

Clinical Attachment Loss in Chilean Adult Population: First Chilean National Dental Examination Survey

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Background: Data from national surveys regarding the periodontal status of the adult population in Latin America are scarce. The aim of this study assesses the prevalence and extension of clinical attachment loss (AL) in the adult population of Chile. Age, sex, and sociodemographic and behavioral differences in the prevalence of clinical AL are also examined.

Methods: A stratified, multistage probability design formula was used to separate the adult Chilean population into two age cohorts. The first group consisted of 1,092 young adults (age range: 35 to 44 years), and the second group consisted of 469 adult seniors (age range: 65 to 74 years). All subjects were examined to measure clinical AL. The research also included an evaluation, conducted through oral interviews, of social and health aspects of the subjects. Clinical AL was measured in all teeth surfaces, excluding third molars. Results were analyzed using a multivariable model and logistic regression.

Results: A total of 93.45% of the young adults had ≥ 1 site with clinical AL >3 mm compared with 97.58% of the adult seniors, with an average of 6.51 and 15.81 missing teeth, respectively ($P < 0.05$). The number of sites with severe clinical AL (>6 mm) was 38.65% in young adults and 69.35% in senior adults ($P < 0.05$). Clinical AL was significantly higher in males than in females ($P < 0.05$). The multivariate analyses identified that the main risk indicators for clinical AL >6 mm in ≥ 1 site were: age (65 to 74 years), sex (male) low education level (≤ 12 years of education), and smoking ($P < 0.05$).

Conclusion: The adult population in Chile shows a high prevalence and extension of clinical AL with age, sex, education level, and smoking as the main risk indicators of severe clinical AL in this population. *J Periodontol* 2010; 81:1403-1410.

KEY WORDS

Edentulous; epidemiology; periodontal disease; periodontitis; risk factors.

Chronic periodontitis is defined as an infectious disease that leads to a slow and progressive loss of attachment of the teeth.¹ Chronic periodontitis is associated with bacterial infection for which there is evidence that only some bacterial species of the complex biofilm adhering to the tooth surface contribute to the disease.^{2,3} Clinical features of periodontitis include clinical attachment loss (AL), alveolar bone loss, periodontal pockets, and gingival inflammation, all of which, without the proper treatment, can lead to tooth loss.⁴ Knowing the epidemiologic pattern of chronic periodontitis in a population is essential for public-health planning services.⁵ In Chile, specific data and information of the prevalence and extension of chronic periodontal disease affecting the adult population are scarce. In Chile, previous studies of periodontal conditions among the adult population were performed using the Community Periodontal Index of Treatment Needs (CPITN) or other related measures,⁶ none of which provide a proper description of the periodontal status in the population.⁷

There are no records that provide a comprehensive and complete assessment of the periodontal status in the Chilean adult population and the risk indicators that may be involved. Risk indicators identified in cross-sectional studies are not always confirmed in longitudinal studies.⁸ The prevalence and severity of clinical

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AL is directly related to age in cross-sectional surveys. In a national survey⁹ performed by the National Institute of Dental Research (NIDR) in employed adults in 1985 to 1986, results showed that the percentage of young adults aged 35 to 44 years old with ≥ 1 site with clinical AL was 70% and the percentage of adults aged 55 to 64 years with clinical AL ≥ 2 sites was 90%. Clinical AL, regardless its level of severity, is generally more prevalent in males than in females. This has been a consistent finding in all national surveys performed in the United States (US) since 1960.⁹ Periodontal disease is also associated with the socioeconomic level of subjects, in which a direct cause and effect is seen. In most cases, those who have a higher level of education, higher income, and live in better conditions have better oral and general health status compared to subjects with less education, lower incomes, and poorer living conditions.^{10,11} Smoking habits and tobacco use have been confirmed as risk factors for periodontal disease and epidemiologic evidence exists on the adverse effects to oral health produced by smoking and other types of tobacco use.¹²

Given the limitations of the CPITN, we measured clinical AL by probing all sites in each tooth (except third molars) of subjects and recorded the data obtained. Although clinical AL is a measure of accumulated past disease at each site, rather than current activity, it remains the diagnostic gold-standard criterion for determining periodontitis.¹³ Our main objective in the present study was to determine the prevalence and extent of clinical AL in the Chilean adult population, considering different severity thresholds in two key-age adult groups, 35 to 44 and 65 to 74 years. We chose a national sociodemographic-representative sample of the adult population and also considered the variables of age, sex, economic status, and behavior to determine whether these are risk-factor indicators.

