



The cardiovascular patient in dental practice: current clinical considerations

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Received 21 March 2025 - Accepted 15 April 2026 - Published 20 May 2026

ABSTRACT:

Background: Cardiovascular diseases are increasingly prevalent due to lifestyle factors and population aging. It is essential for dentists to be familiar with the most common cardiovascular conditions, the medications used to treat them, the risks associated with dental treatment, and the strategies to prevent medical emergencies.

Material and methods: A bibliographic search was performed in PubMed/MEDLINE and the Cochrane Library, including articles published in English on cardiovascular patients in dentistry.

Results and discussion: Cardiovascular diseases encompass a wide range of conditions, from arterial hypertension to ischemic heart disease. Patients with these conditions should be managed on an individualized basis in the dental clinic in order to prevent complications and medical emergencies during dental treatment.

Conclusions: A comprehensive medical history is essential in cardiovascular patients, including a detailed review of their pharmacological treatment and potential drug interactions. Proper risk assessment, individualized treatment planning, and effective communication with the patient's physician when necessary are key to preventing complications and medical emergencies during dental care. Continuous updating of cardiovascular knowledge is therefore fundamental in daily dental practice.

KEYWORDS:

cardiovascular diseases, dental treatment, hypertension, ischemic heart disease, oral surgery, valvular heart diseases.

1. Introduction

Cardiovascular diseases are increasingly prevalent, and dentists must be familiar with these conditions in order to provide appropriate dental care without increasing patient risk.

They comprise a broad group of conditions ranging from arterial hypertension to arrhythmias or valvular heart diseases. Hypertension is the most common cardiovascular condition and may cause serious cardiac damage. Elevated blood pressure can lead to angina pectoris, myocardial infarction, heart failure, and cardiac arrhythmias, which in severe cases may result in sudden cardiac death. Hypertension may also cause obstruction or rupture of the arteries supplying blood and oxygen to the brain, leading to stroke, as well as renal damage resulting in renal failure.

In this literature review, we analyze the main cardiovascular diseases and the precautions that should be taken during dental treatment of these patients.

2. Methodology of the literature review

A narrative literature review was conducted using electronic databases, including PubMed, Scopus, and Web of Science. The search strategy included combinations of keywords such as "cardiovascular diseases", "dental treatment", "hypertension", "ischemic heart disease", "oral surgery", and "valvular heart diseases".

Inclusion criteria: Articles published in English, clinical studies, systematic reviews, guidelines, and studies focusing on the dental management of cardiovascular patients.

Exclusion criteria: Case reports with limited generalizability, non-peer-reviewed articles

The selection process involved screening titles and abstracts, followed by full-text review of relevant articles.

3. Analytical Discussion

Vascular diseases

Arterial hypertension is defined as blood pressure $\geq 140/90$ mmHg according to the European Society of Cardiology, or $\geq 130/80$ mmHg according to the American College of Cardiology. (1)

The basic principles of dental treatment in hypertensive patients are:

Pain should be avoided; therefore, the use of vasoconstrictors is recommended. However, adrenaline can increase blood pressure and may interact with non-selective beta-blockers, causing hypertension and reflex bradycardia. It may also interact with diuretics, potentially worsening hypocalcemia. In hypertensive patients, the use of up to two cartridges of lidocaine 1:100.000 (0.018 mg of adrenaline) is recommended, or alternatively up to four cartridges of articaine 1:200.000, which contains 0.009 mg of adrenaline per cartridge. (2-4)

Short appointments, preferably in the morning; diazepam (5-10 mg) may be prescribed when indicated. To prevent orthostatic hypotension, the patient should be raised gradually. In addition, nonsteroidal anti-inflammatory drugs (NSAIDs) are not recommended, as they may increase blood pressure. Avoid extensive surgical procedures to reduce the risk of bleeding. (2)

The patient's medication must be known and carefully recorded in the medical history. There are several groups of antihypertensive drugs:

Diuretics (hydrochlorothiazide, furosemide, indapamide) promote renal excretion of sodium and water, reducing plasma volume and consequently blood pressure. They are usually the first-line drugs prescribed for hypertensive patients. (5)

