OPEN ACCESS
Saudi Journal of Medical and Pharmaceutical Sciences
Abbreviated Key Title: Saudi J Med Pharm Sci
ISSN 2413-4929 (Print) |ISSN 2413-4910 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: http://scholarsmepub.com/sjmps/

Original Research Article

# Evaluation of Association of Periodontal Disease and Electrocardiographic (ECG) Changes - A Cross Sectional Study

Dr. B. Harshitha[1*], Dr. Ganapati Anil Kumar[2], Dr. Rahul Vinay Chandra Tiwari[3], Dr. Abhishek Patley[4], Dr. Swati Sahu[5], Dr. Nabeel Althaf MS[6]

[1]Senior Lecturer, Department of Periodontics, Sri Sai College of Dental Surgery, 1-2-64/1&2, Kothrepally, Vikarabad, Telangana 501102, India
[2]Senior Lecturer, Deptartment of Conservative Dentistry & Endodontics, Sibar Institute of Dental Sciences, Andhra Pradesh 522509, India
[3]FOGS, MDS, Assistant Professor, Department of Oral and Maxillofacial Surgery, Sri Sai College of Dental Surgery, 1-2-64/1&2, Kothrepally, Vikarabad, Telangana 501102, India
[4,5]Postgraduate Fellow, OMFS, New Horizon Dental College & Research Institute, Sakri, Bilaspur, Chhattisgarh 495001, India
[6]MDS Periodontology, Consultant Periodontist, Kavil's Smiley Multi Specialty Dental Clinic, Uppala, Kasaragod

***Corresponding author:** Dr. B. Harshitha
| **Received:** 27.04.2019 | **Accepted:** 05.05.2019 | **Published:** 15.05.2019
**DOI:**10.21276/sjmps.2019.5.5.1

## Abstract

***Background:*** Periodontal diseases could be regarded as an independent risk factor for the onset of cardiovascular diseases. Evidence documents that periodontal diseases have an independent statistically significant association with cardiovascular diseases, although weak to moderate, after adjusting for potential confounding factors, such as advancing age, gender, race, smoking, hypertension, diabetes, indicators of socioeconomic status, stress, obesity, lipid rich diet and others. ***Aim:*** The aim of the study is to evaluate a correlation between periodontitis and ECG abnormalities. ***Materials and Methods:*** This is a cross-sectional study constituting 15 systemically healthy subjects with moderate to severe periodontitis and 15 systemically healthy subjects without periodontitis. Subjects were selected with proper inclusion and exclusion criteria. For each patient clinical parameters including PI, MGI, PD, CAL, BP and Electrocardiograph (ECG) are recorded. ECG changes like LVH, ST depression etc. are evaluated and the relation with periodontal condition is assessed. ***Results:*** No significant ECG abnormalities were detected in moderate-severe chronic generalised periodontitis patients. ***Conclusion:*** The present study did not find a relationship between periodontitis and ECG abnormalities. Further longitudinal studies with a larger sample size are required to associate the relationship.

**Keywords:** Periodontal diseases, gender, race, smoking, hypertension, diabetes.



## INTRODUCTION

Periodontal disease is a chronic microbial infection which triggers inflammation, affecting the immune system and resulting in alveolar bone destruction. Evidence documents that periodontal diseases have an independent statistically significant association with cardiovascular diseases (CVD) [1]. Electrocardiography (ECG) is a graphical representation of electrical activity of the heart muscles. ECG abnormalities are one of the most sensitive predictors of CVD [2]. As ECG examination takes only less time with minimal patient discomfort, these are widely employed to assess the risk of CVD. Therefore the present study is intended to evaluate a correlation between periodontitis and ECG abnormalities.

## MATERIALS AND METHODS

The present study was cross-sectional in design consisting of 30 patients, attending the Outpatient Department of Periodontics (Fig-1). Ethical clearance was obtained from the Institutional Ethics Committee. All the patients were explained about the study and written informed consent was obtained before the commencement from those who agreed to participate voluntarily in the study.

The subjects were recruited based on the following criteria:

**Inclusion Criteria**

*Group A (Healthy group)*–15 Systemically healthy subjects in the age group ranging from 25-60 years with clinically healthy periodontium and absence of clinical inflammation.

*Group B (Chronic periodontitis group)*–15 Systemically healthy subjects in the age group ranging from 25-60 years having at least a total of 14 teeth, diagnosed with severe, chronic generalized

periodontitis and having at least one site with a PPD ≥6mm in each quadrant that bleed on probing.

