Original Article

Public Awareness on Perio-systemic Interplay: A Cross-Sectional Survey in South India

L Ramachandran, S Sathesh, PSG Prakash, H Parthasarathy, A Sudarsan, TM Balaji[1], IF Halawani[2], FM Alzahrani[2], KJ Alzahrani[2], S Patil[3]

Department of Periodontics, SRM Dental College, Ramapuram, [1]Department of Dentistry, Bharathiraja Hospital, Chennai, India, [2]Department of Clinical Laboratories Sciences, College of Applied Medical Sciences, Taif University, Taif, Saudi Arabia, [3]College of Dental Medicine, Roseman University of Health Sciences, South Jordan, UTAH, USA

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Abstract

Background: The oral cavity has been referred to as "the gateway to overall health." It is also said to be the meeting point of medicine and dentistry. **Aims:** Our study sought to determine the extent to which the public was aware of the connection between oral/periodontal conditions and general health. **Settings and Design:** The observational cross-sectional study's questionnaire was sectioned into oral health awareness, systemic influence on oral health, and personal oral health assessment. **Materials and Methods:** A total of 994 responses were recorded and a Chi-square test was performed to uncover the relationships using SPSS version 22.0. According to responses, 70% of the population on average comprehended the responses to the majority of the oral health awareness-related questions. **Results:** It has been noticed that only 30% of the general public was aware of the prevalent health issues like diabetes, hypertension, and malnutrition's impact on dental health. However, more than 60% had confidence in their oral health and gave a rating of at least 5. **Conclusion:** The study indicates that a good number of the population was prioritizing their oral health. However, there exists a definitive need to improve oral health awareness thereby ameliorating the overall health of an individual.

Keywords: *Periodontitis, periomedicine, survey, systemic health*

Introduction

The oral cavity has been described as "the window to general health". It is also considered as the intersection of medicine and dentistry. One of the most prevalent inflammatory illnesses in adults is periodontal disease. Globally, 3.9 billion people were estimated to have periodontal disease in 2010.[1] Periodontal disease has grown to be a serious public health issue and a huge financial burden on the healthcare system as the world's population ages.[2] The study of periodontal pathogens and inflammation captivated researchers due to the potential influence of periodontitis on the development or progression of various systemic diseases. However, the hypothesis on whether a particular pathogen initiates the development of systemic disease or if the systemic disease stimulates periodontal pathogens to change is still under debate.

Periodontitis, a chronic oral infection, has been identified as a discrete risk factor for cardiovascular disease, cerebrovascular illness, peripheral artery disease, respiratory disorders, and low birth weight because it is a persistent potential source of infection. Moreover, periodontitis has been recognized as a possible predictive marker for higher mortality and morbidity for pregnancy, rheumatoid arthritis, diabetes, insulin resistance, and obesity.[2,3] The common involvement of infection in the pathogenesis of systemic diseases, the transient low-grade bacteremia, and endotoxemia caused by periodontal diseases, the host immune responses,

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Address for correspondence: Dr. PSG Prakash, Department of Periodontics, SRM Dental College and Hospital, Ramapuram, Chennai-89, India.
E-mail: akashpsg@gmail.com

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inflammation induced by periodontal diseases, the expression of virulence factors by periodontal pathogens, and the presence of periodontal pathogens in non-oral tissue are the main putative facts that support the biological connection between periodontitis and systemic diseases.

Although the precise processes underlying this interaction are yet unknown, it is clear from the findings that there is a bidirectional relationship between systemic/metabolic disorders and periodontal diseases, whereby both problems may exacerbate one another.[3-5] Further, Murakami *et al.* and Hemalatha *et al.* have explored the link of periodontitis with systemic diseases, cerebral infarction, and renal failure and tried to reestablish this relationship.

Nevertheless, oral health directly or indirectly has a strong influence over overall health; the general health of an individual can be modulated based on their degree of oral hygiene maintenance. Additionally, raising public knowledge and comprehension of the curable nature of oral and gum disorders could contribute to a game-changing shift in the field of public health. Dental physicians can be the first to identify a major undetected ailment and are vital to the development of a society that is healthy on the whole. However, this requirement demands essential public knowledge regarding the importance of oral health. Hence this study aimed to evaluate the level of awareness cast on the minds of people regarding the association between periodontal/oral diseases over systemic health and their self-assessment of oral health. The systemic-perio interrelationship is depicted in Figure 1.