Beta-blockers (atenolol, carvedilol, propranolol, metoprolol) are commonly prescribed and lower blood pressure by reducing heart rate and

myocardial contractility. (6)

Angiotensin-converting enzyme inhibitors (ACE inhibitors) (enalapril, captopril, lisinopril) block the conversion of angiotensin I to angiotensin II, thereby reducing vasoconstriction and sodium retention. (7)

Calcium channel blockers (amlodipine, nifedipine, diltiazem, verapamil) reduce blood pressure by limiting calcium entry into cardiac muscle and vascular smooth muscle. This results in decreased total peripheral resistance, and some agents also reduce heart rate and myocardial contractility. (8)

Alpha-adrenergic antagonists (doxazosin, prazosin, terazosin) block α_1 -adrenergic receptors in vascular smooth muscle, leading to reduced arteriolar and venous tone. They are less commonly used, usually in combination with other agents, and may increase the risk of falls in elderly patients. (9)

Direct vasodilators (hydralazine, minoxidil) act directly on vascular smooth muscle, producing arteriolar vasodilation and thereby reducing peripheral vascular resistance. They are mainly used in severe or resistant hypertension, usually in combination with other drugs such as diuretics and beta-blockers. (10)

Angiotensin II receptor blockers (ARBs) (losartan, valsartan, irbesartan) selectively block type 1 angiotensin II receptors, reducing vasoconstriction and aldosterone secretion, thereby lowering blood pressure and providing cardiovascular and renal protective effects. (11)

Dentists must be aware of the oral manifestations and effects associated with these medications: Gingival hyperplasia, xerostomia, lichenoid reaction, dysgeusia, ageusia, oral ulceration, angioedema, facial flushing, increased risk of gingival bleeding and infection. (12-17)

Gingival enlargement associated with antihypertensive drugs, particularly calcium channel blockers such as amlodipine and nifedipine, requires a multidisciplinary approach. Initial management is based on non-surgical measures, including intensive plaque control (both professional and at-home), scaling and root planing, oral hygiene instruction, and the use of adjunctive antimicrobial agents such as chlorhexidine. In parallel, consultation with the patient's physician is recommended to evaluate

the possibility of substituting the causative medication when clinically feasible. In cases where gingival overgrowth persists and results in functional or aesthetic impairment, surgical intervention, such as gingivectomy or periodontal flap surgery, may be indicated. (14,18)

Xerostomia is a common finding and is typically diagnosed based on a subjective complaint of dry mouth, reduced salivary flow (unstimulated <0.1 mL/min), and clinical signs such as dry mucosa, fissured tongue, and increased risk of dental caries. Management includes frequent hydration and salivary stimulation (e.g., sugar-free chewing gum), the use of saliva substitutes and oral moisturizers, and, in severe cases, sialogogues such as pilocarpine when not contraindicated. Topical fluoride should be recommended to prevent caries, and alcohol-containing mouthrinses should be avoided. (19)

Oral lichenoid reactions may present as unilateral or bilateral white striations, often accompanied by erythematous or erosive areas, and are frequently associated with medications such as ACE inhibitors or beta-blockers. Diagnosis is primarily clinical, although biopsy may be required to differentiate these lesions from oral lichen planus. Management involves identification and, when possible, substitution of the causative drug in consultation with the patient's physician, along with the use of topical corticosteroids as first-line therapy. Regular follow-up is recommended due to the low but relevant risk of malignant transformation. (17)

Dysgeusia or ageusia may also occur in patients taking cardiovascular medications. Management includes reviewing the patient's medication list to identify potential causative agents and implementing strategies to improve salivary function. These conditions can significantly affect nutrition and quality of life, particularly in elderly cardiovascular patients. (16)

It is also essential to consider the potential interactions between cardiovascular drugs and commonly prescribed medications in dental practice, as these may lead to significant adverse effects. (20) Macrolide antibiotics, such as erythromycin and clarithromycin, can increase the plasma levels of calcium channel blockers, thereby increasing the risk of hypotension and cardiac arrhythmias. (21)

Similarly, azole antifungals, including ketoconazole and fluconazole, may elevate the

serum concentrations of several cardiovascular drugs, such as statins, calcium channel blockers, and certain anticoagulants, potentially leading to toxicity. Metronidazole is also of concern, as it can potentiate the anticoagulant effect of vitamin K antagonists, increasing the risk of bleeding complications. (22)

Opioid analgesics, such as codeine and tramadol, may interact with beta-blockers or other central nervous system depressants, resulting in enhanced sedation and an increased risk of adverse effects, particularly in elderly or medically compromised patients. In addition, nonsteroidal anti-inflammatory drugs (NSAIDs) may reduce the efficacy of antihypertensive medications and contribute to an increased cardiovascular risk. (20)

Therefore, a thorough drug history is essential, and when necessary, consultation with the patient's physician should be undertaken to minimize the risk of drug-related complications and ensure safe dental care.