**Exclusion Criteria**

Subjects with any systemic disease (diabetes, hypertension etc) which can alter the course of periodontal disease, smokers or subjects consuming alcohol, pregnancy/lactation, history of any recent infections, subjects on antibiotics and anti-inflammatory medications within the past 3 months. Subjects with history of periodontal treatment in past 6 months prior to the study and aggressive periodontitis. After recruitment in the study, patients were subjected to a detailed general and clinical examination and the data pertaining to all the relevant parameters were recorded in a proforma specially designed for the study. Each subject completed a questionnaire which included the socioeconomic status, tobacco smoking and alcohol consumption. Clinical parameters like PI, MGI, PD, CAL were recorded using the periodontal probe. Blood pressure was measured using a standard mercury sphygmomanometer with the subjects in sitting position. ECG was recorded in the supine position for each subject using a standard electrocardiograph. The ECG parameters which were evaluated were LVH, P wave changes, QRS complex changes, ST segment changes, T wave changes and U wave changes.

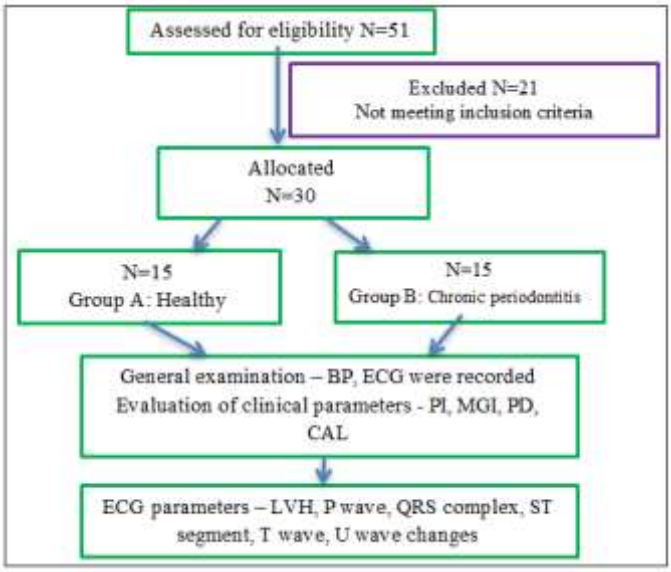


**Fig-1: Consort diagram showing the patients allocation and recorded parameters**

## RESULTS

The clinical parameters of the group A are presented in Table-1 and group B in Table-2. The mean age in the group A is 40.8 and the mean age in group B is 44.0. The mean PD is 1.71 in group A and 6.72 in group B. The mean CAL is 6.74 in the group B. ECG abnormalities are charted in the Table-3. Non- specific T wave changes were seen in one of the patients in the group B. In the group A, LVH was seen in two of them. One patient had ST segment depression and T inversion. These changes may be probably attributed to any other reason and needs further investigation on that. No correlation was seen with any changes in the ECG in the group B with the deep probing depths and CAL. Hence no significant ECG abnormalities were detected in group B that is moderate-severe chronic generalised periodontitis patients.

**Table-1: Group A**

| PATIENT | AGE | SEX | PI | MGI | PD | CAL | BP | LVH | ST CHANGES | T CHANGES |
|---|---|---|---|---|---|---|---|---|---|---|
| C1 | 30 | F | 0.2 | 0 | 1.8 | 0 | 124/68 | NO | NO | NO |
| C2 | 48 | M | 0.1 | 0 | 1.63 | 0 | 120/80 | NO | NO | NO |
| C3 | 32 | F | 0.2 | 0 | 1.71 | 0 | 124/78 | NO | NO | NO |
| C4 | 56 | M | 0.3 | 0 | 1.84 | 0 | 134/96 | NO | NO | NO |
| C5 | 43 | F | 0.2 | 0 | 1.9 | 0 | 132/80 | NO | NO | NO |
| C6 | 45 | M | 0.3 | 0 | 1.45 | 0 | 130/90 | NO | NO | NO |
| C7 | 39 | M | 0.2 | 0 | 1.5 | 0 | 120/80 | **YES** | NO | NO |
| C8 | 35 | M | 0.2 | 0 | 1.93 | 0 | 120/80 | NO | NO | NO |
| C9 | 32 | M | 0.2 | 0 | 1.79 | 0 | 130/76 | NO | NO | NO |
| C10 | 35 | M | 0.1 | 0 | 1.63 | 0 | 126/78 | NO | NO | NO |
| C11 | 47 | F | 0.3 | 0 | 1.68 | 0 | 120/80 | NO | **DEPRESSION** | **INVERSION** |
| C12 | 45 | M | 0.2 | 0 | 1.79 | 0 | 128/74 | **YES** | NO | NO |
| C13 | 38 | F | 0.4 | 0 | 1.5 | 0 | 124/80 | NO | NO | NO |
| C14 | 48 | F | 0.2 | 0 | 1.64 | 0 | 126/78 | NO | NO | NO |
| C15 | 39 | M | 0.2 | 0 | 1.89 | 0 | 124/80 | NO | NO | NO |

