



Prevalence of Periodontitis in Patients with Ischemic Heart Diseases

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Abstract

Background: Periodontitis is currently the main cause of the loss of dental units, thus having a strong impact on the quality of individuals' life. Cardiovascular disease and periodontitis have a diverse range of etiological factors and common risk factors. The correlation between periodontal disease and various systemic conditions, including cerebrovascular disease, heart disease and atherosclerosis, is now recognized. Furthermore, periodontitis is considered to be the most common oral disease in the adult population.

Aim of the Study: The aim of this clinical research was to assess the prevalence of periodontal disease in adults suffering from ischemic heart disease and to evaluate the association between the two pathologies.

Material and Methods: Thirty adult patients from "Niculae Stăncioiu" Heart Institute of Cluj-Napoca, Romania, diagnosed with ischemic heart disease were included in the study. Data were collected by using three methods: consulting the patients' medical records, applying a questionnaire about their oral status and habits, and a clinical evaluation of their periodontal status. For each patient included in the study a periodontal chart was made.

Results: The prevalence of periodontal disease was increased in patients with ischemic heart disease (60%). Most of the patients presenting periodontitis included in the study showed inadequate oral hygiene during the clinical examination. The incidence of unsatisfactory oral hygiene was higher in patients with periodontal disease compared to those with clinical periodontal health. An increase in gingival inflammation was observed with decreasing tooth brushing frequency.

Conclusion: Patients with ischemic heart diseases had a high prevalence of periodontitis. Most of the participants included in the study who had poor hygiene presented an increased bleeding index.

Keywords: Periodontitis; Ischemic Heart Disease; Prevalence; Oral Hygiene; Gingival Bleeding Index

Abbreviations: CAL: Clinical Attachment Loss; IL-1: Interleukin-1; IL-6: Interleukin-6; TNF- α : Tumor Necrosis Factor Alpha; CPR: C-Reactive Protein; ESR: Erythrocyte Sedimentation Rate; GBI: Gingival Bleeding Index; STEMI: St-Elevated Myocardial Infarction; NSTEMI: Non-St-Elevated Myocardial Infarction

Introduction

Periodontal disease or periodontitis is a chronic inflammatory disease, which affects the structures supporting the tooth, leading to bone loss and connective tissue attachment loss. Clinically, it involves clinical attachment loss (CAL) and symptoms like periodontal pockets, gingival recession, tooth mobility or pain. Periodontal disease has its main etiological factor as the presence of pathogenic microorganisms. Thus, periodontitis develops as a result of pre-existing gingivitis [1].

Nowadays, periodontal disease represents the main cause of tooth loss, having a significant impact on the quality of a patient's life, affecting mastication, nutrition, esthetics, or oneself confidence. In 2016, according to the Global Burden of Disease Study, periodontitis was the 11th most prevalent condition worldwide [2]. Moreover, studies show that 64% of the adult population over 65 has moderate or severe forms of periodontal damage [3]. In 2015 the prevalence of periodontal

disease was reported to be 7.4% worldwide [4]. In this context, epidemiological data on the prevalence of periodontal disease in patients with ischemic heart diseases could guide practitioners towards a better understanding of the need for dental treatment among the cardiac population.

Cardiovascular disease is one of the most common causes of death among the adult population. It is estimated that 1 in 3 men in the United States will develop a cardiovascular disease by age 60, while among women the probability is 1:10 [5]. Furthermore, according to a 2015 study, cardiovascular diseases affected approximately 422.7 million people worldwide, being responsible for approximately 17.9 million deaths, and it is estimated that by the year 2030, cardiovascular diseases will be responsible for 23.6 million deaths annually [6].

Most cardiovascular diseases are based on changes caused by anoxic and metabolic disorders at the myocardium level. The causes of these disorders are diverse, in approximately 80% of cases due to coronary atherosclerosis.

Both conditions, periodontitis, and ischemic heart disease, have an increased prevalence among the population and a significant impact on the health and quality of the life of individuals. In Europe, cardiovascular diseases are responsible for 3.9 million deaths (45% of deaths), and severe periodontitis affects around 11.2% of the world's population [7]. Moreover, recent studies suggest an association between periodontitis and systemic pathologies such as cardiovascular disease. Individuals with periodontitis were found to have a 19% higher risk of experiencing a cardiovascular or cerebrovascular event, with this risk being even higher (44%) among people under the age of 65 [8].

