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Association between chronic periodontitis and oral health-related quality of life in Sri Lankan adults

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Objective: To determine the impact of chronic periodontitis on oral health-related quality of life in Sri Lankan adults. **Methods:** A cross-sectional study was conducted among 1,400 participants, 35–60 years of age, residing in the Colombo district of Sri Lanka. Data were collected using two interviewer-administered questionnaires and an oral examination. **Results:** The prevalence, extent and severity of oral impacts increased with the increase in severity of chronic periodontitis. The most commonly experienced impacts were within the domain of physical pain. The adjusted Poisson regression model indicated that chronic periodontitis was significantly associated with the prevalence of oral impacts. The prevalence of oral impacts was 48% and 69% higher in those with moderate and severe periodontitis, respectively, compared with those with no/mild periodontitis. **Conclusions:** Oral health-related quality of life deteriorates with the increase in severity of chronic periodontitis.

Key words: *Chronic periodontitis, OHIP-14, oral health-related quality of life, Sri Lanka*

INTRODUCTION

Oral health-related quality of life (OHRQoL) is a multi-dimensional construct that includes a subjective evaluation of the individual's oral health and physical and psycho-social well-being[1]. It has received increased attention in recent years and researchers have recommended that normative clinical measures be complemented with OHRQoL measures in treatment-needs assessments and in planning oral health services[2,3]. Also, OHRQoL has been used as an outcome measure to determine the effectiveness of treatment[4,5]. Several instruments have been developed to assess OHRQoL and they mainly include generic measures[6] but some researchers have also developed condition-specific OHRQoL parameters[7,8].

Chronic periodontitis is an inflammatory condition that results from a complex interaction among plaque bacterial pathogens, host defence mechanisms and various behavioural, environmental and genetic risk factors, leading to destruction of the periodontal tissues[9]. Although asymptomatic in its early stages, more advanced stages of chronic periodontitis cause gingival recession and drifting, mobility and loss of teeth, which could significantly affect the physical and psycho-social well-being of an individual. In fact, it has been shown that chronic periodontitis is associated with poor OHRQoL[10].

The prevalence of periodontal disease is high in Sri Lanka. According to the third National Oral Survey, 90% of 35- to 44-year-old subjects have periodontal disease, and 14% and 2% of these individuals have periodontal pockets of 4–5 mm and ≥6 mm, respectively[11]. These data are comparable with those from other developing countries, such as China, where it has been reported that the prevalence of periodontal disease is 90% in adults, and 24% and 2% have periodontal pockets of 4–5 mm and ≥6 mm, respectively[12]. The impact of oral conditions, such as dental caries and tooth loss, on physical and psycho-social well-being has been assessed in Sri Lankan adults[13,14]. However, despite the high prevalence of periodontal disease, the impact of this condition on quality of life is yet to be determined. Therefore, the aim of this study was to evaluate the impact of chronic periodontitis on OHRQoL in adults residing in the Colombo district of Sri Lanka. It was hypothesised that OHRQoL deteriorates with the increase in severity of chronic periodontitis.

METHODS

The data for the present paper were obtained from a broader study on chronic periodontitis in 30- to 60-year-old adults residing in the Colombo district of Sri Lanka. Ethical clearance for the study was granted by the Ethical Review Committee, Faculty of Medical Sciences, University of Sri Jayewardenepura, Sri Lanka, following review of the study protocol. This study was carried out in accordance with the World Medical Association Declaration of Helsinki. Also, written informed consent was obtained from all participants. Individuals with fewer than 20 teeth were excluded as it is considered that 20 or more teeth are necessary for satisfactory oral function[15]. In addition, pregnant women, those with learning difficulties and those who are disabled, were excluded. Persons residing in business premises, hostels and religious institutions were not considered for inclusion in the sample as it is possible that they could be temporary lodgers rather than permanent residents of the district.

For this cross-sectional study, hypothesis test for two population proportions was used to calculate the sample size. To calculate the sample size, data from a study that had used the Malaysian version of the Oral Health Impact Profile (OHIP)-14 scale to determine the association between periodontal status and OHRQoL were considered[16]. Using the prevalence of 'food lodging' in those with a healthy periodontium/gingivitis (18%) and periodontitis (31%) reported in that study, for a level of significance of 5% and a power of 80%, a minimum of 171 participants were needed per group. As periodontal status was categorised into three groups, the minimum sample size required was 513. As it was decided to use the cluster sampling method to select the sample it was necessary to make allowance for the design effect, which was considered as 2. After making adjustments for the design effect and potential non-responses (10%), the sample size required was 1,130. However, as the calculated sample size for the main study was greater than 1,130, that sample of 1,400 was adopted also for the present study.