**Table-2: Group B**

| PATIENT | AGE | SEX | PI | MGI | PD | CAL | BP | LVH | ST CHANGES | T CHANGES |
|---|---|---|---|---|---|---|---|---|---|---|
| T1 | 60 | M | 1.9 | 1.23 | 6.2 | 6.76 | 130/90 | NO | NO | NO |
| T2 | 40 | M | 2.1 | 1.54 | 6.4 | 6.53 | 126/84 | NO | NO | NO |
| T3 | 42 | F | 2 | 1.96 | 6.5 | 6.34 | 128/80 | NO | NO | NO |
| T4 | 35 | F | 1.7 | 2.42 | 7.3 | 6.87 | 126/76 | NO | NO | NO |
| T5 | 40 | M | 1.9 | 1.96 | 6.9 | 7.12 | 128/80 | NO | NO | NO |
| T6 | 45 | F | 2.4 | 1.93 | 6.9 | 6.54 | 132/78 | NO | NO | NO |
| T7 | 34 | M | 1.9 | 1.59 | 6.1 | 6.76 | 130/78 | NO | NO | NO |
| T8 | 50 | F | 2 | 1.96 | 7.34 | 6.53 | 132/90 | NO | NO | NO |
| T9 | 42 | F | 1.8 | 2.34 | 7.1 | 6.34 | 126/82 | NO | NO | NO |
| T10 | 38 | M | 2.3 | 1.96 | 7 | 6.87 | 128/76 | NO | NO | NO |
| T11 | 45 | M | 2.2 | 1.67 | 6.4 | 6.67 | 132/80 | NO | NO | NO |
| T12 | 35 | F | 2.6 | 1.21 | 6.3 | 7.24 | 126/80 | NO | NO | NON SPECIFIC |
| T13 | 55 | M | 2.4 | 1.09 | 6.8 | 7.13 | 128/86 | NO | NO | NO |
| T14 | 50 | M | 1.9 | 1.36 | 6.5 | 6.98 | 128/84 | NO | NO | NO |
| T15 | 50 | F | 1.9 | 1.89 | 7.2 | 6.45 | 130/80 | NO | NO | NO |

**Table-3: ECG Abnormalities**

| GROUP | P WAVE | QRS COMPLEX | ST | T WAVE | U WAVE | LVH |
|---|---|---|---|---|---|---|
| GROUP A (N=15) | 0 | 0 | 0 | 1 | 0 | 0 |
| GROUP B (N=15) | 0 | 0 | 1 | 1 | 0 | 2 |

## DISCUSSION

The idea that oral microorganisms were responsible for a wide range of systemic conditions that were not easily recognized as being infectious in nature was first conceived by British physician, William Hunter. He identified caries teeth, gingivitis and periodontitis as foci of infection and advocated extraction of these teeth to eliminate the source of sepsis.

