ISSN: 0975-833X

*Available online at http://www.journalcra.com*

*International Journal of Current Research*
*Vol. 15, Issue, 03, pp.24081-24083, March, 2023*
*DOI: https://doi.org/10.24941/ijcr.45018.03.2023*

**INTERNATIONAL JOURNAL OF CURRENT RESEARCH**

**REVIEW ARTICLE**

# ROLE OF PERIODONTAL HEALTH IN CARDIOVASCULAR DISEASES

***Dr. Arpit Galohda and Dr. Shreehari AK.**

Department of Periodontology, Army Dental Centre (R & R), Delhi Cantt., New Delhi

**ARTICLE INFO**

***Article History:***
Received 25th March, 2023
Received in revised form
26th March, 2023
Accepted 27th March, 2023
Published online 30th March, 2023

***Key words:***

Periodontitis,
Cardiovascular Diseases,
Inflammation, Atherosclerosis.

**ABSTRACT**

Periodontal and cardiovascular diseases are both major health issues. Poor oral health has long been associated with the development of systemic diseases. Through the years, the association of periodontal disease and the development of cardiovascular disease has been brought to attention. Many studies, including systematic reviews and meta-analyses, suggest an important association between periodontal disease and coronary heart disease, cerebrovascular disease and peripheral artery disease. Among the proposed mechanisms of this relationship, systemic inflammation appears to play a major role. Evidence suggests that periodontal inflammation triggers a systemic inflammatory state that appears to promote atheroma plaque development and progression. There are other studies that show a clear relationship between periodontal disease severity, elevations of inflammatory markers, and the presence of atherosclerosis. Here, we give a review of the available evidence supporting this association, and the possible mechanisms involved.

***Corresponding Author:**
*Arpit Galohda*



**Citation:** ***Arpit Galohda and Dr. Shreehari, AK.*** **2023.** "Role of Periodontal Health in Cardiovascular Diseases*". International Journal of Current Research*, 15, (03), 24081-24083.

# INTRODUCTION

Periodontitis is a chronic infectious disease targeting the connective tissue and alveolar bone supporting the dentition.[1]A progressive deterioration of periodontal health is linked to the accumulation of specific oral microorganisms affecting the balance of the different species present in the dental biofilm, switching from a symbiotic into a dysbiotic state.[2]The inflammatory response to these pathogens is responsible for the destruction of the periodontium and if left untreated for years, periodontitis is a leading cause of tooth loss. Cardiovascular disease (CVD) has been defined as a group of disorders of the heart and blood vessels including hypertension, coronary artery disease, cerebrovascular disease, peripheral vascular disease and cardiomyopathy.[3]The objective of the present narrative review is to summarize and update the body of evidence on the association between periodontitis and cardiovascular diseases.

**Historical Review:** There have been alternating periods of interest and dismissal of a possible causal relationship between oral and systemic health since the concept of "focal infection" was proposed (Miller WD, 1891).[4,5]Since 1980s, observational evidence was published that dental health was significantly worse in patients with acute myocardial infarction than in controls (Mattila *et al*.,1989).[6]These associations were reported with little or no description of an underlying mechanism of how these could be linked by common risk traits. DeStefano *et al*. (1993) found that study participants with periodontitis had a 25% increased risk of coronary heart disease (CHD) relative to those with minimal periodontal disease.[7]The authors also observed that men who were younger than 50 y at baseline, had periodontal disease as a strong risk factor for CHD and Men with periodontitis were 1.72 times more likely to have incident CHD compared to men without periodontitis after adjusting for traditional CHD risk factors like alcohol, smoking, high cholesterol, diabetes mellitus etc. The first proposed mechanism for the interaction between periodontitis and cardiovascular disease came from a 1996 longitudinal study in veterans by Beck *et al*.[8] The mechanism suggested individuals with a hyperinflammatory trait who also had oral infections would have an elevated risk for cardiovascular disease. In 1998, Ridker found that C- reactive protein (CRP) levels were excellent predictors of cardiovascular events in healthy women.[9] Thus, these insights led to widespread usage of CRP as a diagnostic tool, raising awareness of the role of inflammation from all sources, including oral infection.