Materials and Methods

Study design and sampling

This observational cross-sectional study was designed following STROBE guidelines and was approved by the ethical committee and institutional review board of the University, and a general population survey was conducted between June 2022 to December 2022 in southern states of India including Tamil Nadu, Kerala, Karnataka, and Andhra Pradesh.

Participants

The study population comprised subjects from the general population aged above 21 years. The questionnaire was personally distributed to 1,100 participants in the southern states of India through email (link was shared in bulk to contacts derived from patient records and posted on social media sites, including Facebook (link was posted in the researcher's profile) and WhatsApp (link was posted by the investigators to contacts derived from patient records as well as non-professional contacts across various states using convenience sampling.

Materials

After analyzing relevant research, worldwide standards, and national guidelines, the study instrument was designed and distributed via Google Forms after validation from experts in the field.[6-8] The purpose of the study was explained in the first paragraph of the questionnaire, and voluntary willingness to fill out the form was procured. Further, the questionnaire was open to fill for the entire period of study. The questionnaire was prepared in English/local languages, comprising a total of 25 questions. Demographic details such as age, gender, income, and educational qualification were collected after obtaining consent. The scientific content of the questionnaire was categorized into three sections, oral health awareness, systemic influence on oral health, and personal oral health assessment with 7, 6, and 9 questions, respectively. The questions were predominantly multiple-choice questions or questions with binary responses.

Inclusion, exclusion criteria, and statistical analysis

Procedure

Among 1,100 invited participants, 106 were excluded owing to incomplete submissions/respondents who did not provide consent to answer and a total of 994 responses, 260 from Tamil Nadu, 235 from Kerala, 250 from Karnataka, and 249 from Andhra Pradesh were included for statistical analysis. The inclusion criteria were subjects over the age of 21 years, residing in South India. All incomplete submissions and those who did not fit the study inclusion were excluded. Only the principal investigators had access to the data and no personal details (phone number, name, etc.) were required as a part of sample collection.

Data analysis

A Chi-square test was performed to uncover the relationships between the variables and identify statistically significant variations in frequency within one or more categories with a confidence interval of 95%. It was done using SPSS version 22.0, which was developed by IBM Corp. in Armonk, New York.

Results

The study included a total of 994 participants from the general populace forming a response rate of about 90%. Out of the entire study population, 46.8% were male and 53.2% were female respondents. According to educational background, 57.3% of subjects were undergraduates, and 42.7% were postgraduates. People in the lower financial

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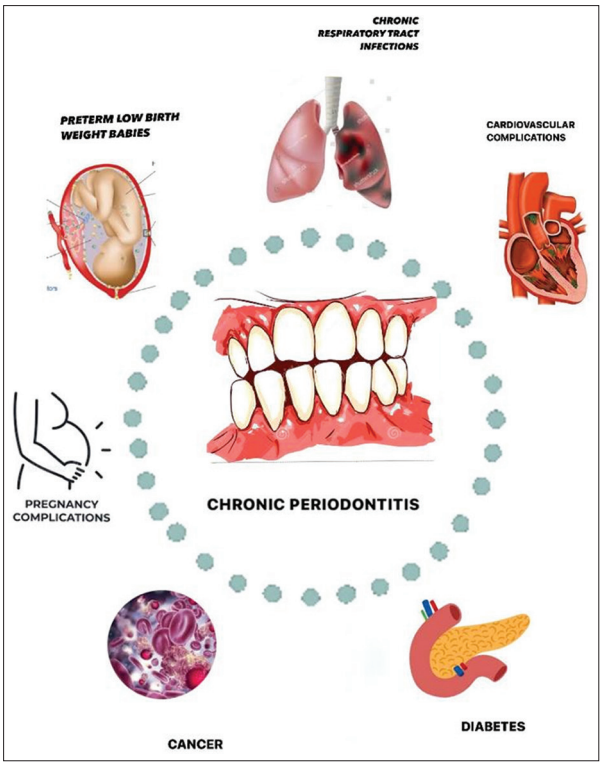

