





RAPID COMMUNICATION

Periodontal disease and risk of atrial fibrillation or atrial flutter: A systematic review and meta-analysis

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Abstract

Background: We conducted a study to evaluate the risk of atrial fibrillation (AF) and atrial flutter (AFL) in periodontal disease (PD) patients.

Methods: Cohort studies that evaluate the risk of AF or AFL in PD patients were included. The risk was expressed in the pooled odd ratio (OR) with 95% confidence interval (CI).

Results: A total of four cohort studies were included. We found that patients with PD have a significantly higher risk of AF/AFL compared to those without PD with the pooled OR of 1.33 (95% CI 1.29–1.38; $p=0.357$, $I^2=3.0\%$).

Conclusions: PD increases the risk of AF and AFL.

KEYWORDS

atrial fibrillation, atrial flutter, cardiovascular disease, periodontal disease

1 | INTRODUCTION

Periodontal disease (PD) is a chronic inflammatory disease caused by the accumulation of dental plaque that triggers an immune response.¹ Studies have found that individuals with PD are at a higher risk of developing cardiovascular diseases (CVD). Recent evidence suggested the possibility of an association between PD and atrial fibrillation (AF).² AF and atrial flutter (AFL) have a significant impact on morbidity and mortality and can lead to various complications such as stroke, systemic thromboembolism, dementia, heart failure, and myocardial infarction. These complications not only affect the

quality of life but also increase healthcare costs.³ In this systematic review and meta-analysis, we aim to evaluate the relationship between PD and AF/AFL.

2 | METHODS

A literature search was performed in the MEDLINE, EMBASE, and SCOPUS, using the search terms “periodontal” and “atrial fibrillation,” “periodontitis” and “atrial fibrillation,” and “periodontal” and “atrial flutter”. Studies were included if they were human studies,

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cohort or case–control studies, and required to report the association between AF or AFL and PD or report the incidence of AF or AFL comparing patients who had PD and patients who did not have PD. AF or AFL was identified from the diagnosis codes or death certificates using the International Classification of Diseases, Ninth Revisions, Clinical Modification (ICD-9-CM) codes or by a standard 12-lead ECG. PD was defined differently among the four studies that were included. It was defined by ICD-9-CM code together with receiving antibiotic therapy or periodontal treatment in one study. Another study defined PD by diagnosis code and subgingival curettage treatment code. Another study defined PD if meeting the World Health Organization Community Periodontal Index greater than or equal to code 3 of periodontitis diagnosis. The last study defined PD according to the Periodontal Profile Class.

The risk of AF or AFL in PD was expressed in the pooled odd ratio (OR) with 95% confidence interval (CI). All statistical analyses in this meta-analysis were performed using STATA 14.2 software.

3 | RESULTS

Our search strategy yielded 344 results. A total of 4 cohort studies met the inclusion criteria.^{2,4–6} However, one study⁶ was further excluded because of a small sample size resulting in a larger confidence interval. A final of 3 studies^{2,4,5} including 1358568 patients

(680549 with PD and 677974 without PD) were included in the study. Figure 1 outlines our search methodology and selection process; the baseline characteristics of the included studies are summarized in Table 1. We found that the patients who had PD had a 33% increased risk of having AF or AFL compared to patients who did not have PD (pooled OR 1.33, 95% CI 1.29–1.38; $p = .357$, $I^2 = 3.0\%$) (Figure 2).

4 | DISCUSSION

To our knowledge, this is the first systematic review and meta-analysis to assess the risk of AF and AFL associated with PD. We found that PD is associated with an increased 1.3-fold risk of AF and AFL.

