

Comparison of Clinical Periodontal Parameters in Two Colombian Oral Health National Studies, 1998 and 2014

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Abstract

Objective: The aim was to compare the results of two large Colombian epidemiological studies in order to describe trends in the presence of clinical periodontal parameters.

Methods: In 1998 and 2014, two epidemiological studies on national representative samples selected following probabilistic methods were performed. In 1998, a total of 9747 subjects received a partial-mouth periodontal examination in ten approximal sites, and in 2014 a total of 9821 participants received a full-mouth examination, with an average of 126 sites per person. Although the studies followed different methodologies, the newer study was adapted to be able to perform a direct comparison, including analysis of index teeth and clinical parameters in accordance with the 1998 protocol. Number of teeth and value of the extent and severity index were compared. Descriptive statistics were reported.

Results: The results showed that the mean number of teeth increased in the more recent study: for the age category 35 - 44 years, this increased from 19.2 to 23.8 teeth; however, both studies described a significant decrease in the number of teeth at later ages. Values for the extent and severity index were high in both studies. A larger proportion of subjects was affected by mild and generalized attachment loss in the new study, but the percentages of participants affected by moderate and severe attachment loss were similar.

Conclusions: It could be concluded that the periodontal conditions of large samples examined 16 years apart did not reveal significant changes in the presence of generalized attachment loss. Renewed health policies are needed to diminish periodontitis prevalence.

Key words: *Periodontitis, periodontal attachment loss, tooth loss, epidemiology, prevalence, Latin America*

Introduction

According to a review on the global burden of severe periodontitis worldwide its prevalence was calculated as 10.8% (95% uncertainty interval 10.1% - 11.6%; Kassebaum *et al.*, 2014). In Colombia, the latest National Oral Health Study reported a prevalence of severe periodontitis of 10.6% (Peñaloza *et al.*, 2014). A review on

periodontitis epidemiology has evidenced a trend towards a decrease in its prevalence for some parts of Europe and the United States (USA). Nevertheless, authors of this review pointed out that a very limited number of studies provide prevalence data of periodontal disease over time (Hugoson and Norderyd, 2008). Variation in the prevalence of periodontitis or its clinical signs, pocket depth (PD) or clinical attachment level loss (CAL), could be observed by the comparison of sectional studies performed over time. Two Scandinavian, one Swiss and one USA study have evaluated the periodontal condition of randomly selected samples of individuals at several points in time (Norderyd *et al.*, 2015; Skutudyte-Rysstad *et al.*, 2007; Schurch Jr *et al.*, 2015; Borrell *et al.*, 2005). A recent report by Norderyd *et al.* (2015) continued previous

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epidemiological research projects performed on samples from the Swedish city of Jonkoping, compiling results from five sectional studies: 1973, 1983, 1993, 2003 and 2013. The study revealed a drastic reduction in the percentage of edentulous individuals, from 16% in 1973 to 0.3% in 2013, a clear reduction in the frequency of individuals with PD > 4 mm, an increase in the number of individuals without bone loss and a reduction in the number of subjects with moderate alveolar bone loss. In the city of Oslo (Norway), four cross-sectional studies performed in the years 1973, 1984, 1993 and 2003 evaluated periodontal health in 35-year-olds using the community periodontal index of treatment needs (CPITN; Ainamo *et al.*, 1982) and bone loss assessments. The results showed that the proportion of individuals with ≥ 1 site with PD ≥ 6 mm decreased from 21.8% in 1984 to 8.1% in 2003, and the proportion of participants affected by pockets ≥ 4 mm decreased from 73.1% to 66.5% (Skutudyte-Rysstad *et al.*, 2007). Another study in the county of Bern, Switzerland, by Schurch Jr. *et al.* (2015) evaluated periodontal conditions in two sectional studies 25 years apart, 1985 and 2010. Results showed an increase in the mean number of teeth from 20.7 to 24.6, and a reduction in the proportion of sites with CAL loss ≥ 6 mm from 2.0% to 0.3%. A comparison of the periodontitis prevalence in two epidemiological studies in the USA, NHANES III and NHANES 1999-2000, was performed by Borrell *et al.* (2005), defining a periodontal case as a subject that had ≥ 3 sites with CAL loss ≥ 4 mm, and ≥ 2 sites with PD ≥ 3 mm: a decrease in the prevalence of periodontitis was observed from 7.3% in NHANES III to 4.2% in NHANES 1999-2000. However, a recent study that used a full-mouth examination method, NHANES 2009 - 2012, reported the prevalence of severe periodontitis to be 8.9%, and other severity categories to be 37.1%. When the partial-mouth examination method used in NHANES III was adopted for the latest study, the prevalence of periodontitis was reported to be 18.8% (Eke *et al.*, 2015).

