MedNEXT
Journal of Medical an Health Sciences

REVIEW ARTICLE

DOI: 10.54448/mdnt25S304

Major considerations and outcomes of the periodontal diseases and infective endocarditis: a concise systematic review

Lívia Bosquilia Caselli[1*], Raiene Larissa Maim[1], Luana Mello Chinarelo[1], Fábio Pereira Linhares de Castro

[1] UNORTE - University Center of Northern São Paulo, Dentistry department, São José do Rio Preto, São Paulo, Brazil.

*Corresponding author: Lívia Bosquilia Caselli.
UNORTE - University Center of Northern São Paulo, Dentistry department, São José do Rio Preto, São Paulo, Brazil.
E-mail: liviabcaselli@gmail.com
DOI: https://doi.org/10.54448/mdnt25S304
Received: 04-04-2025; Revised: 06-05-2025; Accepted: 06-06-2025; Published: 06-18-2025; MedNEXT-id: e25S304

Editor: Dr. Ramkrishna Kumar Singh, MBBS, MPH, CPH.

Abstract

Introduction: Infective endocarditis (IE) is a bacterial infection of the heart's inner lining. Substantial evidence supports a link between oral health and IE, with the oral microbiome impacting multiple aspects of IE, including pathogenesis, diagnosis, treatment, and mortality rates. **Objective:** It was to conduct a concise systematic review of the major guidelines by the American Heart Association and work related to bacterial resistance in periodontal diseases and infective endocarditis. **Methods:** The PRISMA Platform systematic review rules were followed. The search was carried out from February to March 2025 in the Scopus, PubMed, Science Direct, Scielo, and Google Scholar databases. The quality of the studies was based on the GRADE instrument and the risk of bias was analyzed according to the Cochrane instrument. **Results and Conclusion:** A total of 105 articles were found, and 27 articles were evaluated in full and 14 were included and developed in the present concise systematic review study. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 28 studies with a high risk of bias and 20 studies that did not meet GRADE and AMSTAR-2. Most studies showed homogeneity in their results, with X^2=74.7%>50%. It was concluded that there is a significant association between periodontitis and increased cardiovascular risk, promoting integrated health approaches. Infective endocarditis, although relatively uncommon, is a disease that causes substantial morbidity and mortality. Although advances in diagnosis and treatment have improved antimicrobials, prevention is still an important factor. Protocols for the use of prophylactic antibiotics have been used in medical and dental procedures likely to generate the development of the disease in high-risk patients. Thus, the use of antibiotic prophylaxis is associated with a reduced risk of infective endocarditis after invasive dental procedures.

Keywords: Oral microbiota. Infective endocarditis. Bacterial infection. Oral health. Periodontal diseases.

Introduction

Infective endocarditis (IE) is a bacterial infection of the heart's inner lining. Substantial evidence supports a link between oral health and IE, with the oral microbiome impacting multiple aspects of IE, including pathogenesis, diagnosis, treatment, and mortality rates. The oral microbiota is highly diverse and plays a crucial role in maintaining oral health. However, when dysbiosis occurs, conditions such as periodontal or peri-implant disease can arise. Improvements in the diagnosis, treatment, and prognosis of the disease are needed [1].

Although initially established to define more precisely the cases of IE for epidemiological and clinical studies, the criteria have been widely used over the last decade to help physicians in the diagnosis of IE. The two main components of the criteria are persistent bacteremia arising from typical bacteria IE (*Staphylococcus aureus* and *Streptococcus viridans*) and evidence of heart valve involvement, such as infection, abscess paravalvular regurgitation or signs of risk for IE includes fever, in addition to increased risk for patients with vascular disease, immune-

compromised and intermittent bacterial or fungal infections, according to American Heart Association (AHA) [2].

Based on a concrete diagnosis antibiotic treatment is carried out rationally, while the diagnosis is based only on epidemiological data of certain agents responsible for certain infections. The unnecessary and excessive use of antibiotics promotes the development of bacterial resistance resulting in a serious problem in the treatment of infectious diseases. Endocarditis can be bacterial or fungal, being the rare fungal endocarditis, with a high mortality rate [3-6].

Bacterial endocarditis is a serious infection of the heart valves primarily caused by *Staphylococcus aureus* and *Streptococcus viridans. Streptococcus viridans* is not a common bacterial agent in the population, and endocarditis caused by this agent is rare. This pathogen has also been linked to meningitis, bacteremia, urinary tract infection, and septic arthritis. *S. viridans* is generally sensitive to penicillin, sulfamethoxazole-trimethoprim, and glycopeptides [2,7-9].

