Chronic Periodontitis Prevalence and the Inflammatory Burden in a Sample Population from South India

Abstract

**Context:** Periodontal diseases are among the most prevalent oral diseases in the world. Apart from repercussions in the oral cavity, there is evidence that periodontitis contributes to systemic damage in chronic diseases such as cardiovascular disease, diabetes, and preterm low birth weight. **Aims:** The aims of this study were to estimate the prevalence of chronic periodontitis in a sample urban population (>18 years) in Tamil Nadu and to estimate the inflammatory burden posed by chronic periodontitis by calculating the periodontal inflammatory surface area. **Settings and Design:** This was a population-based study and cross-sectional design. **Subjects and Methods:** A total of 1000 individuals (>18 years) were selected and screened for their periodontal status, oral hygiene status (OHI), and the periodontal inflated surface area (PISA) in an outreach center located in Chennai, India. **Statistical Analysis Used:** The proportion of individuals with different periodontal states (health, gingivitis, and periodontitis) was determined. A multivariate logistic regression analysis was performed to assess the influence of the individual risk factors such as habits (tobacco use), systemic conditions (diabetes), and oral hygiene maintenance on periodontitis prevalence in the sample population. **Results:** A high prevalence of periodontal disease was observed in the study population (42.3%). Among the urban participants, age, cigarette smoking, pan chewing, decayed, missing, and filled teeth scores, OHI scores, and PISA scores were found to be significantly associated with periodontitis (P < 0.05). **Conclusions:** Periodontitis prevalence appears to be high even in areas with adequate access to oral health care and an inflammatory burden risk exists in a definitive manner.

**Keywords:** Chronic periodontitis, inflammatory burden, prevalence, risk factors

Introduction

Adult periodontitis is of a chronic nature, and the inflamed pocket surface area represents a source for variety of inflammatory mediators and cytokines which have implication in diabetes, atherosclerosis, and preterm low birth weight.\(^1\)

The studies on the prevalence of periodontitis in rural and urban population in different parts of the world have provided data primarily on populations of different ethnic origins. Corraini et al., 2008,\(^2\) studied the prevalence of periodontitis and its association with demographic, socioeconomic, and behavioral risk factors in an untreated and isolated population in Brazil, and 83% of the population had >4 mm probing depths. Wang et al., 2007,\(^3\) performed a descriptive study of periodontal disease conditions among a selected sample of 400 participants in China. The authors observed that periodontal disease was widespread and very few of the population had access to the oral care facilities. Nalçaci et al., 2007,\(^4\) assessed the oral health status of people aged 65 years and above in a rural district of Turkey. The authors reported a higher level of tooth loss with increasing age. A cross-sectional study performed in a rural area in Brazil wherein a total of 172 participants were examined for periodontal and oral hygiene parameters, and the prevalence of periodontitis was estimated to be 24.4%.\(^5\)

Baelum et al., 2003,\(^6\) described the periodontal condition among rural Thai population. Three hundred and fifty-nine participants were examined, and attachment loss of >4 mm was found in 92% of the participants in the 30–32-year-old group indicating a higher prevalence in Thai population as compared to other Asia populations. Dowsett et al., 2001,\(^7\) determined the periodontal disease status in...
an adult indigenous rural population in Guatemala. Among 120 participants examined, attachment loss of 3 mm and 6 mm was found in 100% and 56% of the participants, respectively, indicating a widespread prevalence of the disease.

The association between periodontal disease and several risk factors was evaluated in a sample population in Ilala, Tanzania. Randomly selected 1764 individuals were examined for periodontal health status. Male sex, presence of dental plaque and calculus, and lower educational status were identified as risk factors for periodontal disease.[8]

Periodontitis has been proposed to have a contributory role to systemic conditions such as cardiovascular disease primarily through the inflammatory and microbial burden posed by the inflamed surface area of the periodontal pocket. Nesse et al., 2008,[9] developed a quantifiable system for determining burden posed by chronic periodontitis. They termed it as “periodontal inflamed surface area (PISA).”

Periodontitis prevalence in India has also been reported. Chawla et al., 1975,[10] carried out a study in 1416 rural children and 189 factory workers in Lucknow area to assess the efficacy of oral hygiene measures and professional scaling in the prevention of disease progression. The authors reported the prevalence of gingivitis and periodontal disease in Lucknow children and adult samples to vary between 93% and 100%. They concluded that scaling half yearly can prevent apical migration of epithelial attachment. Madden et al., 2000,[11] carried out a study in 2 villages in a rural area in Andhra Pradesh. One hundred and sixty participants were interviewed and examined with the community periodontal index of treatment needs index. The authors noted a high prevalence of chronic periodontitis in this population.

