



Cardiovascular Diseases and Apical Periodontitis, Connection of Two Pathologies in Adult Patients; A Systematic Review

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CLINICAL SIGNIFICANCE

Any source of infection, even without clinical signs that force the patient to come to dentist urgently, serves as source of temporary bacteremia in blood, which with specific attacks with different durations, targets tissues of inner walls of blood vessels.

ABSTRACT

Objectives: The objective of this research was to examine the potential relationship between apical periodontitis and arteriosclerosis.

Materials and Methods: A specific query was applied to the Pubmed page containing medical articles. Three independent reviewers were tasked with the collection and selection of articles for inclusion in the study. The selected data items consisted of the year of publication of the article, the article's purpose, the specific name of the bacterium, the causes of endodontic pathology, and the definitive or evasive conclusion of the published article.

Results: The present study included a total of 25 articles. Four review-type studies were identified that demonstrated a positive correlation between apical periodontitis and cardiac diseases. Articles primarily focused on the association between apical periodontitis and cardiovascular diseases, without specifying a specific bacterial strain. The available data suggests that the combination of cardiac examinations and blood tests is the most prevalent methodology employed. A strong or relative interconnection was observed between the pathologies of apical periodontitis and cardiac diseases.

Conclusion: Research indicates that there is a notable correlation between apical periodontitis and cardiac pathologies. It is worth noting that the inflammatory markers found in blood are not specific enough to enable the accurate diagnosis of apical periodontitis.

1. Introduction

Endodontic pathogens are part of the bacterial plaque, but with the characteristic that when these pathogens are given the opportunity to enter the sterile tissue of the pulp tissue limited to the solid walls of the pulp chamber and the tooth root canals, these pathogens, such as *Porphyromonas Gingivalis*, *Prevotella Intermedia* or *Actinomyces*, turn into dangerous pathogens for periapical tissues as well. Precisely in the periapical tissue areas, these pathogens come into contact with the immune cells of the affected individual.^{1,2,3} The battle between endodontic pathogenic bacteria and the host's immune cells can have effects beyond the affected area. For instance, it can cause arteriosclerosis in distant parts of the body, such as the heart or brain.^{2,3-5}

Several articles have focused on assessing the risk of patients with apical periodontitis for developing arteriosclerosis, and vice versa. These studies have often concluded that the elimination of apical periodontitis through endodontic protocols, with or without systemic administration of antibiotics, is effective in reducing the risk of arteriosclerosis.⁶⁻⁷ The main underlying cause of the possible connection between these two pathologies is attributed to the endodontic bacterial flora.^{7,8} The bacterial organization within the pulp chamber or root canals, taking the form of a biofilm, acts as a protective and enhancing agent, thereby increasing bacterial resistance and pathogenicity.^{3,6,9-11}

If the presence of certain actors is confined to the canals of the tooth roots, their impact is limited to the pulp without extending beyond it. Consequently, their effect remains localized and fails to manifest in hard dental structures such as dentin or cementum.¹¹⁻¹³ However, when these actors surpass the tooth's apex into the periapical area, the initial interaction with the host's immune cells is pivotal in establishing a link between the pathology of apical

periodontitis and other organs of the host's body.^{3,14-16} This connection poses a significant threat to the affected individual's overall health.^{2,6,9,12-14}

It has been observed that treated infection foci that require endodontic re-treatment can serve as foci of focal infection, leading to the aggravation of existing cardiac pathologies.^{17,18} Several conducted studies have been published that emphasize the potential relationship between the existence of oral diseases and cardiac diseases.^{1,2,3} However, there is a question about the availability of sufficient data in the published literature regarding this correlation of pathologies.¹⁹⁻²¹ In light of this, it is important to conduct further research to better understand the link between endodontic periapical pathologies and cardiac pathologies, and to develop effective treatment strategies for preventing the progression of these conditions and improving patient outcomes.^{2,22-24} In this article, the orientation towards the relationship between apical periodontitis and cardiovascular diseases was to exclude pathological cases involving two systemic pathologies simultaneously, cardiovascular disease and diabetes.²⁴⁻²⁸ The purpose of this article is to highlight the close connection between endodontic periapical pathologies and cardiac pathologies.