Dentist-Scientist Russell Ross (1999) introduced the concept of a strong inflammatory component in the pathogenesis of atherosclerosis.[10] This further gave strength to a plausible mechanism linking periodontitis and cardiovascular diseases. Haraszthy *et al*. (2000b) were the first to report the detection of periodontal bacterial genome (Tannerella forsythia, Porphyromonas gingivalis, Aggregatibacter actinomycetemcomitans and Prevotella intermedia) in atheromasand suggested that they may play a role in the development and progression of atherosclerosis leading to coronary vascular disease and other clinical sequelae.[11] In 2001, in

a major study by (Beck *et al*). Periodontitis was implicated in the pathogenesis of atherosclerosis as well as in cardiovascular events such as myocardial infarction and stroke.[12] Ide *et al*. (2004) showed that chronic periodontitis patients undergoing an episode of subgingival scaling experienced a significant elevation in circulating tumor necrosis factor α (TNF-α) and interleukin-6 (IL-6). This observation may account for anecdotal reports of post-treatment pyrexia and allude to the relationships between periodontal disease, bacteremia, and cardiovascular disease.[13] Tonetti *et al* (2007) also showed that adjunctive local antimicrobial therapy improved systemic inflammation, demonstrating that periodontal treatment can improve endothelial function and reduce surrogate inflammatory markers of cardiovascular risk. [14] Bokhari *et al*. (2012) showed that after treatment of periodontitis, the proportion of people with high CRP (>3 mg/L) decreased by 38% in the intervention group and increased by 4% in the control group.[15] Zhou *et al*. (2017) demonstrated for the first time that intensive periodontal therapy without antihypertensive medication may lower blood pressure in patients with prehypertension and periodontitis. Reduction in blood pressure and endothelial microparticles were related to improvement in pocket probing depth.[16]

**Mechanisms linking Periodontitis and Cardiovascular Diseases:** To provide plausible and reasonable links between these conditions, there are 2 main hypotheses to explain the link between periodontitis and cardiovascular disease.[17] Bacteria or their by-products (primarily lipopolysaccharides or antigens) can disseminate from the oral cavity into blood vessels and, there, a host response can lead to damage and atherosclerotic plaque formation. Alternatively, localized inflammation from periodontitis enhances ongoing chronic inflammation due to atherosclerosis. Periodontal disease −derived reactive oxygen species contribute to systemic oxidative stress and inflammatory mediators, including various interleukins, chemokines, cytokines (IL-6), immunoglobulins, and inflammatory cells (lymphocytes, macrophages, neutrophils), contribute to a destructive immune response at areas in the vessel wall prone to atherosclerosis (Febbraio *et al*., 2022).

A recent consensus report was published as a result of a joint workshop organised by the European Federation of Periodontology and the World Heart Federation.[18] This report updated much of the current epidemiological evidence for significant association and mechanistic links between periodontitis and CVD (Sanz *et al*., 2020).

