

# Dental Management of the Cardiovascular Compromised Patient: A Clinical Approach

Saurabh Singh<sup>1\*</sup>, Khushboo Gupta<sup>1</sup>, Kavita Nitish Garg<sup>2</sup>, Neeraj Kumar Fuloria<sup>3</sup>, Shivkanya Fuloria<sup>3</sup>, Teerthesh Jain<sup>4</sup>

<sup>1</sup>Faculty of Dentistry, AIMST University, Bedong 08100, Kedah Darul Aman, MALAYSIA.

<sup>2</sup>Department of Oral Pathology, Career Dental College, Lucknow, Uttar Pradesh, INDIA.

<sup>3</sup>Unit of Pharmaceutical Chemistry, Faculty of Pharmacy AIMST University, Bedong, Kedah Darul Aman, MALAYSIA.

<sup>4</sup>Department of Prosthodontics, Imam Abdul Rahman Bin Faisal University, Dammam, SAUDI ARABIA.

## ABSTRACT

Cardiovascular disease trends, complications, and associated therapeutics, impact the dental health and treatment. Such patients require special consideration with regard to when and which dental treatment is appropriate and what precautions are required. A clinical approach is provided for the dental management of patients with Arterial hypertension, Heart failure, and Ischemic Heart disease, Cardiac Arrhythmias, Infective Endocarditis, Stroke and Cardiac Pacemaker. A Medline-PubMed search was conducted of the literature over the last 20 years using the keywords: "cardiovascular diseases", "dental management", "arterial hypertension", "heart failure", "ischemic heart disease", "cardiac arrhythmias", "infective endocarditis", "stroke" and "cardiac pacemaker". A total of 46 articles were reviewed, of which 32 were literature reviews, 3 were expert committee guides and updates and 11 original research papers. The appropriate management of dental patients with cardiovascular disease is contingent on appropriate assessment and evaluation. This article aims to allay many of these uncertainties by describing the commoner cardiac conditions, the risk they pose during dental practice and how they may affect dental treat-

ment. It outlines prophylactic and remediable measures that may be taken to enable safe delivery of dental care.

**Key words:** Cardiovascular disease, Dental management, Arterial hypertension, Heart failure, Ischemic heart disease, Cardiac arrhythmias, Infective endocarditis, Stroke and cardiac pacemaker.

**Key message:** This review aims to allay many of these fears and focuses on common Cardiovascular compromised conditions and risk they pose during dental practice that necessitate extra awareness and caution to prevent potential complications causing otherwise unnecessary morbidity and mortality.

## Correspondence

**Dr. Saurabh Singh** MDS, Lecturer, Faculty of Dentistry, AIMST University, Bedong 08100, MALAYSIA.

Phone: +60103721009

Email: drsaurabhoms@gmail.com

DOI: 10.5530/jyp.2017.9.89

## INTRODUCTION

Cardiovascular disease is the leading global cause of death, accounting for more than 17.3 million deaths per year.<sup>1</sup> Nearly half of all African-American adults have some form of cardiovascular disease. Compared with western countries, most Asian countries have higher age related mortality from cardiovascular disease.<sup>2</sup> Along with the associated morbidity, such disorders are important because many patients are associated with treatment. So, patient with cardiovascular disease constitute risk cases in dental practice. The dental management of these medically compromised patients can be problematic in terms of oral complications, dental therapy, and emergency care. The present study consists of a literature review dental management of patients suffering from various cardiovascular diseases.

## MATERIALS AND METHODS

A Medline-PubMed search was conducted of the literature over the last 37 years using the keywords: "cardiovascular diseases", "dental management", "arterial hypertension", "heart failure", "ischemic heart disease", "cardiac arrhythmias", "infective endocarditis", "stroke" and "cardiac pacemaker". A total of 46 articles were reviewed, of which 32 were literature reviews, 3 were expert committee guides and updates and 11 original research papers.

