologic factors. The association between age and high prevalence of clinical attachment loss was confirmed in our study (Figures 1-3). We demonstrated that subjects aged 20-25 years were 2.92 times more likely to have 2mm of CAL than subjects 15-19 years old. In fact, also considering the most severe cut-off point (3mm of CAL) this pattern of association was observed. In a Chilean school-population, Lopez et al.[23] (2001) found a significant correlation between age and presence of clinical attachment loss of ≥ 3 mm. They estimated that subjects aged 15-17 years and 18-21 years, respectively, were 1.6 and 3 times more likely to have attachment loss than children 12-14 years old. Albandar et al.[4] (2002) evaluated the periodontal status of Ugandan students and related that the percentage of subjects having clinical attachment loss of ≥ 4 mm was 27% in 12-16 years old and 29% among 17-19 years old, and this increased to 35% in subjects 20-25 years old.

In summary, in this young population gender and smoking habits did not show association with periodontal status instead-off, age revealed an association with both presence and severity of clinical attachment loss. Different cut-off points of periodontal disease influenced prevalence data in a significant way.

Resumo

Objetivos: O objetivo deste estudo transversal é determinar a prevalência de perda de inserção clínica em 622 adolescentes e jovens brasileiros (15 a 25 anos) e a correlação existente com idade, gênero e tabagismo. Além disso, avaliar a influência de diferentes pontos de corte na prevalência observada. Material e métodos: dois examinadores treinados e calibrados realizaram as mensurações de profundidade de sondagem (PPD) e nível clínico de inserção (CAL) em 6 sítios utilizando sonda periodontal manual. Os dados analisados foram apresentados de acordo com os pontos de corte (CAL ≥ 1mm, 2mm ou 3 mm). Análise estatística foi realizada utilizando os testes de Wilcoxon, Student-t e Mann Whitney ($p< 0,05$). A associação entre idade e CAL foi analisada por Odds Ratio. Resultados: 454 indivíduos apresentaram CAL de 1mm, 341 de 2mm e 251 de 3mm. Em cada ponto de corte não foi observada diferença estatística significante entre homens e mulheres, nem entre fumantes e não fumantes. Apenas idade foi associada com CAL. Indivíduos com idade entre 20-25 anos apresentaram 2.92 mais chances de ter 2mm de CAL que indivíduos como idade entre 15-19 anos. Conclusões: Nesta jovem população gênero e tabagismo não mostraram associação com CAL, no entanto, idade mostrou associação com a presença e severidade de CAL. Diferentes pontos de corte da doença periodontal influenciaram a prevalência dos dados de maneira significante.

Unitermos

Perda de inserção periodontal; periodontia; epidemiologia; saúde do adolescente.

