

Association between psychological distress and chronic periodontitis in Sri Lankan adults

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Objective: to determine the association between psychological distress and chronic periodontitis in 30-60 year olds residing in Colombo district, Sri Lanka. **Basic research design:** an unmatched case control study which included 694 cases and 706 controls. An interviewer administered pre-tested questionnaire was used to obtain information on socio-demographic and behavioural factors while an oral examination was carried out to record periodontal parameters. Psychological distress was assessed using a validated Sinhala version of the General Health Questionnaire-30. **Participants:** 30-60 year olds residing in Colombo district, Sri Lanka. **Results:** the odds of having chronic periodontitis was nearly three times more (OR=2.71, 95% CI= 2.09-3.51) in those with psychological distress compared to those without psychological distress. Further sex, age group, level of education, current smoking and self reported diabetes were associated with chronic periodontitis. **Conclusion:** psychological distress is an independent risk factor for CP in this population.

Keywords: Psychological distress, chronic periodontitis, Sri Lanka

Introduction

Chronic periodontitis (CP) is an inflammatory disease caused by bacterial infection. Although the emergence of periodontal pathogens in the subgingival biofilm is necessary, it is insufficient for the development of the disease. It is now well established that local and systemic risk factors play an important role in the onset and progression of CP by modifying the susceptibility of the host to periodontal pathogens (Genco and Borgnakke, 2013). Mild to moderate periodontitis is widespread among adults but severe periodontitis, which being the 6th most prevalent oral condition, affects only 11.2% of the global population (Kassebaum, *et al.*, 2014).

Psychological factors are recognized as important determinants of health. (Martikainen *et al.*, 2002). It is well established that psychological stress/distress has a negative impact on the immune system (Segerstrom and Miller, 2004). Also, CP results from a complex interplay between bacteria, the host immune response and other risk factors (American Academy of Periodontology, 2005). It is possible that due to these reasons researchers have attempted to determine whether psychological factors are risk factors for CP. Further, interest in the topic may have arisen due to the increased attention on “periodontal-systemic” associations.

Several studies have attempted to determine the association between psychological factors and CP. Two systematic reviews on the role of stress/psychological factors on periodontal disease have shown a positive relationship (Peruzzo *et al.*, 2006, Halawany *et al.*, 2015). However, the studies considered in these two reviews were mainly confined to populations from western cultures. As there are cultural differences in stress levels, reactions to stress and coping mechanisms employed to alleviate or control stress (Laungani, 1993), it may not be possible to generalise the findings from those studies to coun-

tries with different cultural backgrounds and lower standards of living. Further, the burden of periodontal disease is lower than in countries in Africa and Asia (Petersen and Ogawa, 2012). Therefore, there is a need to assess the influence of stress on chronic periodontitis in diverse populations with varying rates of prevalence and severity of the disease. The aim of the present study was to determine the association between psychological distress and chronic periodontitis in 30-60-year olds residing in Colombo district, Sri Lanka.

Methods

Cases and controls for this population-based un-matched case-control study were derived from a broader study conducted to determine the prevalence of chronic periodontitis in 30-60-year olds in Colombo district. The sample included 1400 participants selected using a two-stage cluster sampling technique combined with the probability proportionate to size sampling method. A detailed description of the method was reported by Wellappulli and Ekanayake (2016). Approval for the study was obtained from the Ethical Review Committee of the Faculty of Medical Sciences, University of Sri Jayewardenepura, Sri Lanka. Written informed consent was obtained from all participants.

The sample size for the present study was calculated using Open Epi sample size calculator for un-matched case-control studies version 3.01(2013). As data on the prevalence of psychological distress among the general population of Sri Lanka are not available, the prevalence of psychological stress (20%) reported by Sloan *et al.* (2013) was used to calculate the sample size. Assuming that the exposure rate among controls is 20% and to detect an odds ratio of 2 with a power of 80% at a significant level of 5%, a minimum of 173 cases and controls were needed.

Case definitions proposed by Centers for Disease Control/American Academy of Periodontology (CDC/AAP) for population-based studies of periodontitis were used to define moderate and severe periodontitis (Page and Eke, 2007). A participant with either moderate or severe periodontitis was considered as a case. As 694 cases and 706 controls were identified from the main study, they were all included here to increase statistical power. The oral examination assessed periodontal probing depth (PPD) and clinical attachment loss (CAL) on six surfaces of all teeth present excluding the third molars using the University of North Carolina (UNC) - 12 probe (Hu-Friedy Manufacturing Co, Chicago, USA) with 1mm increments.