MATERIALS AND METHODS

Sampling and Sample Sizes

A stratified, multistage probability design of the civilian non-institutionalized Chilean population in two age cohorts (young adults aged 35 to 44 years and adult seniors aged 65 to 74 years) was developed in April 2007. Subgroups (35-44 years and 65-74 years) in the Chilean population were oversampled to allow better precision in estimates. Study subjects were selected randomly according to Chilean population registries in a total of 15 administrative regions (Table 1), which in turn constituted a cluster random sample based on region and degree of urbanization (in this study, only urban populations were sampled). The net random sample included 1,092 young adults and 469 senior adult, corresponding to a distribution that reflected the population of Chile.

These two age groups were selected because they are the adult population groups recommended by the World Health Organization for oral health surveys.¹⁴ Estimating that there is a prevalence of 80% adults who suffer mild to severe periodontal disease,⁶ the sample size necessary to achieve a 95% precision rate (95% confidence interval) with a 0.02% range of error was calculated to be 1,561 adults (sample size with a statistical weight).

Adults selected to participate in this study were chosen by using a multistaged probability sample that involved all 15 administrative regions in Chile. A sample with statistical weight was used to generate unbiased total variance estimations. Sample statistical weights were adjusted to obtain a certain number of individuals according to the referent base population of Chile, considering the differences for sex, age, region, and city-size class (number of subjects 35-44 and 65-75 years). In the first stage, the samples of all 15 regions (primary sampling units) were obtained from data registered in the Chilean National Institute of Statistics;¹⁵ from this same source, we obtained the sample of each region's capital city (second stage). After these, the third stage consisted in going to each and every one of the municipalities to select the specific houses (fourth stage) of potential subjects. All adults in the sample were proper candidates for examination (Table 1). More than 40% of all Chilean populations reside in the Metropolitan region; this region includes the capital city (Santiago) and 32 other municipalities. The sample in the Metropolitan region was taken by considering 32 districts that were distributed by socioeconomic level according to a random protocol.

The protocol of this study, along with the informed consent forms, were approved by an independent bioethical committee of the Faculty of Medicine of the University of Chile according to legal regulations. The study protocol was explained to all patients, and informed consent forms were signed prior to entry in the study. At the end of clinical examinations, those participants who were diagnosed with periodontal pathologic conditions were provided a written report of their condition and advised to seek an oral health consultation.

Clinical Evaluation and Sociodemographic and Behavioral Data

Complete dental examinations were performed in each individual. A sociodemographic and general health interview was performed to gather information on the behavioral and sociodemographic characteristics of the population. Some participants did not provide sociodemographic data because they did not know the answers or refused to reveal the information.

The monthly family income was based on the Chilean minimum wage (141,000 pesos [\approx US \$280] per

Table 1.
Study Population by Region, Age, and Sex

Region	City	Age (years)	Male		Female		Total	
			(n)	(%)	(n)	(%)	(n)	(%)
Arica	Arica	35 to 44	9	56.2	7	43.7	16	1.4
		65 to 74	6	50.0	6	50.0	12	2.5
Tarapaca	Iquique	35 to 44	7	46.6	8	53.3	15	1.3
		65 to 74	5	50.0	5	50.0	10	2.1
Antofagasta	Antofagasta	35 to 44	22	52.3	20	47.6	42	3.8
		65 to 74	8	53.3	7	46.6	15	3.1
Atacama	Copiapó	35 to 44	7	41.1	10	58.8	17	1.5
		65 to 74	6	50.0	6	50.0	12	2.5
Coquimbo	La Serena-Coquimbo	35 to 44	13	33.3	26	66.6	39	3.5
		65 to 74	7	30.4	16	69.5	23	4.9
Valparaíso	Valparaíso-Viña	35 to 44	31	32.6	64	67.3	95	8.6
		65 to 74	27	42.1	37	57.8	64	20.2
B. O'Higgins	Rancagua	35 to 44	24	48.0	26	52.0	50	4.5
		65 to 74	7	50.0	7	50.0	14	2.9
Maule	Talca	35 to 44	11	25.0	33	75.0	44	4.0
		65 to 74	5	20.8	19	79.1	24	5.1
Bío-Bío	Concepción	35 to 44	62	50.8	60	49.1	122	11.1
		65 to 74	17	42.5	23	57.5	40	8.5
Araucanía	Temuco	35 to 44	24	51.0	23	48.9	47	4.3
		65 to 74	4	25.0	12	75.0	16	3.4
De los Rios	Valdivia	35 to 44	13	46.4	15	53.5	28	2.5
		65 to 74	3	37.5	5	62.5	8	1.7
Los Lagos	Puerto Montt	35 to 44	18	48.6	19	51.3	37	3.3
		65 to 74	5	50.0	5	50.0	10	2.1
Aysén	Coyhaique	35 to 44	8	44.4	10	55.5	18	1.6
		65 to 74	5	41.6	7	58.3	12	2.5
Magallanes	Punta Arenas	35 to 44	7	41.1	10	58.8	17	1.5
		65 to 74	6	50.0	6	50.0	12	2.5
Metropolitan	Santiago	35 to 44	239	47.3	266	52.6	505	46.2
		65 to 74	70	35.5	127	64.4	197	42.0
		35 to 44 (total)	493	45.1	599	54.8	1,092	69.9
		65 to 74 (total)	181	38.5	288	61.4	469	30.0
		Total sample	674	43.1	887	56.8	1,561	100