## Cardiovascular diseases and their dental management

1. **Hypertension:** Hypertension is high blood pressure. Hypertension is defined as values >140 mmHg systolic pressure and/or >90 mmHg diastolic pressure.<sup>3,4</sup>

## Dental management:

1. A well-controlled hypertensive patients does not pose a risk in clinical practice.
2. The patient is to be instructed to take his or her medication as usual on the day of dental treatment. Prior to such treatment, the patient blood pressure should be recorded.<sup>5,6</sup>
3. It is preferable for the visits to be brief and in the morning. The prescription of anxiolytic agents may prove necessary in particularly anxious patients (5-10 mg of diazepam the night before and 1-2 hours before the appointment) before dental treatment, or alternatively sedation with nitrous oxide may be considered.
4. In the case of emergency dental visits, treatment should be conservative, with the use of analgesics and antibiotics. NSAIDs should not be prescribed for longer than this five-day period.<sup>7,8</sup>
5. Patients with cardiovascular disease are at a greater risk of massive endogenous adrenalin release secondary to deficient local anesthesia than of reaction to the small amount of vasoconstrictor used in local anesthetics.<sup>9,10,11,12</sup> Nevertheless, vasoconstrictor use should be limited, taking care not to exceed 0.04 mg of adrenaline.<sup>1</sup>

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

2. **Heart failure:** Heart failure (HF) is defined as the incapacity of the heart to function properly, pumping insufficient blood towards the tissues and leading to fluid accumulation within the lungs, liver and peripheral tissues.<sup>14</sup>

#### Dental management:

1. Dental treatment is to be limited to patients who are in stable condition.
2. The patient should be placed in the semi-supine position in a chair, with control of body movements (which should be slow), in order to avoid orthostatic hypotension.
3. In patients administered digitalis agents (digoxin, methyl digoxin), the vasoconstrictor dose is to be limited to two anesthetic carpules, since this drug combination can favor the appearance of arrhythmias.
4. Aspirin (acetylsalicylic acid) can lead to sodium and fluid retention, and therefore should not be prescribed in patients with heart failure.
5. In the event of an emergency and after contacting the emergency service, the patient should be placed seated with the legs lowered, and receiving nasal oxygen at a rate of 4-6 liters/minute. Sublingual nitroglycerin tablets are indicated (0.4-0.8 mg), and the dose may be repeated every 5 or 10 minutes if blood pressure is maintained.<sup>14,15</sup>
3. **Cardiac arrhythmias:** A cardiac arrhythmia can be described as an abnormality in rate, regularity, or site of origin of the cardiac impulse.<sup>16</sup>

#### Dental management:

1. Anxiolytics can be used to lessen stress and anxiety.<sup>16,17</sup>
2. Although modern pacemakers are more resistant to electromagnetic interferences, caution is required when using electrical devices (e.g., ultrasound and electric scalpels).<sup>18</sup>

If arrhythmia develops during dental treatment, the procedure should be suspended, oxygen is to be provided, and the patient vital signs are to be assessed. Sublingual nitrites are to be administered in the event of chest pain. The patient should be placed in the Trendelenburg position, with vagal maneuvering where necessary (Valsalva maneuver, massage in the carotid pulse region, etc.).

4. **Infective Endocarditis:** Endocarditis is a life-threatening disease, although it is relatively uncommon. Endocarditis usually develops in individuals with underlying structural cardiac defects who develop bacteremia with organisms likely to cause endocarditis. Some surgical and dental procedures and instrumentations involving mucosal surfaces or contaminated tissue cause transient bacteremia that rarely persists for more than 15 minutes. Blood-borne bacteria may lodge on damaged or abnormal heart valves or on the endocardium or the endothelium near anatomic defects, resulting in bacterial endocarditis or endarteritis.<sup>19,20</sup> *Streptococcus viridans* ( $\alpha$ -hemolytic streptococci) is the most common cause of endocarditis following dental or oral procedures.

