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SYSTEMATIC REVIEW

Systemic Comorbidities and Apical Periodontitis: Influence on Endodontic Treatment Outcomes

Comorbilidades sistémicas y periodontitis apical: Influencia en los resultados del tratamiento endodóntico

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ABSTRACT

Introduction: Systemic diseases are those that affect various parts of the body and do not allow successful treatment or repair due to the involvement of the immune system. At the oral level, these diseases manifest signs and symptoms, which, combined with the deficiency in defense mechanisms and alterations in the healing processes, directly influence the effectiveness of treatments aimed at addressing endodontic pathologies. Objective: To analyze the association between apical periodontitis and various systemic diseases, as well as to evaluate its impact on the quality of life of patients. Materials and methods: Documentary approach research, cross-sectional and retrospective type, descriptive-analytical design, and deductive method; following inclusion and exclusion criteria, 35 articles were included from 2016 to 2024. The information was obtained from databases such as PubMed, Google Scholar, Science, Elsevier, and Dialnet. Through PICO analysis, the keywords were obtained, Mesh and DeCS search terms were added. Results: All systemic diseases analyzed in this study can interfere with the repair process of periapical tissues after conventional root canal treatment. Conclusions: The systemic health of patients can affect favorable results in the treatment of endodontic infections, hence the importance of knowledge for the management of each disease and to promote preventive measures in the patient's oral health.
Keywords: Systemic diseases. Apical periodontitis. Diabetes. Endodontics.

RESUMEN

Introducción: Las enfermedades sistémicas son aquellas que afectan diversas partes del cuerpo y no permiten la reparación exitosa del tratamiento debido a la afectación del sistema inmunológico. A nivel bucal, estas enfermedades manifiestan signos y síntomas, los cuales, combinados con la deficiencia en los mecanismos de defensa de los pacientes y alteraciones en los procesos de cicatrización, influyen directamente en la eficacia de los tratamientos dirigidos a abordar las patologías endodónticas. Objetivo: Analizar la asociación entre la periodontitis apical y diversas enfermedades sistémicas, así como evaluar su afectación a la calidad de vida de los pacientes. Materiales y métodos: Investigación enfoque documental, tipo transversal y retrospectivo, diseño descriptivo-analítico y método deductivo; siguiendo criterios de inclusión y exclusión se incluyeron 35 artículos desde el año 2016 a 2024. La obtención de información se seleccionó de bases de datos como PubMED, Google Académico, Science, Elsevier y Dialnet. A través del análisis PICO, se obtuvieron las palabras clave, se agregaron términos de búsqueda de Mesh y DECS. Resultados: Todas las enfermedades sistémicas analizadas en este estudio pueden interferir en el proceso de reparación de los tejidos periapicales después del tratamiento de conducto convencional. Conclusiones: La salud sistémica de los pacientes pueden llegar afectar resultados favorables al tratamiento de infecciones endodónticas por ende la importancia del conocimiento para el manejo de cada enfermedad e impulsar a medidas preventivos en la salud bucal del paciente.
Palabras clave: Enfermedades sistémicas. Periodontitis apical. Diabetes. Endodoncia.

INTRODUCTION

Apical periodontitis (AP) is a multifactorial inflammatory disease of bacterial origin. It is characterized by microorganisms present within the root canal. If left untreated, AP may cause radicular bone resorption, cyst formation, granulomas, or periapical lesions. These consequences can compromise the prognosis of endodontic treatment.[1–2]

Apical periodontitis not only affects the tissues surrounding the tooth but may also contribute to systemic alterations, as bacteria, endotoxins, and inflammatory mediators can disseminate from the root canal into the bloodstream.[3] This phenomenon promotes the activation of systemic immune responses that negatively impact the body, exacerbating diseases such as diabetes mellitus, cardiovascular diseases, and rheumatoid arthritis, as well as associated factors such as smoking and alcohol consumption.[4] This process of microbial dissemination from the dental infection focus to other body systems promotes a systemic inflammatory state, which may aggravate or predispose individuals to these diseases.[5–7]