Figure 1: The systemic-perio interrelationship

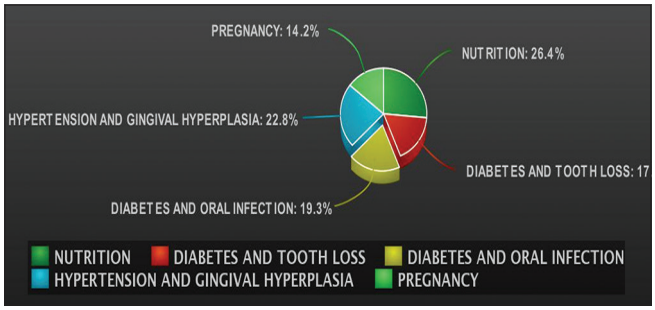

Figure 3: Awareness based on impact of systemic conditions on oral health

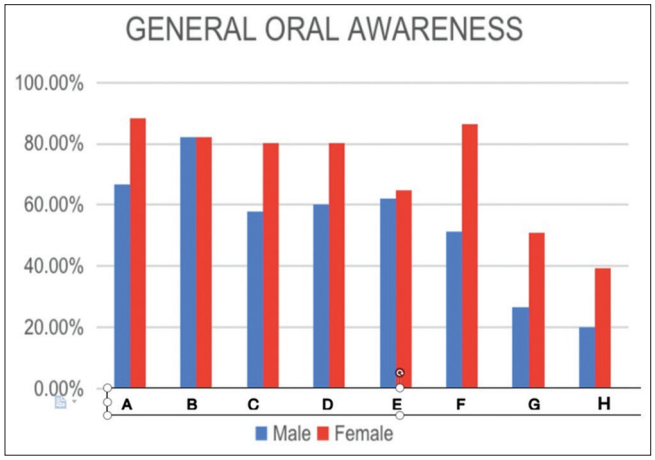

Figure 5: Impact of gender on overall oral awareness among the general population

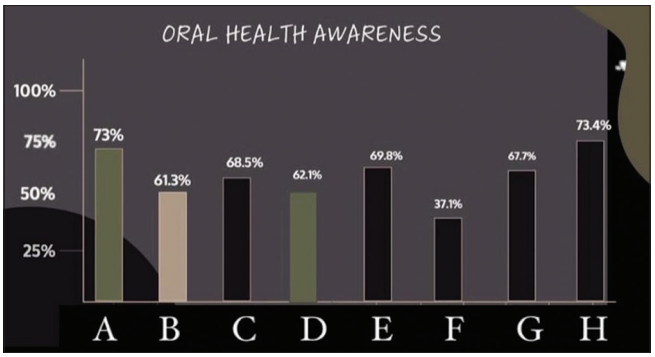

Figure 2: Oral health awareness in the population. A. Do You Know That Gum Disease Is Periodontitis. B. Do You Know That Gum Disease Is Preventable. C. Did You Know That Gum Disease Is A Major Reason For Bad Breath. D. Do You Know That Smokers Have Gum Disease. E. Do You Know That Good Oral Health Improves Overall Health. F. Do You Know That Gum Disease Increase Premature Deliveries. G. Do You Know The Symptoms Of Gum Disease. H. Were You Aware Those Microbes Causing Gum Disease Can Lead to Narrowing of Blood Vessels Supplying Heart Leading To Various Heart Diseases?

QUESTIONS BASED ON SCALE 1-10	Greater than 5	Lesser than 5
1. RATE YOUR GUM HEALTH (GOOD/REGULAR)	48	52
2. RATE YOUR ORAL HYGIENE ON A SCALE OF 1 TO 10.	69	31
QUESTIONS		
3.ANY PAIN OR SENSITIVITY ON YOUR GUMS AFTER BRUSHING	45.2	47.6
4. DURING TOOTH BRUSHING ,DOES YOUR GUMS BLEED	46.4	48
5. IN THE PAST MONTH, HAVE YOU FELT YOUR GUMS RED OR SWOLLEN?	25.4	74.6
6. ARE YOUR TEETH NON ALIGNED OR CROOKED	29.4	56.5
7. HAVE YOU HAD DENTAL SCALING OR DEEP CLEANING DONE BY THE DENTIST?	41.9	58.1
8. HOW MANY TIMES A DAY ,YOU USE DENTAL FLOSS?	20.1	80.6
9. HAVE YOU VISITED YOUR DENTIST IN THE PAST YEAR?	42.7	57.3