#### Dental Management:

1. Individuals who are at risk for developing bacterial endocarditis should establish and maintain the best possible oral health to reduce potential sources of bacterial seeding.
2. In general, antimicrobial prophylaxis is recommended for procedures associated with significant bleeding from hard or soft tissues, periodontal surgery, scaling, and professional teeth cleaning. In such an event, data from experimental animal models suggest that antimicrobial prophylaxis administered within 2 h following the procedure will provide effective prophylaxis.<sup>23</sup>
5. **Ischemic Heart Disease:** Ischemic heart disease is characterized by a reduction (partial or total) in coronary blood flow. In 90% of all cases,

this occurs following thrombus formation secondary to an atheroma plaque that occludes the arterial lumen, though other factors such as cold, physical exercise or stress can act as coadjuvant factors or (less frequently) trigger the event themselves.<sup>24</sup> Chest pain (angina) occurs when coronary occlusion is partial and no myocardial necrosis is produced, while acute myocardial infarction is observed when coronary occlusion is total and necrosis is produced as a result. In turn, sudden death may also occur, generally as a result of arrhythmias.<sup>14</sup>

#### Dental management:

1. In dental practice a minimum safety period of 6 months has been established before any oral surgical procedure can be carried out. After this safety period, the treatment decision should be established on the basis of the situation and medical condition of each individual patient.<sup>25,26,14</sup> If nitrates are used, the patient should bring them to each visit to the dental clinic, in case chest pain develops.<sup>18</sup>
2. In the case of very anxious patients, premedication can be administered to lessen anxiety and stress (5-10 mg of diazepam the night before and 1-2 hours before treatment).
3. The patient should be placed in the position most comfortable for him or her (semi-supine), and should get up carefully in order to avoid orthostatic hypotension. Depending on the patient, blood pressure and pulseoxymetric monitoring may be required before and during dental treatment.
4. If the patient is receiving anticoagulants, the international normalized ratio (INR) on the day of treatment should be determined, and treatment should be provided within the recommended limits (< 3.5), with local hemostasis if surgery is planned. If the patient is receiving antiplatelet medication, excessive local bleeding is to be controlled.
5. The local hemostatic measures that can be used comprise bone wax, sutures, gelatin of animal origin, regenerated oxidized cellulose, collagen, platelet rich plasma, thrombin, fibrin sealants, electric or laser scalpels, antifibrinolytic agents such as tranexamic acid.<sup>27</sup>
6. **Cardiac pacemakers and implantable cardioverter-defibrillators:** Automated Implantable Cardioverter Defibrillators (AICDs) or otherwise simply known as Implantable Cardioverter Defibrillators (ICDs) have been in use for more than 30 years. An ICD is a small battery-powered electrical impulse generator that is implanted in patients who are at a risk of sudden cardiac death due to ventricular fibrillation and ventricular tachycardia.

In practice, the most common cause of problems is the electrosurgical unit or diathermy. Diathermy is best avoided in patients with pacemakers. If diathermy must be used, bipolar diathermy is preferred. If unipolar diathermy must be used, the ground pad should be placed so that the pacemaker or its leads do not lie within the electric field (between the ground pad and the instrument). Thus, it is commonly recommended that if diathermy is to be used, ICD devices should be programmed off immediately prior to surgery and on again postoperatively.<sup>28,29</sup>

#### Dental Management:

1. All patients who have any type of implantable cardiac devices should provide the details of manufacturer's identification card like manufacturer of the device, model number, serial number, date of implantation, and mode of operation to their oral health provider.<sup>30,31,32</sup>
2. Dental professionals should encourage sterilized working environment.
3. Before any therapeutic service dentist should consult patient's cardiologist and if needed, cardiologist should be informed about the dental procedure.

4. For oral prophylaxis, the dentist should consider the use of hand scalers although piezoelectric scalers are documented to be safe.
5. Care should be taken not to place electrical cords over patient's chest.
6. Unshielded pacemakers should be covered with a lead apron.
7. Dentists should be aware of symptoms of pacemaker malfunction such as difficulty in breathing, lightheadedness, dizziness, change in pulse rate, prolonged hiccoughing, swelling in chest and arm, and chest pain. In such conditions, cardiologist should be consulted immediately.
7. **Patients on anticoagulant therapy:** Anticoagulant treatment is very common in cardiac patients. For a healthy person without anticoagulant treatment, the International Normalized Ratio (INR) = 1. Anticoagulant treatment usually targets to an INR between 2.0–3.0. In certain high-risk situations (e.g. a mechanical mitral valve prosthesis), higher INR values 2.5–3.5 (–4.0) may be required.<sup>33-36</sup>