In Colombia, four national oral health studies have been performed since the 1960s; in particular the Third National Oral Health Study in 1998 (ENSAB; Franco *et al.*, 1999), and the Fourth National Oral Health Study from 2014 (Peñalozza *et al.*, 2014), which evaluated periodontal conditions based on PD and CAL parameters, but with significant methodological differences. The study in 1998 used a partial periodontal examination based on 10 index teeth for the calculation of the CPITN, and on 10 approximal periodontal sites (Papapanou *et al.*, 1993), for the calculation of the extent and severity index (Carlos *et al.*, 1986). In contrast, the study in 2014 used a full-mouth examination on six sites per tooth for the evaluation of PD and CAL values and determination of the extent and severity index. The aim of the present study was to perform a secondary analysis to

compare the results of the two latest Colombian National Oral Health Studies in order to describe trends in the presence of clinical parameters associated with periodontal disease.

Materials and methods

Population

Two sectional studies on oral health conditions of the Colombian population performed in the years 1998 and 2014 served as the basis for comparison. Both studies included a clinical examination and application of a survey to samples of the Colombian population selected according to probabilistic, stratified, multi-stage methods. Representative samples corresponding to the five main regions of the country were analyzed during the two time periods: Atlantic coast, eastern region, central region, western region and Bogotá. In 1998, a sample age range from 5 to 74 years was analyzed, though periodontal data were collected from 7 years of age. In 2014 the sample age range consisted of 1- to 79-year-old individuals; however, periodontal examinations were performed only on individuals of age ≥ 18 years, and as a consequence comparison was done only for adult participants.

Study samples

In 1998, a target sample of 12,848 individuals (8448 adults and 4400 children) was selected based on the approximate population of Colombia by 1998 of 40 million people, and the prevalence of the most frequent oral disease conditions was measured as in previous studies. A final sample of 9747 individuals was examined (6153 adults and 3594 children), a positive response rate of 75.86%. No specific reasons for the non-participation of a percentage of the planned sample were given.

In 2014, a target sample size of 23,283 individuals was selected, based on similar factors to those in 1998; of these, 20,534 individuals were examined, the response rate being 88.2%. Of the 11.8% of the planned sample that was not examined, 10.3% refused to receive a clinical examination and the other 1.5% were absent from home during three visits on different dates. As only individuals of age ≥ 18 years received a periodontal examination, the final sample size was 9821 subjects.

Sampling procedures

For selecting both samples, stratified, multistage and probabilistic methods were employed. For both studies, primary sampling units were randomly selected Colombian municipalities. In 1998, municipality selection was stratified according to geographic region, being mainly urban or rural, the availability of basic public services and membership in different health insurance systems, which in Colombia is related to income. Then sectors

were chosen based on geographic location and approximated estimates of income for large and medium sized cities, and solely on geographic position in small cities and rural areas. Inhabitants of randomly selected households were examined; however, children were also examined at randomly selected schools for each sector.

In 2014, stratification was also performed based on the region of the country, being urban or rural communities, and socio-economic aspects. Then municipalities were selected following a randomized simple sampling method (RSS). At a later stage, they were divided into mainly urban or rural areas. Thereafter, urban zones were divided into large cities and other towns, while

rural areas were divided into small villages and rural sectors. For large cities, cartographic sectors were chosen using a probability method according to their surface area, and then blocks were selected according to RSS. In smaller urban areas, blocks were directly selected by RSS. In predominantly rural areas, blocks in small villages, or household groups located in close proximity were chosen by RSS. Finally, specific households in blocks of urban or rural areas were randomly selected. No replacement was applied when the inhabitants of the house could not be examined after three attempts (*Figure 1*).