month). Subjects were defined by their smoking habits as either never-smokers or smokers (current or former smokers). The Chilean educational system was categorized as ≤ 12 or ≥ 13 years of school. Other variables such as sex (male or female), age (35 to 44 and 65 to 74 years), and diabetes (self-reported) were recorded.

All examiners in the survey group received theoretical classes, clinical training, and calibration in clinical AL, which were administered by a senior member of the Periodontal Department of the Faculty of Dentistry, University of Chile (JG). Clinical AL was used to record the periodontal condition of the individuals. Eight dentists (IE; Gloria Ahumada and Soledad Carrasco, University of Chile, Santiago; Lía González and Sandra Gallardo, University of Antofagasta, Antofagasta; Rodrigo Fuentes, University of Valparaíso, Valparaíso; Miguel Rojas, University of Talca, Talca; and Juan Kunstman, University Austral, Valdivia) performed the clinical evaluations. Calibration training was performed within successive days during which groups of 20 subjects were examined. All examinations were repeated until an acceptable consistency was achieved, which was determined with intraclass and interclass correlation coefficients. Results were between 0.80 and 0.90, as assessed previously by κ statistics. The reliability of the examiners was in a range considered good to excellent (κ statistics).¹⁶ Validity and reliability examinations were performed during the field period at the beginning, development, and end of the study.

Clinical evaluations were carried out in dental clinics of public primary care health centers that were near the sampled house. Periodontal clinical parameters were evaluated at six sites in all teeth, excluding third molars. These parameters included probing depth (PD), clinical AL, dichotomous mid-buccal, mid-buccal, disto-buccal, disto-lingual, mid-lingual, and mesio-lingual measurements of supragingival plaque accumulation (plaque index [PI]), and bleeding on probing (BOP) at the base of the crevice. Clinical AL was determined using the distance from the cemento-enamel junction (CEJ) to the free gingival margin (FGM) and the distance from the FGM to the bottom of the pocket/sulcus. From these two measurements, the clinical AL (distance from the CEJ to the bottom of pocket/sulcus) was calculated. The assessment of the periodontal supporting tissue status was made with a periodontal probe. At the time of recording depths, if necessary, measurements were rounded down to the nearest whole millimeter. The number of teeth present in the mouth was counted, excluding wisdom teeth.

The prevalence of clinical AL was defined as the percentage of participants who had ≥ 1 site. The extent was defined as the percentage of teeth displaying the

condition. Edentulous participants were excluded from the clinical analyses when we determined clinical AL.

Statistical Analyses

Continuous data are displayed as means \pm SDs, and categorical values are presented as percentages. The data were stratified according to sociodemographic, behavioral, and periodontal values. Chi-square tests, univariate analyses, and analysis of variance were calculated. Statistical analyses were performed using a statistical software package.[#] Data were analyzed with a univariate model using logistic regression analyses. These analyses used the prevalence of clinical AL ≥ 3 , ≥ 4 , ≥ 5 , and ≥ 6 mm present in ≥ 1 site, representing moderate to severe clinical AL, as a dependent variable. Only variables with a significance at $P < 0.05$ were included. The contribution of each variable to the model was evaluated to assess the influence of variables such as age, sex, smoking, and social or cultural factors. Risk ratios were calculated with 95% confidence intervals. Statistical significance was defined as $P < 0.05$.