Referências

1. Albandar JM, Brown LJ, Löe H. Clinical features of early-onset periodontitis. J Am Dent Assoc. 1997;128(10):1393-9.
2. Albandar JM, Brunelle JA, Kingman A. Destructive periodontal disease in adults 30 years of age and older in the United States, 1988-1994. J Periodontol. 1999;70(1):13-29.
3. Albandar JM, Streckfus CF, Adesanya MR, Winn DM. Cigar, pipe, and cigarette smoking as risk factors for periodontal disease and tooth loss. J Periodontol. 2000;71(12):1874-81.
4. Albandar JM. Global risk factors and risk indicators for periodontal diseases. Periodontol 2000. 2002;29:177-206.
5. American Academy of Periodontology: Position paper. Epidemiology of periodontal disease. J Periodontol. 1996;67(9):935-45.
6. Araujo MW, Hovey KM, Benedek JR, Grossi SG, Dorn J, Wactawski-Wende J, et al. Reproducibility of probing depth measurements using a constant – force electronic probe: analysis of inter- and intraexaminer variability. J Periodontol. 2003;74(12):1736-40.
7. Beck JD. Methods of assessing risk for periodontitis and developing multifactorial models. J Periodontol. 1994;65(5 Suppl):468-78.
8. Bouchard P, Boutouyrie P, Mattout C, Bourgeois D. Risk assessment for severe clinical attachment loss in an adult population. J Periodontol. 2006;77(3):479-89.
9. Clerehugh V, Lennon MA, Worthington HV. 5-year results of a longitudinal study of early periodontitis in 14- to 19-year-old adolescents. J Clin Periodontol. 1990;17(10):702-8.
10. Clerehugh V, Worthington HV, Lennon MA, Chandler R. Site progression of loss of attachment over 5 years in 14- to 19-year-old adolescents. J Clin Periodontol. 1995;22(1):15-21.
11. Collins J, Carpio AM, Bobadilla M, Reyes R, Gúzman I, Martínez B, et al. Prevalence of clinical attachment loss in adolescents in Santo Domingo, Dominican Republic. J Periodontol. 2005;76(9):1450-4.
12. Genco RJ. Current view of risk factors for periodontal diseases. J Periodontol. 1996;67(10 Suppl):1041-9.
13. Greene, JC. Epidemiological and indexing of periodontal disease. J Periodontol. 1959;30:133-9.
14. Griffiths GS, Duffy S, Eaton KA, Gilthorpe MS, Johnson NW. Prevalence and extent of lifetime cumulative attachment loss (LCAL) at different thresholds and associations with clinical variables: changes in a population of young male military recruits over 3 years. J Clin Periodontol. 2001;28(10):961-9.
15. Grossi SG, Zambon JJ, Ho AW, Koch G, Dunford RG, Machtei EE, et al. Assessment of risk for periodontal disease. I. Risk indicators for attachment loss. J Periodontol. 1994;65(3):260-7.
16. Grossi SG, Genco RJ, Machtei EE, Ho AW, Koch G, Dunford R, et al. Assessment of risk for periodontal disease. II. Risk indicators for alveolar bone loss. J Periodontol. 1995;66(1):23-9.
17. Hancock EB, Wirthlin MR. The location of the periodontal probe tip in health and disease. J Periodontol. 1981;52(3):124-9.
18. Hashim R, Thomson WM, Pack AR. Smoking in adolescence as a predictor of early loss of periodontal attachment. Community Dent Oral Epidemiol. 2001;29(2):130-5.
19. Hunt RJ, Fann SJ. Effect of examining half of the teeth in a partial periodontal recording of older adults. J Dent Res. 1991;70(10):1380-5.
20. Hyman JJ, Reid BC. Epidemiologic risk factors for periodontal attachment loss among adults in the United States. J Clin Periodontol. 2003;30(3):230-7.
21. Jenkins WMM, Papapanou PN. Epidemiology of periodontal disease in children and adolescents. Periodontol 2000. 2001;26:16-32.
22. Kinane DF, Podmore M, Murray MC, Hodge PJ, Ebersole J. Etiopathogenesis of periodontitis in children and adolescents. Periodontol 2000. 2001;26:54-91.

23. Lopez R, Fernandez O, Jara G, Baelum V. Epidemiology of clinical attachment loss in adolescents. J Periodontol. 2001;72(12):1666-74.
24. Lopez R, Baelum V. Classifying periodontitis among adolescents: implications for epidemiological research. Community Dent Oral Epidemiol. 2003;31(2):136-43.
25. Mombelli A, Mühle T, Frigg R. Depth-force patterns of periodontal probing. Attachment-gain in relation to probing force. J Clin Periodontol. 1992;19(5):295-300.
26. Ranney RR. Classification of periodontal diseases. Periodontol 2000. 1993;2:13-25.
27. Susin C, Kingman A, Albandar JM. Effect of partial recording protocols on estimates of prevalence of periodontal disease. J Periodontol. 2005;76(2):262 -7.
28. Tanner AC, Kent R Jr, Van Dyke T, Sonis ST, Murray LA. Clinical and other risk indicators for early periodontitis in adults. J Periodontol. 2005;76(4):573 -81.
29. Tessier JF, Kulkarni GV, Ellen RP, Mcculloch CAG. Probing velocity: novel approach for assessment of inflamed periodontal attacment. J Periodontol. 1994;65(2):103-8.
30. Thomson WM, Hashim R, Pack AR. The prevalence and intraoral distribution of periodontal attachment loss in a birth cohort of 26-year-olds. J Periodontol. 2000;71(12):1840 -45.
31. Timmerman MF, van der Weijden GA. Risk factors for periodontitis. Int J Dent Hyg. 2006;4(1):2-7.
32. Tomar SL, Asma S. Smoking-attributable periodontitis in the United States: findings from NHANES III. National Health and Nutrition Examination Survey. J Periodontol. 2000;71(5):743-51.
33. Tonetti MS. Cigarette smoking and periodontal diseases: etiology and management of disease. Ann Periodontol. 1998;3(1):88-101.
34. USPHS. Surgeon's General Report. U.S. Public Health Service 1997. U.S. Department of Health and Human Services, Washington, DC.

Recebido em 07/03/08
Aprovado em 28/03/08

Correspondence to:
José Roberto Cortelli
Rua Professor Nelson Freire Campelo, 343
Jardim Eulália, Taubaté, SP - Brazil.
Cep 12010-700
e-mail: jrcortelli@uol.com.br