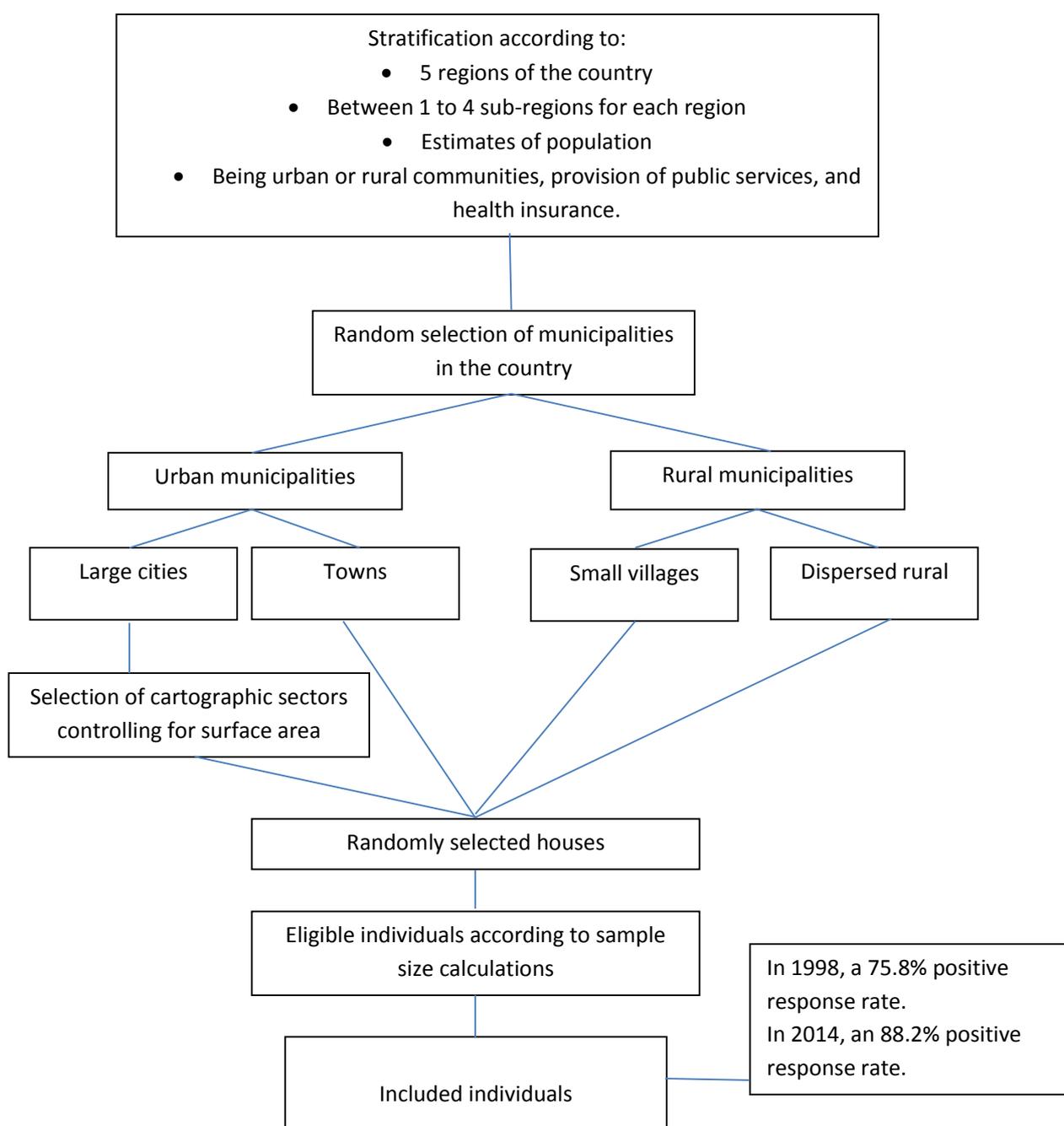


Figure 1. Common features of sampling strategy for both studies, 1998 and 2014.

Periodontal examination

In both studies, the clinical examination was performed by groups of four people: coordinator, examining dentist, assistant and surveyor. A total of 18 teams participated in the 1998 study, and 24 in the 2014 study.