RESULTS

Table 2 shows the distribution of the sample according to age and sociodemographic data. Over 70% of participants were between 35 to 44 years of age (young adults). Females represented 56.8% of the sample. Individuals with a low educational level and low monthly family income were the most prevalent. The prevalence of individuals with diabetes in the age group of 65 to 74 years was 23.8%. Fifty-six percent of the total population were smokers and 20% of the older group were edentulous.

The older group had a significantly higher number of missing teeth (Table 3). This population also presented with significantly higher mean BOP and clinical AL > 5 mm (81.45% versus 58.30%, $P < 0.05$). In relation to sex prevalence, there were no differences in the number of missing teeth; however, males had significantly higher mean PDs and clinical ALs of > 4 , > 5 , and > 6 mm than females ($P < 0.05$). Individuals with ≤ 12 years of education had a significantly higher mean number of missing teeth, BOP, PD, and clinical AL. Participants with a lower income had a higher number of missing teeth, and a higher mean clinical AL ($P < 0.05$). Subjects with diabetes had poorer periodontal conditions ($P < 0.05$). Smokers had a significantly higher mean PD and clinical AL than never-smokers ($P < 0.05$) and showed a significantly higher proportion of sites with severe clinical AL ($P < 0.05$) (Table 3).

A multivariate logistic regression analysis was employed to determine the association between two

[#] StataCorp, College Station, TX.

Table 2.
Sociodemographic Data of the Study Population

Variables	35 to 44 years		65 to 74 years		Total	
Age group (n [%])	1,092	70.0	469	30.0	1,561	100
Sex (n [%])						
Female	599	54.8	288	61.4	887	56.8
Male	493	45.1	181	38.5	674	43.1
Education (n [%])*						
≤12 years	842	77.1	434	92.9	1,276	81.9
≥13 years	249	22.8	33	7.0	282	18.9
Monthly income (n [%])†						
≤141,000	589	54.8	345	75.9	934	61.1
≥142,000	484	45.1	109	24.0	593	38.8
Type 2 diabetes (n [%])						
Presence	58	5.3	112	23.8	170	10.8
Absence	1,034	94.6	357	76.1	1,391	89.1
Smoking (n [%])						
Never	423	38.7	249	53.0	672	43.0
Smoker	669	61.2	220	46.9	889	56.9
Missing teeth (all/average) (n [%])	8	0.7	97	20.6	105	6.73

* Data available for 1,558 subjects

† Data available for 1,527 subjects (141,000 Chilean pesos = ≈US \$280).

variables clinical AL (≥ 3 mm, ≥ 4 mm, ≥ 5 mm, and ≥ 6 mm) and socioeconomical status, then clinical AL with demographic characteristics. Results are shown in Table 4. A significant higher risk of having clinical AL ≥ 6 mm was observed in those participants who were 65 to 74 years of age, male, had ≤ 12 years of education, and were smokers ($P < 0.05$). The odds ratio of older adults with clinical AL increased in severity by 2.18 for clinical AL ≥ 3 mm to 3.7 for clinical AL ≥ 6 mm ($P < 0.05$).

DISCUSSION

To our knowledge, the present study is the first study performed to determine the prevalence of clinical AL in a national representative sample of the Chilean population aged 35 to 44 and 65 to 74 years. In this study, 70% of the population were 35 to 44 years of age, 30% of the sample was 65 to 74 years of age, 57% were males, and 43% of the sample were females. This cross-sectional study showed a significantly high frequency of participants with clinical AL ≥ 3 mm in ≥ 1 site (97% in older adults and 93% in younger adults). The severity in clinical AL (≥ 6 mm) was high in both adult populations (69% in adult seniors and 38% in younger subjects).