### Dental management:

Warfarin treatment may interact with several drugs, causing derangement of anticoagulant treatment. Following are the key recommendation for dental treatment.<sup>37</sup>

1. The risk of significant bleeding in patients on oral anticoagulants and with a stable INR in the therapeutic range 2-4 (i.e.<4) is very small and the risk of thrombosis may be increased in patients in whom oral anticoagulants are temporarily discontinued. Oral anticoagulants should not be discontinued in the majority of patients requiring outpatient dental surgery including dental extraction.
2. The risk of bleeding in patients on oral anticoagulants undergoing dental surgery may be minimized by:
  - a. The use of oxidized cellulose (Surgicel) or collagen sponges and sutures.
  - b. 5% tranexamic acid mouthwashes used four times a day for two days. Tranexamic acid is not readily available in most primary care dental practices.
3. Patients taking warfarin should not be prescribed non-selective NSAIDs and COX-2 inhibitors as analgesia following dental surgery.
8. **Stroke Patient:** Stroke (produced by cerebral hemorrhage or cerebral ischemia) is a serious neurological accident, often fatal, due to a sudden interruption of the oxygenated blood supply to the brain.<sup>38,39</sup>

### Dental management:

1. Blood pressure and pain should be monitored and maintained during the entire intervention.<sup>40,41</sup>
2. If the required dental treatment may cause bleeding, anticoagulant systemic medication may cause serious hemorrhage, therefore anti-coagulant drugs like heparin should be stopped at least 6-12 hours before treatment. Six hours after bleeding, when blood clots are built up, heparin systemic treatment can be resumed.<sup>42</sup>
3. The minimal amount of anesthetic solutions should be injected, concentration of added epinephrine should be very low (1:100,000 or 1:200,000).<sup>43</sup>
4. If the patient shows symptoms of stroke, he should get oxygen therapy immediately and should be referred to a hospital as soon as possible.<sup>44-46</sup>

### CONCLUSION

Cardiovascular disease is one of the most common disease in the developed and developing countries as well. In most developing countries

it is the most common cause of death followed by cancer and cerebrovascular disease. It is therefore important for dental surgeons to know the medical problems of each individual patient, the treatments received, and the possibilities for dental treatment. In addition, dental surgeons must be able to identify medical emergencies and adopt the opportune measures to avoid them or treat them quickly and effectively.

### CONFLICT OF INTEREST

No Conflict of interest declared

### ABBREVIATION USED

HF: Heart failure; NSAIDs: Nonsteroidal anti-inflammatory drugs; INR: international normalized ratio; AICDs: Automated Implantable Cardioverter Defibrillators; ICDs: Implantable Cardioverter Defibrillators.