2. Materials and Methods

2.1. Guidance and eligibility criteria

The systematic review in question used the Prisma transparent reporting guidelines, which are designed to ensure a rigorous and transparent approach to conducting systematic reviews and meta-analyses. The review focused on articles that discuss the pathology of apical periodontitis and cardiovascular diseases in adult patients. In order to ensure the highest level of relevance and

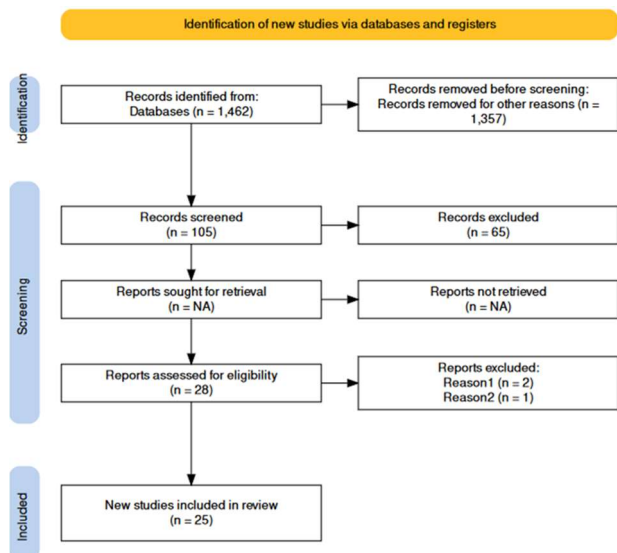


Fig. 1. Flow diagram of the study protocol

accuracy, articles that included patients with diabetes mellitus in addition to the aforementioned pathologies were excluded from the review.

2.2. Information sources and search strategy

The screening process was completed in January 2024. Keywords were applied to the Pubmed page of medical articles with the primary aim of finding initial articles including apical periodontitis and cardiovascular disease. The following query was used to screen the literature via Pubmed Advanced Search: (cardiovascular disease OR arteriosclerosis OR Penicillin OR Amoxicillin) AND (apical periodontitis OR endodontic treatment OR endodontics).

2.3. Selection and data collection process

In the collection and selection of articles to be included in the study, three reviewers (I.R, N.A, K.C). worked independently, who were previously familiar with the combination of key words and the manner of their application. The data collected in this way from three reviewers (I.R, N.A, K.C) were further analyzed together, to determine the final number of articles included in the review of this article.

2.4. Data items

The selected data items were: the year of publication of the article, the purpose of the article, the specific name of the bacterium, the causes of endodontic pathology, the concise and definitive or evasive result of the published article.

Table 2. Data on the relationship between cardiac diseases and oral health based on the review type studies included in this study.

The connection between pathologies	Endodontic	Endodontic periodontal	Total
Connection is available	Jakovljevic et al. 2020 ³ Noites et al. 2022 ¹	Folwaczny et al. 2019 ¹² Hassan et al. 2021 ²²	4 studies
No connection	-	-	-
Total	2 studies – 8%	2 studies – 8%	4 – 16%

3. Results

3.1. Study selection

Upon conducting an analytical examination of the situation from a dental pathology perspective, it was observed that there existed approximately 1,462 articles. However, when a specific query was employed, the aforementioned number was reduced to a mere 105 articles. The second combination of key words had to do with the age of the patients, and with the non-inclusion of diabetes as an accompanying pathology of cardiac diseases in most cases. These found articles were also filtered for 10 years and reached the value of 28 articles for further analysis in this study.

From 28 studies selected for the realization of the purpose of our study, about 25 studies were taken for further analysis based on the inclusion and exclusion criteria during the selection of the study sample. Three of the studies selected in the first phase (3 articles) were excluded because the purpose of these studies did not match the purpose of our study.