Data collection took place at the participant's home. The first author, who was calibrated against a professor in Periodontology conducted the examination using a head light with the participant seated on a chair. A pre-tested interviewer administered questionnaire was used to obtain information about socio-demographics and behavioural factors. A validated Sinhala translation of Goldberg's 30-item General Health Questionnaire-30 (GHQ 30) was used to assess psychological distress and a cut-off score of ≥ 6 was defined as having psychological distress (Abeyseena *et al.*, 2012). The GHQ was designed to assess psychological distress in the general population, within a community or non-psychiatric clinical settings (Goldberg and Williams, 1988) and now available in several versions. The response to each item is recorded on a 4-point scale where the two lower points of the scale are given a score of 0 and the two upper points are given a score of 1 (0-0-1-1; bimodal scoring method). The total GHQ-30 score would be 30 and ranged from 0-30.

The questionnaires and the oral examination method were pre-tested on a sample of 15 Sinhala and Tamil speaking subjects from another area.

The oral examination was carried out first. Five per cent of the sample was re-examined with Kappa statistics for intra-examiner variability for PPD and CAL being 0.87 and 0.92 respectively. Subsequently two field assistants, one of whom was conversant in both Sinhala and Tamil languages administered the GHQ-30 and the questionnaire to obtain information about socio-demographics and behavioural factors to the participant.

Data were analysed using Stata Statistical Software Release 1.2 (Stata Corp, Texas, USA). The Chi-square test was used to determine the differences in categorical exposure variables while Mann-Whitney test was used to assess the differences in GHQ scores in cases and

controls. Multiple binary logistic regression analysis was used to determine the independent effects of exposure variables on chronic periodontitis. Only those variables that were associated with CP at $p < 0.05$ level in the unadjusted binary logistic regression models were included in the final model.

Results

The mean age of cases and controls were 47.1 (SD=9.5) and 40.1 (SD=9.1) years respectively.

Data related to psychological distress in cases and controls are shown in Table 1. The median GHQ-30 score was significantly higher in the cases compared to controls. Psychological distress was present in 45.4% and 27.9% of cases and controls respectively. Table 2 compares values for exposure variables in cases and controls. Cases of periodontitis and controls differed significantly in relation to sex, age group, ethnicity, level of education, current smoking, current alcohol use and self-reported diabetes

In logistic regression, being a male, belonging to the 45-60-year-old age group, being educated up to 5 years and 6-10 years, a current smoker and having self-reported diabetes were independently associated with CP (Table 3). Psychological distress was independently associated with CP; the odds of having CP increased nearly three-fold in those with psychological distress compared to those without.

Discussion

The findings of the present community-based case-control study clearly showed that psychological distress was independently associated with CP. Several researchers using different study designs have assessed the role of psychological stress/distress in periodontal disease. The Erie County Study assessed the relationship between stress, distress, inadequate coping behaviour and periodontal disease (Genco *et al.*, 1999). They found that psycho-social measures of stress associated with financial strain and distress manifesting as depression were risk indicators for severe periodontal disease. Further a cross-sectional study among Hong Kong adults found that chronic job and financial strain, depression, inadequate coping and maladaptive trait dispositions were risk indicators for periodontal attachment loss (Ng and Kenung Leung, 2006). Chiou *et al.* (2010) used the 12-item Chinese Health Questionnaire (CHQ-12), adapted

Table 1. Psychological distress in cases and controls

	Cases (694)	Controls (706)	<i>p</i>
Mean GHQ-30 score (SD)	9.53 (10.5)	5.19 (7.7)	
Median GHQ-30 score (minimum-maximum)	4.00 (0-30)	2.00 (0-30)	<0.001*
Psychological distress status			
Present (GHQ score ≥ 6)	45.4% (n=315)	27.9% (n=197)	<0.001**
Absent (GHQ score <6)	54.6% (n=379)	72.1% (n=509)	

GHQ-General Health Questionnaire

*Mann-Whitney test

**Chi square test

Table 2. Exposure variables in cases and controls

Variable	Cases (694)		Controls (706)		p value
	n	%	n	%	
<i>Sex</i>					
Female	261	37.6	419	59.3	<0.001
Male	433	62.4	287	40.7	
<i>Age group (years)</i>					
30-44	298	42.9	539	76.3	<0.001
45-60	396	57.1	167	23.7	
<i>Ethnicity</i>					
Sinhala	545	79.2	581	82.4	0.033
Tamil	75	10.9	81	11.5	
Muslim	68	9.9	43	6.1	
<i>Level of education (years)</i>					
0-5	86	12.4	50	7.1	<0.001
6-10	277	39.9	197	27.9	
11-13	299	43.1	401	56.8	
>13	32	4.6	58	8.2	
<i>Tooth cleaning frequency</i>					
Once/day	125	18.0	105	14.9	0.11
>once/day	569	82.0	601	85.1	
<i>Smoking status</i>					
Not a current smoker	550	79.3	670	94.9	<0.001
Current smoker	144	20.7	36	5.1	
<i>Alcohol use status</i>					
Not a current user	591	85.2	671	95.0	<0.001
Current user	103	14.8	35	5.0	
<i>Self-reported diabetes</i>					
Yes	104	15.0	48	6.8	<0.001
No	590	85.0	658	93.2	