It has been found that there is scientific evidence to support an association between the two conditions, both of which share common pathogenetic mechanisms as well as several common risk factors. However, now there is limited scientific data to categorize cardiovascular diseases as a risk factor for the onset or progression of periodontal disease [7]. In order to be able to analyze the correlation between the two entities, it should be noted that periodontal disease and cardiovascular diseases have several common characteristics, both being multifactorial inflammatory diseases, with common risk factors such as: advanced age, obesity, smoking, type 2 diabetes, or socio-economic status [8,9]. Moreover, periodontal pathogens could be isolated from atheromatous plaques. For example, periodontopathogenic bacteria such as *P. gingivalis* or *A. actinomycetemcomitans* have been detected in carotid atheromas [10].

On the other hand, pro-inflammatory cytokines, and chemokines (IL-1, IL-6, TNF- α) are produced and released from the destroyed periodontium, which stimulates the liver production of proteins (C-reactive protein, fibrinogen, etc.) [9]. Thus,

periodontal pathogens induce an acute phase systemic response, which will lead to increased serum C-reactive protein (CRP) levels. CRP, an inflammatory marker found in both periodontitis and atherosclerosis, is a protein produced by the liver as part of the immune response [9]. This, together with fibrinogen, stimulates coagulability [9].

The aim of this clinical study was to assess the prevalence of periodontal disease in adults suffering from ischemic heart disease and evaluate the association between the two pathologies.

Materials and Methods

This clinical study was conducted at "Niculae Stăncioiu" Heart Institute, Cluj-Napoca, between May and June 2022, involving 30 adult patients diagnosed with ischemic heart disease, who signed the informed consent. The study was approved by the Ethics Committee of "Iuliu Hațieganu" University of Medicine and Pharmacy Cluj-Napoca (No. 19/9.11.2021) and the Ethics Committee of "Niculae Stăncioiu" Heart Institute (No. 12839/13.12.2021).

In the study, the patients' medical records were consulted to determine their cardiovascular diagnosis, leukocyte count, ESR, fibrinogen and CPR values, as well as recording their medical history and medical status. Only the medical staff had access to the patients' medical records, and the patients' data was anonymized. The values of the following parameters were analyzed in each patient: leukocytes, ESR, fibrinogen, CRP, and blood glucose. The values were compared with the reference values (normal values) of the Medical Analysis Laboratory from the "Niculae Stăncioiu" Heart Institute.

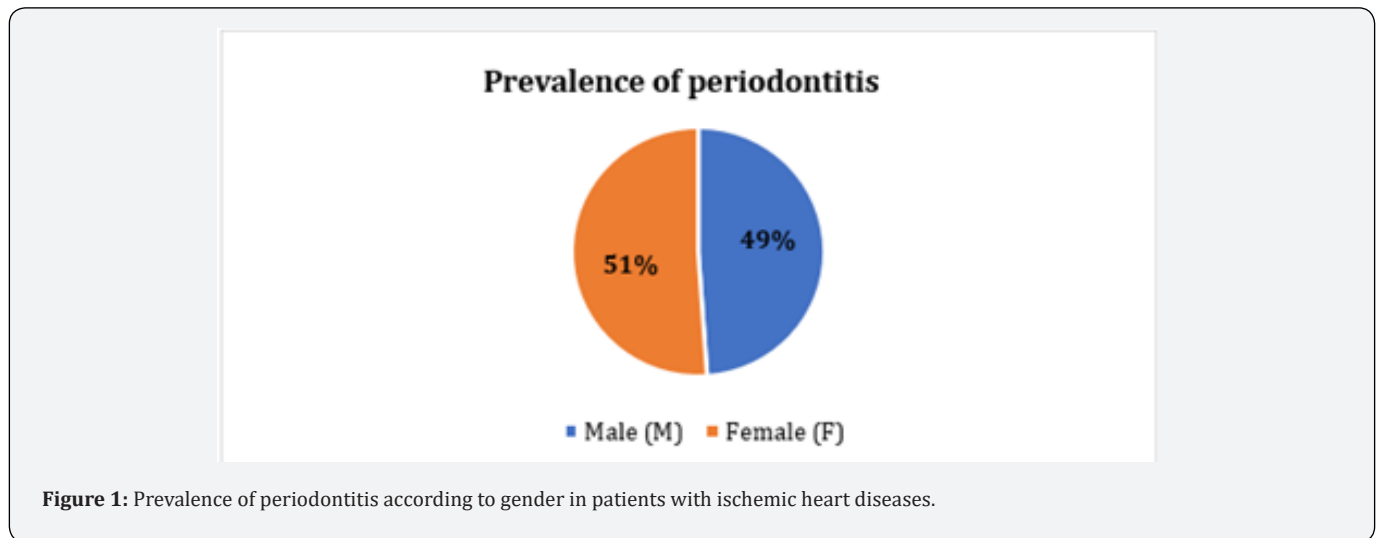
During the evaluation, each patient had to answer a questionnaire about their oral status. Patients were asked about their oral hygiene habits such as frequency of brushing their teeth or the use of dental floss, mouthwash, or oral irrigator. Moreover, each participant included in the study had to specify the last time they went to the dentist, as well as the frequency of smoking and alcohol consumption. In the last part of the questionnaire, the participants had to answer questions regarding their periodontal status: the existence or not of a previous diagnosis of periodontal disease, the hereditary-collateral history of periodontal disease, the existence of the sensation of tooth mobility and the presence of bleeding during tooth brushing.