**The excerpts from this consensus were[18]:**

- There is evidence from epidemiological studies that periodontitis patients exhibit significant endothelial dysfunction, measured by flow-mediated dilation (FMD), arterial stiffness (e.g., pulse wave velocity—PWV) and a significantly greater thickness of the carotid intima-media and elevated arterial calcification scores.
- There is robust evidence from epidemiological studies for a positive association between periodontitis and coronary heart disease.
- There is evidence from epidemiologic studies for a positive association between periodontitis and cerebrovascular disease.
- There is currently limited scientific evidence that CVD is a risk factor for the onset or progression of periodontitis.
- There is evidence that oral bacterial species can enter the circulation and cause bacteremia, which has been demonstrated following daily life activities (tooth brushing, flossing, chewing or biting an apple), although it has been studied more frequently following professional interventions (tooth polishing, scaling, tooth extraction, surgical extraction of third molars and periodontal probing). It is more frequent of longer duration and involves more virulent bacteria in periodontitis patients.
- There is evidence through traces of DNA, RNA or antigens derived from oral bacterial species, mainly periodontal pathogens, that have been identified in atherothrombotic tissues.
- There is evidence of significantly higher levels of C-reactive protein (CRP) in periodontitis patients versus healthy controls and in CVD and periodontitis patients compared with either condition alone.
- Heat shock proteins (HSPs) from periodontal pathogens (Porphyromonasgingivalis, Tannerella forsythia, Aggregatibacter actinomycetemcomitans and Fusobacterium nucleatum) generate antibodies that can cross-react with human HSPs. These antibodies have been shown to activate cytokine production, as well as monocyte and endothelial cell activation.
- There is evidence from systematic reviews that serum total cholesterol levels, low-density lipoproteins (LDL), triglycerides, very-low- density lipoproteins (VLDL), oxidized LDL and phospholipase A2 are elevated in periodontitis. High-density lipoprotein (HDL) levels are reduced in periodontitis patients compared with controls. These levels are reversed after periodontal therapy.
- There is scientific evidence of pleiotropy between periodontitis and cardiovascular diseases. Pleiotropy occurs when one gene influences two or more seemingly different phenotypic traits. Plasminogen has got role in inflammation regulation. It plays role in the degradation of matrix proteins, including fibrin; activation of matrix metalloproteinases; regulation of growth factor and chemokine pathways.
- There have been no prospective randomized controlled periodontal intervention studies on primary prevention of cardiovascular diseases. However, consistent observational evidence suggests that Oral health interventions including self-performed oral hygiene habits (toothbrushing) and periodontal treatment produced a reduction in the incidence of atherosclerotic cardiovascular disease (ACVD) events including acute myocardial infarction and ischaemic stroke.
- There is only one pilot multicentre study on secondary prevention of ACVD events which reported No statistically significant difference in the rate of CVD events between patients who underwent treatment of periodontitis versus community care (Beck JD *et al*., 2008)[19]

**Effect of the treatment of periodontitis in improving surrogate parameters of CVD:** There is moderate evidence for reduction of low-grade inflammation as assessed by serum levels of CRP, IL-6 and improvements in surrogate measures of endothelial function (flow-mediated dilatation of the brachial artery).There is limited evidence, suggesting that periodontal treatment reduces arterial blood pressure and subclinical atherosclerotic cardiovascular disease (ACVD) as assessed by mean carotid intima-media thickness which is reduced.Moderate evidence suggests that periodontal treatment does not have an effect on lipid fractions except LDL which has been shown to get reduced following periodontal therapy. (Orlandi M *et al*., 2020)[20]

**Rationale for a Causal Link Between Periodontitis and Cardiovascular Diseases**

- Periodontitis has not yet been established as an independent casual factor in the onset and progression of atherosclerosis or CVD.
- Periodontitis and cardiovascular diseases are positively associated.
- Bradford-Hill criteria have been adopted to define causation in disease models not responding to a single causal factor (Orlandi M *et al*., 2020)

Though periodontitis satisfies the majority of the criteria, large longitudinal studies are still needed to get a deeper knowledge about these hypothesis and mechanistic links proposed. Well designed, adequately powered randomised controlled trials (RCTs) with large sample size are also needed to prove the effect of periodontal treatment on CVD-related variables.[20]

# CONCLUSION

Cardiovascular diseases are the worldwide leading cause of mortality and their clinical manifestations include major cardiovascular events such as myocardial infarction and stroke. Studies continue to support a link between periodontal health and cardiovascular disease (CVD), but causality remains unproven. Improvement in cardiovascular surrogate markers following periodontal treatment has been shown, albeit, the follow-up periods are mostly short. Reasonable evidence supports the contribution of good oral health to overall and heart health. The safe bet then? Continue to advise patients that a healthy mouth supports a healthy heart.

