

## Latest Concepts in the Endodontic Management of Patients with Cardiovascular Disorders

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### ABSTRACT

There are several cardiovascular interventions that need special considerations in the provision of treatments within the scope of endodontics. If these interventions are not carefully identified, diagnosed, and considered in the overall treatment plan for the patient, they may result in fatal conditions. These include hypertension that causes fatal cardiac disorders, such as angina pectoris, ischemic heart diseases, and myocardial infarction, and also cerebrovascular diseases; congestive heart failure; infective endocarditis, valvular diseases, and carrying pacemakers; and the use of antiplatelet and anticoagulant drugs that are commonly prescribed for patients who have experienced heart stroke. The aim of this article is to review the newest recommendations for patients with these disorders who require endodontic treatments.

**Keywords:** Cardiovascular disorders, endodontic management, heart patients, hypertension

### HIGHLIGHTS

- All dental treatments, including root canal treatments, should start after providing a permission letter from a cardiologist, in patients with cardiovascular disorders. In the recently released guideline, the blood pressure frame to define patients with hypertension has changed from 140/90 mm Hg to 130/80 mm Hg.
- The endodontists and other specialists in the field of dentistry have no right to interrupt, change the dose, or prescribe any drug for these groups of medically compromised patients by themselves and without the cardiologist's confirmation. It is better to decrease the dose and to increase the time intervals between local anesthesia injections in cardiovascular patients.
- Aspirin is not recommended for patients with congestive heart failure (CHF). Sublingual nitroglycerin pills along with nasal oxygen (4–6 L/min) are promising treatments in case of emergency episodes in CHF, angina pectoris, and all ischemic heart conditions.
- Antibiotic prophylaxis has been recommended for patients with any history of rheumatoid heart disease, pacemakers, congenital cardiac diseases, prosthetic cardiac valves, and grafts before starting any dental treatment to avoid infective endocarditis. In these groups of patients, tooth retention via a root canal treatment is always preferable to extractions.
- Anti-anxiety drugs for reducing the arrhythmic patient stress and sublingual nitrites if chest pain is present are some useful ways to manage this group of cardiac patients. In patients receiving long-term anticoagulant therapy (stable on warfarin), an international normalized ratio check 72 h prior to endodontic surgery is recommended.

### INTRODUCTION

Dealing with patients with either a history or current cardiovascular disease has always been a thorough challenge for the endodontists. This challenge is so serious that it may end any clinical practice if a deficiency in knowledge or performance is proven following a diseased patient. Having a history of such a case that has happened because of shortages may always annoy minds even if no complaint has been registered because of that. Therefore, knowing the latest concepts and guidelines regarding patients with cardiovascular disorders is an important topic that must be discussed by different publishers in the related clinical fields every now and then. There are several cardiovascular interventions that need special attentions and warnings. This article aims to explain the most important interventions that are: hypertension that may cause fatal cardiovascular disorders, such as angina pectoris, ischemic heart diseases, and myocardial infarction (MI), and also cerebrovascular diseases; congestive heart failure (CHF); infective endocarditis (IE), valvular diseases, and carrying pacemakers; and the use of an-

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tiplatelet and anticoagulant drugs that are commonly prescribed for patients who have a history of heart stroke.

### **Hypertension**

Hypertension is the medical term for high blood pressure, meaning that the blood applies too much force against the blood vessel walls. It is estimated that approximately 1 billion people worldwide and 85,000,000 people in the United States suffer from blood pressure (1). Taking and recording a thorough medical history and, in all cases, measuring the blood pressure are mandatory to identify compromised systemic conditions, and diagnose the specific conditions for management. Many patients are unaware of having this chronic illness until a blood pressure check is made. Once made, consultation with the medical team/physician for guidance, which includes a detailed medical release and patient consent letter from them before commencing any dental procedures, is a must (2).