A total of 28 articles were selected, of which 3 articles were not taken for further evaluation as they did not meet 1 or some of the following criteria:

- 1.The article describes the connection between the pathology of apical periodontitis and cardiovascular pathology, but in a patient who also suffers from another pathology before (2 articles).^{25,27}
- 2.The article describes the connection between the pathology of apical periodontitis and cardiovascular pathology, but in a patient who also suffers from another pathology before (1 article).²⁸

At this stage, 25 articles were selected as part of the basic articles included in the study (Fig. 1).^{1-24,26}

3.2. Findings of the publications

This analysis comprises four review-type studies that investigate the correlation between apical periodontitis and cardiac diseases.^{1,2,12,23} Two studies^{1,3} reveal a positive correlation between apical periodontitis and cardiac diseases, while the other two studies^{12,23} indicate the presence of a connection between cardiac diseases and endodontic/periodontal pathologies (Table 1). The results of review-type studies have demonstrated a correlation between cardiac pathologies associated with endodontic and endodontic/periodontal conditions (Table 2). Table 3 highlights the research trend in this area with a focus on identifying specific bacterial strains. Prior to the COVID-19 pandemic, research mostly centered on the link between apical periodontitis and

Table 1. Review-type studies are presented in this table based on the purpose of the study and the main conclusions reached. The order of placement of the articles respects the ascending order of the year of publication.

Studies	Aim	Conclusions	Oral diseases
Folwaczny et al. 2019 ¹²	Presentation of the latest data on the oral health of patients with congenital heart disease.	Oral diseases serve as a cause of bacteremia that can cause infective endocarditis in patients with congenital heart disease, but the reverse of this phenomenon is also true.	Endodontic - periodontal
Jakovljevic et al. 2020 ³	Finding the correlation between cardiovascular diseases and apical periodontitis.	There is a weak correlation between the two pathologies. Longitudinal cohort studies are needed.	Endodontic
Hassan et al. 2021 ²²	To show how oral diseases can be related to cardiovascular ones.	Endodontic - periodontal	Endodontic - periodontal
Noites et al. 2022 ¹	There is insufficient data on the link between oral health and cardiovascular disease.	Weak association between apical periodontitis and cardiac diseases, cohort-longitudinal studies are needed.	Endodontic

Table 3. Studies conducted in vivo with the aim of finding the correlation between oral pathologies and cardiovascular diseases, also classified depending on the year of publication of the article.

The Pathogen	2013-2019	2020-2022
Specific pathogen	Reis et al. 2016 ²³	Jimenez et al. 2022 ²
Nonspecific pathogen	Glodny et al. 2013 ¹⁷	Montano et al. 2021 ²⁴
	Inchingolo et al. 2013 ²⁰	Bilgin Cetin et al. 2020 ⁹
	Willershansen et al. 2014 ¹⁶	Leao et al. 2022 ¹
	Petersen et al. 2014 ¹³	
	Cotti et al. 2015 ¹⁹	
	Vidal et al. 2016 ¹⁰	
	Gomes et al. 2016 ⁵	
	Virtanen et al. 2017 ⁸	
	Rashmi et al. 2017 ¹⁵	
	Allareddy et al. 2017 ²⁶	
	Chauhan et al. 2019 ⁴	
	Garrido et al. 2019 ⁶	
	Bergandi et al. 2019 ⁷	
Total of articles	14 articles – 78%	4 articles – 22%

cardiovascular diseases without identifying a particular bacterial strain.^{4-8,10,13,15-17,20} However, in the three-year period following the pandemic, the number of articles that identified specific bacterial flora^{2,24} in association with the connection between apical periodontitis and cardiovascular diseases was roughly equal to that of those that did not specify the bacterial strain responsible,¹⁹ with a ratio of 1:1.

