

## CARDIOVASCULAR DISEASES AND PERIODONTAL TREATMENT

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### Abstract

Safe and effective periodontal treatment requires knowledge and understanding of diseases specifically those affecting the cardiovascular system in order to institute necessary modifications to periodontal therapy accordingly. Considering the high incidence of periodontal diseases in elderly individuals, the periodontist must be prepared to provide periodontal therapeutic support for an increasing number of cardiovascular patients. In this review, common cardiovascular disorders and associated periodontal issues will be discussed briefly. *Heart Views* 2007;8(3):100–105. © Gulf Heart Association 2007.

### INTRODUCTION

Successful and safe periodontal care is accomplished by obtaining a thorough medical history and physical examination to identify symptoms and signs of cardiac diseases and by obtaining cardiology consultation if indicated. Cardiovascular diseases account for 29% of deaths worldwide and rank as the second leading cause of death after infectious and parasitic diseases<sup>1</sup>. Atherosclerosis, a major component of cardiovascular diseases, affects one in four persons and contributes to 39% of deaths annually in the United States of America<sup>2</sup>. More than half of the Caucasian population over age 75 is affected by cardiovascular diseases<sup>2</sup>, and it is reasonable to assume that the incidence of

heart diseases will continue to increase among the elderly. Likewise, the increased incidence of periodontal diseases in elderly individuals indicate that periodontists must be prepared to provide periodontal care for increasing numbers of cardiovascular patients. For periodontists, the following are the commonest cardiovascular diseases which need to be taken into account: cardiac arrhythmias, coronary artery disease, valvular heart disease, hypertension, and heart transplantation<sup>3</sup>.

### Cardiac arrhythmias

Cardiac arrhythmias may be caused by a variety of reversible abnormal physiologic events such as hypoxia or electrolyte/acid-based abnormalities. Other important causes are myocardial ischemia, increased sympathetic activity, and congestive heart failure. Some antiarrhythmic drugs cause xerostomia, gingival hyperplasia and blood dyscrasias as their side effects, which can contribute to the development as well as increase the severity of periodontal diseases. Table A shows commonly used antiarrhythmic drugs. Some arrhythmias need pacemakers, which are mostly implanted transvenously. Until now, the American heart Association (AHA) does not recommend prophylactic antibiotic coverage for dental procedures in pacemaker patients. During a

**Table A: Common antiarrhythmic drugs**

Generic name	Trade name
Amiodarone	Cordarone
Digitalis	Lanoxin, Crystodigin
Diltiazem	Cardizem
Disopyramide	Norpace
Lidocaine	Xylocaine, Lidopen
Mexiletine	Mexitil
Phenytoin	Dilantin
Procainamide	Pronestyl
Propranolol	Inderol
Quinidine	Carioguin, Quenalon
Tocainide	Tonocard
Verapamil	Calan

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dental procedure, the pacemaker maybe disrupted by external electrical

Another potential risk for patients with a pacemaker is their disruption by external electrical fields such as those generated by powerful magnets during a dental procedure. Pacemaker disruption was a major problem with older models which were unipolar and not well insulated. The newer generation of pacemakers are bipolar and well insulated so the small amount of electromagnetic radiation generated by dental equipments pose little threat to their functions. Information regarding the type of pacemaker in place can usually be obtained from the patient's physician<sup>4</sup>. Automatic implantable cardioverter defibrillator devices may get activated without significant warning, potentially causing the patient to perform sudden movements that may result in injury to the patient or the clinician. The placement of a mouth prop should be considered to minimize this potential risk. This is probably less likely to occur with newer devices that initially emit low level bursts followed by stronger electrical shocks if cardioversion does not occur immediately. Epinephrine is contraindicated in all refractory arrhythmias and it should be used with caution (reduced dose with careful monitoring) in patients with pacemakers and implanted defibrillators.

### Congestive Heart Failure

Elective periodontal treatment for these patients should ideally be delayed until the condition has been stabilized with medical treatment. Emergency periodontal treatment should consist of conservative therapy including analgesics and antibiotics if necessary<sup>5</sup>. Periodontal appointments should be brief and the patient seated in the dental chair should be in a partially reclining or erect position. Sedatives should be considered for the anxious patients, and supplemental oxygen should be readily available. Patients should not be placed in a supine position, since this position allows peripheral blood to return to the central circulation and overwhelms the decompensated myocardium, resulting in orthopnea.