According to the new medical guidelines issued in November 2017 by the American Heart Association, hypertension is defined as a blood pressure >130/80 mm Hg. All dental treatments are permitted to be applied within this pressure frame, although in the former guideline, this pressure frame was 140/90 mm Hg. Any dental treatment over this frame may lead to angina and ischemic conditions of the heart, including MI (2, 3). Another important consideration regarding blood pressure patients requiring Endodontic treatment is the administration of local anesthetics (LAs) to manage the stress and pain of treatment. Up to one to two cartridges containing 1/100,000 epinephrine (adrenaline) has no adverse side effects. However, the cardiovascular effects of epinephrine-containing solutions may be intensified by the use of medications, such as nonselective beta-blockers including propranolol. Guidelines recommend to decrease the dose and to increase the time intervals between LA injections in cardiac patients.

The long-term use of nonsteroidal anti-inflammatory drugs (NSAIDs) that are commonly prescribed in these patients may antagonize the antihypertensive effects of diuretic drugs, beta-blockers, alpha-blockers, vasodilators, and angiotensin-converting enzyme inhibitors. In these cases, paracetamol (acetaminophen) can be prescribed as an alternative to avoid these side effects (4).

The exact reason for hypertension is still unknown. Chronic kidney disease is believed to be the common cause for high blood pressure, since the kidney does not filter out well the fluids and this excess fluid causes hypertension. Some other medical conditions and medications may also lead to high blood pressure. Furthermore, there are many risk factors that increase the risk of hypertension, such as age, ethnicity, weight, alcohol, smoking, gender, and health conditions (cardiovascular disease, diabetes, chronic kidney disease, and high cholesterol levels) especially in the elderly. Hypertension has been reported to be more prevalent in men >60 years. A salt-rich diet, processed fatty foods, low level potassium diet, and inactivity are other lifestyle habits that intensify potential hypertension.

A family history of hypertension that should be identified in the initial patient examination, along with a stressful life, is

another predisposing factor. Currently, there is more emphasis on managing blood pressure through diet, sporting activities, and lifestyle (5, 6). Patients with hypertension whose blood pressure is well controlled are not considered a risk in dental practice. Prior to any dental procedures, the patient must be instructed to take the blood pressure medication as usual on the day of dental appointment. Furthermore, prior to treatment, the blood pressure must be measured, and during treatment, monitoring of blood pressure may be indicated. Dental visits are preferable to be short and in the mornings. A prescription of 5–10 mg diazepam the night before and also 1 h before the dental treatment or nitrous oxide sedation may also be useful to manage the anxiety if indicated in patients with hypertension and other patients with cardiac disorders. In emergency situations, the dental practice must be conservative along with prescription analgesics. NSAIDs should not be used for >5 days. Moreover, heart patients are at the risk of higher adrenaline secretion due to the low amount of LA injection than reaction due to the low amount of vasoconstrictor in LA solutions.

Generally, vasoconstrictor use in cardiac patients should be limited and not exceed >0.04 mg. In case of any hypertensive crisis, all dental treatments must be terminated, and the patient should be sent to a hospital as soon as possible (7-9).

### **Angina pectoris and ischemic heart diseases**

Angina pectoris is a cardiac condition with pain that is often experienced in the mandible, neck, and right arm. Patients with a history of angina usually know their symptoms and more often than not, carry with themselves nitroglycerin (NTG) medication. Slow injection of an anesthetic solution with epinephrine (1:100,000) along with aspiration is recommended for patients with a history of angina pectoris (10). Any dental appointment increases the chance of an angina attack because of experiencing fear and pain. The emergency treatment for dealing with an angina attack in a dental clinic is to (1) stop the undergoing dental treatment, (2) bring the patient in a comfortable position reassuring and loosening the restricting garments, and (3) allow the patient to use NTG medication or spray, which has previously been prescribed for these episodes. Up to three doses of NTG spray can be applied within 15 min. If the signs and symptoms of the patient resolved, the dental procedure can be restarted. If the angina signs did not disappear after 2 or 3 min, another dose of the NTG spray should be given along with monitoring the vital signs, contacting the physician or emergency medical team, and accompanying the patient to the emergency department of the hospital. There, 4–6 L/min oxygen is indicated, and appropriate tests to determine the cause of the patient's distress should be undertaken (11).