Our results show that the extent of affected sites with clinical AL ≥ 3 to ≥ 6 mm and the prevalence of

missing teeth and BOP increased significantly with age. The multivariate analyses showed that age was a risk indicator for clinical AL ≥ 6 mm. The present study corroborates the data reported in the U.S. national survey⁹ (1985 to 1986) which showed that 13.8% of adults aged 25 to 34 years had ≥ 4 mm of clinical AL compared to 53.6% of adults aged 55 to 64 years. Other surveys in older people performed in Canada,¹⁷ the US,¹⁸ and Australia¹⁹ found a 15% to 30% of clinical AL or PD > 6 mm. In France, a National Periodontal and Systemic Examination Survey²⁰ was performed in a stratified quota sample of 2,144 adults (age range: 35 to 64 years), and results showed that the number of participants with clinical AL increased significantly with age, with a constant and significant progression ($P = 0.001$) in all ages except in the 60- to 64-year-old group. The assumption that periodontitis is a disease of aging is no longer tenable, and the current view establishes that the greater periodontal destruction seen in the elderly population is only a reflection of lifetime disease accumulation, rather than an age-specific condition.²¹⁻²³

We found that males showed increased periodontal destruction with a greater percentage of AL compared to females. These findings agree with other studies^{24,25} that reported males have a greater prevalence, extent, and higher risk of clinical AL than females. Reasons

Table 3.**Clinical Data and Percentage of Subjects (mean \pm SD) With ≥ 1 Site With Different Clinical AL According to Age, Sex, Education, Income, Diabetes, and Smoking Status**