Figure 4: Responses to oral self-assessment questionnaire

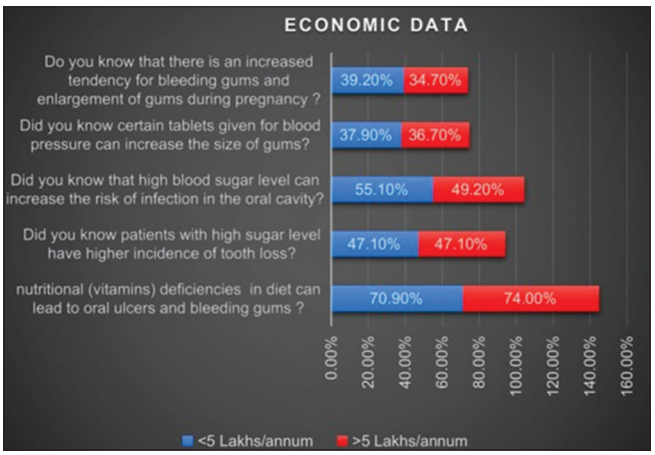

Figure 6: Influence of estrata on awareness on the interrelationship

strata made up roughly 61.2% of the population, and those in the higher strata made up 38.6%, considering the

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mid-range of the economic scale as 5 lakhs per annum. The responses of the 994 individuals were evaluated and represented as figures. Overall oral health awareness among the 994 individuals based on different question categories was assessed. Analyzing the questionnaire's responses, on average 70% of the population was aware of most of the questions about oral health awareness. However, only 37% were aware of oral health during preterm deliveries. [Figure 2].

The next section dealt with the awareness relating to the impact of systemic conditions on oral health, and we observed that the awareness of the general population on common health concerns such as diabetes, hypertension, and malnutrition affecting oral health was notably less (30%). Further, only a meager 14% of the study participants had an idea about the effect of oral health on preterm deliveries [Figure 3].

The last section was the oral self-assessment questionnaire, reviewing the responses, it was evident that greater than 60% of the population was confident in their oral profile and rated their oral hygiene as more than 5 (on a scale of 10.) While only 20% of the study group had used dental floss which was significantly low. It could be noted that only 42.7% of the study group had visited a dentist in the past year [Figure 4]. Correlating gender with the overall response rate concerning general oral awareness, a notable female preponderance ranging from 55% to 85% was evident [Figure 5]. On the other hand, based on the influence of economic strata of awareness on the interrelationship between systemic health and periodontal health, the higher economic strata had a slightly better understanding of the link [Figure 6].

Discussion

Periodontal disease is an infectious inflammatory condition spurred on by the bacteria in dental biofilm. It causes the supporting apparatus namely the cementum, the gingiva, the periodontal ligament, and the alveolar bone to gradually deteriorate.[9,10] Times of intensification are interspersed with periods of abstinence in periodontal disease, which is characterized by the local bacterial burden that promotes tissue inflammation and loss.[11] Furthermore, the clinical course is influenced by a combination of systemic and local factors. Aging, smoking, poor oral hygiene, socioeconomic status, genetics, etc., are potential risk factors that complicate the disease process.[3,12] This suggests that periodontitis does not only develop as a result of plaque accretion but is also associated with several host factors which could alter the effect of plaque on the patient.

In recent years, there has been an increased interest in the potential link between oral and systemic diseases, particularly as a result of the case–control study by Mattila *et al*., which found a significant correlation between poor dental health and acute myocardial infarction in patients compared to controls.[13-16] The causal relationship between periodontitis and several clinical systemic diseases has since been investigated and supported by numerous epidemiological studies, including those on cardiovascular disease, diabetes, respiratory disease, unfavorable pregnancy outcomes, Alzheimer's disease, pancreatic cancer, and cerebral infarction.[17-19] The main contributing factor includes risk factors like age, smoking, lifestyle, socioeconomic status, and genetic or environmental factors that are present in both systemic diseases and oral infections. The systemic inflammation against local infection or circulating pathogens and rising levels of circulating inflammatory biomarkers that are associated with it may be another mechanism that contributes to systemic illness.[20-22]

Periodontists play a critical role in educating patients about this systemic interplay. Hence as a part of patient education and motivation, the survey was conducted. Based on the result analysis of our study, 70% of respondents had adequate oral health awareness which can be compared to the results obtained by Hemalatha *et al.* who obtained 78% awareness in the Mahe population (Pondicherry District).[23] There are several theories put up to explain the link between periodontal and cardiovascular diseases. Increases in the white blood cell count, C-reactive protein, fibrinogen, cell adhesion molecules, and pro-inflammatory cytokines with periodontal inflammation inadvertently result in systemic inflammatory and immunological response. However, despite higher rates of valve replacements in our country, the awareness between periodontal inflammation and endocarditis remained low (37.1%).[24]

On analyzing the responses concerning systemic health awareness and the impact on oral health, the understanding of the general public was very low. For instance, around 40% of women encounter some form of periodontal disease during pregnancy, and the rate is higher among racial and ethnic minorities and women of low socioeconomic status. But, as per our study, only 14.2% of the surveyed had known about the possible impact of pregnancy on gum health. The alarmingly high number of individuals taking antihypertensive medications for hypertension raises the distant possibility that some of these people are aware that some antihypertensive medications have the potential to lead to gingival hyperplasia which has to be informed to these patients, and the current survey

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showed that only 22.8% of the participants were aware of this relationship.