The correlation between apical periodontitis and cardiac pathologies seen not in the presence of a specific causative pathogen is the subject of Table 4, which outlines the relevant literature. Notably, numerous articles^{4,7,9,11-13,17,19,26} examined the relationship between these conditions through cardiac analyses and examinations. In contrast, other publications suggest that blood tests and the monitoring of specific inflammation markers in the blood are essential to control the association between the two pathologies.^{6,7,10,15,19,20} A few articles evaluated this relationship by analyzing the change in periodontal index values.^{5,8,9,11,13,15-17} However, the data indicate that the combination of cardiac examinations and blood tests^{7,19} or blood tests and periodontal indices^{15,16} is the predominant methodology. A recent trend in scientific research is the combination of cardiac and periodontal examinations.^{9,11} Notably, dental professionals emphasize the importance of combining endo-periodontal indicators with blood tests or cardiac examination techniques in about six articles^{9,11,13,15-17}.

Based on the data presented in Table 5, it is evident that an interconnection exists between the pathologies of apical periodontitis and cardiac diseases. Two articles^{6,10} strongly support this connection, as evaluated by changes in blood markers. However, the analyses of cardiac parameters do not exhibit a similar strong connection.^{4,26} Of particular interest is the strong correlation between cardiac tests and oral pathologies expressed in articles^{9,13,14}, while for the combination of blood tests and periodontal index, positive¹⁵ as well as negative¹⁶ results have been reported for the association between the two pathologies.

Upon examining the data presented in Table 6 with a focus on specific bacteria, it is notable that there exist three articles containing specific names.^{2,23,24} However, only one of these articles² discusses the link between apical periodontitis and cardiac diseases with endo-periodontal pathogens. The data presented in Table 7 are expressed based on the references of these articles, specifically for pathogenic flora.

4. Discussion

Based on an analysis of various review type studies that examined the relationship between oral diseases and cardiac diseases, it is evident that a weak correlation exists between the two pathologies. Specifically, data from both longitudinal and retrospective cohort studies indicate that only about 16% of the studies support the existence of this correlation.^{3,7,12,26} The data under consideration pertains to the years between 2019 and 2022, which are the corresponding years of the articles included in our study. Specifically, the articles are divided equally, with 50% supporting the notion that endodontic pathology is the root cause of both apical periodontitis and caries, while the other 50% attribute temporary bacteremia in the blood to a combination of periodontitis, apical periodontitis, and caries, which can lead to infective endocarditis.^{5,8,12}

Dental caries, a common dental disease, can lead to pulpal pathologies that may result in apical periodontitis. However, when viewed as a pathology that involves bacterial flora, it is comparable to other periodontitis. Therefore, it may be necessary to shift the focus of review studies of this nature towards the pathogens that cause apical periodontitis rather than solely on the name of the pathology, which is distinct from periodontal pathologies.^{21,23}

Table 4. Studies about the relationship between oral health and cardiac pathologies seen not in the presence of a specific causative pathogen.

No.	Average age	Heart	Blood	Oral Indexes	Interconnection
2013-2019					
1.	AP ⁴ 20-40 years	Carotid intima-media thickness	-	-	+
2.	AP ⁵ 55 years	-	-	Endo-perio	+
3.	AAP ⁶ 18-40 years	-	Protein C-reactive IL-6, IL-10 MMP-8 E-selectin	-	+
4.	CAP ⁷ -	Endothelial dysfunction	IL-6, IL-1 TMF-alfa ICAM-1 E-selectin	-	+
5.	AP ⁸ -	-	-	Endo-perio	+
6.	CAP ¹⁰ – 53 years	-	CPR IL-6 Fibrinogen	-	+
7.	CAP ¹³ – 50 years	Abdominal aorta tomography	-	Endo	+
8.	CAP ¹⁵ -	-	CRP IL-6 Fibrinogen	Endo-perio	+
9.	CAP ¹⁶ -	-	CRP	Endo	-
10.	CAP ¹⁷ – 54 years	Tomography arteriosclerotic aorta	-	Endo	+
11.	AP ¹⁹ – 31 years	Endotelial Flow	IL-2 TNF – alfa Oksidant status Stresi oksidativ	-	+/-
12.	CAP ²⁰ -	-	-	-	+
13.	AP ²⁶ 19-65 years	Open cardiac procedures	-	-	+
2020-2022					
1.	AP ⁹ -	Coronarography	-	Perio	+
2.	AP ¹¹ – 62 years	Angiography	-	Endo-perio	+/-
Total	15 studies	8 studies – 44%	8 studies – 44%	8 studies – 44%	12/2/1 studies