The objectives of this study were to estimate the prevalence of chronic periodontitis in a sample urban population (>18 years) in Tamil Nadu and to estimate the inflammatory burden posed by chronic periodontitis by calculating the periodontal inflammatory surface area.

Subjects and Methods

The study involved participant selection from an urban center followed by examination at Sri Ramachandra Dental College, Sri Ramachandra University, Porur, Chennai, India.

Sample size determination

A wide variation in the prevalence rates has been reported in the literature as mentioned in the review above. The prevalence rates vary from 7% to 24% to 93%. With the most probable prevalence rate of chronic periodontitis assumed to be 10% (also based on clinical experience) and with a limit of accuracy of 20% of 10%, i.e., 2, a minimum sample size of 864 is required.

Based on sample size calculation, anticipating noneligibility, and unwillingness to participate in the study, a sample of 1000 individuals in the urban population was chosen for this study.

Subject selection in urban population

A total of 1000 participants above the age of 18 years were selected from participants visiting the Outreach Center of Sri Ramachandra Dental College in Ram Colony in Division 24, Zone 8 of Chennai Corporation, between March and November of 2012. Participants who were pregnant, mentally ill, edentulous, not ambulatory, and critically ill were excluded from the study population.

The selected participants were interviewed with a structured questionnaire and were examined for the following periodontal parameters: clinical attachment loss, gingival recession, bleeding on probing, oral hygiene index, decayed, missing, and filled teeth (DMFT) index, and PISA score. All parameters were recorded by two trained examiners. Intra-examiner variability was assessed in a subsample, and the intraclass coefficient of >0.90 was found.

Calculation of inflammatory burden (PISA) was performed as given by Nesse et al., 2008.[9] Criteria for chronic periodontitis were participants with clinical attachment loss of more than 1 mm in <30% of the sites examined were considered to have localized chronic periodontitis and with attachment loss more than 1 mm in more than 30% sites of the teeth present were considered to have generalized chronic periodontitis, along with the presence of subgingival calculus deposits.[12]

Statistical analysis

Mean and standard deviation was assessed for continuous variables, and a multivariate logistic regression analysis was performed to assess the influence of risk elements on periodontitis prevalence. \( P < 0.05 \) was considered statistically significant.

Results

This study was conducted to evaluate the prevalence of chronic periodontitis in a representative sample of urban population in Chennai, Tamil Nadu. A total of 1000 participants were selected based on specific inclusion and exclusion criteria and recruited for the study. The prevalence of chronic periodontitis in the urban population was found to be 42.3% (localized form - 29.3% and generalized form - 13%). The prevalence of gingivitis ( reversible form of the disease) in the urban population was 54.2%. The prevalence of healthy participants in the rural population was 4.8%. A summary of the descriptive data is provided in Tables 1 and 2. The periodontitis prevalence amongst different age strata of the study population is summarized in Figure 1.
The mean periodontal epithelial surface area (PESA) and PISA scores were summarized in Table 3. The mean PESA was 1164.21 and the mean PISA score was 275.71. In the sample population, the mean PESA score for healthy participants was 794.73 and PISA score was 5.66. For participants with gingivitis, the mean PESA score was 1072.49 and PISA score was 219.08. Participants with generalized chronic periodontitis had a mean PESA score of 1552.39 and PISA score of 477.37.

PISA scores were also calculated following stratification based on medical history (diabetics and hypertensives) and habits [Table 4]. The PISA scores were found to be higher in people with a positive history for diabetes and hypertension as compared to healthy individuals. Among participants with a history of tobacco usage (smokers [cigarette and beedi] and smokeless tobacco), the mean PISA scores were found to be lower as compared to individuals who did not have the above-mentioned habits.

Risk indicators for periodontitis

A multivariate logistic regression analysis was done to assess the influence of each of the independent risk indicators on periodontitis and gingivitis prevalence in the study population. The following variables were examined as independent risk factors for periodontitis: age, gender, socioeconomic status (income group), hypertension, diabetes, diet, cigarette smoking, tobacco chewing, alcohol consumption, pan chewing, DMFT score, oral hygiene status (OHI) score, and PISA score.

Among the sample population, age, cigarette smoking, pan chewing, DMFT score, OHI score, and PISA scores had statistically significant association ($P < 0.05$) with periodontitis prevalence independent of the other risk factors evaluated [Table 5].
A high prevalence of periodontal disease was observed in the study population (42.3%). The results observed in our study are comparable to the observations of various studies done in India and different parts of the world as discussed below.

### Discussion

A multivariate logistic regression analysis was also done after stratifying the participants into three age groups: 18–30, 31–60, and more than 61 years with periodontitis as the dependent variable. In the sample population, age in the ranges of 18–30 and 31–60 years had a statistically significant association with periodontitis prevalence in the study populations [Table 7].