Patients with a history of **thrombosis or embolism** are at risk of stroke or myocardial infarction due to blood clots that obstruct or travel through the vascular system. These patients are commonly treated with anticoagulant or antiplatelet therapy. (23–25)

In oral surgery, the protocol for patients receiving antiplatelet or anticoagulant therapy is as follows, depending on the medication: Acetylsalicylic acid. For minor interventions, such as simple extractions (fewer than three teeth) or uncomplicated surgeries (e.g., implants without grafting), discontinuation of antiplatelet therapy is not necessary. Local hemostatic measures should be implemented. The risk of discontinuing antiplatelet therapy generally outweighs the risk of bleeding. (26)

Patients treated with acenocoumarol should not receive modifications or suspension of their treatment. However, the patient must be asked for an INR on the same day or the day before the procedure. If the value is under 3, surgery can be performed. (27)

If the value of INR is above 3 and an important bleeding is expected due to procedures such as multiple extractions, multiple implants, or a flap surgery combined with ostectomy, the dose must be adjusted, or the acenocoumarol should be changed to heparin by the treating physician

two days prior to surgery and resumed the same day as the extraction, about 12 hours after. Also, the patient must continue with heparin treatment until the anticoagulation levels are reached. However, it is preferable to postpone surgery until the INR is below 3, measured on the same day or within 24 hours prior to the procedure, and to avoid complex interventions by, for example, staging the treatment, limiting the number of extractions, or avoiding multiple implant placements. (27)

Patients treated with direct oral anticoagulants (DOACs):

Dabigatran, a thrombin inhibitor, is recommended at a dosage of 150 mg twice daily. (28)

Rivaroxaban, a direct Factor Xa inhibitor, is recommended at 15–20 mg once daily. (29)

Apixaban, another Factor Xa inhibitor, is typically prescribed at 5 mg twice daily. (30)

Edoxaban, also a Factor Xa inhibitor, has a recommended dosage of 60 mg once daily. (31)

The time to reach maximum plasma concentration ranges from 1 to 4 hours, and the anticoagulant effect usually diminishes within 12 to 24 hours after administration. (30)

For non-invasive oral surgeries, current recommendations advise against interrupting anticoagulant therapy to reduce the risk of thromboembolism. (32)

For more invasive surgical procedures, such as multiple extractions, implant placement with grafting, wide mucoperiosteal flaps, impacted third molar removal involving ostectomy, or long surgical duration (>45–60 minutes), it is essential to evaluate both bleeding and thrombotic risks. Treatment should be scheduled early in the day. For patients taking apixaban or dabigatran (administered twice daily), some clinicians recommend that the morning dose be omitted. Patients taking rivaroxaban or edoxaban (once daily) should delay the dose until at least four hours after the procedure. If the usual dosing time is in the afternoon, no adjustment is necessary. (33)

The procedure must be performed as late as possible after the last intake (at least 12 hours after in twice daily dose and 24 hours after in single daily dose. (33)

In periodontal therapy, the protocol varies depending on the procedure.

Non-surgical periodontal therapy (scaling and root planing) is considered a low-risk procedure; anticoagulant/antiplatelet therapy should not be interrupted, and local hemostatic measures (pressure, tranexamic acid) are usually sufficient.

Periodontal surgery (e.g., flap surgery): moderate bleeding risk, procedures should be limited in extent (quadrant-based approach recommended), careful flap design and atraumatic technique are essential, and use of local hemostatic agents and sutures is mandatory.

Regenerative procedures (bone grafts, membranes): higher bleeding risk, require individualized assessment, and in selected cases, temporary modification of anticoagulant therapy may be considered in consultation with the physician.