Table 5. Method of evaluation of patients included in studies with the aim of analyzing the relationship between cardiac pathologies and oral health.

The evaluation element	Reference articles	Interconnection	Total
Only the heart	Chaudan N et al.2019 ⁴	Impairment in carotid intima media thickness in AP indicates possible correlation! Infectious complications in patients with apical abscess are more numerous in cases of open cardiac surgery.	Evasive +
	Allareddy V et al.2017 ²⁶		Evasive +
Only the blood	Garrido M et al.2019 ⁶ Vidal F et al.2016 ¹⁰	Mechanistic connection Modest participation in the impact of endodontic lesions Correct endodontic treatment regulates the balance of oxidative stress	2 – 11% Evasive + Positive
	Inchingolo F et al.2013 ²⁰		Positive 3 – 17%
Oral only	Gomes MS et al.2016 ⁵	Age equal to or over 60 years old with hypertension and endodontic pathology has a high risk for cardiac incidents. Regression analyzes indicated a correlation of about 3.83 between AP and cardiac diseases.	Positive
	Virtanen E et al.2017 ⁸		Positive
Heart+blood	Bergandi L et al.2019 ⁷	The increase in markers in the blood as a result of AP has a potential impact on endothelial dysfunction. CAP may cause a greater effect in men than in women for endothelial dysfunction, as a consequence of the action of estrogen.	2 – 11% Evasive +
	Cotti E et al.2015 ¹⁹		Positive
Heart+oral	Petersen J et al.2014 ¹³	CAP without endodontic treatment has more effect than apical radiolucencies with endodontic treatment. CAP is directly proportional while retreatments are inversely proportional to the association between CAP and cardiac disease. Edentulism as a result of periodontitis is also related to cardiac diseases. Univariable studies show that AP is correlated with cardiac disease, while multivariable studies show that AP is independent of cardiac disease.	2 – 11% Positive
	Glodny et al.2013 ¹⁷		Positive
	Bilgin Cetin M et al.2020 ⁹		Positive
	Leao TSS et al.2020 ¹¹		Evasive +
Blood+oral	Rashmi N et al 2017 ¹⁵	Systemic levels of Il-6 and fibrinogen are affected by CAP. CRp values have no significant correlation with the number of apical lesions.	4 – 22% Positive
	Willershausen I et al.2014 ¹⁶		Negative 2 – 11%
Total	9 studies positive/ 5 studies evasive +/1 study negative		15 studies

Upon evaluating the in vivo studies conducted, it can be determined that the quantity of articles published between 2020-2022 pertaining to the relationship between oral pathologies and cardiac diseases has decreased by 22%. Furthermore, it is noteworthy to mention that only 17% of the articles in this area of study specify the pathogenic bacteria responsible for the connection, while the remaining 83% examine the relationship between oral pathologies and cardiac diseases through inflammation markers in the bloodstream.^{2,7,11} It is observed that roughly 44% of the studies analyze the heart, blood, or oral endodontic and periodontal status as an element of analysis, with almost equal distribution.^{6,17}