Systemic disorders and oral infections share several risk factors.[8] This interrelationship may influence the prognosis of endodontic treatment.[9] Although inflammation is a defense mechanism of the body, the continuous release of inflammatory mediators may exacerbate preexisting inflammatory processes.[10] Furthermore, there is a relevant connection between autoimmune diseases and endodontic disease, as both share pathogenic mechanisms mediated by microbial elements that promote bone loss.[11–13]

Among systemic diseases, there is an association between apical periodontitis (AP) and diabetes mellitus (DM); both conditions may interact with each other.[14] AP is a chronic infection affecting the apical region of the tooth and surrounding tissues, caused by various bacteria.[15] Meanwhile, individuals with diabetes exhibit an altered innate immune response, which is associated with endodontic disease.

On the other hand, the association between apical periodontitis (AP) and rheumatoid arthritis (RA) involves chronic inflammatory diseases that share pathogenic mechanisms and may exert mutual influence. [16]

The association between smoking and apical periodontitis is crucial, as smoking significantly increases the risk and severity of injury.[17] Smokers often present a compromised immune response, facilitating the progression of bacterial infections and reducing the effectiveness of endodontic treatments. [18]

Furthermore, the association between alcoholism and apical periodontitis (AP) is significant. Chronic alcohol consumption aggravates inflammation and periapical lesions, altering the oral microbiota and promoting the proliferation of pathogens that contribute to AP.[19] According to epidemiological literature reviews, the association between apical periodontitis and various systemic diseases has received increasing attention in recent years. It is estimated that up to 52% of the global population may be affected by this chronic inflammatory condition. [20]

In patients with diabetes mellitus, studies have shown that between 39% and 56% present significant involvement. [21] Similarly, among those with rheumatoid arthritis, 47.9% show a direct relationship with this pathology. [22] in individuals with cardiovascular disease, the incidence reaches 42.6%, demonstrating a relevant association with chronic inflammation. [23]

Studies revealed that approximately 75.7% of smoking patients presented apical periodontitis.[24] Research has found that up to 57% of patients with periodontal health problems were regular alcohol consumers.[25] Scientific data indicate that approximately 35–40% of hypertensive patients present periodontitis, and this relationship may influence the development or persistence of AP, although additional studies are needed to determine this percentage specifically in AP cases.[26]

Systemic diseases may compromise the outcome of endodontic treatment, as they can increase the risk of infections, delay recovery, modify the inflammatory response, and affect coagulation processes. Likewise, endodontic conditions may impact systemic health status. [27]

