

**Dental-Care Utilization, Periodontal Health, and Cardiovascular Outcomes**  
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**ABSTRACT:**

*Background*

Periodontitis is a chronic inflammatory condition that can be involved in systemic inflammation, vasculopathy, and cardiovascular disease. This literature review aimed to assess the impact of dental-care utilization on periodontal and cardiovascular outcomes/risk factors.

*Methods*

This review identified English-language articles published over the last two decades in PubMed using keywords related to periodontal disease, gum disease, dental-care access and utilization, cardiovascular disease, hypertension, atrial fibrillation, and stroke.

*Results*

Regular dental-care utilization was related to reduced risk of ischemic stroke and atrial fibrillation, whereas late dental appointments were linked with slightly elevated systolic blood pressure and increased probability of having high or uncontrolled blood pressure. Severe periodontitis was linked with the development of atrial fibrillation and some ischemic stroke types. Intensive periodontal treatment caused a temporary increase in inflammation and decreased endothelial function; however, at two and six months the latter parameter has improved.

*Discussion*

These results indicate that regular dental care and better periodontal health are linked to improved cardiovascular health. Further research should clarify whether preventive dental care and periodontal treatment affect clinical events, such as stroke and myocardial infarction.

**INTRODUCTION:**

Good oral hygiene is an essential component of overall well-being, but it is often considered separately from other aspects of health. Periodontitis is a particularly severe form of gum disease characterized by bacterial dysbiosis and chronic inflammation of the gums and other tissues that support the teeth [1–3]. Recent scientific studies suggest that periodontitis may also negatively affect cardiovascular health [1–3]. Periodontal pathogens, their products, and inflammatory mediators produced in infected periodontal tissues may enter the bloodstream, promote systemic inflammation, and impair vascular endothelial function [1–3]. These processes may contribute to

atherosclerosis and endothelial dysfunction, which are associated with myocardial infarction and stroke [1–3]. Although substantial evidence suggests an association between periodontal and cardiovascular diseases, there is insufficient evidence to establish a direct cause-and-effect relationship between the two conditions [1–3].

Regular use of dental-care services may be another factor involved in this association. Regular dental examinations can assist in the early detection and treatment of periodontal disease and may help prevent its progression through professional dental cleaning, preventive care, consultation, and treatment [2–4]. An analysis of 10,362 participants without a history of stroke found that regular dental-care utilization was associated with a lower risk of incident ischemic stroke than episodic dental-care utilization [4]. In another study, adults whose last dental visit had occurred more than six months earlier had approximately 2 mm Hg higher systolic blood pressure and greater odds of high or uncontrolled blood pressure than those who had visited a dentist within the previous six months [5]. These associations remained present in a propensity-matched sample limited to participants with higher levels of education and income [5]. A randomized controlled trial involving individuals with severe periodontitis found that intensive periodontal treatment initially increased systemic inflammation and temporarily worsened endothelial function; however, improvements in endothelial function were observed after two and six months [6]. This trial investigated vascular function rather than clinical cardiovascular outcomes.

Overall, these findings suggest that dental-care utilization may contribute to the relationship between periodontal and cardiovascular health by supporting the prevention, early detection, and treatment of periodontal inflammation [4–6]. However, the studies examining dental-care utilization were observational and may therefore have been affected by residual confounding. Factors including smoking, nutrition, diabetes, income, education, health-related behaviors, and access to medical care may influence both dental-care utilization and cardiovascular disease risk [1,2,4,5]. Although the periodontal-treatment study was a randomized controlled trial, it assessed endothelial function as a surrogate indicator of cardiovascular health rather than measuring clinical outcomes such as myocardial infarction or stroke [6].

Therefore, the research question for this systematic literature review is as follows: How is dental-care utilization associated with periodontal health and cardiovascular outcomes or risk factors? The review will assess human studies that contain information about dental-care utilization, periodontal disease, and cardiovascular outcomes or risk factors, including hypertension, atrial fibrillation, myocardial infarction, and stroke. It will evaluate the associations between regular or preventive dental-care utilization, periodontal health, and cardiovascular outcomes or risk indicators. The findings may help clarify the role of dental-care access as a social determinant of health, encourage cooperation between dental and medical practitioners, and raise awareness of the relationship between oral and cardiovascular health [2,3].

## METHODS:

For this study, a systematic review of literature was conducted to find out the relationship between dental care access, gum disease, and risk of heart disease. PubMed was searched for original and peer reviewed scientific research papers about humans that have been written in English within the past two decades. The main keywords used included ("periodontal disease" OR "gum disease") AND ("cardiovascular disease" OR "heart disease"), "periodontitis" AND "atherosclerosis," "oral health" AND "cardiovascular disease," "dental care access" AND "heart disease," "oral health" AND "health care access" AND "cardiovascular disease," and "social determinants of health" AND "oral health" AND "heart disease." Papers that investigated gum disease, oral health, dental-care access, and cardiovascular disease were considered eligible. However, review papers, meta-analysis papers, editorials, opinion papers, animal studies, case reports, research articles not relating to cardiovascular disease, and dental treatment research articles were excluded from this study.