# REFERENCES


1. Pihlstrom BL, Michalowicz BS, Johnson NW. Periodontal diseases. Lancet. 2005;366(9499):1809–1820.
2. Hajishengallis G. Periodontitis: from microbial immune subversion to systemic inflammation. Nat Rev Immunol. 2015;15(1):30–44.
3. Froum SJ, Hengjeerajaras P, Liu KY, Maketone P, Patel V, Shi Y. The Link Between Periodontitis/Peri-implantitis and Cardiovascular Disease: A Systematic Literature Review. Int J Periodontics Restorative Dent. 2020 Nov/Dec;40(6):e229-e233.
4. Miller WD. 1891. The human mouth as a focus of infection. Lancet. 138(3546):340–342
5. Okell C, Elliott TS. 1935. Bacteriaemia and oral sepsis with special reference to the aetiology of subacute endocarditis. Lancet. 2:869–872
6. Mattila KJ, Nieminen MS, Valtonen VV, Rasi VP, Kesäniemi YA, Syrjälä SL, Jungell PS, Isoluoma M, Hietaniemi K, Jokinen MJ. 1989. Association between dental health and acute myocardial infarction. BMJ. 298(6676):779–781
7. DeStefano F, Anda RF, Kahn HS, Williamson DF, Russell CM. 1993. Dental disease and risk of coronary heart disease and mortality. BMJ. 306(6879):688–691
8. Beck J, Garcia R, Heiss G, Vokonas PS, Offenbacher S. 1996. Periodontal disease and cardiovascular disease. J Periodontol. 67(Suppl 10S):1123–1137
9. Ridker PM, Buring JE, Shih J, Matias M, Hennekens CH. 1998. Prospective study of C-reactive protein and the risk of future cardiovascular events among apparently healthy women. Circulation. 98(8):731–733
10. Ross R. 1999. Atherosclerosis—an inflammatory disease. N Engl J Med. 340(2):115–126
11. Haraszthy, V. I., Zambon, J. J., Trevisan, M., Zeid, M. & Genco, R. J. (2000) Identification of periodontal pathogens in atheromatous plaques. Journal of Periodontal Research 71, 1554–1560.
12. Beck JD, Elter JR, Heiss G, Couper D, Mauriello SM, Offenbacher S. 2001. Relationship of periodontal disease to carotid artery intima-media wall thickness: the Atherosclerosis Risk in Communities (ARIC) study. ArteriosclerThrombVasc Biol. 21(11):1816–1822
13. Ide M, Jagdev D, Coward PY, Crook M, Barclay GR, Wilson RF. 2004. The short-term effects of treatment of chronic periodontitis on circulating levels of endotoxin, C-reactive protein, tumor necrosis factor–alpha, and interleukin-6. J Periodontol. 75(3):420–428
14. Tonetti MS, D'Aiuto F, Nibali L, Donald A, Storry C, Parkar M, Suvan J, Hingorani AD, Vallance P, Deanfield J. 2007. Treatment of periodontitis and endothelial function. N Engl J Med. 356(9):911–920.
15. Bokhari SA, Khan AA, Butt AK, Azhar M, Hanif M, Izhar M, Tatakis DN. 2012. Non-surgical periodontal therapy reduces coronary heart disease risk markers: a randomized controlled trial. J Clin Periodontol. 39(11):1065– 1074
16. Zhou QB, Xia WH, Ren J, Yu BB, Tong XZ, Chen YB, Chen S, Feng L, Dai J, Tao J, *et al*. 2017. Effect of intensive periodontal therapy on blood pressure and endothelial microparticles in patients with prehypertension and periodontitis: a randomized controlled trial. J Periodontol. 88(8):711–722
17. Febbraio M, Roy CB, Levin L. Is There a Causal Link Between Periodontitis and Cardiovascular Disease? A Concise Review of Recent Findings. Int Dent J. 2022 Feb;72(1):37-51.
18. Sanz M, Marco Del Castillo A, Jepsen S, *et al*. Periodontitis and cardiovascular diseases: consensus report. J Clin Periodontol2020;47:268–88
19. Beck JD, Couper DJ, Falkner KL, Graham SP, Grossi SG, Gunsolley JC, Madden T, Maupome G, Offenbacher S, Stewart DD, Trevisan M, Van Dyke TE, Genco RJ. The Periodontitis and Vascular Events (PAVE) pilot study: adverse events. J Periodontol. 2008 Jan;79(1):90-6.
20. Orlandi M, Graziani F, D'Aiuto F. Periodontal therapy and cardiovascular risk. Periodontol 2000. 2020 Jun;83(1):107-124.


*******