Similarly when evaluating the association with gingivitis, age, socioeconomic status (income group; pan chewing, DMFT score, OHI score, PISA score had a statistically significant association \( P < 0.05 \) with gingivitis prevalence independent of the other risk factors evaluated [Table 6].

A multivariate logistic regression study conducted by Balaji, et al., 2007, available about periodontitis prevalence in the Indian population is the multicentric study carried out by the Government of India in collaboration with the World Health Organization.[13] A total of 22,400 participants covering both rural and urban districts of 7 different states of India were examined for their periodontal status. A prevalence of 100% for periodontal disease was reported for the states of Orissa and Rajasthan. In addition, a varied prevalence of attachment loss >3 mm was observed in different states (Maharashtra = 78%, Orissa = 68%, and Delhi = 46%). Our study was carried out in a representative sample from an urban and rural district in the state of Tamil Nadu, and we observed similar prevalence rates of...
The prevalence rates for periodontitis observed in most of the studies in Indian population are high (ranging from 27% to 100%). Studies done in various populations worldwide have shown similarly high prevalence rates in developing countries as compared to developed countries wherein a decrease in the prevalence of periodontitis has been observed. The periodontitis prevalence observed in a Brazilian rural population ranged between 24.4% and 83%,[12,15] and, in a Thai population, it ranged from 92% to 100%.[7] About 100% of a Vietnamese study population exhibited at least one site with attachment loss,[16] and 90% of the adult participants in a Guatemalan population exhibited at least one site with clinical attachment level ≥6 mm.[17] These findings are in contrast to the observation of the National Health and Nutrition Examination Survey and Health and Nutrition Examination Survey studies done in the United States of America which have reported a decline in the prevalence of periodontitis over the years.[18] The above data demonstrate the amount of periodontal disease burden in developing countries and also highlight an urgent need for community-based strategies to control the prevalence of periodontal disease.

In the present study, when the prevalence of periodontitis was stratified based on age, among the 423 participants who had periodontitis in the urban study population, 210 participants (49.6%) belonged to the 18–30 years age group, 197 (46.6%) belonged to the 31–60 years' age group, and 16 (3.8%) belonged to the above 60 years' age group. These data appear to indicate that the prevalence of periodontitis decreased above 60 years. This may be attributed to the increased tooth loss as evidenced by a DMFT index score in older individuals.[19]

With regard to the prevalence of periodontitis among diabetic and hypertensive participants in the study population, 19 of the 423 chronic periodontitis participants (4.5%) had hypertension and 25 of the 423 chronic periodontitis participants (5.9%) had Type II diabetes. An assessment of the risk posed by each variable for periodontitis prevalence was done using the multivariate logistic regression model. Among the urban participants, age, cigarette smoking, pan chewing, DMFT scores, OHI scores, and PISA scores were found to be significantly associated with periodontitis.

One of the unique parameters which we have taken in this study is the PISA index developed by Nesse et al., 2006.[9] This index quantifies the inflamed surface area present in the periodontal tissues and represents an indirect clinical measure of inflammatory burden posed by chronic periodontitis.

To the best of our knowledge, this is the first report which has used the PISA system to assess the inflammatory burden posed by chronic periodontitis at a population level. In addition, a correlation of the PISA scores with healthy and different stages of periodontal disease (gingivitis and chronic periodontitis) was also performed. A consistent rise in the PISA and PESA scores with different stages of periodontal disease progression (healthy-gingivitis-periodontitis) was observed.

Furthermore, the PISA and PESA scores were correlated with oral hygiene status of the study participants, and it was observed that PISA and PESA scores increased as the oral hygiene status of the study participants became poor (good-fair-poor). PISA scores were also found to be more in males than females. This may be attributed to the poorer oral hygiene status in males as compared to females. The PISA scores were lesser in smokers than nonsmokers. The lesser scores are a result of reduced bleeding on probing levels in smokers as compared to nonsmokers. The bleeding on probing is an important clinical parameter which is used for calculating the PISA score from PESA score.

In our study, PISA scores for diabetic individuals were found to be higher than among nondiabetics in the sample population examined. This observation appears to indicate that higher PISA scores may be associated with diabetic status of the individual. Supportive evidence is given by the study by Nesse et al., 2009,[20] wherein the authors attempted to correlate the PISA scores in diabetic participants with glycosylated hemoglobin levels (HbA1c). The authors observed a dose–response relationship between the PISA scores and HbA1c levels among Type II diabetics.

Our study is probably the first study, which has applied the PISA scoring to assess the inflammatory burden at a
population level and also correlate the PISA scores among diabetics, hypertensive participants, and those with tobacco usage.

**Conclusion**

Guidelines need to be established to tackle and reduce the periodontal disease burden at a community level.

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**Conflicts of interest**

There are no conflicts of interest.

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