Vitamin deficiency often results in oral inflammation leading to several non-specific oral conditions such as glossitis, stomatitis, and mucosal ulcerations. Only 26.4% of the study population were aware that malnutrition and vitamin deficiencies had an impact on oral and general health.[25] People with diabetes are more likely to develop gingivitis, periodontitis, oral thrush, xerostomia, mouth ulcers, dental caries, and other dental diseases, according to the American Diabetes Association. Our study revealed that just 20% of the study population was aware of the connection between dental health and diabetes.[26,27]

On correlating the results based on gender we observed that there were increased levels of understanding among females on periodontitis and its systemic interrelationship than males. These findings were consistent with those of Gupta *et al.* and Hemalatha *et al.* where the female ratio of awareness was more than males.[6,26]

On the contrary, while analyzing the awareness based on economic strata, there were no significant differences between the lower and higher strata. A higher percentage of respondents were undergraduates to avoid the possible bias in the sample, and we did not correlate responses based on educational qualification [Figure 5].

Even for individuals who have never had any health issues before, self-reported health measurements are an effective patient-centered tool for determining health outcomes.[28,29] Oral health self-assessment questionnaires have been evaluated for identifying periodontal disease and dental caries correlated with general health, with results modified by factors such as age, gender, race, education, and psychosocial stressors.[30] This study revealed that 60% of the study population were satisfied with their oral health profile and gave a rating of 5 or more on a scale of 10. This indicates that a good number of the population was prioritizing their oral health.

The survey's limitations stemmed from the fact that it was carried out by collecting online forms, which may have had an impact on the results since they would fully depend on the comprehension of the respondents. Furthermore, because the study was conducted post-pandemic, we had to use convenience sampling. The physician may evaluate the survey along with an oral health examination in the future to analyze the results more objectively, to better comprehend public awareness of the issue, and perhaps to motivate the participants to understand the importance of the concern.

Conclusions

The study indicates that a decent stratum of the population were giving priority to their dental health based on the self-assessment questionnaire, on the contrary there were varied responses with respect to the understanding of the perio-systemic link. Raising awareness of oral health issues and how they impact a person's overall health is undeniably necessary. Dental and medical professionals need to have an impact on society to create healthy communities. The public should also be made aware of the significance of the reversible nature of oral and gum inflammation and encouraged to visit an oral health specialist to accomplish the very objective of "Health to all."

Institutional review board statement

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board (or Ethics Committee) of SRM Dental College, Ramapuram, Chennai.

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Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Richards D. Oral diseases affect some 3.9 billion people. Evid Based Dent 2013;14:35.
2. Bui FQ, Almeida-da-Silva CLC, Huynh B, Trinh A, Liu J, Woodward J, *et al*. Association between periodontal pathogens and systemic disease. Biomed J 2019;42:27-35.
3. Taylor GW, Borgnakke WS. Periodontal disease: Associations with diabetes, glycemic control and complications. Oral Dis 2008;14:191-203.
4. Mealey BL, Rethman MP. Periodontal disease and diabetes mellitus. Bidirectional relationship. Dent Today 2003;22:107-13.
5. Sukumar K, Tadepalli A. Nexus between COVID-19 and periodontal disease. J Int Med Res 2021;49:3000605211002695.
6. Singh AK, Gupta V, Gupta B. Assessment of oral hygiene practices and awareness of periodontal-systemic health interrelationship amongst the local population of Kanpur region – A cross sectional study. J Oral Health Community Dent 2016;10:1-8.
7. DeSalvo KB, Fan VS, McDonell MB, Fihn SD. Predicting mortality and healthcare utilization with a single question. Health Serv Res 2005;40:1234-46.
8. Benyamini Y, Leventhal H, Leventhal EA. Self-rated oral health as an independent predictor of self-rated general health, self-esteem and life satisfaction. Soc Sci Med 2004;59:1109-16.
9. Nagpal R, Yamashiro Y, Izumi Y. The two-way association of periodontal infection with systemic disorders: An overview. Mediators Inflamm 2015;2015:793898.
10. Carranza FA, Newman MG, Takei HH, Klokkevold PR. Carranza's clinical periodontology. Saunders Elsevier. 2002.
11. Pihlstrom BL. Periodontal risk assessment, diagnosis and treatment planning. Periodontol 2000 2001;25:37-58.
12. Rai B, Kaur J KS. Pregnancy gingivitis and periodontitis and its systemic effect. Internet J Dent Sci 2009;6.
13. Chaffee BW, Weston SJ. Association between chronic periodontal disease and obesity: A systematic review and meta-analysis.