Periodontitis is characterized by episodes of inflammation that result from gram-negative bacteria. These bacteria have lipopolysaccharides (LPS) in their cell walls which activate the production of inflammatory mediators such as TNF-α and IL-1β [3, 4]. IL-1β itself is a promoter of smooth muscle cell proliferation and can be responsible for thickening of blood vessels walls and increases the risk of cardiac or cerebrovascular events [5-7]. Resting ECG abnormalities were significant predictors of both total and fatal CHD independent of other confounding variables [8, 9]. Changes in the ECG like LVH, ST depression, T inversion suggest ischemia, MI and other CVD [10, 11]. Research documents the association between PD and cardiovascular disease. This was reported by a landmark cross sectional study which first pointed out the association between CVD and PD [12]. After this a number of studies implicating periodontitis for etiopathogenesis were published, however, few of the studies did not find any association. Beck et al established Periodontal disease as a risk factor for CVD, including atherosclerosis, MI and stroke. They concluded that patients with severe periodontitis were twice as likely to have fatal heart attack and three times as likely to have a stroke compared to those without periodontitis [13]. Meta-analysis by Bahekar *et al*., studied 5 prospective cohort studies indicated that patients with periodontal disease has 1.14% RR of developing CVD than healthy subjects [14]. Another meta-analyses by Mustafa et al and Humphrey *et al.*, found that periodontal disease may only slightly increase the risk of cardiovascular disease [15, 16]. The incidence of ACVD, as represented by incident CHD, cerebrovascular disease and peripheral arterial disease is higher in subjects with PD and/or worse periodontal status, compared to subjects without PD or with better periodontal status, independent of many established cardiovascular risk factors [17, 18]. Several studies have reported no relationship between periodontitis and CVD [19, 20]. Hujoel *et al*., defined edentulous status as completely eliminating dental infections and showed that edentulous subjects did not have a lower CVD risk than subjects with periodontitis [21]. Both edentulous status and severe periodontitis are significant risks for CVD [22, 23]. Linkai *et al*., in a systematic review evaluated the effects of periodontal therapy on CVD outcomes and concluded that periodontal treatment has good effects on controlling high-density lipoprotein cholesterol [24]. The findings from a systematic review by D Aiuto *et al.*, suggest that Periodontal therapy triggers a short-term inflammatory response followed by a progressive and consistent reduction of systemic inflammation and an improvement in endothelial function [25]. There is limited evidence that these acute and chronic changes will either increase or reduce CVD burden of individuals suffering from periodontitis in the long term [26, 27]. The association of periodontal disease and the risk of CVD can be evaluated by clinical intervention studies before and after treatment

of periodontal disease, if any reduces the risk of CVD or not.

## CONCLUSION

The present study did not find a correlation between periodontitis and ECG abnormalities. Further longitudinal studies with a larger sample size are required to associate the relationship.