	Missing Teeth (n)	BOP (%)	PD (mm)	Clinical AL (mm)	Percentage of Clinical AL				
					0 to 3 mm	>3 mm	>4 mm	>5 mm	>6 mm
35- to 44-year-old group	6.5 \pm 5.1	50.4 \pm 31.4	2.1 \pm 0.6	2.7 \pm 0.9	6.6 \pm 24.7	93.4 \pm 24.7	77.5 \pm 41.7	58.3 \pm 49.3	38.6 \pm 48.7
Sex									
Female	6.5 \pm 5.2	51.6 \pm 31.8	2.0 \pm 0.5	2.5 \pm 0.9	7.7 \pm 26.7*	92.3 \pm 26.7	72.6 \pm 44.6	51.6 \pm 50.0	32.3 \pm 46.7
Male	6.5 \pm 5.0	49.0 \pm 30.9	2.2 \pm 0.6*	2.9 \pm 0.9*	5.1 \pm 22.0	94.9 \pm 22.0*	83.6 \pm 37.0*	66.5 \pm 47.2*	46.4 \pm 49.9*
School education									
≤ 12 years	7.2 \pm 5.2*	51.5 \pm 31.6*	2.1 \pm 0.6*	2.8 \pm 1.0*	6.0 \pm 23.7	94.0 \pm 23.7	78.9 \pm 40.8*	60.0 \pm 49.0*	39.8 \pm 48.9
≥ 13 years	4.3 \pm 3.8	46.7 \pm 30.4	2.0 \pm 0.5	2.6 \pm 0.8	8.5 \pm 27.8	91.5 \pm 27.8	73.0 \pm 44.4	52.4 \pm 50.0	35.1 \pm 47.8
Monthly income [†]									
$\leq 141,000$	6.9 \pm 5.3*	52.9 \pm 31.9*	2.1 \pm 0.5	2.7 \pm 0.9	6.3 \pm 24.3	93.7 \pm 24.3	76.4 \pm 42.5	55.5 \pm 49.7	36.0 \pm 48.0
$\geq 142,000$	5.9 \pm 4.6	47.2 \pm 30.3	2.1 \pm 0.6	2.7 \pm 0.8	6.4 \pm 24.5	93.6 \pm 24.5	79.0 \pm 40.7	61.6 \pm 48.6*	41.9 \pm 49.3*
Diabetes									
Presence	7.3 \pm 5.7	50.3 \pm 31.4	2.1 \pm 0.6	3.1 \pm 1.4*	5.4 \pm 22.7	94.6 \pm 22.7	82.1 \pm 38.6	66.1 \pm 47.7	48.2 \pm 50.4
Absence	6.5 \pm 5.0	52.3 \pm 31.9	2.3 \pm 0.7*	2.6 \pm 0.9	6.6 \pm 24.8	93.4 \pm 24.8	77.3 \pm 41.8	57.9 \pm 49.3	38.1 \pm 48.5
Smoking									
Never-smoker	6.4 \pm 5.1	51.7 \pm 31.0	2.0 \pm 0.5	2.5 \pm 0.8	7.9 \pm 26.9	92.1 \pm 26.9	73.5 \pm 44.1	53.5 \pm 49.9	32.7 \pm 46.9
Smoker	6.6 \pm 5.0	49.6 \pm 31.6	2.1 \pm 0.6*	2.8 \pm 1.0*	5.7 \pm 23.2	94.3 \pm 23.2	80.2 \pm 39.9*	61.4 \pm 48.7*	42.4 \pm 49.4*
65- to 74-year-old group	15.8 \pm 6.5*	55.6 \pm 32.0*	2.1 \pm 0.7	3.8 \pm 1.4*	2.4 \pm 15.3*	97.5 \pm 15.3*	92.7 \pm 25.9*	81.4 \pm 38.9*	69.3 \pm 46.1*
Sex									
Female	15.6 \pm 6.2	53.7 \pm 31.5	2.0 \pm 0.6	3.5 \pm 1.3	2.7 \pm 16.4	97.3 \pm 16.3	90.9 \pm 28.8	76.7 \pm 42.3	62.6 \pm 48.5
Male	16.0 \pm 6.9	58.0 \pm 32.5	2.2 \pm 0.7*	4.1 \pm 1.5*	2.0 \pm 13.9	98.0 \pm 13.9	95.4 \pm 20.9*	88.2 \pm 32.3*	79.1 \pm 40.1*
School education									
≤ 12 years	16.1 \pm 6.5*	55.6 \pm 31.9	2.1 \pm 0.6	3.8 \pm 1.4*	2.4 \pm 16.0	97.4 \pm 16.0	92.6 \pm 26.1	81.8 \pm 38.7	70.0 \pm 45.9
≥ 13 years	12.2 \pm 5.3	54.1 \pm 34.2	1.9 \pm 0.7	3.3 \pm 1.1	0.0 \pm 0	100 \pm 0	93.3 \pm 25.3	76.7 \pm 43.0	63.3 \pm 49.0
Income									
$\leq 141,000$	16.1 \pm 6.3	55.5 \pm 32.8	2.1 \pm 0.6	3.7 \pm 1.3	2.2 \pm 14.6	97.8 \pm 14.6	92.4 \pm 26.5	79.7 \pm 40.2	67.7 \pm 46.8
$\geq 142,000$	14.8 \pm 6.7	53.9 \pm 29.0	2.2 \pm 0.8	3.8 \pm 1.4	3.4 \pm 18.3	96.6 \pm 18.3	94.3 \pm 23.4	88.5 \pm 32.0*	77.0 \pm 42.3
Diabetes									
Presence	16.6 \pm 5.8	59.8 \pm 31.0	2.2 \pm 0.6	3.8 \pm 1.4	0.0 \pm 0	100 \pm 0*	93.5 \pm 24.8	83.7 \pm 37.1	72.8 \pm 44.7
Absence	15.6 \pm 6.7	54.1 \pm 32.2	2.1 \pm 0.7	3.7 \pm 1.4	3.2 \pm 17.6*	96.8 \pm 17.6	92.5 \pm 26.3	80.7 \pm 39.5	68.2 \pm 46.6
Smoking									
Never smoker	15.5 \pm 6.6	55.1 \pm 30.6	2.1 \pm 0.7	3.6 \pm 1.4	3.1 \pm 17.4	96.9 \pm 17.4	90.7 \pm 29.1	76.7 \pm 42.3	66.3 \pm 47.3
Smoker	16.1 \pm 6.4	55.9 \pm 33.4	2.2 \pm 0.6	3.9 \pm 1.4*	1.7 \pm 12.8	98.3 \pm 12.8	95.0 \pm 21.9	86.6 \pm 34.1*	72.6 \pm 44.7

* Significant differences in the following variables: age, sex, education, income, diabetes, and smoking for different conditions: missing teeth, BOP, PD, clinical AL, and percentage of clinical AL (*t* test $P < 0.05$).

[†] 141,000 Chilean pesos = \approx US \$280.

for these gender differences have not been studied in detail, but they are probably more related to poorer oral hygiene, less positive attitudes toward oral health, and dental-visit behaviors seen in males than to any specific genetic factor.²⁶

In addition to age and gender, multivariate analysis demonstrated that a level of education ≤ 12 years and smoking were significant risk indicators for a clinical AL ≥ 6 mm. Even though gingivitis and poor oral hygiene are clearly related to a lower socioeco-

nomics status, the relationship between periodontitis and socioeconomic status is less direct. For example, the 1985 to 1986 U.S. national survey⁹ found that the prevalence of clinical AL, at all levels of severity was not closely related household income. On the other hand, clinical AL ≥ 4 and ≥ 7 mm in ≥ 1 site were both closely correlated with educational levels.⁹ It is probable that the widely observed relationship between socioeconomic status levels and gingival health is a function of better oral hygiene seen among the