For all variables but ethnicity, the total number of cases and controls were 694 and 706 respectively. For ethnicity 7 participants who belonged to minor races were excluded in the analysis; cases=688 and controls= 705)

from the GHQ in Taiwanese adults. A CHQ score ≥ 6 was associated with loss of attachment but not with overall periodontal status. However, the researchers did not control for diabetes, which is an important risk factor for periodontal disease. In addition to community-based studies, a hospital-based study among German patients associated psychosocial stress with periodontal disease (Dolic *et al.*, 2005). In contrast, no association was found between psychological stress and periodontal disease in hospital attendees (Solis *et al.*, 2004).

Few researchers have used the case-control study design to elicit the relationship between psychological stress and periodontal disease in adults. In contrast to our findings, one early community-based and two dental hospital-based case-control studies failed to reveal an association. Moss *et al.* (1996) studied 71 cases with CP and 77 controls among participants of the Erie County Risk Factor study. Psychological distress assessed using the Brief Symptom Inventory was not associated with CP. Vettore *et al.* (2003) found that psychological stress was not associated with CP but those with high levels of trait anxiety appeared to

be more prone to CP. According to Castro *et al.* (2006) psychological stress, anxiety and depression were not associated with CP. The difference between these and the present study may be due to the small samples compared to the present study giving insufficient power to detect an association. Second, there were wide variations in the clinical criteria used to define cases and controls between studies. The present study used the AAP definition of CP recommended for population-based studies, whereas others had devised their own criteria for defining periodontal health/disease. Third, there was a marked variation in the instruments used to assess psychological distress.

Two pathways, involving biological and behavioural changes may explain the stress-periodontal disease relationship. According to the biological pathway, the hypothalamus releases corticotrophin releasing hormone in response to chronic stressors, which activates the hypothalamus-pituitary-adrenal axis leading to the production of cortisol; the primary stress hormone. Long-term elevation of cortisol suppresses both the immune and inflammatory responses of an individual, resulting

Table 3. Logistic regression model for predictors of chronic periodontitis

Variable	OR	95% CI	p value
<i>Sex</i>			
Female	1.00		
Male	2.35	1.78-3.09	<0.001
<i>Age (years)</i>			
30-44	1.00		
45-60	4.98	3.84-6.48	<0.001
<i>Ethnicity</i>			
Sinhala	1.00		
Tamil	0.80	0.54-1.20	0.29
Muslim	1.41	0.88-2.26	0.16
<i>Level of education (years)</i>			
>13	1.00		
11-13	1.72	1.01-2.94	0.024
6-10	2.95	1.70-5.14	<0.001
0-5	2.66	1.35-5.21	0.03
<i>Smoking status</i>			
Not a current smoker	1.00		
Current smoker	3.81	2.24-6.49	<0.001
<i>Alcohol use status</i>			
Not a current user	1.00		
Current user	1.78	0.97-3.29	0.06
<i>Current alcohol user × current smoker</i>			
No	1.00		
Yes	0.81	0.29-2.24	0.69
<i>Self-reported diabetes</i>			
No	1.00		
Yes	1.87	1.24-2.86	0.003
<i>Psychological distress</i>			
Absent (GHQ <6)	1.00		
Present (GHQ ≥6)	2.71	2.09-3.51	<0.001

in more pathogenic infection leading to periodontal destruction. The behavioural pathway proposes that stress could affect periodontal health through changes in health-related behaviours such as smoking and oral hygiene practices (Sabbah *et al.*, 2018). There is evidence that psycho-social stress can lead to smoking, drinking, obesity and neglect of oral hygiene (Deinzer *et al.*, 2001; Chamik *et al.*, 2018), which are all risk factors for CP.

This study has limitations. Variables that confound the association between psychological stress and CP, such as smoking and alcohol consumption, may have been under-reported as they are considered as unhealthy habits. Also, the prevalence of diabetes; another confounder may have been under-estimated as it was based on self-reports. As the study was confined to Colombo district, caution is warranted when generalising the findings to the wider Sri Lankan population. In conclusion, the present study showed psychological distress to be an independent risk factor for CP in this population.

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