For each patient an intraoral examination was conducted, followed by completing a periodontal chart. The examination included the evaluation of oral hygiene, gingival health, the presence or absence of tooth migrations, tooth loss and tooth mobility, and probing. In the present study, the bleeding on probing was determined to highlight gingival inflammation. To quantify gingival bleeding, the "gingival bleeding index" (GBI) was calculated. For probing a UNC-15 probe developed by the University of North Carolina was used. The diagnosis of

periodontitis was based on two main elements: the presence of gingival inflammation and clinical attachment loss. Furthermore, for a patient to be classified as a patient with periodontitis, two conditions had to be accomplished: proximal attachment loss had to be detectable in two or more non-adjacent teeth and there had to be a greater clinical vestibular or oral attachment loss or equal to 3 mm, with the presence of periodontal pockets greater than 3 mm in two or more dental units, in accordance with the Classification of Periodontal and Peri-Implant Diseases and Conditions developed by the American Academy of Periodontology (AAP) and the European Federation of Periodontology (EFP) [11].

The data collected through the questionnaire, the patient's medical record and the clinical examination were centralized in a table created in the Microsoft Excel program. The results were processed statistically, using the calculation formulas from the Excel program, and the related diagrams were created with the help of the same program. Data analysis was conducted using GraphPad Prism 5 (GraphPad Software, San Diego, CA, USA). The t test was used to compare the values of the parameters between the two study groups. The statistical significance was considered for p-value less than 0.05.

Results and Discussion



Data were collected from a number of 30 patients diagnosed with various forms of ischemic heart diseases, of which 17 men (56.66%) and 13 women (43.33%). Patients ranged in age from 37 to 80 years, with a mean age of 64.4 years.

From the sample of 30 patients, the presence of the following ischemic cardiovascular pathologies could be observed: chronic myocardial infarction (6 cases), STEMI (17 cases), NSTEMI (1 case), unstable angina (5 cases), bivascular coronary disease (2 cases), multivesicular coronary disease (2 cases), and acute coronary syndrome (1 case). It should be noted that multiple ischemic heart conditions could be observed in the same patient. Of the group of 30 patients included in the study, 18 had periodontitis, the prevalence of periodontal disease being 60%. In terms of gender distribution, the prevalence of periodontitis among women (51%) was higher than that among men (49%) (Figure 1). Current expert data show differences in the prevalence of periodontal disease, with the prevalence of periodontitis varying between 20 and 50% [3]. However, due to the small sample size of patients included in the study (30 patients), future observational studies could provide a better representation of the frequency of periodontal pathology in patients diagnosed with ischemic heart diseases.