J Periodontol 2010;81:1708-24.
14. DeStefano F, Anda RF, Kahn HS, Williamson DF, Russell CM. Dental disease and risk of coronary heart disease and mortality. BMJ 1993;306:688-91.
15. Rughwani RR, Cholan PK, Victor DJ. Contemporary consortium of periodontal diseases and atherosclerotic cardiovascular diseases-A narrative review. J Clin Diagnostic Res 2022;16:1-6.
16. Offenbacher S, Katz V, Fertik G, Collins J, Boyd D, Maynor G, *et al*. Periodontal infection as a possible risk factor for preterm low birth weight. J Periodontol 1996;67 (10 Suppl):1103-13.
17. Mattila KJ, Nieminen MS, Valtonen VV, Rasi VP, Kesäniemi YA, Syrjälä SL, *et al*. Association between dental health and acute myocardial infarction. BMJ 1989;298:779-81.
18. Beck JD, Offenbacher S. Systemic effects of periodontitis: Epidemiology of periodontal disease and cardiovascular disease. J Periodontol 2005;76 (11 Suppl):2089-100.
19. Hosomi N, Aoki S, Matsuo K, Deguchi K, Masugata H, Murao K, *et al*. Association of serum anti-periodontal pathogen antibody with ischemic stroke. Cerebrovasc Dis 2012;34:385-92.
20. Taylor GW, Burt BA, Becker MP, Genco RJ, Shlossman M, Knowler WC, *et al*. Severe periodontitis and risk for poor glycemic control in patients with non-insulin-dependent diabetes mellitus. J Periodontol 1996;67 (10 Suppl):1085-93.
21. Scannapieco FA, Ho AW. Potential associations between chronic respiratory disease and periodontal disease: Analysis of National Health and Nutrition Examination Survey III. J Periodontol 2001;72:50-6.
22. Xiong X, Buekens P, Fraser WD, Beck J, Offenbacher S. Periodontal disease and adverse pregnancy outcomes: A systematic review. BJOG 2006;113:135-43.
23. Kamer AR, Dasanayake AP, Craig RG, Glodzik-Sobanska L, Bry M, de Leon MJ. Alzheimer's disease and peripheral infections: The possible contribution from periodontal infections, model and hypothesis. J Alzheimers Dis 2008;13:437-49.
24. Michaud DS, Joshipura K, Giovannucci E, Fuchs CS. A prospective study of periodontal disease and pancreatic cancer in US male health professionals. J Natl Cancer Inst 2007;99:171-5.
25. Murakami M, Suzuki J, Yamazaki S, Ikezoe M, Matsushima R, Ashigaki N, *et al*. High incidence of Aggregatibacter actinomycetemcomitans infection in patients with cerebral infarction and diabetic renal failure: A cross-sectional study. BMC Infect Dis 2013;13:557.
26. Hemalatha DM, Melath A, Feroz M, Subair K, Mohandas A, Chandran N. A survey on the awareness of interrelationship of periodontal disease and systemic health among Mahe population. J Indian Soc Periodontol 2020;24:271-5.
27. Mustapha IZ, Debrey S, Oladubu M, Ugarte R. Markers of systemic bacterial exposure in periodontal disease and cardiovascular disease risk: A systematic review and meta-analysis. J Periodontol 2007;78:2289-302.
28. Graells J, Ojeda RM, Muniesa C, Gonzalez J, Saavedra J. Glossitis with linear lesions: An early sign of vitamin B12 deficiency. J Am Acad Dermatol 2009;60:498-500.
29. Genco RJ, Grossi SG, Ho A, Nishimura F, Murayama Y. A proposed model linking inflammation to obesity, diabetes, and periodontal infections. J Periodontol 2005;76 (11 Suppl):2075-84.
30. Mealey BL, Rose LF. Diabetes mellitus and inflammatory periodontal diseases. Curr Opin Endocrinol Diabetes Obes 2008;15:135-41.

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