### REFERENCES

1. Mozaffarian D, Benjamin EJ, Go AS, Arnett DK, Blaha MJ, Cushman M *et al*; on behalf of the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2016 update: a report from the American Heart Association. *Circulation*. 2016; 133:000-000.
2. Ueshima H. Explanation for the Japanese paradox: prevention of increase in coronary heart disease and reduction in stroke. *J Atheroscler Thromb*. 2007;14(6):278–86.
3. Kaplan NM. Primary hypertension. From pathophysiology to prevention. *Arch Intern Med*. 1996;156(17):1919-20.
4. Popescu M, Scriciecu M, Mercut V, Tuculina M, and Dascalu I. Hypertensive Patients and Their Management in Dentistry. *ISRN Hypertension*, vol. 2013, Article ID 410740, 8 pages, 2013. doi:10.5402/2013/410740
5. Mancia G, Fagard R., Narkiewicz K. *et al.*, 2007 ESH-ESC Practice Guidelines for the Management of Arterial Hypertension: ESH-ESC Task Force on the Management of Arterial Hypertension. *J Hypertens*. 2007;25(9):1751-62.
6. Mask AG Jr. Medical management of the patient with cardiovascular disease. *Periodontol* 2000;23:136-41
7. Gómez-Moreno G, guardia J, Cutando A, Calvo-guirado J. Pharmacological interactions of anti-inflammatory-analgesics in odontology. *Med Oral Patol Oral Cir Bucal*. 2009;14(2):81-9.
8. Salort-Illorca C, Mínguez-Serra MP, Silvestre-Donat FJ. Interactions between ibuprofen and antihypertensive drugs: Incidence and clinical relevance in dental practice. *Med Oral Patol Oral Cir Bucal*. 2008;13(11):E717-21.
9. Silvestre FJ, Verdú MJ, Sancho JM, Peñarocha M. Effects of vasoconstrictors in dentistry upon systolic and diastolic arterial pressure. *Med oral*.2001;6(1):57-63.
10. Cáceres MT, Iudovice AC, Brito FS, Darrioux FC, Neves RS, Scanavacca MI, *et al.* Effect of local anesthetics with and without vasoconstrictor agent in patients with ventricular arrhythmias. *Arq Bras Cardiol*. 2008;91:128-33.
11. Iaragnoit AB, Neves RS, Neves II, Vieira JE. Locoregional anesthesia for dental treatment in cardiac patients: a comparative study of 2% plain lidocaine and 2% lidocaine with epinephrine (1:100,000). *Clinics (Sao Paulo)*. 2009;64(3):177-82
12. Medeiros FB, de Andrade AC, Angelis GA, Conrado VC, Timerman L, Farsky P, Dib LL. Bleeding evaluation during single tooth extraction in patients with coronary artery disease and acetylsalicylic acid therapy suspension: a prospective, double-blinded, and randomized study. *J Oral Maxillofac Surg*. 2011;69(12):2949-55.
13. Steinhauer T, Bsoul SA, Terezhalmay gT. Risk stratification and dental management of the patient with cardiovascular diseases. Part I: Etiology, epidemiology and principles of medical management. *Quin-tessence Int*. 2005;36:119-37
14. Margaix-Muñoz M, Jiménez-Soriano Y, Poveda-Roda R, Sarrión G. Cardiovascular diseases in dental practice. Practical considerations. *Med Oral Patol Oral Cir Bucal*. 2008;13(5):296-302.
15. Cruz-Pamplona M, Jimenez-Soriano Y, Sarrión-Pérez MG. Dental considerations in patients with heart disease. *J Clin Exp Dent*. 2011;3(2):e97-105.
16. Friedlander AH, Yoshikawa TT, Chang DS, Feliciano Z, Scully C. Atrial fibrillation: pathogenesis, medical-surgical management and dental implications. *J Am Dent Assoc*. 2009;140(2):167-77
17. Muzyka BC. Atrial Fibrillation and its relationship to dental care. *J Am Dent Assoc*. 1999;130:1080-5.
18. Rose LF, Mealey B, Minsk L, Cohen DW. Oral care for patients with cardiovascular disease and stroke. *J Am Dent Assoc*. 2002;133:37-44.
19. Adnan S. Dajani, Kathryn A. Taubert, Walter Wilson, Ann F. Bolger, Arnold Bayer, Patricia Ferrieri, *et al.* Prevention of Bacterial Endocarditis. *Circulation*. 1997;96(1):358-66.
20. Steckelberg JM, Wilson WR. Risk factors for infective endocarditis. *Infect Dis Clin North Am*. 1993;7(1):9-19.
21. Saiman L, Prince A, Gersony WM. Pediatric infective endocarditis in the modern