Both studies registered the number of teeth. The 1998 ENSAB III study used a partial periodontal examination on 10 index teeth. The following clinical parameters were evaluated using the World Health Organization (WHO) periodontal probe (Hu-Friedy Mfg Co., Chicago, IL, USA): dental plaque and calculus accumulation, bleeding on periodontal probing, PD and CAL. Clinical attachment level loss was calculated by computing PD and gingival margin level values. Results of clinical parameters served for the calculation of two different indices: 1) the community index of periodontal treatment needs (CPTIN; Ainamo *et al.*, 1982), calculated on ten index teeth (17, 16, 11, 26, 27, 37, 36, 31, 46 and 47). A CPTIN value was given for each tooth sextant according to the following scale: periodontal health, presence of bleeding on probing, presence of plaque and calculus, presence of PD 4 - 5 mm or of PD \geq 6 mm; and 2) the extent and severity index (ESI; Carlos *et al.*, 1986), measured on ten approximal periodontal sites (16 mesial, 16 distal, 11 mesial, 23 mesial, 25 distal, 35 mesial, 34 distal, 41 mesial, 43 mesial and 43 distal). These sites were selected because of their adequate correlation to full-mouth examination scores as described in the literature (Papapanou *et al.*, 1993). The ESI was calculated as the percentage of tooth sites presenting with CAL \geq 1 mm, and the average amount of CAL in these affected sites. Additionally, CAL extent and severity were determined. Severity was categorized on four levels: no CAL loss up to 0.9 mm, mild loss 1.0 - 2.9 mm, moderate loss 3.0 - 4.9 mm and severe loss \geq 5.0 mm. Extent was categorized on three levels: no loss, localized loss up to 50% of sites and generalized loss $>$ 50% of the sites.

The 2014 ENSAB IV study performed a periodontal examination of all present teeth, except third molars, on six sites per tooth using the North Carolina periodontal probe (Hu-Friedy Mfg Co.). Two clinical parameters were evaluated: PD and CAL. These clinical parameters were the basis for the calculation of the ESI (Carlos *et al.*, 1986).

All participants in both studies signed informed consent forms. All procedures were performed following the Helsinki declaration about research methods on human beings that were valid at the time of both studies. The 2014 project was approved by an ethical committee specifically created for the conduction of the study by the Colombian Health Ministry and the Pontificia Universidad Javeriana (Bogotá, Colombia).

Comparison of clinical parameters between the two studies

As the clinical examination from the National Study in 1998 was performed on 10 sites on index teeth for the ESI, these same teeth and sites were extracted from the 2014 study to allow comparison. Mean values of the ESI index

between the studies could be compared. Additionally, the extent and severity classification categories were amenable for comparison.

Three similar age categories were used for analysis in both studies: 20 - 34, 35 - 44 and $>$ 65 years. However, the 1998 study used the category 55 - 64 years, while the 2014 study used the category 45 - 64 years. Other factors for comparison included gender, living in urban or rural areas, and being registered in the high-income contributory health insurance system or the low-income subsidiary insurance.

Measurement training and reproducibility

In 1998, examiner calibration exercises were performed among a group of approximately 300 subjects in all clinical aspects included in the national study: dental caries, periodontal status, occlusion and oral lesions. Reproducibility was calculated as being good for dental variables, but moderate for periodontal variables. For inter-examiner reproducibility, kappa values varied between 0.31 and 0.63; for intra-examiner reproducibility, the kappa value range was 0.29 to 0.94.

In 2014, all 24 examining dentists received a theoretical training course of 52 hours including all variables of the study. Afterwards, all examiners participated in a calibration exercise on 285 people, from which 45 individuals were selected for periodontal examination training. During the course of the study, 1144 re-examinations were performed. The kappa value for inter-examiner reproducibility was 0.7, and for intra-examiner reproducibility was 0.9.

Data analysis

In the two national studies adjustments to the selected sample were performed, considering an expansion factor that accounted for the probability of not being included in the sample, refusal to participate, or collection of data not possible due to security reasons.

Descriptive statistics were used for comparison. As no standard deviation or confidence intervals were reported for the 1998 study, no statistical tests could be performed.

Results

Number of teeth

A larger mean number of teeth was present in the 2014 study compared to the 1998 study. While the mean number of teeth in the age category 20 - 34 years was 24.7 in 1998, it was 26.7 in 2014; for the age category 35 - 44 years, the number of teeth was 19.2 in 1998, and 23.8 in 2014. A drastic reduction in the mean number of teeth was observed at later ages in the two studies. In 1998, subjects \geq 55 years old had 9.7 teeth, in the 2014 study subjects aged 45 - 64 had 17.6 teeth, and those \geq 65 years had only 8.0 teeth.

For both studies, men, individuals living in urban areas, and participants in the higher-income health insurance system had a larger mean number of teeth (*Table 1*).

Extent and severity index

The ESI value for the 2014 study, when considering only the 10 sites examined in 1998, was 35.3, 1.33; this means that 35.3% of the sites were affected by CAL \geq 1 mm, and the average amount of CAL in affected sites was 1.33 mm. The value in 1998 was similar (32, 1.4). Both values implied generalized CAL.