Also, IE remains a serious and deadly complication in patients at risk because it causes valvular destruction and congestive heart failure, although not a frequent event. Today, the strains of *Staphylococcus aureus* are held responsible for the higher incidence of infective endocarditis, followed by *Streptococcus viridans* comprising four phylogenetic groups *mitis*, *S. mutans, salivarius,* and *anginosus* group or *milleri*. Some of these bacteria are implicated in oral diseases as caries and periodontitis, which are the most common bacterial infections [2,10].

The main bacterial species associated with the development of caries (cariogenic bacteria) are *Streptococcus mutans* and *Lactobacillus spp*. There are about 100 species of *Lactobacillus* and some of these species live in various parts of our body, for example, the gastrointestinal and female urogenital tract Both *Lactobacillus*, as *S. mutans*, exhibit certain characteristics with high acidic potential genes [2,11,12].

The aim of this study was to conduct a concise systematic review of the major guidelines by the American Heart Association and work related to bacterial resistance in periodontal diseases and infective endocarditis.

Methods

Study Design

This study followed the international systematic review model, following the PRISMA (preferred reporting items for systematic reviews and meta-analysis) rules. Available at: http://www.prisma-statement.org/?AspxAutoDetectCookieSupport=1. Accessed on: 03/11/2025. The AMSTAR-2 (Assessing the methodological quality of systematic reviews) methodological quality standards were also followed. Available at: https://amstar.ca/. Accessed on: 03/11/2025.

Data Sources and Search Strategy

The literature search process was carried out from February to March 2025 and developed based on Scopus, Embase, PubMed, Lilacs, Ebsco, Scielo, and Google Scholar, covering scientific articles from various periods to the present day. The following descriptors (DeCS /MeSH Terms) were used: *"Oral microbiota. Infective endocarditis. Bacterial infection. Oral health. Periodontal diseases"*, and the Boolean expression "and" was used between the MeSH terms and "or" between the historical findings.

Study Quality and Risk of Bias

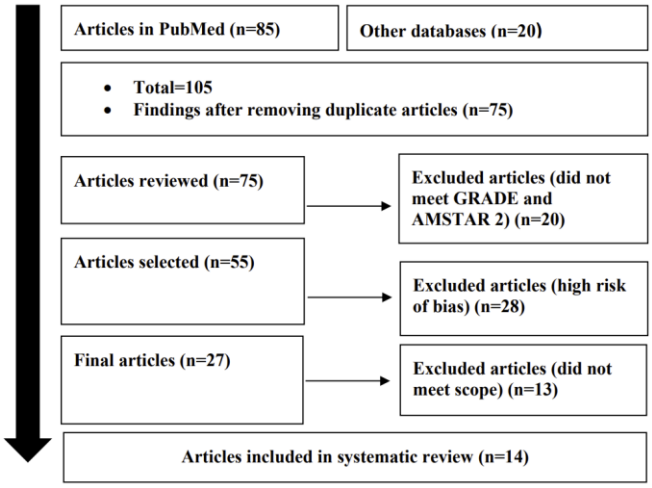
The quality was classified as high, moderate, low, or very low regarding the risk of bias, clarity of comparisons, precision, and consistency of analyses. The most evident emphasis was on systematic review articles or meta-analyses of randomized clinical trials, followed by randomized clinical trials. The low quality of evidence was attributed to case reports, editorials, and brief communications, according to the GRADE instrument. The risk of bias was analyzed according to the Cochrane instrument by analyzing the Funnel Plot graph (Sample size versus Effect size), using Cohen's d test.

Results and Discussion

Summary of Findings

A total of 105 articles were found and submitted to eligibility analysis, with 14 final studies being selected to compose the results of this systematic review. The studies listed were of medium to high quality (Figure 1), considering the level of scientific evidence of studies such as meta-analysis, consensus, randomized clinical, prospective, and observational. Biases did not compromise the scientific basis of the studies. According to the GRADE instrument, most studies presented homogeneity in their results, with X^2=74.7%>50%. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 28 studies with a high risk of bias and 20 studies that did not meet GRADE and AMSTAR-2.