The cluster sampling technique, a method of probability sampling, was used to select the sample and when this technique is used at least 30 clusters should be included to obtain valid data[17]. It was decided to select the participants from 40 clusters and a total of 35 subjects from a cluster (1,400/40 = 35). A 'Grama Niladhari' Division (GND), which is the smallest administrative unit in Sri Lanka, was considered as the cluster. The GNDs in the Colombo district are categorised into three sectors: urban CMC [GNDs under the Colombo Municipal Council (CMC)]; urban non-CMC (GNDs under other municipal/urban councils); and rural GNDs. The 40 clusters were then allocated across the three sectors based on the population proportions of the three sectors. Accordingly 12, 10 and 18 clusters were allocated to urban CMC, urban non-CMC and rural sectors, respectively. The probability proportionate to size technique was used to identify the required number of clusters from each sector. The 35 subjects selected from a cluster included both male subjects and female subjects and from the 35–44 and 45–60 years age groups. They were selected based on the population proportions of these groups in the Colombo district. To identify 'the households, the Grama Niladhari office of the cluster was first located and the method recommended by the World Health Organization for cluster surveys[18] was used to select the households from that point. Only one individual was chosen from each household.

Data were collected using two pretested interviewer-administered questionnaires and an oral examination. The first questionnaire was used to obtain information on sociodemographic and behavioural factors, while the second included a Sinhalese translation of the OHIP-14 scale[6], which had been validated previously[19]. For Tamil-speaking subjects, a Tamil translation prepared by an expert in both Sinhala and Tamil languages was used. The OHIP-14 scale consists of 14 impact items: trouble pronouncing words; taste worsened; pain in mouth; uncomfortable to eat; feeling tense; feeling self-conscious; unsatisfactory diet; having to interrupt meals; difficult to relax; feeling embarrassed; feeling irritable; difficulty in doing usual work; life less satisfying; and totally unable to function. The respondents indicated the frequency of experiencing each impact over the past 12 months on a five-point scale: never (score = 0); hardly ever (score = 1); occasionally (score = 2); fairly often (score = 3); and very often (score = 4). However, to reduce recall bias, a period of 6 months was considered in the present study. Data collection took place at the participant's home. The first author, who was calibrated against a professor in Periodontology to record the periodontal parameters, carried out the oral examination under an artificial head light while the subject was seated on a high-back regular chair. The oral examination included the assessment of bleeding on probing (BOP) and measurements of periodontal pocket depth (PPD), clinical attachment loss (CAL) and gingival recession (GR) on six surfaces (mesio-buccal/labial, buccal/labial, disto-buccal/labial, disto-lingual/palatal, lingual/palatal and mesio-lingual/palatal) of all teeth present in the mouth, excluding the third molars. The University of North Carolina-12 probe with 1-mm increments (Hu-Friedy Manufacturing Co., Chicago, IL, USA) was used to record the periodontal parameters. Carious and missing teeth were also recorded. Intra-examiner variability related to the assessment of periodontal parameters was determined by re-examining 5% of the sample (70 subjects) and the weighted

kappa statistics were 0.94, 0.86, 0.92 and 0.93 for BOP, PPD, CAL and GR, respectively. Following the oral examination, two trained field assistants, one of whom was conversant in both Sinhala and Tamil languages, administered the questionnaires to the subjects. The questionnaires and the oral examination method were pretested on a sample of 15 Sinhala- and Tamil-speaking subjects selected from another district.

Data were analysed using Stata 12.0 (StataCorp., College Station, TX, USA) and SPSS 21.0 (SPSS Inc., Chicago, IL, USA) software. OHIP-14 scores were computed according to: (i) prevalence, namely the percentage of subjects reporting one or more items 'fairly often' or 'very often'; (ii) extent, namely the number of items reported 'fairly often' or 'often'; and (iii) severity, namely the total OHIP-14 score obtained by summing scores for responses for all 14 items, with possible scores ranging from 0 to 56. Higher scores indicated poorer OHRQOL[20]. Case definitions proposed by the Centers for Disease Control and Prevention (Atlanta, GA, USA) for use in population-based studies of periodontitis, were used to define periodontitis. The case definition for severe periodontitis was two or more interproximal sites with CAL of ≥6 mm (not on the same tooth) and one or more interproximal sites with PPD of ≥5 mm (not on the same tooth), while for moderate periodontitis it was two or more interproximal sites with CAL of ≥4 mm (not on the same tooth) or two or more interproximal sites with PPD of ≥5 mm (not on the same tooth)[21]. Those with no disease and mild periodontitis were grouped together as a single category.