The distribution of the extent categories in the two national studies showed different proportions. The percentage of individuals affected by generalized attachment loss in the 2014 study was approximately three times as large compared to the 1998 study: 29.2% and 8.1%. As the percentage of individuals in the localized attachment loss category was similar for both studies (42 - 45%), a larger proportion of subjects unaffected by attachment loss was observed in the 1998 study (Table 2).

The distribution of ESI severity categories had marked differences for mild attachment loss; while 41.1% of participants had mild loss in 1998, a larger percentage of individuals, 64.8%, had mild loss in 2014. Similar percentage values were

Table 1. Mean number of teeth in different categories (SE).

	1998 study	2014 study
Gender		
Male	21.5	22.4 (0.06)
Female	20.2	21.0 (0.10)
Living area		
Urban community	21.2	22.1 (0.03)
Rural community	19.7	20.2 (0.40)
Health insurance		
Contributory	21.0	22.4 (0.05)
Subsidiary	20.2	20.6 (0.12)

SE, standard error

present for subjects in the moderate and severe categories in the two studies; approximately 7 - 8% of the subjects had moderate attachment loss, and 1.1 - 1.2% had severe attachment loss. As a consequence, more subjects in 1998 were categorized as not having attachment loss (Table 3).

A difference was present between the two studies for the prevalence of moderate mean CAL 3 - 5 mm related to the health insurance system, which is associated with income. In 1998, the value for the two groups was the same, 8.3%, while in 2014 the value for the high income group was half that for the low-income group, 5.2% compared to 10.4% (Table 3).

Table 2. Comparison of the ESI extent categories between 1998 and 2014. Mean (SE).

	1998 study		2014 study	
	Localized	Generalized	Localized	Generalized
Age range				
20 - 34	42.7	4.7	42.4 (0.7)	14.9 (0.5)
35 - 44	52.1	15.8	55.8 (0.9)	26.3 (0.8)
45 - 54			46.6 (0.7)	46.0 (0.7)
55 - 64	49.2	36.8	46.3 (1.4)	56.6 (1.3)
> 65	44.3	46.3	25.0 (0.9)	73.9 (0.9)
Gender				
Male	42.3	10.3	42.2 (0.5)	47.4 (0.6)
Female	41.7	5.8	34.5 (0.5)	23.8 (0.5)
Living area				
Urban	42.1	7.8	44.7 (0.3)	28.5 (0.4)
Rural	41.9	8.9	44.0 (2.2)	32.2 (1.8)
Health insurance				
Contributory	41.4	7.9	43.7 (0.5)	26.7 (0.7)
Subsidiary	44.8	9.5	45.0 (0.7)	33.1 (0.7)
Total	42.0	8.1	44.8 (0.4)	29.2 (0.5)

ESI, extent and severity index; SE, standard error

Table 3. Comparison of ESI severity categories between 1998 and 2014. Mean (SE).

	1998 study			2014 study		
	Mild	Moderate	Severe	Mild	Moderate	Severe
Age range (yrs)						
20 - 34	40.4	6.0	0.6	53.7 (0.8)	3.5 (0.4)	0.07 (0.03)
35 - 44	51.1	13.9	2.2	75.5 (0.6)	6.0 (0.2)	0.6 (0.09)
45 - 54				77.7 (0.6)	11.4 (0.5)	3.4 (0.3)
55 - 64	48.9	31.1	6.3	70.7 (0.7)	22.6 (0.6)	1.2 (0.1)
> 65	56.1	27.1	7.3	69.8 (1.2)	24.9 (1.1)	4.2 (0.3)
Gender						
Male	41.6	9.1	1.7	64.2 (0.4)	10.8 (0.4)	1.7 (0.08)
Female	40.5	6.3	0.7	65.3 (0.8)	5.5 (0.2)	0.4 (0.09)
Living area						
Urban	41.7	7.3	0.9	64.5 (0.4)	7.9 (0.1)	0.8 (0.06)
Rural	39.4	9.1	2.0	65.1 (2.0)	8.7 (0.9)	2.5 (0.2)
Health insurance						
Contributory	40.3	8.3	0.7	64.5 (0.5)	5.2 (0.1)	0.7 (0.05)
Subsidiary	44.8	8.3	1.1	66.1 (0.8)	10.4 (0.5)	1.5 (0.1)
Total	41.1	7.7	1.2	64.8 (0.5)	8.1 (0.2)	1.1 (0.06)