Several mechanisms have been proposed to explain the potential link between PD and CVD with systemic inflammation being one of the most important.⁷ Multiple studies demonstrated that patients who have higher levels of c-reactive protein (CRP) have a greater risk of acute myocardial infarction and cardiovascular events.⁸ Inflammation is a key pathophysiologic factor of AF. Chronic inflammation in the atrial leads to fibrosis and dilatation, which can disrupt the normal electrical activity of the heart and increase risk of AF. This process is referred to as atrial remodeling.⁹ The high incidence of AF in a state of the inflammatory process such as postcardiac surgery

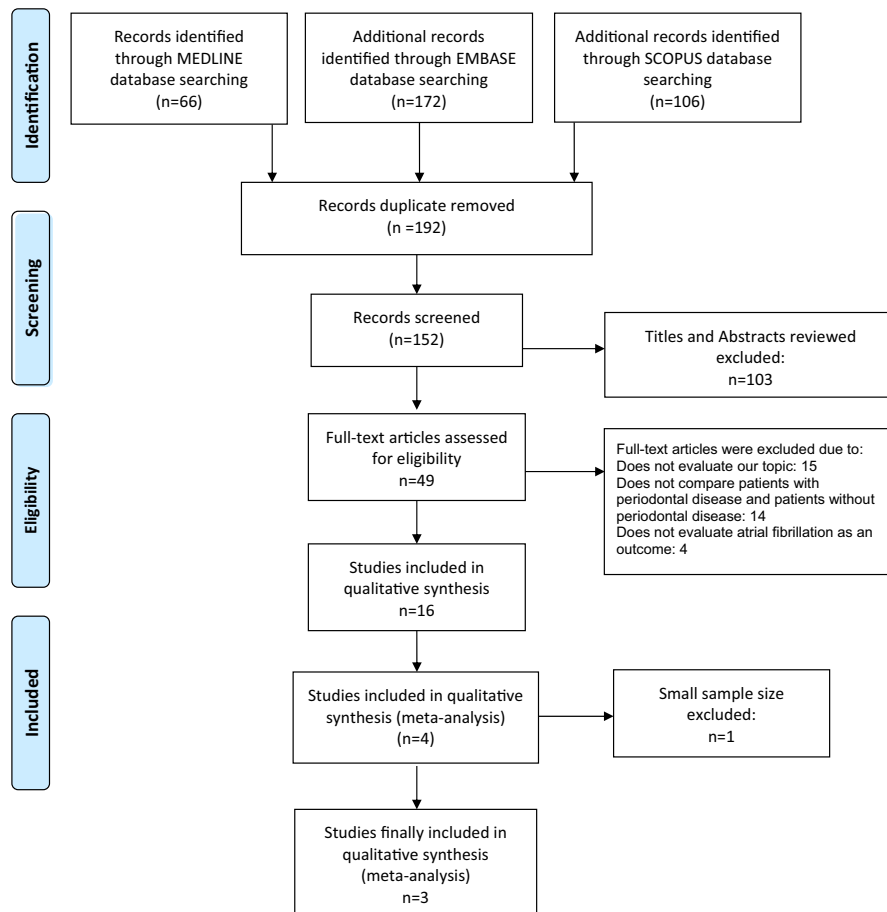
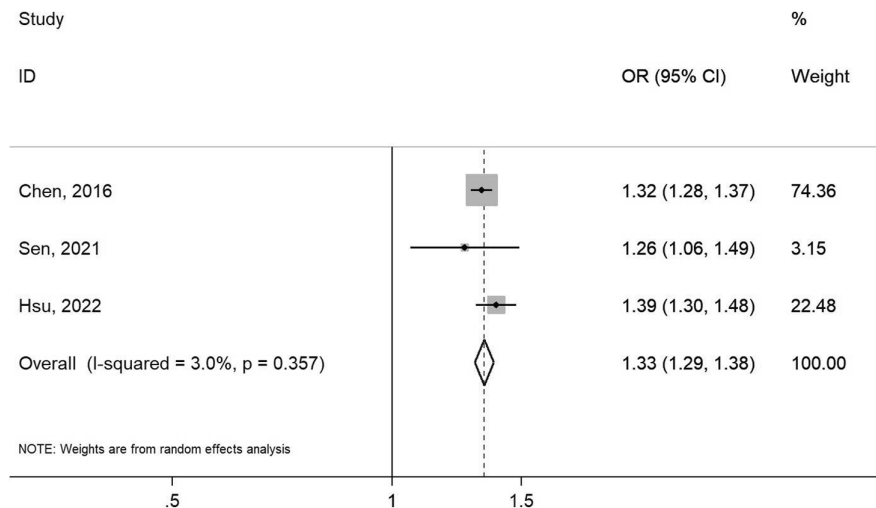


FIGURE 1 Prisma flow diagram demonstrates search methodology and selection process. For more information, visit www.prisma-statement.org.