As the distribution of OHIP scores was skewed, non-parametric tests were used in the data analysis. Chi-square for trend (linear by linear association chi-square statistic) and Jonckheere–Terpstra tests were used to test the distribution of trends in the prevalence, extent and severity of oral impacts across ordered disease-severity groups. Unadjusted and adjusted Poisson regression models with robust variance were fitted to determine the factors associated with the prevalence of oral impacts. Only those variables that were associated with the dependent variable at a P <0.10 in the unadjusted models were included in the adjusted model. Decayed and missing teeth were included as continuous variables in the models.

RESULTS

The sample included 1,400 participants, of which 51% were male subjects and 81%, 11% and 8% were Sinhalese, Tamils and Muslims, respectively. The mean age of the sample was 43.5 (±9.9) years and nearly 60% were in the 35–44 years age group. A majority had 11–13 years of education (50%), whereas 44% and 6% had fewer than 10 years and over 13 years of education, respectively. Seventy-two per cent indicated that their monthly income was less than 20,000 rupees.

Table 1 shows the prevalence, extent and severity of oral impacts according to disease severity. The prevalence of oral impacts was 40.7%, 59.6% and 68.8% in those with no/mild, moderate and severe chronic periodontitis, respectively. There were significant upward monotonic trends for prevalence, extent and severity of oral impacts across ordered disease-severity groups; all three entities increased with the increase in the severity of chronic periodontitis. In all three disease groups, the most commonly experienced impacts were within the domain of physical pain, and 'painful aching in the mouth' was the most commonly experienced impact. Except for two impact items ('irritable with people' and 'totally unable to function'), the trends in the prevalence of all other impact items were monotonic and statistically significant across ordered disease-severity groups (*Table 2*). The findings of the Poisson regression analyses are shown in *Table 3*. According to the adjusted model, the prevalence of oral impacts was significantly lower in male subjects and in those with >13 years of education compared with female subjects and those with up to 5 years of education, while current smokers had a higher prevalence of oral impacts compared with never smokers. Also, chronic periodontitis was significantly associated with the experience of oral impacts. Compared with those with no/mild periodontitis, the prevalence of oral impacts was 48% and 69% higher in those with moderate and severe periodontitis, respectively. Although both decayed and missing teeth were associated with the prevalence of oral impacts in the unadjusted models, they lost significance in the adjusted model.

DISCUSSION

The impact of chronic periodontitis on OHRQoL has received less attention compared with other oral

Table 1 Prevalence, extent and severity of oral impacts according to severity of periodontitis

	No/mild periodontitis (n = 706)	Moderate periodontitis (n = 505)	Severe periodontitis (n = 189)	P value
Prevalence[‡] (%)	287 (40.7)	301 (59.6)	130 (68.8)	<0.001*
Severity[§]	6.92 (8.8)	13.43 (12.1)	16.38 (12.7)	<0.001†
Extent[¶]	1.23 (2.1)	2.52 (2.8)	3.50 (3.2)	<0.001†

The P value was determined using the chi-square for trends test* or the Jonckheere–Terpstra test†.
[‡]Prevalence: percentage of subjects reporting one or more items 'fairly often' or 'very often'.
[§]Severity: mean (standard deviation) Oral Health Impact Profile-14 (OHIP-14) score.
[¶]Extent: mean (standard deviation) number of items reported 'fairly often' or 'often'.