Table 4.**Multivariate Logistic Regression Analysis of Age, Sex, Smoking Status, Diabetes, Education, and Income for Outcome Variables Clinical AL ≥ 3 , ≥ 4 , ≥ 5 , or ≥ 6 mm in at ≥ 1 Site (First Chilean National Dental Examination Survey)**

Predictor Variables	Clinical AL ≥ 3 mm			Clinical AL ≥ 4 mm			Clinical AL ≥ 5 mm			Clinical AL ≥ 6 mm		
	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P
Aged 65 to 74 years	2.1	1.0 to 4.5	0.039	3.4	2.1 to 5.3	0.0001	3.0	2.2 to 4.1	0.0001	3.7	2.7 to 4.9	0.0001
Male	1.4	0.8 to 2.4	0.140	1.8	1.3 to 2.5	0.0001	1.8	1.4 to 2.3	0.0001	1.8	1.4 to 2.3	0.0001
Education ≤ 12 years	1.3	0.8 to 2.2	0.245	1.5	1.1 to 2.0	0.004	1.6	1.2 to 2.0	0.0001	1.3	1.0 to 1.7	0.012
Monthly income $\leq 141,000^*$	1.1	0.7 to 1.8	0.578	0.9	0.7 to 1.2	0.740	0.8	0.6 to 1.0	0.108	0.8	0.6 to 1.1	0.264
Presence of diabetes	3.2	0.7 to 13.7	0.106	1.3	0.7 to 2.3	0.338	1.3	0.8 to 2.0	0.246	1.3	0.9 to 2.0	0.132
Smoker	1.4	0.9 to 2.3	0.109	1.3	1.0 to 1.8	0.031	1.3	1.0 to 1.6	0.020	1.3	1.0 to 1.7	0.010

OR = odds ratio; CI: confidence interval.

* 141,000 Chilean pesos = \approx US \$280.

more-educated population who show more positive attitudes toward oral hygiene, visit a dentist more frequently, and generally have dental insurance.²⁶ Smoking was first identified as a risk factor from an analysis²⁷ of data performed in 1971 to 1975, when the National Health and Nutrition Examination Survey in the U.S. (NHANES I) showed an association between smoking and periodontal diseases that was independent of oral hygiene, age, or other probable risk factors. Since then, there has been enough evidence to identify smoking as a risk factor for periodontitis;²⁸⁻³¹ in assessments^{32,33} of randomly chosen groups of patients, those who were smokers invariably show a higher prevalence of periodontitis.

Regarding diabetes (the presence or absence, which was self-reported), 10.89% of the present sample had diabetes, with a 23.88% prevalence in the senior group. No significant associations were found, for the whole sample, between diabetes and the pathologic periodontal parameters examined. However, when results were analyzed separately for the senior-adult group, we found a positive relation between clinical AL and diabetes. Previous studies^{34,35} reported comparable results regarding this association between type 2 diabetes and periodontal disease.

CONCLUSIONS

The present survey was a population-based study representative for the Chilean adult population (the First Chilean National Dental Examination Survey). The prevalence and extent of clinical AL was extremely high in both groups studied. Overall, two-thirds of the individuals in the 65- to 74-year-old group and one-third of the individuals in the 35- to 44-year-old group had severe clinical AL (≥ 6 mm). National surveys indicate that milder forms of periodontitis are the most fre-

quently seen, whereas severe periodontitis affects only a subset of the populations studied.²⁶ In contrast, some representative studies^{7,24} performed in South and Central America showed that the prevalence of severe disease seemed to be comparably much higher ($>30\%$) in these populations. More recently, one study,³⁶ of Brazilian subjects 21- to 70- years of age and who received dental care in a public dental school, showed that the prevalence of individuals with ≥ 1 site with clinical AL ≥ 5 or ≥ 7 mm was 72.1% and 60.9%, respectively. Limited data from selected populations in Europe and the US point to a decrease in the prevalence of severe periodontal disease, giving step to a rise in gingivitis and mild to moderate periodontitis.³⁷ There is a strong need in Chile to focus on more effective intervention programs to prevent and control periodontal disease at a national level. For an effective prevention and treatment intervention program, it is necessary to have data on the periodontal conditions of the population and the main risk factors involved.

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