Digitalis has been used for many years to increase contraction of cardiac muscle and enhance cardiac output in patients with heart failure<sup>6</sup>. The periodontist should be alert for evidence of toxicity in any patient receiving this drug. Common toxicity symptoms may include

nausea, vomiting, yellow-green vision, anorexia, diarrhea, fatigue, headache, dizziness, delirium; but the most dangerous manifestation is altered cardiac rhythm. Diuretics, vasodilators, angiotensin converting enzyme inhibitors and calcium channel blocking agents are also used in the treatment of congestive heart failure. Each of these drugs has potential side effects and must be monitored in periodontal practice. In a recent publication, 43.6% of patients receiving nifedipine were reported to experience some gingival hyperplasia<sup>7</sup>. In some cases, gingival surgery is necessary for regaining a physiological mastication.

### Coronary Artery Disease

Cardiovascular and periodontal diseases are common inflammatory conditions in human population. Atherosclerosis is a diffuse process that starts in early childhood and progresses asymptotically through adult life<sup>8</sup>. Later on, it is clinically expressed as ischemic coronary syndrome, stroke/transient ischemic stroke and peripheral artery disease. Exposures to infections like periodontal diseases have been postulated to perpetuate inflammatory events in atherogenesis. Recent observational and meta-analysis studies continue to demonstrate a modest but statistically significant increased risk of cardiovascular diseases among persons exposed to periodontal disease or infection. Furthermore, experimental animal models indicate that periodontal infection can increase atherosclerosis in the presence or absence of hypercholesterolemia. Although available pilot data in patients suggests that periodontal treatment can improve serum biomarkers and cardiovascular disease response, the effect of these interventions on true outcomes of cardiovascular diseases like myocardial infarction and stroke is presently unknown<sup>9</sup>.

Nevertheless, clinicians and patients should be aware of consistent association between cardiovascular and periodontal diseases along with potential preventive benefits of periodontal interventions. The patient with ischemic heart disease may experience angina pectoris or myocardial infarction<sup>10</sup>.

### Angina Pectoris

Angina pain is caused by discrepancy between myocardial oxygen demand and inability of the coronary arteries to deliver it. In most instances,

this occurs due to narrowing of a major coronary artery<sup>10</sup>.

### **Stable angina**

This status refers to chest pain that results from a predictable amount of exertion and responds to rest or nitroglycerine. Patients with stable angina are usually under medical care, which commonly includes combinations of beta-adrenergic blocking agents, nitrates, and calcium channel blocking agents. For these patients, periodontal appointments should be short, minimally stressful, and preferably during morning hours. Generous local anesthesia is recommended to prevent large amounts of endogenous epinephrine from being released in response to pain. The smallest quantity of local anesthetic with the lowest concentration of epinephrine (not exceeding 1:100,000) should be used. As a general rule, the dosage for epinephrine should not exceed 0.04 to 0.08 mg per appointment for a patient with stable angina. In order to minimize stress, conscious sedation can be given. In case angina occurs during periodontal treatment, the procedure should be terminated and the patient be placed in a semi-supine position. Oxygen (100%) should be administered and sublingually nitroglycerin be placed. Nitroglycerine should be repeated if necessary, but the minimal dose necessary to abort the angina should be used. Vital signs should be monitored and further emergency measures taken if necessary. Pain that persists after 3 doses of nitroglycerin given every 5 minutes, lasts more than 15 to 20 minutes, or is associated with sweating, nausea, vomiting, syncope or hypotension, may be suggestive of myocardial infarction and immediate arrangements should be made for transportation to the hospital. In the mean time, vital signs must be closely monitored. The patient should continue oxygen and 5 to 10 mg of morphine sulfate may be given intravenously for pain and anxiety. Should cardiopulmonary arrest occur while aid is still forthcoming, resuscitative measures must be undertaken.

### **Unstable angina**

Unstable angina represents a clinical syndrome which is intermediate between stable angina and myocardial infarction. Patients with known unstable angina should only receive emergency treatment or minimum periodontal care, and only

after the consultation with his/her physician in-charge. For such patients, administration of vasoconstrictors is contraindicated and periodontal as well as dental treatments should be given in a hospital environment<sup>11</sup>.

### **Prinzmetal angina (Variant angina)**

This variant angina is believed to be precipitated by coronary artery spasm with or without coronary artery compromise. Coronary artery spasm has been reported with cocaine abuse. For variant angina, especially in the absence of vascular lesions, a detailed work-up to rule out the possibility of drug abuse must be done. During periodontal treatment for such patients, vasoconstrictors should be used with caution<sup>11</sup>.