### **Myocardial infarction**

MI is an ischemic condition of the heart muscle due to many different conditions. Cardiac arrest resulting from MI can be a major challenge in a dental clinic. For patients with MI, any dental treatment is contraindicated within the 6-month period. During this period, urgent dental treatments should be performed in a hospital where required facilities are provided if an emergency episode occurs. Regarding a patient with a MI history, a careful medical history should be taken. Short

appointments and the use of sedation (N<sub>2</sub>O) and anti-anxiety drugs (diazepam) are recommended to manage the stress. The availability of supplemental oxygen in a dental clinic is necessary with the normal administration being 4 L/min.

Prior to definitive treatment, do not inject >3 mL of 1:80,000 adrenaline-containing LA solution. Care must also be exercised not to cause drug interactions between penicillin, NSAIDs, metronidazole, and tetracycline with anticoagulant drugs in patients with MI (11-13).

### **Congestive heart failure**

CHF is due to the improper function of the heart and the inability to deliver blood to the necessary tissues. Thereafter, fluids accumulate inside peripheral tissues, such as lungs and liver. In patients whose disease is controlled and who are in stable condition, dental procedures, including endodontic treatments, are permissible. If the patient is in distress, start by placing them in a chair and in a semi-supine position to avoid orthostatic hypotension. In patients under digoxin consumption, LA should be limited to two anesthetic cartridges to avoid arrhythmias. Aspirin is not recommended for patients with CHF, since it may lead to sodium and fluid retention. Sublingual NTG (0.4–0.8 mg) and nasal oxygen (4–6 L/min) are promising treatments in case of emergency episode along with contacting medical support (11, 14).

### **Infective endocarditis**

Patients with any history of rheumatoid heart disease, pacemakers, congenital cardiac diseases, prosthetic cardiac valves, and grafts are at risk to develop an IE due to a transient bacteremia after undergoing different dental procedures, even a simple tooth scaling. Some signs and symptoms of IE include tiredness, loss of appetite, chills, and night time perspiration that manifests itself in a patient approximately 2 weeks after Endodontic treatment, especially if any over-instrumentation or perforation has occurred following a root canal procedure. Presently, no satisfactory antibiotic prophylaxis (AP) regimen has been established to prevent IE in high-risk patients. Currently, the general prophylaxis prescribed for an adult patient is 2 g oral amoxicillin 0.5 to 1 h before starting a root canal procedure. In patients with allergy, azithromycin 500 mg can be prescribed. Regarding antibiotic prescriptions, the risk of an allergic reaction and anaphylaxis shock should never be neglected, and information to this potential should be obtained initially in the patient's medical/dental history (12, 13).

Patients who are at risk of IE should be encouraged to maintain the highest oral hygiene level. It is incumbent upon the dental professional through education, demonstration, and practice to insure that the patient has the knowledge and tools to achieve the necessary oral hygiene goals. Any inflamed and infected area in the oral cavity should be treated and eliminated as soon as possible and using mouth rinses, such as chlorhexidine, which may be advisable prior to any dental intervention, even a simple periodontal assessment that includes probing. In patients at risk for IE, tooth retention via a root canal procedure is always preferable to extractions, with a prescription for antibiotics up to 7 days, serving as an adjunct to reduce the risk of bacteremia (15, 16).