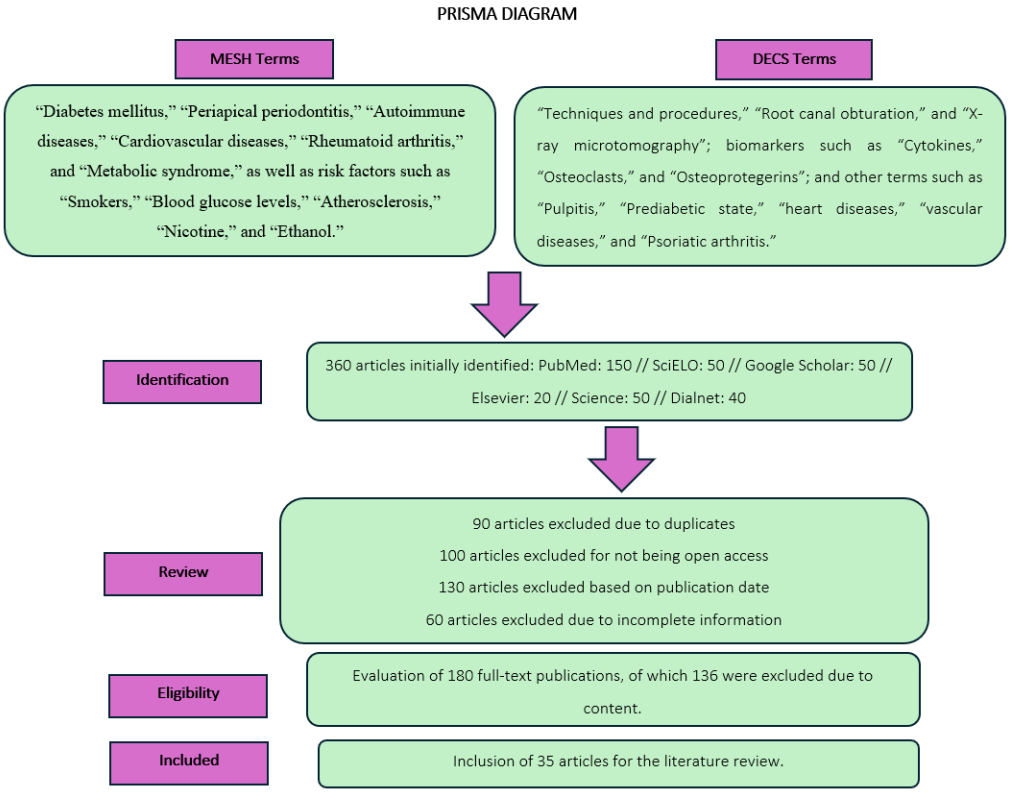
The purpose of this research is to analyze the association between apical periodontitis and various systemic diseases, as well as to evaluate their impact on patients' quality of life.

MATERIALS AND METHODS

The present research work employed a documentary, cross-sectional, and retrospective methodology, with a descriptive-analytical design and a deductive method. The PRISMA flowchart was used for the search, review, analysis, and selection of articles. A total of 560 articles were initially identified; following the inclusion and exclusion criteria, 44 articles with significant contributions to the research were selected.

The search for articles related to the research topic was conducted using the PICO analysis to determine keywords from PubMed and DeCS, using various information sources, including specialized scientific literature search engines and databases such as PubMed, Google Scholar, Science, Elsevier, and Dialnet. Meta-analyses, systematic reviews, literature reviews, case reports, and randomized clinical trials were included.

Figure 1. Diagram of the article selection process. PRISMA analysis.



The inclusion criteria considered were full-text publications in English, Spanish, and Portuguese; articles mentioning the relationship between systemic diseases and apical periodontitis; analyses describing the relationship between systemic diseases and endodontics; and studies determining the success and failure of endodontic treatments in patients with systemic diseases. For this review, gray literature, studies addressing the topic in a general manner, duplicate articles, limited-access articles, and incomplete information were excluded.
The following variables were analyzed: diabetes, cardiovascular diseases, rheumatoid arthritis, smoking patients, and patients with alcoholism.

RESULTS

Table 1. Systemic Diseases and Apical Periodontitis

Author	Characteristics	Relevant Factors
Segura-Egea J et al., 2023[1]	Systemic diseases – Apical periodontitis	Influences the clinical outcomes of root canal treatment.
Tiburcio-Machado M et al., 2021[2]		Tissue healing and regeneration.
Ambreen-Niazi; Aziz-B et al., 2022[3]		Immunological and microbiological aspects.
Segura-Cabanillas G et al., 2023[4]		Inflammatory mediators and metabolic alterations.