### **Myocardial infarction**

Myocardial infarction occurs when a narrowed atherosclerotic coronary artery gets acutely occluded leading to necrosis of the heart muscle supplied by that artery. Affected patients generally complain of a crushing substernal pain with radiation to the neck, jaw, or left arm. The pain may be accompanied by shortness of breath, anxiety, nausea and sweating. The highest risk of death following acute myocardial infarction occurs during first 12 hours when the risk of ventricular fibrillation is greatest<sup>12</sup>. Within 6 months following an episode of myocardial infarction, patients are at increased risk of an additional infarction. Consequently, only minimal treatment for acute periodontal problems is advised within 6 months of an episode of myocardial infarction, and preferably after consultation with the patient's physician. Same principles for periodontal treatment are followed as for angina pectoris: morning appointments, profound local anesthesia, oral or inhalation sedation (if needed) and close monitoring of the vital signs of the patient.

### **Hypertrophic Cardiomyopathy**

Hypertrophic cardiomyopathy is generally an autosomal dominant condition that features unexplained myocardial hypertrophy. These patients are at risk for myocardial ischemia, arrhythmias including ventricular fibrillation, and exercise induced sudden death is a constant risk. It is important to note that nitroglycerin and related drugs are contraindicated in patients with hypertrophic cardiomyopathy<sup>13</sup>.

Nitroglycerin should not be administered to these patients if they develop angina pectoris in the periodontal/dental office and epinephrine should be administered with extreme caution on these patients.

## Valvular Heart Diseases

Rheumatic fever, congenital abnormalities, ischemic heart disease, mitral valve prolapse, Kawasaki disease, systemic lupus erythematosus and metabolic processes are associated with valvular heart disease and can be stenotic and/or regurgitant in nature. Mitral valve prolapse (also named floppy valve syndrome) is characterized by idiopathic loss of fibrous and elastic tissue of mitral leaflets or the chordae tendinae. It is prevalent in hereditary connective tissues disorders, particularly with Ehlers-Danlos and Marfan's syndrome. Mitral valve prolapse is relatively common in general population, especially in young women and individuals suffering from psychiatric disorders like panic disorder, severe depression, anorexia nervosa, or in Down's syndrome<sup>14</sup>. Ischemic heart disease may result in calcific degeneration, rupture, or scarring of perivalvular muscle tissue leading to mitral valve regurgitation.

Patients with valvular heart disease face 3 major risks namely infective endocarditis, heart failure, and hemodynamically significant arrhythmia<sup>15,16</sup>. Blood born bacteria may lodge on damaged and abnormal heart valves, in the endocardium, or in the endothelium near congenital anatomic defects, resulting in infective endocarditis or endarteritis. For periodontists, it is important to determine whether or not regurgitation is present in patients with mitral valve prolapse since this condition requires

prophylactic antibiotic coverage for periodontal procedures only if regurgitation is present. The AAP (American Association for Periodontology) recognized that 1 out of 4 infective endocarditis is caused by periodontal germs like *Actinobacillus actinomycetemcomitans*, *Eikenella corrodens*<sup>17</sup>. Simple scaling resulting in bleeding can produce transient bacteremia. There is some evidence that use of oral subgingival irrigators or air polishing devices may create risk for bacteremia, if improperly used<sup>18,19</sup>. Cardiologists and dental associations worldwide have agreed on prophylactic antibiotic guidelines for patients with cardiac conditions requiring prophylaxis (Table B and C). In patients at risk, antibiotic prophylaxis is recommended in all periodontal procedures likely to induce gingival or mucosal bleeding, including professional tooth polishing<sup>20</sup>. If several appointments are necessary to perform complete periodontal treatment, it may be prudent to observe an interval of 7 to 14 days between each procedure, in order to minimize the risk of emergence of resistant strains of periodontal and oral bacteria. Before each treatment, the patient must be asked to rinse for 1 minute with a solution containing an antiseptic, such as chlorhexidine. For most adults, prophylactic dose of 2 gm of amoxicillin one hour before the periodontal procedure is recommended (Table C). In some cases bacterial resistance may be encountered in patients who take oral penicillin for secondary prevention of rheumatic fever or for other purposes. In such cases, the periodontist should select another antibiotic.