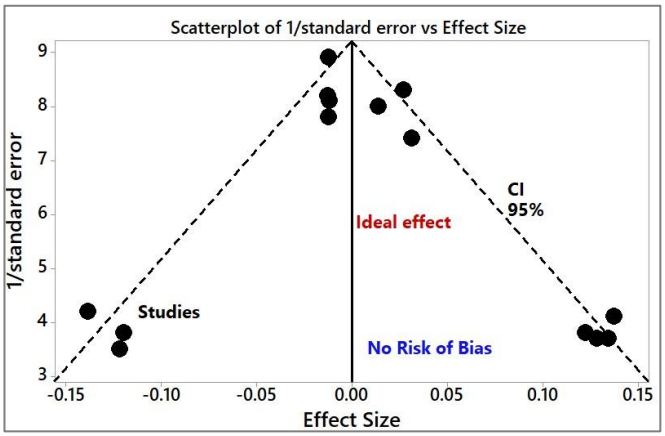
Figure 1. Screening and selection of the article.



Source: Own authorship.

Figure 2 presents the results of the risk of bias of the studies through the Funnel Plot, showing the calculation of the Effect Size (Magnitude of the difference) using Cohen's Test (d). The precision (sample size) was determined indirectly by the inverse of the standard error (1/Standard Error). This graph had a symmetrical behavior, not suggesting a significant risk of bias, either among studies with small sample sizes (lower precision) that are shown at the base of the graph or in studies with large sample sizes that are presented at the top.

Figure 2. The symmetric funnel plot suggests no risk of bias among the small sample size studies shown at the bottom of the graph. High confidence and high recommendation studies are shown above the graph (n=14 studies).



Major Results

Authors Sperotto et al. (2024) [13] performed a meta-analysis study to analyze the association between antibiotic prophylaxis and infective endocarditis after invasive dental procedures. Of 11,217 identified records, 30 were included (1,152,345 cases of infective endocarditis). Of these, 8 (including 12 substudies) were case-control/crossover or cohort studies or self-controlled case series, while 22 were time trend studies; all were of good quality. Eight of the 12 substudies with case-control/crossover, cohort, or self-controlled case series designs performed a formal statistical analysis; 5 corroborated a protective role of antibiotic prophylaxis, especially among high-risk individuals, while 3 did not. Antibiotic prophylaxis was associated with a significantly lower risk of infective endocarditis after invasive dental procedures in high-risk individuals. The use of antibiotic prophylaxis is associated with a reduced risk of infective endocarditis after invasive dental procedures in high-risk individuals.

A study explored the association between periodontitis and cardiovascular disease (CVD) and the impact of periodontal therapy on cardiovascular health. The review identifies a substantial association between periodontitis and an increased risk of several CVD, corroborated by epidemiological and interventional studies. The results suggest the complexity of the relationship, influenced by factors such as the severity of periodontitis and the presence of other systemic conditions. Clinical data indicate that periodontal therapy, particularly nonsurgical periodontal therapy, may reduce systemic inflammatory markers and therefore play a role in the primary and secondary prevention of CVD events. Current evidence supports a significant association between periodontitis and increased cardiovascular risk, promoting integrated health approaches that consider oral health as an essential component of cardiovascular care and well-being [14].

Dentistry has played an important role in the detection and prevention of systemic diseases since many diseases can be caused or oral repercussions. In this practice, significant complications can be prevented or minimized in the appropriate care of patients at risk for endocarditis. In the literature, there is controversy about the occurrence of endocarditis or not originating from dental treatments or even antibiotic prophylaxis efficiency in the prevention of this disease, however, despite these uncertainties, as a preventive measure, the AHA provides a prophylactic protocol for risk patients, which has been followed for the care of these [1-3].

The three generations of infective endocarditis were already inevitable. Studies made possible the improved treatment of the disease with tests, especially echocardiography, even with the infectious process in activity, and recommendations for antibiotics preoperatively. Today is treatable infectious endocarditis. Antibiotics are of great importance in clinical performance, it is necessary to know the dosage of the medicine and ways to use it. Prophylaxis of endocarditis has been widely. In the test and after the incubation period, the reading is performed based on

the specific chromogenic biochemical reactions and after incubation, the minimum inhibitory concentration Reading is performed from the point where it begins inhibiting bacterial growth [2,4,5].

According to work done previously and the guidelines of the AHA, there is only need for antibiotic prescription in dentistry in invasive procedures that involve bleeding and patients with underlying diseases already installed or in use of cardiac valvular prostheses, although endocarditis is not common cases reported show that this condition is severe it may result in morbidity and mortality of patients. For dental procedures involving risks to patients in whom prophylaxis is recommended, the regime has been considered as a single dose of 2g. (or 50 mg/kg in children) of amoxicillin, an additional dose is not necessary. Erythromycin started to not be recommended as an alternative in patients allergic to penicillin but is Clindamycin [2].