Table 2. Association Between Diabetes and Apical Periodontitis

Author	Characteristics	Relevant Factors
Yip et al., 2021[5]	Diabetes Mellitus – Apical periodontitis	Elevated glucose levels negatively affect the effectiveness of endodontic treatment.
Segura-Egea et al., 2022[6]	Root canal treatment in patients with DM and AP	DM reduces success rates in endodontic treatment due to metabolic complications.
Ríos-Muñoz A et al., 2020[7]	Pulpal and periapical pathology	The progression of endodontic pathologies is more complex in patients with DM due to systemic alterations.
Shengming Wang S et al., 2023[8]	Clinical evaluation of endodontic treatment in patients with DM	Endodontic treatment may have a positive effect on glycemic control in patients with DM and AP.
Pinto-Alves M et al., 2023[9]	Bacterial resistance in patients with DM	Immunological and microbiological factors hinder the response in patients with AP.
Smadi Uinm L, 2017[10]	Comparison of AP prevalence in diabetics vs. non-diabetics	DM increases the prevalence of AP and affects periapical health.
Khalighinejad-Navid M et al., 2016[11]	Association between DM and periapical healing	Host-modifying factors associated with diabetes.

Table 3. Association Between Rheumatoid Arthritis and Apical Periodontitis

Author	Characteristics	Relevant Factors
Ertuğrul Karatas T et al., 2020[12]	Relationship between Rheumatoid Arthritis and Apical Periodontitis	RA increases risk and accelerates apical destruction due to inflammation.
Ertuğrul Karata et al., 2023[13]		RA makes patients more prone to AP.
Yilmaz M; Fatma T, 2023[14]	RA and ankylosing spondylitis in periapical lesions	RA and AS are associated with a higher frequency of radiopaque and mixed lesions.
Marwa Allihaibi S et al., 2023[15]	Prevalence of AP in RA	RA increases the prevalence of AP in autoimmune patients.
Huili Wu L et al., 2024[16]	Genetic relationship between RA and AP	Shared genetic factors between RA and AP contribute to tissue damage.

Table 4. Association Between Cardiovascular Diseases and Apical Periodontitis

Author	Methods Analyzed	Relevant Factors
Sharvi Arora; Rohit K, 2024[17]	Cardiovascular disease and apical periodontitis	Inflammation and risk factors induce AP, affecting CVD.
González B et al., 2020[18]		Oral inflammatory burden and metabolic syndrome increase CVD risk.
Jakovljevic A et al., 2020[19]		AP bacteria may enter the bloodstream and contribute to CVD.
Virtanen E et al., 2017[22]		AP is linked to a higher risk of CVD.
Giuliat Mal V et al., 2023[20]	AP and atherosclerotic cardiovascular disease	AP is associated with secondary outcomes in atherosclerotic CVD.
Saimir H et al., 2024[21]	AP and arteriosclerosis	AP and periodontal diseases are risk factors for arteriosclerosis progression in CVD.

Table 5. Association Between Smoking Patients and Apical Periodontitis

Author	Characteristics	Relevant Factors
Janardhana A et al., 2019[23]	Bone destruction in smoking patients with AP	Smokers present greater bone destruction in AP.
Paljevic E et al., 2023[24]	Smoking and AP healing	Lower effectiveness of endodontic treatment in smokers.
Rane E et al., 2021[25]	Impact of smoking on the apical region	Smokers experience apical complications despite treatment.
Ríos N et al., 2022[26]	Smoking and post-endodontic AP	Greater development of post-endodontic apical complications in smokers.
Shetty K et al., 2021[27]	Pain perception in smokers vs. non-smokers with AP	Smokers report greater pain during treatment.
Waleed O, 2023[28]	Smoking and delayed AP healing	Severe smoking delays AP healing.
Pinto K et al., 2020[29]	Smoking and endodontic treatment	Impacts endodontic planning and prognosis.

Table 6. Association Between Alcohol and Apical Periodontitis

Author	Methods Analyzed	Relevant Factors
Custódio dos Santos V et al., 2023[30]	Alcohol and AP	Periapical lesions are more common in patients with poor dental health and systemic diseases.
Freitas C et al., 2020[31]	Effect of alcohol on bone destruction	Increased periapical bone destruction evaluated with micro-CT.
Pinto P et al., 2023[32]	Combined effect of alcohol and nicotine	Chronic alcohol and nicotine consumption exacerbates inflammation, bone destruction, and elevated pro-inflammatory cytokine levels.
Marques F et al., 2019[34]	Impact of chronic alcohol consumption	Increased osteoclastogenesis and inflammation in AP due to alcohol.
Fabbro R et al., 2019[35]	Alcohol concentration and AP development	High alcohol levels aggravate inflammation and bone destruction.
Fabbro L et al., 2021[36]	Effect of red wine and its polyphenols	Polyphenols show protective effects, reducing inflammation and bone resorption.