## REFERENCES


1. Genco, R., Offenbacher, S., & Beck, J. (2002). Periodontal disease and cardiovascular disease: epidemiology and possible mechanisms. *The Journal of the American Dental Association*, *133*, 14S-22S.
2. Cedres, B. L., Liu, K., Stamler, J., Dyer, A. R., Stamler, R., Berkson, D. M., ... & Stevens, E. (1982). Independent contribution of electrocardiographic abnormalities to risk of death from coronary heart disease, cardiovascular diseases and all causes. Findings of three Chicago epidemiologic studies. *Circulation*, *65*(1), 146-153.
3. Chiu, B. (1999). Multiple infections in carotid atherosclerotic plaques. *American heart journal*, *138*(5), S534-S536.
4. Haraszthy, V. I., Zambon, J. J., Trevisan, M., Zeid, M., & Genco, R. J. (2000). Identification of periodontal pathogens in atheromatous plaques. *Journal of periodontology*, *71*(10), 1554-1560.
5. Joshipura, K. J., Rimm, E. B., Douglass, C. W., Trichopoulos, D., Ascherio, A., & Willett, W. C. (1996). Poor oral health and coronary heart disease. *Journal of dental research*, *75*(9), 1631-1636.
6. Saito, T., Murakami, M., Shimazaki, Y., Oobayashi, K., Matsumoto, S., & Koga, T. (2003). Association between alveolar bone loss and elevated serum C- reactive protein in Japanese men. *Journal of periodontology*, *74*(12), 1741-1746.
7. Loos, B. G., Craandijk, J., Hoek, F. J., Dillen, P. M. W. V., & Van Der Velden, U. (2000). Elevation of systemic markers related to cardiovascular diseases in the peripheral blood of periodontitis patients. *Journal of periodontology*, *71*(10), 1528-1534.
8. Shimazaki, Y., Saito, T., Kiyohara, Y., Kato, I., Kubo, M., Iida, M., & Koga, T. (2004). Relationship between electrocardiographic abnormalities and periodontal disease: the Hisayama Study. *Journal of periodontology*, *75*(6), 791-797.
9. Cedres, B. L., Liu, K., Stamler, J., Dyer, A. R., Stamler, R., Berkson, D. M., ... & Stevens, E. (1982). Independent contribution of electrocardiographic abnormalities to risk of death from coronary heart disease, cardiovascular diseases and all causes. Findings of three Chicago epidemiologic studies. *Circulation*, *65*(1), 146-153.
10. Rose, G., Baxter, P. J., Reid, D. D., & McCartney, P. (1978). Prevalence and prognosis of electrocardiographic findings in middle-aged men. *Heart*, *40*(6), 636-643.
11. De Bacquer, D., De Backer, G., Kornitzer, M., & Blackburn, H. (1998). Prognostic value of ECG findings for total, cardiovascular disease, and coronary heart disease death in men and women. *Heart*, *80*(6), 570-577.
12. Mattila, K. J., Nieminen, M. S., Valtonen, V. V., Rasi, V. P., Kesäniemi, Y. A., Syrjälä, S. L., ... & Jokinen, M. J. (1989). Association between dental health and acute myocardial infarction. *Bmj*, *298*(6676), 779-781.
13. Beck, J. D., Elter, J. R., Heiss, G., Couper, D., Mauriello, S. M., & Offenbacher, S. (2001). Relationship of periodontal disease to carotid artery intima-media wall thickness: the atherosclerosis risk in communities (ARIC) study. *Arteriosclerosis, thrombosis, and vascular biology*, *21*(11), 1816-1822.
14. Bahekar, A. A., Singh, S., Saha, S., Molnar, J., & Arora, R. (2007). The prevalence and incidence of coronary heart disease is significantly increased in periodontitis: a meta-analysis. *American heart journal*, *154*(5), 830-837.
15. Mustapha, I. Z., Debrey, S., Oladubu, M., & Ugarte, R. (2007). Markers of systemic bacterial exposure in periodontal disease and cardiovascular disease risk: a systematic review and meta-analysis. *Journal of periodontology*, *78*(12), 2289-2302.
16. Humphrey, L. L., Fu, R., Buckley, D. I., Freeman, M., & Helfand, M. (2008). Periodontal disease and coronary heart disease incidence: a systematic review and meta-analysis. *Journal of general internal medicine*, *23*(12), 2079-2086.
17. Cueto, A., Mesa, F., Bravo, M., & Ocaña- Riola, R. (2005). Periodontitis as risk factor for acute myocardial infarction. A case control study of Spanish adults. *Journal of periodontal research*, *40*(1), 36-42.
18. Schenkein, H. A., & Loos, B. G. (2013). Inflammatory mechanisms linking periodontal diseases to cardiovascular diseases. *Journal of clinical periodontology*, *40*, S51-S69.
19. Howell, T. H., Ridker, P. M., Ajani, U. A., Christen, W. G., & Hennekens, C. H. (2001). Periodontal disease and risk of subsequent cardiovascular disease in US male physicians. *Journal of the American College of Cardiology*, *37*(2), 445-450.
20. Hujoel, P. P., Drangsholt, M., Spiekerman, C., & DeRouen, T. A. (2000). Periodontal disease and coronary heart disease risk. *Jama*, *284*(11), 1406-1410.
21. Hujoel, P. P., Drangsholt, M., Spiekerman, C., & DeRouen, T. A. (2002). Pre-existing cardiovascular

disease and periodontitis: a follow-up study. *Journal of dental research*, *81*(3), 186-191.

22. Morrison, H. I., Ellison, L. F., & Taylor, G. W. (1999). Periodontal disease and risk of fatal coronary heart and cerebrovascular diseases. *Journal of cardiovascular risk*, *6*(1), 7-11.
23. Dietrich, T., Sharma, P., Walter, C., Weston, P., & Beck, J. (2013). The epidemiological evidence behind the association between periodontitis and incident atherosclerotic cardiovascular disease. *Journal of periodontology*, *84*, S70-S84.
24. Linkai, G., Chunjie, L., & Qian, L. (2013). Periodontal treatment for cardiovascular risk factors. *West China J Stomatol*, 31: 463-467.
25. D'aiuto, F., Orlandi, M., & Gunsolley, J. C. (2013). Evidence that periodontal treatment improves biomarkers and CVD outcomes. *Journal of clinical periodontology*, *40*, S85-S105.
26. Tonetti, M. S., & Van Dyke, T. E. (2013). Periodontitis and atherosclerotic cardiovascular disease: consensus report of the Joint EFP/AAPWorkshop on Periodontitis and Systemic Diseases. *Journal of periodontology*, *84*, S24-S29.
27. Linden, G. J., Herzberg, M. C., & working group 4 of the joint EFP/AAP workshop*. (2013). Periodontitis and systemic diseases: a record of discussions of working group 4 of the Joint EFP/AAP Workshop on Periodontitis and Systemic Diseases. *Journal of periodontology*, *84*, S20-S23.