- era. *J Pediatr.* 1993;122(6):847-53.
22. Guntheroth WG. How important are dental procedures as a cause of infective endocarditis? *Am J Cardiol.* 1984;54(7):797-801.
  23. Kaye D. Prophylaxis for infective endocarditis: an update. *Ann Intern Med.* 1986;104:419-23.
  24. Berney P, Francioli P. Successful prophylaxis of experimental streptococcal endocarditis with single-dose amoxicillin administered after bacterial challenge. *J Infect Dis.* 1990;161(2):281-5.
  25. Silvestre FJ, Miralles-Jorda L, Tamarit C, Gascon R. Dental management of the patient with ischemic heart disease: an update. *Med. Oral.* 2002;7:222-30.
  26. Elad S, Zadik Y, Kaufman E, Leker R, Finfter O, Findler M. A new management approach for dental treatment after a cerebrovascular event: a comparative retrospective study. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2010;110(2):145-50.
  27. Lifshay FM. Evaluation of and Treatment Considerations for the Dental Patient with Cardiac Disease. *NY State Dent J.* 2004;70(8):16-9.
  28. Silvestre-Donat FJ. Dental management of ischaemic heart disease. *Medicina Oral.* 2003;8:230
  29. Miller CS, Leonelli FM, Latham E. Selective interference with pacemaker activity by electrical dental devices. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1998;85(1):33-6.
  30. Eagle KA (Chair). ACC/AHA guideline update for perioperative cardiovascular evaluation of noncardiac surgery-executive summary. *J Am Coll Cardiol* 2002;39(3):542-53.
  31. Roedig, J.J., Shah, J., Elayi, C.S., Miller, C.S.,. Interference of cardiac pacemaker and implantable cardioverter-defibrillator activity during electronic dental device use. *J. Am. Dent. Assoc.* 2010;141(5):521-6.
  32. Shah AH, Khalil HS, Kola MZ. Dental management of a patient fitted with subcutaneous Implantable Cardioverter Defibrillator device and concomitant warfarin treatment. *Saudi Dent J.* 2015;27(3):165-70. doi: 10.1016/j.sdentj.2014.11.015. Epub 2015 Apr 23
  33. Yeo TP, Berg NC. Counseling patients with implanted cardiac devices. *Nurse Pract* 2004;29:58;61-5.
  34. Sirois DA, Fatah-zadeh M. Valvular heart disease. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2001;91:15-9.
  35. Blinder D, Manor Y, Martinowitz U, Taicher S. Dental extractions in patients maintained on continued oral anticoagulant. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1999;88(2):137-40.
  36. Souto JC, Oliver A, Zuazu-Jausoro I, Vives A, Fontcurbetas J. Oral surgery in anticoagulated patients without reducing the dose of oral anticoagulant: a prospective randomized trial. *J Oral Maxillofacial Surg* 1996;54(1):27-32.
  37. Jowett NI, Cabot LB. Patients with cardiac disease: considerations for the dental practitioner. *Br Dent J* 2000;189(6):297-302.
  38. Perry DJ, Noakes TJ, Helliwell PS. Guidelines for the management of patients on oral anticoagulants requiring dental surgery *Br Dent J.* 2007;203(7):389-93.
  39. Brandt T, Orberk E, Weber R, *et al.* Pathogenesis of cervical arterial dissection. *Neurology* 2001;57(1):24-30.
  40. Buhlin K, Gustafsson A, Pockley AG, *et al.* Risk factors for cardiovascular disease in patients with periodontitis. *Eur Heart J* 2003; 24:2099-107.
  41. Arseni C. *Tratat de neurologie, Vol.IV, Partea I, Ed. Medicala: Bucuresti* 1982, p. 140-262
  42. Dörfer CE, Becher H, Ziegler CM, *et al.* The association of gingivitis and periodontitis with ischemic stroke. *J Periodontol* 2004;31(5):396-401
  43. Bodnar DC, Varlan CM, Varlan V, Vaideanu T, Brandusa M .Dental Management in Stroke Patients. *TMJ.* 2008;58(3-4):228
  44. Joshipura KJ, Hung HC, Rimm EB, *et al.* Periodontal disease, tooth loss, and incidence of ischemic stroke. *Stroke* 2003; 34:47-52.
  45. Söder PO, Söder B, Nowak J, Jogestrand T. Early carotid atherosclerosis in subjects with periodontal disease. *Stroke* 2005;36(6):1195-200.
  46. Syrjanen J. Vascular diseases and oral infections. *J Am Heart Assoc.* 2003; 17(s1):497-500.

**Article History:** Submission Date : 13-07-2017 ; Revised Date : 25-07-2017; Acceptance Date : 19-08-2017.

**Cite this article:** Singh S, Gupta K, Garg KN, Fuloria NK, Fuloria S, Jain T. Dental Management of the Cardiovascular Compromised Patient: A clinical approach. *J Young Pharm.* 2017;9(4):453-6.