Of the total cases of patients with periodontitis and ischemic heart disease, 38.88% reported smoking, and 38.88% consuming alcohol (occasionally or frequently). The average number of cigarettes smoked per day by them was about 17 cigarettes. In the group of patients with ischemic heart disease, but without periodontal disease, the frequency of smoking was 41.66%. Although smoking is considered a risk factor for developing periodontitis, in our study the percentage of smokers was lower in the group of patients presenting both periodontitis and ischemic heart disease than in the group of patients without periodontitis.

The present study showed increased values of both CRP and fibrinogen in most patients with cardiovascular involvement and periodontal disease. A percentage of 72% patients with periodontitis presented increased values of CRP, while a lower percentage (50%) of patients without periodontal disease had CRP levels above normal values. Most patients with periodontitis showed an increase in fibrinogen levels (88.88%). Among patients without periodontal disease, 66.66% of them had elevated fibrinogen values. However, there were no statistically significant differences between the two groups (patients with and without periodontitis), in any of the compared parameters (CRP, Fibrinogen, ESR and Leukocytes) (Figure 2).

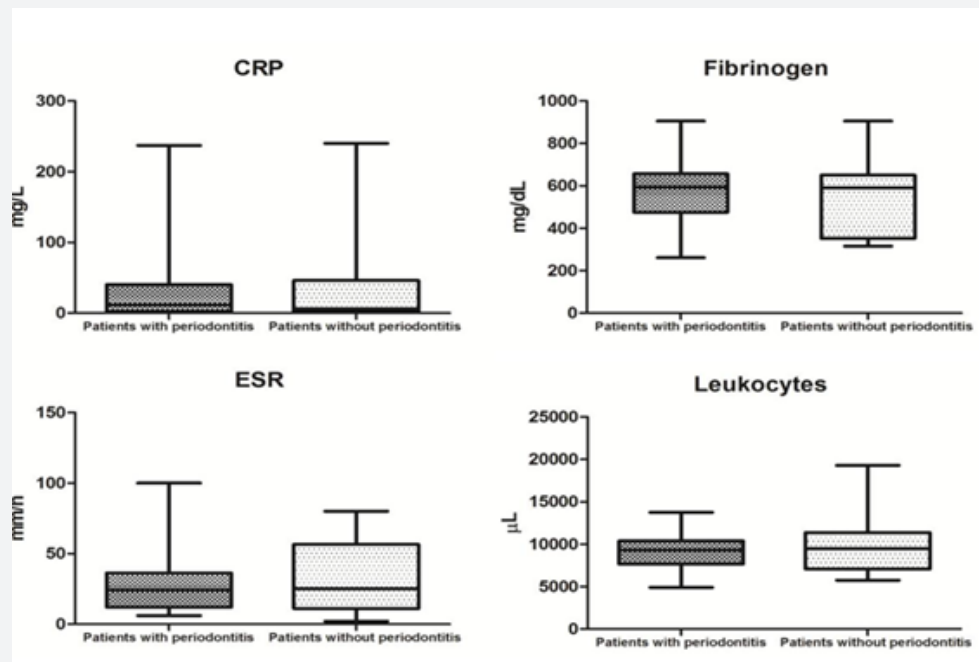


Figure 2: CRP, Fibrinogen, ESR and Leukocytes levels.

CRP and fibrinogen are markers of acute inflammation, which stimulate coagulability. An interventional study showed high levels of CRP in patients infected with periodontal pathogens [8]. Also, other research has associated the treatment of periodontal pocket patients with scaling and root planning as being associated with lower CRP levels one year after therapy [8]. However, further studies are needed to determine whether there is a higher frequency of increased fibrinogen and CRP in patients presenting both periodontal disease and ischemic heart disease. Such data could provide the establishment of a clearer prognosis in this category of patients and the premises for the implementation of specific prophylaxis and treatment programs.

The majority of patients (12 out of 18) suffering from ischemic heart diseases and periodontal disease reported bleeding during tooth brushing. By comparison, only one patient from the group without periodontitis reported bleeding while brushing. Thus, it was observed that bleeding while brushing is more common in cases with periodontal disease (Figure 3A). The presence or absence of gingival inflammation was determined by calculating the gingival bleeding index. Of the total of 30 participants examined in the study, 20 had GBI values greater than or equal to 10%, 15 of them also falling into the category of patients with periodontal disease. An increased frequency of gingival inflammation (quantified by a GBI greater than or equal to 10%) was found in patients with periodontitis (83.33%) compared to those without periodontitis (41.66%) (Figure 3B). Although 66.66% of patients included in the group of subjects with periodontal disease self-

reported bleeding during tooth brushing, the clinical evaluation of the bleeding index showed a higher incidence of bleeding (83.33%).