ANALYSIS AND DISCUSSION OF RESULTS

Systemic diseases have a considerable influence on the clinical, immunological, and microbiological outcomes of apical periodontitis. [1] The interaction between inflammatory mediators and metabolic alterations complicates root canal repair[2–3] due to their significant impact on tissue healing and regeneration. [4]

Diabetes Mellitus adversely affects endodontic treatment and periapical healing processes due to elevated glucose levels and chronic hyperglycemia, which alter the immune response.[5–6] Systemic alterations complicate the progression of periapical pathologies.[7] However, endodontic treatment may contribute to improved metabolic control in diabetic patients, demonstrating a bidirectional relationship between both conditions.[8] DM is associated with a higher prevalence of periapical lesions and difficulty in periapical healing compared to non-diabetic patients.[9–10] Early recognition of the systemic disease is essential for interdisciplinary management and the achievement of comprehensive patient improvement.[11]

Rheumatoid Arthritis (RA) is associated with a higher prevalence of periapical lesions due to chronic inflammation and altered immune response that characterize this disease.[12–13] RA and ankylosing spondylitis (AS) are linked to a greater frequency of periapical lesions.[14] Both diseases may present an inflammatory response that affects not only periodontal tissues.[15] The presence of periodontal bacteria, such as *Porphyromonas gingivalis*, has been implicated in the pathogenesis of RA, suggesting a bidirectional connection between oral infections and systemic autoimmune diseases.[16]

Cardiovascular Disease (CVD) is associated with a higher risk of AP due to inflammation and disease-induced risk factors.[17] Oral inflammatory burden and bacterial dissemination into the bloodstream may contribute to cardiovascular risk.[18–19] However, this relationship may be influenced by multiple factors such as age, smoking, diet, body composition, cholesterol levels, family history of CVD, and socioeconomic factors.[20] Tooth loss has been used as a direct indicator of poor oral health and potential cardiovascular risk.[21] Finally, it is suggested that

successful endodontic treatment could contribute to reducing systemic inflammatory burden, thereby potentially decreasing disease progression.[22]

Smoking is a risk factor associated with a higher prevalence and persistence of AP, characterized by greater bone destruction in the periapical region[23] and lower success rates of endodontic treatment.[24–26] Smoking patients experience more pain during endodontic procedures and have increased post-endodontic complications;[27] therefore, they present a higher risk of delayed AP healing.[28] Smoking is considered a relevant factor in treatment planning and in the evaluation of endodontic clinical prognosis.[28–29]

Alcohol consumption is associated with a higher risk of prevalence and severity of AP, characterized by increased periapical bone destruction. An increase in periapical bone destruction evaluated by micro-CT has also been reported.[30–31] Chronic alcohol consumption, especially in combination with nicotine, exacerbates periapical inflammation, promotes osteoclastogenesis, and increases pro-inflammatory cytokine levels.[32–33] High alcohol levels aggravate inflammation in AP and delay periapical bone repair.[34] On the other hand, studies suggest that red wine polyphenols may also exert modulatory effects on inflammation and bone resorption.[35]

CONCLUSIONS

Apical periodontitis is influenced by various systemic diseases, such as diabetes mellitus, rheumatoid arthritis, and cardiovascular disease, which affect immune response, healing, and tissue regeneration. Additionally, factors such as smoking and alcohol consumption worsen the disease by increasing bone destruction and delaying healing. Therefore, it is essential to consider patients' systemic health to ensure the success of endodontic treatment and prevent complications.

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AUTHOR CONTRIBUTIONS

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CONFLICTS OF INTEREST

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