The evaluation of cardiac functioning and oral endodontic status has yielded positive results when these elements are combined. However, when the evaluation is performed only through blood tests, the results are not as specific to endodontic pathologies.²⁹⁻³¹ In such cases, markers of inflammation in the blood are not sufficient to diagnose the condition accurately. Therefore, the best approach is to identify a combination of specific markers of inflammation in the blood and the presence of apical periodontitis. However, it should be noted that the specific connections between these elements are relatively few in number and not very specific

in terms of the connection mechanism.^{13,23}

Apical periodontitis, a common dental condition, is often perceived as an endodontic pathology. However, it should be regarded as a periodontal pathology due to its impact on the healthy tissues of the periapex.^{7,32,33} Unlike pulpal endodontic infections that are typically confined to the solid walls of the root of the affected tooth, apical periodontitis is not limited by the size of the apical foramen. This unrestricted "wave of attack" can cause significant damage to the healthy tissues of the periapex. The immunological cells that combat the oral bacterial flora are situated in this area, making it a prime target for the members of the oral flora to enter the bloodstream. The oral flora's infiltration into the bloodstream can lead to further damage in other areas of the body.^{5,34,35} Therefore, it is crucial to consider the impact of apical periodontitis beyond its immediate location and understand its potential to cause long-lasting harm.

The process of arteriosclerosis causes visible damage to the affected organ via blood attack and related mechanisms, regardless of the location of the affected blood vessel. The heart is one of the organs that undergoes life-threatening consequences as a result of arteriosclerosis. Whether it originates from oral flora or is initiated by sensitive attacks of temporary oral bacteremia,

Table 6. Specific pathogen causing the relationship between oral pathologies and cardiovascular diseases based on the studies carried out in selected publications in accordance with the purpose of the study.

No.	Type of study	Specific pathogen	The evaluative element
2013-2019			
1.	Reis LC et al.2016 ²³ Cohort study	Streptococci	Bacterial samples from canals before and after mechanochemical preparation
2020-2022			
2.	Jimenez C et al.2022 ² Cross-sectional	Porphyromonas gingivalis Porphyromonas endodontalis	Antibodies in the patient's serum Intracanal bacteremia
3.	Montano TCP et al.2021 ²⁴ Retrospective	Streptococcus Viridans	The frequency of cardiac diseases, Frequency of caries, apical periodontitis

Table 7. Results of studies after analyzing the specific pathogen responsible for the relationship between oral health and heart disease.

No.	Methodology	Results	Conclusion
2013-2019 1. Reis LC et al.2016 ²³ Cohort study	Blood sample after 5 and after 30 minutes after root canal treatment in 32 patients PCR assay	Streptococci In 18% of cases, bacteremia occurs in patients who are not treated with prophylaxis 5 minutes after endodontic treatment 10% of cases presented with bacteremia in patients treated with prophylactic antibiotics	Bacteremia is not detected after endodontic treatment of infected canals. Regardless of receiving prophylaxis or not, streptococci in the blood appeared without significant difference.
2020-2022 2. Jimenez C et al.2022 ² Cross-sectional	In 80 patients under or equal to 40 years old, bacteremia of tooth root canals was evaluated by PCR and antibodies in blood by ELISA.	Porphyromonas gingivalis 22% intracanal Porphyromonas endodontalis 33% intracanal, associated with high endotoxemia	P.endodontalis is associated with increased cardiovascular risk.
3. Montano TCP et al.2021 ²⁴ Retrospective	Cardiac and oral profiles were evaluated in 100 patients, 70% men with an average age of pathology diagnosis of about 45 years.	Streptococcus Viridans - valvular voice problems in almost 52% of cases were associated with 96% presence of caries and 45% of apical periodontitis	S. Viridans is the most common cause of infective endocarditis associated with poor oral status.

the manifestation of arteriosclerosis in the heart is of particular concern.³⁶⁻³⁹

Numerous studies have explored the relationship between apical periodontitis and cardiovascular diseases. However, only a limited number of articles have examined this relationship beyond oral bacteria.³⁹ In vivo clinical studies demonstrating this association are also scarce. The majority of articles on this subject matter are case reports, with the remaining studies primarily focused on analyzing the link between the two pathologies using "in vitro" experiments on animals.⁴⁰⁻⁴²