The first record of bacterial resistance cases was in the 1940s but is still a current problem and of such importance. Bacterial resistance has been considered a growing problem worldwide in public health and the biggest obstacle to the success of a treatment, as it continues to reduce the number of valid antibiotics available. The resistance on previously susceptible organisms occurs when using antibiotics in human or animal infections [4-7].

The antimicrobial agent alone does not induce resistance, but due to the inappropriate use of a selective pressure occurs more resistant strains among a population. The natural selection of resistant strains has created a competition between technology and microbial evolution. With the rampant use of antimicrobial agents, for decades, resistance appears in viruses, bacteria, fungi, and protozoa, leading to new challenges both for individual treatment and for control programs. However, in immunosuppressed patients, *Staphylococcus aureus* presence can promote the occurrence of infection [8,9].

In general, these microorganisms are aggregates of skin and soft tissue infections and may also cause severe and even fatal diseases. While 37.2% of people have gram-positive cocci in their nasal mucosa infections caused by *S. aureus* small complications may arise, such as osteomyelitis, endocarditis, and pneumonia. Thus, to evaluate bacterial resistance against the antimicrobial possible bacterin risk patients with endocarditis is particularly important because even microorganisms. The irrational use of antimicrobials determined the emergence of multiresistant microorganisms, which boosted the scientific community research in the fields of chemistry, pharmacology, and microbiology for the discovery of new antibiotics [2,10].

The IE has multiple etiologies and may be from an invasive dental treatment since the deployment of cardiac prostheses, and invasive medical procedures in patients with underlying diseases already installed, such as autoimmune diseases, heart disease, and frequent use of antibiotics. Other cardiovascular complications are very prevalent, such as congestive heart failure (20% of patients referred for dialysis have this diagnosis), acute coronary syndrome, heart valve disease (mitral calcification, esclerosaortics, accelerating the degeneration of the bioprosthesis, predisposition to bacterial endocarditis) and arrhythmias [1].

Finally, patients present a suggestive clinical picture of fever, heart murmur appearance, anemia, splenomegaly, petechiae in the skin, conjunctiva, mucous membranes, and vasculitis. AHA I patients the manifestation of IE because of its stabilized systemic health picture is not frequent. Antibiotic prophylaxis in dentistry and recommended in patients with underlying heart disease, when it involves manipulation of tissues, and coronary access AHA seconds [2]. Thus, IE has been 100% fatal for our great-grandparents. Research and clinical observations motivated by concern and collaboration were essential to the progress therapeutic diagnostics in the second half of the twentieth century who gave evidence on the pathogenesis in previous centuries [2].

Conclusion

It was concluded that there is a significant association between periodontitis and increased cardiovascular risk, promoting integrated health approaches. Infective endocarditis, although relatively uncommon, is a disease that causes substantial morbidity and mortality. Although advances in diagnosis and treatment have improved antimicrobials, prevention is still an important factor. Protocols for the use of prophylactic antibiotics have been used in medical and dental procedures likely to generate the development of the disease in high-risk patients. Thus, the use of antibiotic prophylaxis is associated with a reduced risk of infective endocarditis after invasive dental procedures.

CRediT

Author contributions **Conceptualization-** Lívia Bosquilia Caselli, Raiene Larissa Maim, Luana Mello Chinarelo, Fábio Pereira Linhares de Castro; **Formal Analysis-** Lívia Bosquilia Caselli, Raiene Larissa Maim, Luana Mello Chinarelo; **Investigation-** Lívia Bosquilia Caselli, Raiene Larissa Maim, Luana Mello Chinarelo, Fábio Pereira Linhares de Castro**; Methodology-** Lívia Bosquilia Caselli, Raiene Larissa Maim, Luana Mello

Chinarelo; **Project administration-** Lívia Bosquilia Caselli, Raiene Larissa Maim, Luana Mello Chinarelo; **Supervision-** Fábio Pereira Linhares de Castro; **Writing - original draft-** Lívia Bosquilia Caselli, Raiene Larissa Maim, Luana Mello Chinarelo, Fábio Pereira Linhares de Castro; **Writing-review & editing-** Lívia Bosquilia Caselli, Raiene Larissa Maim, Luana Mello Chinarelo, Fábio Pereira Linhares de Castro.

Acknowledgment
Not applicable.

Ethical Approval
Not applicable.

Informed Consent
Not applicable.

Funding
Not applicable.

Data Sharing Statement
No additional data are available.

Conflict of Interest
The authors declare no conflict of interest.