Regarding oral hygiene, most of the patients with periodontitis (12 out of 18) had unsatisfactory oral hygiene at the time of examination. A higher incidence of poor oral hygiene was recorded in patients with periodontal disease (66.66%) compared to those with clinical periodontal health (58.33%) (Figure 4). An increase in gingival inflammation, quantified by an increased bleeding index, was also observed with decreased tooth brushing frequency. Referring to individual oral hygiene habits and prophylaxis, most of the patients with periodontitis brush their teeth once a day or less, with only 4 of the patients reporting a frequency of twice a day. By comparison, a slightly higher frequency of brushing was observed in healthy patients, with 33.33% of them brushing twice a day, 41.66% once a day, 8.33% three times a week and 16.66% less than three times a week.

Current data suggest that brushing properly once a day is sufficient to maintain good oral health and prevent periodontal disease [12]. However, most patients fail to remove plaque after a single brush, so personal dental hygiene twice a day is recommended to improve plaque control and prevent periodontal disease [12]. Good oral hygiene, with the removal of plaque and calculus deposits, is the premise for good gingival health. Moreover, given that gingival inflammation precedes periodontitis, gingivitis prophylaxis represents an important primary prevention tool in the occurrence of periodontal disease. In the present research,

gingival inflammation among the participants included in the study and objectivized by increased bleeding index ($\geq 10\%$) was associated with a decrease in the frequency of tooth brushing. Thus, people who brush less than once a day have the highest frequency of gingival inflammation (88.88%), while individuals

who brush their teeth twice a day have the lowest frequency of gingival inflammation (37.50%) (Figure 5). Therefore, regular tooth brushing can have a positive impact in preventing plaque-induced gingivitis.

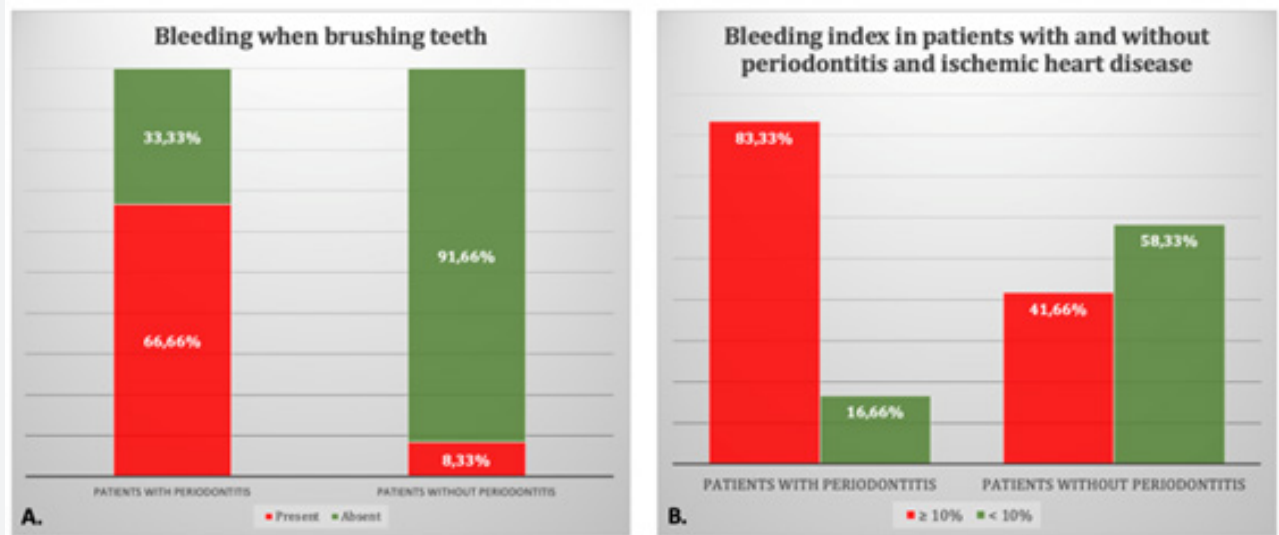


Figure 3: A. Bleeding reported when brushing teeth (self-reporting); B. Bleeding index calculated in patients with and without periodontitis and ischemic heart diseases.