Table 2 Prevalence (defined as the percentage of subjects reporting the impact item 'fairly often' or 'very often') of different Oral Health Impact Profile-14 (OHIP-14) items according to severity of periodontitis

Oral impact item	No/mild periodontitis (n = 706)		Moderate periodontitis (n = 505)		Severe periodontitis (n = 189)		P value*
	n	%	n	%	n	%	
Functional limitations	56	7.9	107	21.2	66	34.9	<0.001
Trouble pronouncing words	30	4.2	58	11.5	25	13.2	<0.001
Taste worsened	33	4.7	74	14.7	57	30.2	<0.001
Physical pain	187	26.5	254	50.3	114	60.3	<0.001
Painful aching in mouth	150	21.2	231	45.7	107	56.6	<0.001
Uncomfortable to eat	116	16.4	153	30.3	77	40.7	<0.001
Psychological discomfort	166	23.5	177	35.0	81	42.9	<0.001
Felt self-conscious	133	18.8	146	28.9	61	32.3	<0.001
Felt tense	92	13.0	130	25.7	58	30.7	<0.001
Physical disability	127	18.0	176	34.9	79	41.8	<0.001
Diet unsatisfactory	53	7.5	78	15.4	53	28.0	<0.001
Had to interrupt meals	70	9.9	132	26.1	71	37.6	<0.001
Psychological disability	100	14.2	190	37.6	86	45.5	<0.001
Difficult to relax	78	11.0	182	36.0	81	42.9	<0.001
Felt a bit embarrassed	32	4.5	25	5.0	19	10.1	0.012
Social disability	46	6.5	41	8.1	30	15.9	<0.001
Irritable with people	29	4.1	16	3.2	14	7.4	0.203
Difficulty in doing usual jobs	34	4.8	34	6.7	22	11.6	0.001
Handicap	16	2.3	11	2.2	14	7.4	0.003
Felt life less satisfying	12	1.7	9	1.8	12	6.3	0.002
Totally unable to function	6	0.8	5	1.0	4	2.1	0.20

*P values were determined using the chi-square for trends test.

conditions. The limited studies on this topic have been mainly confined to patients seeking periodontal care, and the present study is one of the very few population-based studies to have assessed the association between chronic periodontitis and OHRQoL.

The prevalence of oral impacts was high in the present sample and increased significantly with the increase in severity of chronic periodontitis. Surprisingly, even patients seeking periodontal care, who can be expected to have severe disease, had a lower prevalence of oral impacts when compared with the prevalence of oral impacts in subjects with chronic periodontitis in the present study. For example, Cunha-Cruz *et al.*[22] found that only 20% of patients presenting for a comprehensive clinical examination by a periodontist experienced an oral impact either fairly often or often. Also, a study on patients seeking care at a periodontics unit of a university dental centre in Jordan has reported that the prevalence of oral impacts in patients with moderate and severe periodontitis was 54% and 64%, respectively[23]. The present study used the case definitions recommended for population-based surveillance of periodontitis[21], while the above studies used other definitions. The prevalence or frequency of a condition depends on how it is defined. Therefore, the differences between studies could be attributed to the differences in case definitions used. In fact, Costa *et al.*[24] showed that prevalence rates varied from 14% to 65% when different case definitions were used to define periodontitis. Also, differences in instruments used to measure OHRQoL, variations in the severity of disease, and social, cultural and ethnic differences in the perceptions of oral impacts may have been responsible for the differences observed between studies. Furthermore, the severity of oral impacts also increased with the increase in disease severity and is in agreement with the findings of both population-based and patient-based studies[25–27]. The most commonly reported impacts were within the domain of physical pain. A similar finding has been reported by Al-Habashneh *et al.*[23] in patients seeking care for periodontal disease. On the other hand, 'trouble pronouncing words', an impact within the domain of functional limitation of the OHIP-14 scale, was the most common impact experienced by German patients who needed periodontal care[27]. As there are social, cultural and ethnic dimensions to the perception of oral impacts[28], this difference is to be expected.

The present study used the OHIP-14, which is a generic instrument, to measure OHRQoL. This instrument taps impacts associated with the overall oral health status of an individual, rather than periodontal disease per se. Indeed, the findings of the univariate Poisson regression models support this fact. In addition to chronic periodontitis, both decayed and missing teeth were strongly associated with poor OHRQoL in the unadjusted models. However, in the adjusted analysis, both variables lost significance, indicating that decayed and missing teeth were not independently associated with OHRQoL. Some investigators who assessed the impact of periodontal disease on OHRQoL using generic instruments failed to control for the confounding effects of other oral conditions in the analysis[29,30] and therefore their findings may be biased. According to

Table 3 Variables associated with prevalence of oral impacts based on Poisson regression analysis (n = 1,400)