ESI, extent and severity index; SE, standard error

Discussion

The present comparison showed conflicting evidence regarding improved, similar or worse periodontal conditions in representative national samples examined in 1998 and 2014. The number of teeth showed an increment in 2014: in different age categories, subjects had 2 - 3 teeth more in 2014 compared to 1998. Other proportions such as presence of mild and generalized forms of attachment loss had worse values in the most recent study: the percentage of subjects with mild attachment loss was 41.4% in 1998 and increased to 64.8% in 2014. Similarly, the presence of generalized attachment loss as defined in that study, > 50% of sites affected, increased from 8.1% in 1998 to 29.2% in 2014. Finally, proportions of moderate and severe attachment loss had a similar distribution in the two studies.

Few recent studies have described the prevalence of periodontal disease in Colombia. The two studies compared in the present report are the only ones that included national representative samples. Other studies have included probabilistic samples from large Colombian cities (Gómez-Restrepo *et al.*, 2008), or convenience samples from isolated communities in the Colombian Amazon region (Ronderos *et al.*, 2001; Triana *et al.*, 2005), or the Caribbean seacoast (Orozco *et al.*, 2004). Some of these articles focused on the occurrence of periodontal disease in children (Gómez-Restrepo *et al.*, 2008; Triana *et al.*, 2005), while others analyzed adult participants also (Ronderos *et al.*, 2001; Orozco *et al.*, 2004). These studies described how the presence of gingival bleeding and dental calculus, measured using the CPITN index (Ainamo *et al.*, 1982), was a common finding. Of a sample of children from a Colombian Amazon community, 39.3% had gingival bleeding and calculus (Triana *et al.*, 2005), while 51.7% of inhabitants of an island on the Colombian Caribbean coast had this clinical condition. Other studies measured CAL levels. Gómez-Restrepo *et al.* (2008) found that 40.6% of a sample of 629 children from Medellín (Colombia) had CAL \geq 1 mm, but only 16.0% had CAL \geq 3 mm. Meanwhile, Ronderos *et al.* (2001) found that only 5.4% of a sample of 244 persons of isolated Amazon indigenous communities had mean CAL loss \geq 3 mm, 40.6% of the sample had \geq 1 site with CAL 4 - 6 mm, but only 7.1% had \geq 1 site with CAL \geq 7 mm. The latest two reports could agree with the results of the present study, as mild CAL loss was a common finding, but severe CAL loss was present in a small proportion of individuals.

A literature review addressing the subject of a change in the prevalence of periodontitis in the last 30 years concluded that the prevalence of periodontitis has decreased in parts of Europe and the USA (Hugoson and Norderyd, 2008). The results of five sectional studies performed in the Swedish city of Jonkoping showed a

constant increase in the number of teeth and reduction in the percentage of periodontally affected individuals. In this study, the presence of moderate periodontitis diminished from 47% in 1973 to 22% in 2013 (Norderyd *et al.*, 2015; Hugoson *et al.*, 2008). The decrease in periodontitis prevalence for this population was partly associated with emphasis on preventive dental care and improved continuing education for dentists (Hugoson and Koch, 1981). Another summary of four sectional studies performed in the city of Oslo (Norway) showed a significant decrease in the proportion of subjects with PD \geq 6 mm. The proportion of individuals with PD \geq 6 mm decreased from 21.8% in 1984 to 8.1% in 2003. Notably, the proportion of individuals showing periodontal health improved three-fold in 2003 (Skutudyte-Rysstad *et al.*, 2007). Two sectional studies performed in the Berne region (Switzerland) 25 years apart showed a clear improvement of oral and periodontal health conditions. The mean number of teeth increased from 20.7 to 24.6 and the percentage of proximal sites showing PD 4 - 6 mm decreased from values around 40.5 - 42.3% to values of 3.0 - 3.4% (Schurch Jr *et al.*, 2015). The study by Borrell *et al.* (2005) compared the proportions of periodontitis in two USA national studies. The overall prevalence of periodontitis in NHANES III (1988-1994) was 7.3%, while prevalence in NHANES 1999-2000 was 4.2%. These references described how the prevalence of periodontitis or its associated clinical signs have decreased over the years in industrialized countries. This tendency was not observed in Colombia, based on the national studies in 1998 and 2014. On the contrary, the two Colombian samples showed subjects with mean CAL \geq 3 mm of nearly 9%.