## RESULTS:

### *Study Characteristics*

There were four original human studies on dental care usage, periodontal status, and cardiovascular outcomes or vascular risk indicators [4-7]. Two prospective studies analyzed data from the ARIC study and assessed incident ischemic stroke or atrial fibrillation [4,7]. One cross-sectional study analyzed national survey data to assess dental visit timing and blood pressure profiles [5]. One randomized controlled trial compared intensive periodontal treatment versus community-based periodontal care and assessed endothelial function [6]. The study design, population, exposure, and outcome in the reviewed studies are presented in Table 1 below.

**Table 1. Summary of Included Studies Examining Dental Care, Periodontal Health, and Cardiovascular Outcomes**

| Study | Design and sample | Dental or periodontal measure | Cardiovascular outcome | Main reported result |
|-------|-------------------|-------------------------------|------------------------|----------------------|
|-------|-------------------|-------------------------------|------------------------|----------------------|

|                      |                                                                                                                                           |                                                                    |                                                                   |                                                                                                                                                                                                                                                                                                                |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sen et al. [4]       | Prospective ARIC cohort; 10,362 stroke-free participants for dental-care analysis and 6,736 participants for periodontal-profile analysis | Regular versus episodic dental-care use; periodontal profile class | Incident ischemic stroke and stroke subtypes                      | During 15 years of follow-up, 584 ischemic strokes occurred. Regular dental-care use was associated with a lower adjusted stroke rate (HR, 0.77; 95% CI, 0.63–0.94). Periodontal disease was associated with cardioembolic stroke (HR, 2.6; 95% CI, 1.2–5.6) and thrombotic stroke (HR, 2.2; 95% CI, 1.3–3.8). |
| Del Pinto et al. [5] | Cross-sectional population analysis, n=27,725; propensity-score-matched subgroup, n=2,350                                                 | Last dental visit $\leq 6$ months versus $>6$ months               | Systolic blood pressure and high or uncontrolled blood pressure   | Forty-six percent reported a dental visit within six months. In the matched subgroup, a visit $>6$ months earlier was associated with systolic blood pressure approximately 2 mm Hg higher and 23%–35% higher odds of high or uncontrolled blood pressure.                                                     |
| Tonetti et al. [6]   | Randomized controlled trial, n=120; community care, n=59; intensive treatment, n=61                                                       | Community-based care versus intensive periodontal treatment        | Brachial artery flow-mediated dilation and circulating biomarkers | At 24 hours, flow-mediated dilation was 1.4 percentage points lower in the intensive-treatment group. At 60 and 180 days, it was 0.9 and 2.0 percentage points higher, respectively. No cardiovascular events occurred.                                                                                        |

|                |                                                                                    |                                                                       |                              |                                                                                                                                                                                                                                                                                                                                                   |
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| Sen et al. [7] | Prospective ARIC analyses; periodontal cohort, n=5,958; dental-use cohort, n=9,666 | Periodontal-disease severity; regular versus episodic dental-care use | Incident atrial fibrillation | Atrial fibrillation occurred in 754 participants in the periodontal cohort and 1,558 in the dental-use cohort. Severe periodontal disease was associated with atrial fibrillation (adjusted HR, 1.31; 95% CI, 1.06–1.62). Regular dental-care use was associated with lower atrial-fibrillation incidence (adjusted HR, 0.88; 95% CI, 0.78–0.99). |
|----------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

*Note: ARIC, Atherosclerosis Risk in Communities; CI, confidence interval; HR, hazard ratio.*

#### *Dental Care Usage and Ischemic Stroke*

Sen et al. analyzed data on 10,362 patients without history of stroke and divided them into two groups based on dental care usage – regular or episodic [4]. Regular dental users visited dentists routinely, while episodic ones used dental care due to pain or need for repairs or never used the services [4]. In 15 years, 584 patients developed ischemic stroke. Prior to multivariable adjustment, regular users had a lower rate of ischemic stroke than episodic ones (HR, 0.52; 95% CI, 0.44-0.61). After adjusting for demographic variables and vascular risk factors, the effect was still present (HR, 0.77; 95% CI, 0.63-0.94) [4].

For periodontal analysis, Sen et al. selected 6,736 patients without history of stroke [4]. Periodontal status was estimated by using periodontal profile classes, which were calculated using clinical measures such as attachment loss, probing depth, bleeding on probing, gingival inflammation, plaque, tooth loss and other tooth-level findings [4]. Periodontal disease was related to certain types of ischemic stroke [4]. Adjusted hazard ratio for cardioembolic stroke was 2.6 (95% CI, 1.2-5.6), and for thrombotic stroke – 2.2 (95% CI, 1.3-3.8) [4].