Tetracyclines are not recommended for prophylactic cardiovascular antibiotic coverage. However, some studies have demonstrated that patients with periodontal diseases associated with tetracycline-sensitive germs, can be treated by administration of tetracyclines for 2 to 3

**Table B: Cardiac conditions requiring antibiotic prophylaxis for infective endocarditis/endarteritis prior to dental procedure (24).**

	Cardiac Conditions
1	Prosthetic cardiac valves (including bioprosthetic and homograft valves)
2	Previous infective endocarditis
3	Congenital heart diseases (CHD) except secundum atrial septal defect
4	Palliative shunts and conduits
5	Completely repaired congenital heart defect with prosthetic material or device during first 6 months after the procedure
6	Repaired CHD with residual defects
7	Rheumatic and other acquired valvular dysfunction
8	Hypertrophic cardiomyopathy
9	Mitral valves prolapse with valvular regurgitation

**Table C: Antibiotic regimens (24).**

Situation	Agent	Adult dose	Children dose
Oral	Amoxicillin	2 g	50 mg/kg
Unable to take Oral	Ampicillin	2 g IM or IV	50 mg/kg IM/ IV
	Cefazoline	1g IM/IV	50 mg/kg IM/ IV
Allergic to Penicillin	Clindamycin	600 mg	20 mg/kg
	Azithromycin/ Clarithromycin	500 mg	15 mg/kg

- Cephalosporines should not be used in case of penicillin allergy.
- Oral antibiotic should be given 1 hour and IM (intramuscular)/ IV (intravenous) 30 minutes before procedure.

weeks followed by one week delay for tissue manipulative therapy under coverage of AHA recommended prophylactic regimens<sup>17</sup>. Antibiotic prophylaxis may reduce the risk of infective endocarditis but does not preclude its occurrence<sup>15,20</sup>. The clinician must remain alert for persistent fever or other symptoms associated with endocarditis. Periodontal examination and elimination of periodontal diseases should be performed and potential sources of bacteremia eliminated, on all patients who need valve replacement or other cardiac surgeries.

## Hypertension

Hypertension is one of the major risk factors for cardiovascular diseases and a major cause of renal failure and stroke. Blood pressure > 160/95 mm Hg is generally considered as hypertension and 140/90 – 160/95 mmHg as borderline for an adult.

Periodontists and dental care workers have an important role in the detection and management of hypertensive patients. With routine blood pressure monitoring on different visits, undiagnosed hypertensive patients may be identified and advised to consult a physician. Previously identified hypertensive patients should have their blood pressure taken at each visit. Elective periodontal treatment for uncontrolled hypertensive patients should be deferred until control is achieved. Emergency treatment for uncontrolled hypertensive patients should be as conservative as possible. Some clinical studies have indicated that absorption of sodium bicarbonate, used during periodontal cleaning of tooth surfaces with an air abrasive cleansing device may alter serum electrolyte balance. Any such effects appear minimal and transient. Until now, there is no strong evidence to suggest that use of these substances is contraindicated in patients with cardiovascular disease<sup>21,22</sup>. The use of

epinephrine in combination with local anesthetics is not contraindicated in the hypertensive patient unless the systolic is > 200 and/or diastolic > 115 mmHg. Most authorities recommend small amounts of epinephrine; 0.04 to 0.08 mg/appointment as compared to a maximum of 0.2 mg in a healthy 70 kg adult. Generous local anesthesia is indicated to minimize the release of endogenous epinephrine in response to pain<sup>23</sup>. For prosthodontic treatments, use of vasopressors to control local bleeding and gingival retraction cord containing vasopressors is contraindicated<sup>24</sup>. General anesthesia is not recommended in out-patients with significant hypertensive disease because of the risk of secondary hypertension, and medical advice and care in a hospital setting may be indicated.

## Heart Transplantation

Protocols have not yet been established for periodontal or dental management of patients with organ transplants. Active and potential sources of infection (periodontal and dental) should be eliminated and necessary dental care should be accomplished before transplant. Patients who receive a heart transplant on an emergency basis and who have existing and identified dental infection, should receive antibiotics before and after the transplant, until dental treatment is rendered. Following heart transplantation, recipients may be maintained on life long immunosuppressive drugs to blunt the host rejection. These drugs may include cyclosporine, corticosteroids, antilymphocyte globulin (ALG), Azathioprine, or combinations.

Periodontists and dental care workers should remain alert for signs and symptoms of unusual systemic fungal infections such as cryptococcus and mucormycosis. These infections may lead to severe disseminated disease in immunosuppressed patients and must be detected early on for appropriate antimicrobial

therapy. Prophylactic antibiotics are recommended for all dental procedures likely to cause bacteremia in transplant patients taking immunosuppressive drugs, and physician consultation is appropriate. For these reasons, mouth wash for one minute with antiseptic at periodontal surgical site may reduce the incidence of possible bacteremia<sup>15</sup>. The use of surgical aspiration can also considerably reduce the bacterial aerosol. Patients under cyclosporine, may harbor gingival enlargement or hyperplasia and gingival surgery is sometimes necessary<sup>7</sup>. Moreover, for patients under adrenal suppressive doses of corticosteroids, supplementary steroids may be necessary prior to stressful periodontal treatments.<sup>?</sup>

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