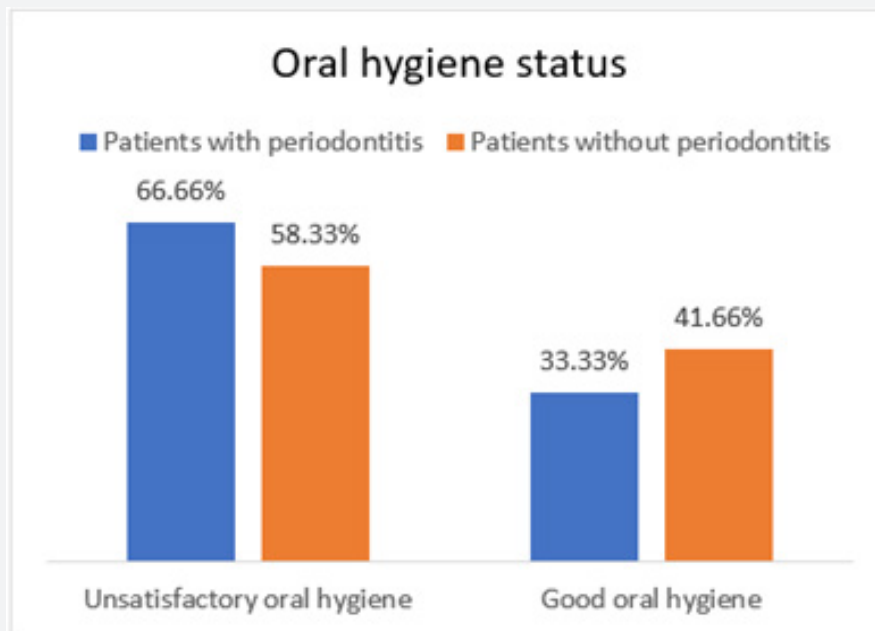


Figure 4: Oral hygiene status of patients with and without periodontitis.

During the clinical evaluation, it was observed that most of the patients classified as periodontal cases presented pathological tooth mobility of various degrees, while a percentage of 22% presented no tooth mobility. Regarding other systemic conditions,

besides ischemic heart disease patients with periodontitis also presented: obesity, type 2 diabetes with or without insulin requirement, hypertension, cerebrovascular ischemic events, and other conditions (epilepsy, Parkinson's disease, chronic

hepatitis C, bronchial asthma, anemic syndrome, and pulmonary hypertension). The most common systemic condition in patients with periodontal disease and ischemic heart disease was hypertension, followed by type 2 diabetes (Figure 6). Among the systemic diseases currently considered as risk factors for periodontal disease, in the present research it was observed that type 2 diabetes was the most common systemic condition

among patients with periodontal disease. Moreover, most of the participants with type 2 diabetes (85.71%) were patients with periodontitis. The literature shows that diabetes is a risk factor for periodontal diseases and can play an important role in the initiation and progression of periodontitis, being associated with the destruction of the periodontal ligament [3].

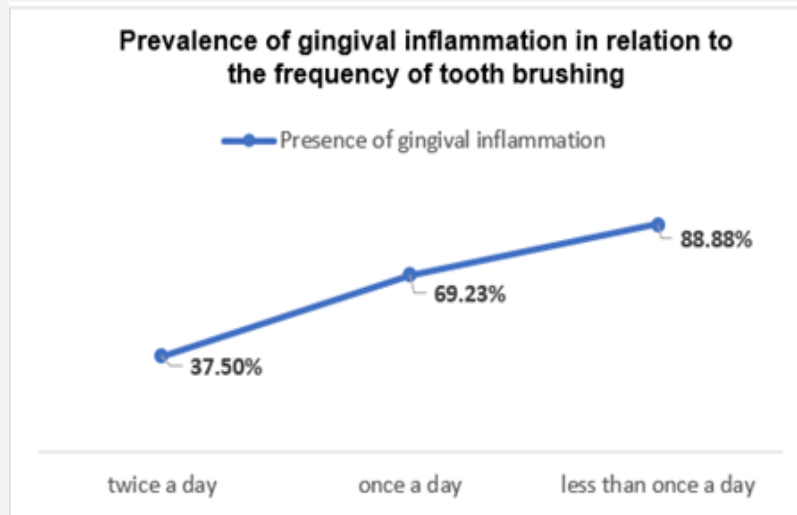


Figure 5: Prevalence of gingival inflammation in relation to the frequency of tooth brushing.