#### *Dental Visits and Blood Pressure Profile*

Del Pinto et al. analyzed data on 27,725 adults, of whom 46% reported that their most recent dental visit happened less than six months ago [5]. Then, a propensity score-matched sample of 2,350 people with high socioeconomic status was selected [5]. In comparison with people whose most recent visit happened less than six months ago, those whose visit happened more than six months ago had higher systolic blood pressure by approximately 2 mm Hg (P=0.001) [5]. Across all described statistical models, the group whose most recent visit happened more than six

months ago had 23%-35% higher odds of having high or uncontrolled blood pressure [5]. Including dental visits into the prediction model improved prediction of high blood pressure by 2% [5].

#### *Periodontal Disease, Dental Care Usage and Atrial Fibrillation*

In another analysis from the ARIC study, 5,958 participants without prior history of atrial fibrillation underwent periodontal examination [7]. During follow-up, 754 participants developed atrial fibrillation. Severe periodontal disease was linked to atrial fibrillation development in unadjusted (HR, 1.54; 95% CI, 1.26-1.87) and adjusted analyses (HR, 1.31; 95% CI, 1.06-1.62) [7].

As for dental care usage, 9,666 participants without prior history of atrial fibrillation were evaluated [7]. Within 17 years of follow-up, 1,558 patients developed atrial fibrillation [7]. Regular dental care users had lower rate of atrial fibrillation development than episodic ones in unadjusted (HR, 0.82; 95% CI, 0.74-0.90) and adjusted analyses (HR, 0.88; 95% CI, 0.78-0.99) [7].

#### *Periodontal Treatment and Endothelial Function*

Tonetti et al. randomly allocated 120 adults with severe periodontitis to the control group (community-based periodontal care, n=59) or experimental group (intensive periodontal treatment, n=61) [6]. Flow-mediated dilation 24 hours after the procedure was 1.4 percentage points lower in the treatment group (95% CI, 0.5-2.3; P=0.002) in comparison with the control one. C-reactive protein, interleukin-6, soluble E-selectin and von Willebrand factor levels were higher in the treatment group at that time point [6].

After 60 days, flow-mediated dilation was 0.9 percentage points higher in the experimental group (95% CI, 0.1-1.7; P=0.02) [6]. After 180 days, the difference was 2.0 percentage points (95% CI, 1.2-2.8; P<0.001). Soluble E-selectin levels were lower in the experimental group at 60 and 180 days after the intervention. There were no serious adverse effects and cardiovascular events in either group [6].

### **DISCUSSION:**

The results are in accordance with current scientific literature on the link between periodontitis, systemic inflammation, and cardiometabolic disease [1–3]. Previous studies have postulated the entry of periodontal pathogens and inflammatory mediators into the circulation and their possible roles in endothelial dysfunction and atherosclerosis [1–3]. These studies advance existing literature through the introduction of dental-care utilization as a possible additional parameter. Regular dental visits may not only improve periodontal disease but also represent an indicator of better preventive habits and higher health literacy and accessibility to healthcare services.

However, dental-care utilization cannot be considered an independent treatment for cardiovascular disease. Patients who visit dentists on a regular basis may have a different socioeconomic background, education, smoking status, dietary preferences, physical activity levels, treatment adherence, insurance coverages, and healthcare accessibility when compared to episodic dental-care utilization patients [4,5,7]. While some observational studies took several such confounders into consideration, there is still a possibility of residual confounding [4,5,7]. Hence, it is impossible to conclude that regular dental visits had caused decreased incidence of stroke or atrial fibrillation.

Such data may prove useful in future collaboration between dentists and physicians. Dentists can use dental visits to screen patients for periodontitis, hypertension, diabetes mellitus risk factors, smoking status, and accessibility to preventative medicine. In addition, physicians can consider inquiring patients with cardiovascular risk factors about periodontal problems and dental-care utilization. Such data has wider significance in relation to any inflammatory condition since it shows that health status may be affected by preventative services accessibility.

There are several weaknesses of this review and the primary studies included in it. Four human studies were found for review, all of which had many differences in terms of methodology and definition of variables used in them. Moreover, two of the studies utilized the ARIC cohort, which might affect the validity of the evidence provided by them. In addition, the study on blood pressure was a cross-sectional one, which means that it was not able to determine the temporal relationship between the two variables; the trial on the periodontal treatment had a small sample size (120 participants) and used the endothelial function and inflammatory biomarker outcomes instead of myocardial infarction or stroke. Furthermore, this review is limited to English-language papers that appeared in the PubMed database during the last two decades. All this means that the results of this research provide an association but not the proof of the fact that dental-care utilization or periodontal treatment can prevent cardiovascular disease [4–7].

## REFERENCES:

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