Variable	Unadjusted models			Adjusted model		
	PR	95% CI	*P* value	PR	95% CI	*P* value
Sex						
Female	1.00			1.00		
Male	0.91	0.82–1.01	0.08	0.77	0.68–0.90	0.001
Age group (years)						
30–44	1.00			1.00		
45–60	1.14	1.03–1.26	0.01	0.96	0.86–1.07	0.44
Ethnicity						
Sinhala	1.00					
Non-Sinhala	1.04	0.92–1.18	0.54	#		
Education (years)						
Up to 5	1.00			1.00		
6–10	0.92	0.80–1.08	0.31	0.97	0.82–1.14	0.71
11–13	0.74	0.64–0.87	<0.001	0.84	0.70–1.01	0.06
>13	0.57	0.41–0.77	<0.001	0.70	0.50–0.98	0.04
Monthly income (rupees)						
Up to 20,000	1.00			1.00		
>20,000	0.85	0.76–0.97	0.10	0.96	0.84–1.09	0.55
Smoking status						
Never	1.00			1.00		
Former	0.94	0.78–1.15	0.60	1.03	0.83–1.29	0.77
Occasional	1.01	0.77–1.32	0.97	1.09	0.83–1.43	0.53
Current	1.28	1.21–1.45	<0.001	1.26	1.07–1.48	0.006
Periodontitis status						
No/mild	1.00			1.00		
Moderate	1.47	1.31–1.64	<0.001	1.47	1.29–1.68	<0.001
Severe	1.69	1.48–1.93	<0.001	1.70	1.40–2.07	<0.001
Toothbrushing frequency						
<Twice/day	1.00					
≥Twice/day	1.03	0.89–1.19	0.67	#		
Self-reported diabetes						
No	1.00					
Yes	1.14	0.99–1.33	0.07	1.05	0.90–1.23	0.55
History of dental care						
No	1.00					
Yes	0.88	0.72–1.08	0.23	#		
Decayed teeth	1.31	1.10–1.17	<0.001	0.99	0.94–1.05	0.89
Missing teeth	1.11	1.10–1.41	<0.001	0.99	0.95–1.04	0.89

95% CI, 95% confidence interval; PR, prevalence ratio.
#Variables with $P < 0.10$ in the unadjusted models were not included in the adjusted model.

the adjusted Poisson regression model, chronic periodontitis was independently associated with poor OHRQoL. A few studies that have controlled for the effects of other oral conditions in the analysis have also found that periodontal disease is associated with poor OHRQoL[25,31,32]. Moreover, the magnitude of the prevalence ratio for severe chronic periodontitis was higher than the prevalence ratio for moderate periodontitis, indicating that OHRQoL is poorer in those with severe periodontitis compared with those with moderate periodontitis, thus confirming the hypothesis of the study, namely that OHRQoL deteriorates with the increase in severity of chronic periodontitis. A similar finding has been reported elsewhere. Bernabé and Marcenes[31] found that as the numbers of teeth with periodontal pockets of ≥4 mm and loss of attachment of ≥4 mm increased, OHRQoL worsened. It is also noteworthy that there were very few differences between the unadjusted and adjusted prevalence ratios for moderate and severe periodontitis, suggesting that the observed association between chronic periodontitis and OHRQoL was not confounded by other variables included in the adjusted model. In contrast, in a previous study, the strength of association between periodontal disease and OHRQoL was attenuated when controlled for dental caries, traumatic dental injuries and tooth wear, suggesting that these variables were weak confounders of the association between periodontal disease and OHRQoL[31]. In addition to chronic periodontitis, sex, education level and current smoking were independently associated with OHRQoL. Similar findings have been observed in other Asian adult populations[33,34].

This study has a few limitations. The oral examination was carried out at the participant's home while he/she was seated on a high-back regular chair. Examining the participants while they were seated on a portable dental chair rather than on a regular chair may have enhanced the accuracy of data collected during the oral examination. Also, the multivariate Poisson regression model controlled only for dental caries and missing teeth, two common oral conditions

that lead to oral impacts in adults. It is possible that other oral conditions present in the subjects, and even denture wear, may have had an effect on their OHRQoL.

In conclusion, the present study, which is the first to assess the impact of chronic periodontitis on Sri Lankan adults, revealed that there is a significant association between chronic periodontitis and OHRQoL and that OHRQoL deteriorates with an increase in severity of the disease. As chronic periodontitis significantly affects the OHRQoL of an individual, it highlights the need for effective measures to prevent and control this condition.

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Conflicts of interest

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