TABLE 1 Characteristics of studies in the meta-analysis that investigate the association between periodontal disease and atrial fibrillation/atrial flutter.

First author/ year	Country	Study design	Patients (n)		Study population/inclusion criteria	Exclusion criteria	Periodontal disease diagnosis	Atrial fibrillation/atrial flutter diagnosis
			Periodontal disease	Nonperiodontal disease				
Chen/2016	Taiwan	A retrospective cohort	393 745	393 745	Participants from The Taiwanese National Health Insurance Research Database (NHIRD) included patients with PD and non-PD that were individually matched with a 1:1 ratio based on gender and individual age	Previous diagnoses of AF or AFL	A diagnosis code (ICD9-CM Codes 523.3-5)	A diagnosis code (ICD9-CM Codes 427.31-2)
Hsu/2022	Taiwan	A retrospective cohort	282 560	282 560	Participants from The Taiwanese National Health Insurance Research Database (NHIRD) included patients with periodontitis and nonperiodontitis that were individually matched with a 1:1 ratio based on age, urbanization level, income, and index day	Prior stroke	A diagnosis code 523.X with subgingival curettage treatment code (91006-91008)	N/A
Sen/2021	United States	A prospective cohort	4289	1669	Participants from the Atherosclerosis Risk in Communities (ARIC) Study	Prior AF, participants with medical contraindications to a dental exam, those with dental implants only, not African American or white (because of limited sample size of other races)	The periodontal profile class (PPC); periodontal health (PPC-A), mild PD (PPC-B and C), moderate PD (PPC-D and E), and severe PD (PPCF and G)	A standard 12-lead ECG, hospitalization, and death certificates using ICD-9-CM codes 427.31 or 427.32

FIGURE 2 Forest plot of the included studies that evaluate the risk of developing atrial fibrillation/atrial flutter between patients with and without periodontal disease.



also suggested the link between inflammation and AF.¹⁰ Studies have reported an association between inflammatory markers, such as CRP and interleukin-6 (IL-6), and AF.⁹ Furthermore, Im et al. found that AF patients with periodontitis had a higher risk of major cardiac events compared to those without periodontitis. The study also found that patients with periodontitis had a higher prevalence of other arrhythmias, including atrial premature beat, atrial tachycardia, and ventricular tachycardia.⁶ Not only we found an elevation of inflammatory markers in AF, but an elevation of CRP and IL-6 is also seen in PD as well,² and there is a reduction of inflammatory markers including CRP, IL-6, and tumor necrosis factor-alpha after dental treatment.¹¹ This may be a reasonable presumption based on the evidence available that decreasing systemic inflammation through dental treatment could potentially lower the risk of developing AF and improve prognosis in patients who have established AF diagnosis.

Not only inflammation, but platelet and coagulation cascade activations also play a role in the development of AF and lead to consequent AF thrombotic complications.⁹ The study in 76 AF patients suggests that periodontitis is not only positively correlated with LAA fibrosis but also with the presence of atrial thrombi, further highlighting the potential link between poor dental health and cardiovascular event.¹²

The current 2019 AHA/ACC/HRS guideline for the management of patients with AF emphasizes addressing the risk factors as one of the treatment approaches for AF.¹³ Weight reduction resulted in a reduction in AF burden with the explanation that obesity is associated with a systemic proinflammatory state and diastolic dysfunction.¹⁴ Thus, reducing systemic inflammatory conditions by promoting oral hygiene care could be another easy way to reduce the risk of developing AF.

5 | CONCLUSIONS

Our study suggested that PD is associated with an increased risk of AF/AFL. Thus, better oral health might be an easily modifiable

risk factor to reduce the risk of developing AF/AFL. However, more research is needed to clarify the relationship to identify the most effective strategy for preventing and managing both conditions.

CONFLICT OF INTEREST STATEMENT

All the authors declare no conflict of interest.


ETHICS APPROVAL STATEMENT, PATIENT CONSENT STATEMENT, AND CLINICAL TRIAL REGISTRATION

Not applicable.

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