Similarity Check
It was applied by Ithenticate®.

Application of Artificial Intelligence (AI)
Not applicable.

Peer Review Process
It was performed.

References
1. Falconer JL, Rajani R, Androshchuk V, Yogarajah A, Greenbury RA, Ismail A, Oh N, Nibali L, D'Agostino EM, Sousa V. Exploring links between oral health and infective endocarditis. Front Oral Health. 2024 Dec 2;5:1426903. doi: 10.3389/froh.2024.1426903.
2. American Heart Association – AHA. Infective endocarditis. Available on: https://www.heart.org/en/health-topics/infective-endocarditis. Accessed on: 03/11/2025.
3. Rajani R, Klein JL. Infective endocarditis: A contemporary update. Clin Med (Lond). 2020 Jan;20(1):31-35. doi: 10.7861/clinmed.cme.20.1.1.
4. Li M, Kim JB, Sastry BKS, Chen M. Infective endocarditis. Lancet. 2024 Jul 27;404(10450):377-392. doi: 10.1016/S0140-6736(24)01098-5.
5. Khaledi M, Sameni F, Afkhami H, Hemmati J, Asareh Zadegan Dezfuli A, Sanae MJ, Validi M. Infective endocarditis by HACEK: a review. J Cardiothorac Surg. 2022 Aug 19;17(1):185. doi: 10.1186/s13019-022-01932-5.
6. Hubers SA, DeSimone DC, Gersh BJ, Anavekar NS. Infective Endocarditis: A Contemporary Review. Mayo Clin Proc. 2020 May;95(5):982-997. doi: 10.1016/j.mayocp.2019.12.008.
7. Mulliken JS, Bainbridge ED. Infective Endocarditis. Med Clin North Am. 2025 May;109(3):667-681. doi: 10.1016/j.mcna.2024.12.009.
8. Cahill TJ, Harrison JL, Jewell P, Onakpoya I, Chambers JB, Dayer M, Lockhart P, Roberts N, Shanson D, Thornhill M, Heneghan CJ, Prendergast BD. Antibiotic prophylaxis for infective endocarditis: a systematic review and meta-analysis. Heart. 2017 Jun;103(12):937-944. doi: 10.1136/heartjnl-2015-309102.
9. Thornhill MH, Gibson TB, Yoon F, Dayer MJ, Prendergast BD, Lockhart PB, O'Gara PT, Baddour LM. Antibiotic Prophylaxis Against Infective Endocarditis Before Invasive Dental Procedures. J Am Coll Cardiol. 2022 Sep 13;80(11):1029-1041. doi: 10.1016/j.jacc.2022.06.030.
10. Wang H, Yu X, Guo J, Ma S, Liu Y, Hu Y, Li J, Song Y, Zou Z. Burden of cardiovascular disease among the Western Pacific region and its association with human resources for health, 1990-2021: a systematic analysis of the Global Burden of Disease Study 2021. Lancet Reg Health West Pac. 2024 Sep 3;51:101195. doi: 10.1016/j.lanwpc.2024.101195.
11. Saraç F, Öztürk S, Abuawwad T, Çelikel P, Erdem F, Derelioğlu SŞ. The relationship between severity of periapical periodontitis and next-generation systemic inflammatory biomarkers in children with early childhood caries. BMC Oral Health. 2024 Sep 9;24(1):1056. doi: 10.1186/s12903-024-04842-1.
12. Bereckis J, Rowan S, Hanna D, Narvekar A, Koerber A. Assessing Variances in Dentist's

Interpretations of Antibiotic Prophylaxis Guidelines: A Survey of Dental School Faculty. Int J Dent. 2025 Jan 29;2025:9355907. doi: 10.1155/ijod/9355907.

13. Sperotto F, France K, Gobbo M, Bindakhil M, Pimolbutr K, Holmes H, Monteiro L, Graham L, Hong CHL, Sollecito TP, Lodi G, Lockhart PB, Thornhill M, Diz Dios P, Turati F, Edefonti V. Antibiotic Prophylaxis and Infective Endocarditis Incidence Following Invasive Dental Procedures: A Systematic Review and Meta-Analysis. JAMA Cardiol. 2024 Jul 1;9(7):599-610. doi: 10.1001/jamacardio.2024.0873.
14. Bertoldi C, Salvatori R, Pinti M, Mattioli AV. Could the periodontal therapy improve the cardiologic patient health? A narrative review. Curr Probl Cardiol. 2024 Sep;49(9):102699. doi: 10.1016/j.cpcardiol.2024.102699.