Renal function must be considered, especially for dabigatran, which is primarily renally excreted.

Unlike vitamin K antagonists, direct oral anticoagulants (DOACs) do not usually require bridging therapy with heparin due to their short half-life and rapid onset of action. Bridging is generally discouraged, as it may increase bleeding risk without reducing thromboembolic events. (34)

The use of hemostatic measures during or after the procedure can often eliminate the need to suspend antiplatelet or anticoagulant therapy. The most recommended techniques include alveolar curettage to remove granulation tissue, use of sutures (preferably resorbable), gauze compression, fibrin sponges, resorbable gelatin sponges, oxidized cellulose, and bone wax. Although bone wax can be effective for controlling bleeding from cancellous bone, its use is associated with potential complications, including foreign body reactions, chronic inflammation, infection, and impaired bone healing. Therefore, its use should be limited to cases where other hemostatic measures are insufficient.

Antifibrinolytic agents may also be employed, such as Tranexamic acid (500 mg injectable solution), which can be used to soak gauze pads for gentle rinsing during the first two days, at least one minute every 6 hours. Also, Epsilon-

aminocaproic acid (4 g injectable solution) may be applied in the same manner as tranexamic acid. (35)

Tranexamic acid is the most widely studied agent. It acts by inhibiting plasminogen activation, thereby stabilizing the fibrin clot.

Epsilon-aminocaproic acid (EACA) has a similar mechanism of action but is less potent and less extensively studied in dental settings. Current evidence suggests that tranexamic acid provides more predictable hemostasis and is therefore preferred in clinical practice.

However, both agents are effective when used adjunctively with local measures such as sutures and gelatin sponges. (35)

Peripheral arterial disease (PAD) is characterized by obstruction of arteries in the extremities, most commonly in the lower limbs, and represents a manifestation of systemic atherosclerosis. It is associated with a high cardiovascular and cerebrovascular risk, including myocardial infarction and stroke. These patients are treated with antiplatelet therapy, with the same implications regarding bleeding risk during oral surgery.

Cerebrovascular diseases

Stroke. These patients are commonly treated with antiplatelet agents, anticoagulants, antihypertensive drugs, and other cardiovascular medications.

Traditionally, it has been recommended to wait between 6 and 12 months before providing dental treatment to these patients; however, maintaining good oral health and oral care is essential, and with appropriate medical supervision, dental treatment may be performed before the 6-month period. (36) In these patients, oral health is often neglected due to limited ability to maintain oral hygiene; therefore, early oral assessment is essential to prevent complications such as aspiration pneumonia and malnutrition. (37)

Aneurysms are abnormal dilatations of blood vessel walls, such as the aorta. These patients are usually polymedicated and receive antihypertensive drugs, antiplatelet therapy such as acetylsalicylic acid or clopidogrel, sometimes dual antiplatelet therapy, and, in some cases, anticoagulants when atrial

fibrillation is present. They have an increased risk of bleeding during oral surgery, and medication should not be discontinued without a medical indication. Short appointments and adherence to antihemorrhagic protocols are recommended. (33)

Cardiac diseases

A thorough medical history should be obtained to identify the type and severity of the cardiac

condition, its duration, any previous complications, and the medication the patient is receiving.

It is important to emphasize that periodontal disease and cardiovascular diseases, particularly atherosclerosis and ischemic heart disease, exhibit a well-documented bidirectional relationship. Chronic periodontal inflammation contributes to systemic inflammatory burden through the release of pro-inflammatory mediators such as interleukin-6 (IL-6), tumor necrosis factor-alpha (TNF- α), and C-reactive protein (CRP), which are known to play a role in endothelial dysfunction and atheroma formation.

Periodontal pathogens, including *Porphyromonas gingivalis*, have been identified in atherosclerotic plaques, suggesting a direct microbial contribution to vascular disease.

Conversely, cardiovascular patients often present with worsened periodontal status due to reduced immune response, polypharmacy, and limited ability to maintain oral hygiene.

Therefore, periodontal therapy should be considered part of the global management of cardiovascular patients, as it may contribute to reducing systemic inflammation and improving cardiovascular outcomes. (38)

Periodontal evaluation in cardiovascular patients should include probing depth, bleeding on probing, and radiographic bone loss, as these parameters are essential for assessing disease severity and guiding treatment planning.