### **Valvular diseases and prosthetic valves (pacemakers)**

All dental patients who have any type of cardiac devices should provide and show the manufacturer's identification card that provides information about the model, serial number, and date of implantation. Patients who have cardiac pacemakers, prosthetic heart valves, and cardioverter defibrillators are at higher risk of experiencing thromboembolisms. The valves placed inside the aortic artery are at higher risk than those in the mitral. Aspirin alone or plus warfarin is the medication of choice to prevent thromboembolism in this group of patients. These patients are also categorized as a high-risk group, and before any Endodontic treatment, providing a consent letter along with the necessary recommendations from the cardiologist is mandatory. Since this group of cardiac patients is also prone to IE, strict sterilized procedures along with Antibiotic prophylaxis (AP) regimen that the cardiologist suggests should be performed. Electrical cords should not be placed over the patient's chest, and model of pacemakers without shield should be protected with a lead apron. Any dizziness, difficulty in breathing, change in pulse rate, and swelling in the chest and arm that are symptoms of pacemaker malfunction must be considered by the dental professional, and the cardiologist should be contacted immediately. Generally, the provision of dental procedures on cardiac patients is better to be performed in a clinic with close access to the cardiologist and necessary facilities (17-19).

### **Cardiac arrhythmias and dysrhythmias**

Taking a careful medical history and determining the patient's pulse help to recognize this cardiac dysfunction, which is characterized by an abnormality in rate, regularity, or location of the cardiac impulse. Diagnosing any type of arrhythmias or dysrhythmias is available through continuous electrocardiogram monitoring and knowledge of the interpretation of abnormalities. In patients whose arrhythmia is accompanied with heart failure, myocardial diseases, and carrying prosthetic valves and pacemakers, careful consultation with the cardiologist and asking for necessary recommendations are mandatory. If a cardiac patient shows arrhythmia while performing any endodontic procedure, treatment should cease, and oxygen support should be provided along with careful monitoring of vital signs. The cardiologist must manage the condition, and a consent letter for completing the dental procedure is required because of the risk of further complications, such as cardiac arrest. Anti-anxiety drugs for reducing the arrhythmic patient stress and sublingual nitrites if chest pain is present are some useful ways to manage this group of cardiac patients (20, 14).

### **Patients on anticoagulant therapy**

Aspirin, a combination of aspirin/dipyridamole and clopidogrel, is the medication that is usually prescribed for patients at risk for coagulative disorders and cardiac arrest. In this group of medically compromised patients, providing a consent letter along with the necessary drug recommendations is mandatory before starting the root canal treatment. Local hemostatic measures to control bleeding in anticoagulated patients, atraumatic surgical methods, pressure application, proper wound closure, and topical clotting agents are some useful recommendations to manage surgical and nonsurgical endodontic patients who receive anticoagulant medications. Oral rinsing with tranexamic acid is

also applicable in patients under Anticoagulant Therapy (AT). Any discontinuation of this group of drugs requires having the permission of the cardiologist. In patients with prosthetic valves and pacemakers, the anticoagulant drug must not be discontinued, and close consultation must remain between the dental professional and the cardiologist (20-22).

In situations where clopidogrel should be stopped, discontinuation should not last >5 days because of the threat of stent thrombosis. Consultation with the cardiologist and minimal invasive endodontic procedures should be performed without totally interrupting the anticoagulant coverage. In patients receiving long-term AT (stable on warfarin), an international normalized ratio (INR) check 72 h prior to surgery is recommended. This allows sufficient time for dose modification if necessary to ensure a safe INR (2–4) on the day of surgery. The accepted range of INR to allow surgical endodontic procedures is 2–4. There is no need to check the INR for nonsurgical treatments and non-invasive dental procedures (21, 22).

## CONCLUSION

It is mandatory for the patient to provide a consent letter from the cardiologist along with all therapeutic, analgesic, and sedative drugs prescriptions before starting any endodontic treatment on patients with a current or history of any cardiovascular diseases. The appointments are better to be scheduled in short times and in the mornings. Local anesthesia should be injected slowly and with recommended doses in each condition. Endodontic treatments for all cardiovascular patients are better to be performed near or at a heart hospital where cardiologists and special facilities are easily accessed in case of emergency episodes for this group of medically compromised patients. All endodontic clinics have to be equipped with facilities, such as blood pressure measurement device, oxygen mask, NTG pills, sedation facilities, and the emergency and a cardiologist call number.

## Disclosures

**Conflict of interest:** Nothing to be declared.

**Ethics Committee Approval:** This is a review of the literature and like research studies doesn't need committee approval.

**Peer-review:** Externally peer-reviewed.

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