Theoretical evidence suggests a potential relationship between periodontitis and arteriosclerosis, albeit limited to inflammation markers in blood tests, which are not exclusive to the link between these two pathologies.⁴³⁻⁴⁷ Moreover, in some cases, cardiac diagnostic tests are used to carry out analyzes, lacking the capacity for specific investigation of the relationship between particular oral bacterial pathogens and the underlying causes of the aforementioned association.⁴⁸

The aging process, a physiological phenomenon, is often accompanied by the simultaneous occurrence of several systemic diseases.⁴² The co-occurrence of diseases such as diabetes and cardiovascular diseases, nephritis and cardiovascular diseases, and pathologies with embolic etiology of the brain and cardiovascular pathologies makes it challenging to analyze the close relationship between periodontitis and cardiovascular diseases.^{49,50} There is a dearth of review-type studies in the form of meta-analysis on this topic. Furthermore, studies on the role of antibiotic treatment and the destruction of the oral bacterial flora are scarce, thereby reducing the possibility of negative effects of temporary oral bacteremia on existing systemic pathologies. Patients suffering from apical periodontitis, regardless of the different forms of this pathology, are often left with few options for treatment.^{1,3,49,50}

It is important to emphasize that apical periodontitis is a type of endodontic pathology that requires specific treatment approaches. One of the main challenges in treating apical periodontitis is the risk of temporary oral bacteremia that can occur during endodontic re-treatments. This bacteremia refers to the presence of bacteria in the bloodstream that can cause infections in other parts of the body. While temporary oral bacteremia is usually harmless, it can pose a risk for patients who have underlying medical conditions that weaken their immune system. Therefore, it is crucial for dental practitioners to take necessary precautions to minimize the risk of temporary oral bacteremia during endodontic re-treatments. This can include the use of antimicrobial agents and the proper management of the root canal system. By doing so, dental practitioners can help ensure the best possible outcomes for their patients and reduce the risk of complications.

Many articles discussing the topic of the relationship between apical periodontitis and cardiovascular pathologies share a common characteristic: they tend to emphasize the limited number of articles on which their discussion of the results is based,

Many articles discussing the topic of the relationship between apical periodontitis and cardiovascular pathologies share a common characteristic: they tend to emphasize the limited number of articles on which their discussion of the results is based, and the lack of conclusive evidence on the topic. Upon conducting a detailed observation of the articles, it was found that the number of patients included in the studies was relatively small. 5,8,12,15-19 Therefore, it is clear that further research, particularly of the longitudinal type, is necessary to gain a better understanding of the relationship between apical periodontitis and cardiovascular pathologies. In other words, to draw more definitive conclusions about the topic, we need to conduct more studies with larger sample sizes and a longer follow-up period.

The topic of endodontic treatments and re-treatments remains a hot topic in the field of dentistry due to the fact that humans live with the oral flora throughout their entire lives. This flora can cause attacks starting from adolescence, and become even more sensitive in the age of geriatrics. As a result, it is important to consider the typology of systemic diseases from which the patient who is undergoing treatment for apical periodontitis is suffering when developing protocols for endodontic treatments and re-treatments. By adapting these protocols to the specific needs of the individual patient, it is possible to ensure that the treatment is effective and safe, regardless of their age or underlying health conditions.

5. Conclusion

The link between endodontic pathologies and cardiac diseases warrants evaluation from the perspective of oral pathogens causing temporary bacteremia in the bloodstream, leading to infective endocarditis and other related conditions. This relationship is better assessed through the types of review studies that focus on oral pathogens rather than the name of the oral pathology. Similarly, the correlation between cardiac pathologies and apical periodontitis is more significant when the patient with cardiac pathologies is examined for the presence or absence of apical periodontitis, as opposed to the reverse. In vivo clinical studies in patients indicate this trend, with fewer studies confirming the opposite correlation. However, inflammatory markers in the blood are insufficient for diagnosing apical periodontitis. Future studies are required to establish the parameters of specific markers of inflammation in the bloodstream and oral endodontic or periodontal indices to draw a more definitive conclusion.

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Conflict of Interest

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