Antimicrobial mouthrinses, particularly chlorhexidine (0.12–0.2%), are recommended in the perioperative management of cardiovascular patients undergoing periodontal or surgical procedures. Preoperative rinsing reduces bacterial load and the risk of bacteremia, while postoperative use may help prevent infection and support wound healing.

Ischemic heart disease (IHD) is characterized by insufficient blood supply to the heart, usually due to obstruction of the coronary arteries, and includes conditions such as angina pectoris and acute myocardial infarction.

The main symptom of ischemic heart disease is precordial pain, which occurs when the balance between myocardial oxygen supply and demand is altered. This pain may radiate to the left arm, neck, jaw, palate, or tongue, and can be triggered by meals, physical exertion, or stress.

Orofacial pain may represent, therefore, the initial manifestation of ischemic heart disease and should be carefully distinguished from odontogenic or temporomandibular disorders. Pain of cardiac origin is typically diffuse, poorly localized, and relieved following administration of nitroglycerin. In contrast, odontogenic pain is usually well localized and associated with thermal stimuli, while temporomandibular disorder-related pain is often linked to jaw movement and presents as muscular or joint discomfort. Given that cardiac-related orofacial pain may occur in the absence of evident dental pathology, clinicians must maintain a high index of suspicion; if such an origin is suspected, dental treatment should be discontinued immediately, and the patient referred for urgent medical evaluation. (39)

In stable angina, the pain lasts for a few minutes and resolves when the triggering stimulus ceases, whereas in myocardial infarction and unstable angina, it persists for a longer duration. The general treatment of ischemic heart disease is based on nitrates, beta-adrenergic blockers, calcium channel blockers, antiplatelet agents, and anticoagulants. It is recommended to wait at least 6 months before providing dental treatment to a patient who has suffered a myocardial infarction. In this case, the use of adrenaline is also recommended with caution. No more than two cartridges of lidocaine 1:100.000 with vasoconstrictor (equivalent to 0.036 mg of adrenaline) or four cartridges of articaine 1:200.000 containing the same total amount of adrenaline should be administered. (2)

In anxious patients, benzodiazepines such as diazepam (5–10 mg) may be administered; however, caution is required in elderly patients (risk of oversedation and falls), patients with respiratory disease or sleep apnea, and those taking opioids or consuming alcohol. Additionally, potential drug interactions must be considered,

as benzodiazepines may potentiate the effects of opioids, increasing the risk of respiratory depression, and may also enhance sedation when combined with beta-blockers or other antihypertensive medications. (40)

Blood pressure and pulse oximetry should be monitored. Patients with unstable angina must be medically stabilized before dental treatment. In case of chest pain, sublingual nitroglycerin and oxygen therapy (3 L/min) should be provided. Postoperative bleeding and pain should be minimized. (41,42)

Heart failure is a condition in which the heart is unable to pump blood efficiently, leading to its accumulation in the lungs, lower limbs, or other organs. Patients may present with cough, fatigue, and dyspnea. It commonly coexists with hypertension, ischemic heart disease, valvular heart disease, and arrhythmias, and these patients are often polymedicated. For dental management, appointments should be short, and benzodiazepines may be administered to reduce stress. The patient should not be placed fully supine to avoid dyspnea and pulmonary congestion, and the dental chair should be raised gradually. Adrenaline use should be limited to a maximum of two cartridges of 1:100.000 or four cartridges of 1:200.000. In patients with

severe functional limitation, only short and urgent treatments should be performed after consultation with the cardiologist. Nonsteroidal anti-inflammatory drugs should be avoided, with paracetamol recommended instead. Due to increased bleeding risk, prolonged surgical procedures in a single session should be avoided. (2) In some cases, these patients may receive a ventricular assist device. Oral sanitation should be performed prior to device implantation to prevent infections, and patients should be instructed on proper oral hygiene. In addition, these patients are usually receiving anticoagulant therapy. (43)