Periodontal disease and its ultimate consequence, tooth loss, are important public health problems (Petersen and Ogawa, 2012). Factors associated with periodontitis are common to other chronic diseases such cardiovascular disease, diabetes mellitus or cancer. In addition to proper plaque control, other important behavioral factors include tobacco use, malnutrition, excessive alcohol consumption and psychosocial stress (Baehni, 2012). Control of these factors, through organized preventive care programs, could contribute to control of periodontitis and important related systemic diseases. These programs should encompass social determinants of disease, relation to general health, lifestyle modification and emphasis on self-care (Petersen and Ogawa, 2012). Integration of general dentists, specialists and public health policy planners is necessary in order to decrease prevalence of periodontitis in Colombia.

Different methodology aspects in periodontal epidemiology could affect the results of these studies: study design, methods for sampling subjects, selection of sites for examination, and examiner training and calibration, are the most relevant (Kingman and Albandar, 2002).

The two studies compared in the present report used probability and multistage sampling techniques for selection of subjects, which would be representative of the country. Regarding the number of sites examined, the Third Colombian Oral Health Study in 1998 (Franco *et al.*, 1998) used a partial periodontal examination system following recommendations described in the literature (Papapanou *et al.*, 1993; Ainamo and Ainamo, 1985). Several studies have described how use of partial recording systems could lead to significant bias in the recording of variables (Kingman and Albandar, 2002; Susin *et al.*, 2005). However, this bias would be similar for both studies, when selection of specific teeth and sites was performed for the 2014 study. Because measurement reliability and consistency play an important part in an epidemiological study, periodontal probing should include training in pressure, angulation and rounding, as these factors could produce different score values for the same periodontal site. Of interest for the comparison of the Colombian studies is the use of two different periodontal probe types: the 1998 study used the WHO probe, as CPITN values were evaluated, although CAL values were also recorded; the 2014 study used the North Carolina periodontal probe, with a system marking each millimeter, for measurements of PD and CAL. The WHO probe does not have a millimeter marking system; it has a 0.5 mm rounded tip and a black-colored area that represents PD between 3.5 and 5.5 mm. For the 1998 study, it is possible to assume that CAL measurements would not be as reliable as for the 2014 study. This could partly explain the larger range for kappa values in 1998 where the intra-examiner kappa value range was 0.29 - 0.94, compared to a value of 0.9 in 2014. A more extensive calibration program would have been needed to compensate for the use of the WHO probe. The two Colombian national studies defined the presence of CAL when measurements were ≥ 1 mm, a low threshold value considering possible inaccuracies of CAL measurements, particularly for the 1998 study. Usually, longitudinal studies evaluating the incidence of CAL in specific populations have used larger thresholds in order to avoid measurement error (Tonetti and Claffey, 2005; Beck *et al.*, 1994; Thomson *et al.*, 2004; Haas *et al.*, 2012).

When considering moderately advanced and generalized CAL loss, greater prevalence was seen for men, people living in rural areas and members of the subsidiary health insurance system. Reviews on analytical periodontal epidemiology have referred to an increased prevalence of periodontitis in men and subjects with low socio-economic status. This probably is a consequence of better oral hygiene practices and/or utilization of oral health care services by women, and differential access to resources such as preventive dental care procedures (Borrell and Papapanou, 2005). Similarly, two epidemiological

studies in Latin America on large representative samples have found the same results. In South Brazil, Susin *et al.* (2004) found that men had a significantly higher risk of having severe attachment loss compared to women, with an odds ratio of 1.6. At the same time, people with low or medium socio-economic status had 1.8 and 1.6 odds ratios for severe CAL loss. In Chile, Gamonal *et al.* (2010) reported that being male was significantly associated with having ≥ 1 site with CAL loss ≥ 6 mm. Among men, 46.4% of the participants had ≥ 1 site with CAL loss ≥ 6 mm compared to 32.3% for women.

When comparing the periodontal clinical results of two Colombian National Oral Health Studies 16 years apart, 1998 and 2014, it can be concluded that the periodontal conditions in both samples are similar. This could imply that improvement of periodontal health seen in industrialized countries such as the USA and some parts of Europe is not present in this country. This should serve as a starting point for renewed preventive and therapeutic strategies. These would need to target recognized risks factors for periodontitis through public health programs.

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