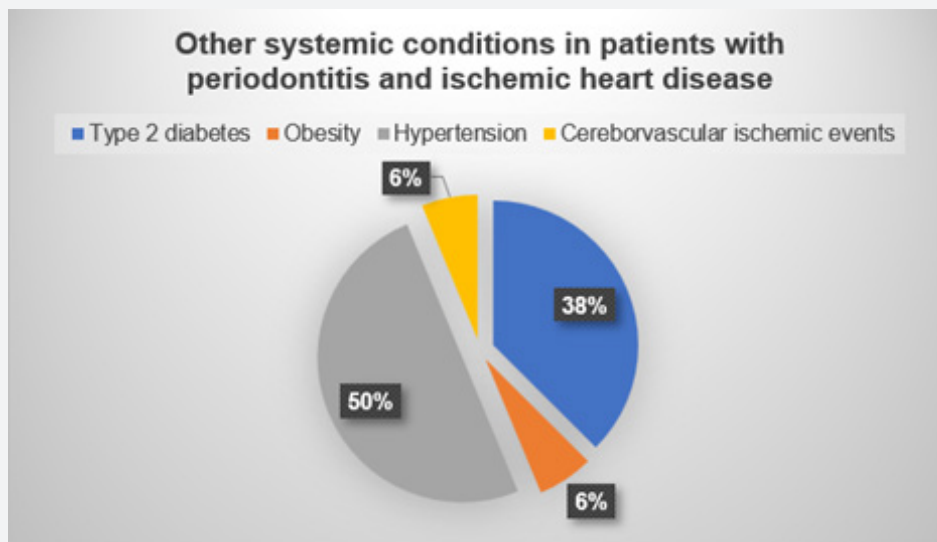


Figure 6: Other systemic conditions in patients with periodontitis and ischemic heart disease.

Thus, medication can be a factor influencing salivary flow, with certain medications producing xerostomia in the oral cavity. A low salivary flow leads to an increase in the vulnerability of the oral cavity to infections and an intensification of periodontitis. According to literature data, drugs that decrease salivary flow

include beta-blockers, tricyclic antidepressants, atropine, and antihistamines [3]. This study found that the most common drug class among patients with ischemic heart disease were antiplatelet agents, followed by beta-blockers, 94.44% of periodontal patients being under beta-blocker treatment. Considering that in the

documents of the European Society of Cardiology (ESC) beta-blockers have a class I A indication in the treatment of ischemic coronary diseases and that they represent a potential risk factor for the occurrence of gingival inflammation and periodontitis (through the accumulation of dental plaque caused by decreased salivary flow), increased attention should be paid to these patients [13]. Future studies should observe over time the appearance of periodontitis as well as the progression of periodontal disease in patients with ischemic heart disease under beta-blocker treatment for a better understanding of the correlation between the drug use and the onset and progression of periodontitis.

Conclusion

The increased prevalence of periodontal disease in patients with ischemic heart disease and the impact of periodontitis require future implementation of screening programs in this population category. Furthermore, increasing awareness among general medicine specialists on the importance of detecting periodontitis cases among patients with ischemic heart disease could contribute to a better control of the systemic inflammation present in these patients. Thus, an interdisciplinary approach would have a positive impact on the patient's health. At the same time, periodontal disease prevention programs should aim to control the common risk factors of the two studied conditions.

In addition, physicians should consider the potential association between the use of beta-blocker medication and the occurrence of periodontal disease. Cardiologists should inform patients about the possible adverse effects of medication and their impact on oral health. Given the increased prevalence of both cardiovascular events and periodontitis, as well as the association between the two conditions, appropriate treatment of both pathologies would lead to an improvement in patient prognosis. Maintaining good oral hygiene, with regular and more frequent tooth brushing, contributes to the prevention of plaque-induced gingivitis.

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