Valvular heart diseases include rheumatic heart disease, mitral valve prolapse, aortic valve disease, prosthetic valves, prior infective endocarditis, and congenital valve disorders. Patients should maintain good oral hygiene and receive regular professional dental care. Strict infection control is required, and antibiotic prophylaxis is recommended before high-risk dental procedures, including extractions, oral and periodontal surgery, gingival or periapical manipulation, and dental implant placement. (2)

High-risk patients include those with a history of infective endocarditis, those with prosthetic heart valves or any implanted material used for valve repair, patients with congenital heart disease associated with a risk of infective endocarditis, whether untreated or treated with prosthetic material, and patients with ventricular assist devices implanted for heart failure. (2,44)

Antibiotic prophylaxis for infective endocarditis consists of a single dose administered 30–60 minutes before the procedure. Amoxicillin is the first-line antibiotic (2 g orally in adults; 50 mg/kg in children). In penicillin-allergic patients, recommended alternatives include cephalexin (2 g orally in adults; 50 mg/kg in children), azithromycin (500 mg orally), clarithromycin (500 mg orally; 15 mg/kg in children), or doxycycline (100 mg orally; 2.2 mg/kg in patients <45 kg). Clindamycin is discouraged due to the increased risk of *Clostridioides difficile* infection. (44)

Arrhythmias include atrial fibrillation, ventricular tachycardia, and bradycardia. Patients with atrial fibrillation are usually anticoagulated and require bleeding management protocols. (45) Anxiety control and limited use of adrenaline are essential to prevent arrhythmias. (2) Some patients may have pacemakers, and dental clinics should be equipped with a semi-automatic external defibrillator. (46) Patients with cardiomyopathies, heart failure, or valvular disease have a higher arrhythmic risk and are commonly treated with beta-blockers. (2,47)

4. Conclusions

Cardiovascular diseases represent the leading cause of mortality worldwide and are highly prevalent among patients attending dental clinics. Specific guidelines must be followed to prevent potentially serious complications.

Epidemiological studies indicate that a significant proportion of adult dental patients present with at least one cardiovascular risk factor, such as hypertension, diabetes, or dyslipidemia.

Socioeconomic disparities significantly influence both cardiovascular and oral health outcomes. Patients with lower socioeconomic status often exhibit a higher prevalence of cardiovascular diseases and periodontal disease, compounded by reduced access to dental and medical care.

Barriers include financial limitations, low health literacy, and limited access to preventive services. These factors contribute to delayed diagnosis, poor disease control, and increased risk of complications.

Community-based strategies should focus on improving access to affordable dental care, integrating oral health into primary healthcare systems, and promoting interdisciplinary collaboration between dentists and physicians. In addition, enhancing patient education on the relationship between oral and systemic health is essential to increase awareness and encourage preventive behaviors, particularly in populations at higher risk of both oral and cardiovascular diseases.

Continuous professional development is essential to ensure that dental practitioners are adequately prepared to manage patients with cardiovascular diseases. Training should include medical risk assessment, management of emergencies, and pharmacological knowledge, particularly regarding drug interactions and anticoagulation. In addition, public health initiatives should promote cardiovascular screening in dental settings and interdisciplinary collaboration. These strategies can improve patient safety and reinforce the role of dentistry within the broader healthcare system.

The dental team, including dentists and dental hygienists, plays a critical role in the early detection of undiagnosed cardiovascular disease through routine clinical assessment. A thorough evaluation should include inquiry about symptoms such as chest pain or discomfort, dyspnea on exertion, palpitations, or syncope, as well as a review of the patient's medical history for known hypertension, previous myocardial infarction or stroke, and current medication use, particularly anticoagulants and antihypertensive agents. In addition, measurement of blood pressure during the dental visit is an essential screening tool. Patients presenting with suspicious findings should be referred for medical evaluation prior to undergoing elective dental treatment, thereby contributing to improved patient safety and overall healthcare outcomes.

1. Conflict of interest. There is no conflict of interest
2. Ethics. Complies with ethical parameters
3. Source of Funding. This work has not received any funding.

4. Authors' contributions. C.L-C performed the study design, conceptualization, bibliographic search, writing original draft, C.M-G conceptualization, bibliographic search, C.M-M-P conceptualization, bibliographic search, I.L-B conceptualización, bibliographic

search, supervision; All authors have read and agreed to the published version of the manuscript.

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