

Systemic Problems and Management in Endodontics

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Abstract: *Many people in the world today are elderly, and as the prevalence of certain pathologies rises with age, it is expected that millions of people may have systemic medical disorders that can impair oral health and the need for following dental care. In terms of oral problems, dental therapy, and emergency care, these medically impaired patients' dental management might occasionally provide challenges. Assessing and managing these individuals is one of the difficulties dental specialists confront today.*

Keywords: Endodontics, Systemic Medical Disorders, Dental Management, Cardiac Disorders, Diabetes Mellitus

1. Introduction

Heart disease, pulmonary disease, diabetes, bleeding disorders, patients who are pregnant, multiple drug interactions, infectious diseases, renal complications, diabetes, and hypertension are just a few of the common medical conditions that dentists encounter on a regular basis that call for additional knowledge. When a healthy person is being treated, it is sufficient to focus on the technical aspects of the procedure, but when treating systemically ill patients who are being managed by a doctor, it is equally important to prevent any potential medical emergencies or complications.

1.1 Importance of History Taking

Getting a complete medical history is very important. A systematic review of the patient's chief or primary complaint, a thorough history of the complaint, details about past and present medical conditions, relevant social and family histories, and an analysis of symptoms by organ system are all included in this process of gathering information to determine the patient's health status. The interpretation of this data enables the monitoring of medical conditions and the evaluation of underlying systemic conditions that the patient may or may not be aware of, provides a basis for determining whether dental treatment may have an impact on the patient's systemic health, and provides a first step in evaluating the potential impact of the patient's systemic health on dental treatment.

The patient's homeostasis changes as a result of dental therapy. The alterations that must be made prior to, during, and after dental treatment should be evaluated using a risk assessment. Determining the disease status in a patient with a pre-existing condition is an important part of dental therapy planning. The patient's condition and how it may

affect their physiology, responsiveness to dental care, and healing following dental treatment should be understood by the physician. Having the necessary management skills is also crucial.

1.2 Cardiac Disorders

1) Hypertension

It is a typical burden that increases the risk of myocardial infarction, cerebrovascular disorders, angina, and ischemic heart disease. Values >140 mmHg for systolic and/or >90 mmHg for diastolic are considered to be hypertension. [1, 2] To prevent causing serious issues during the endodontic process, discomfort and anxiety must be under control.

Monitoring the interactions between medications is the next level of consideration. Nonselective beta-blockers may increase the toxicity of local anesthesia (LA) when they interact. [3] Use of drugs like nonselective beta-blockers (propranolol and nadolol), which increase the effects of epinephrine on the cardiovascular system. Guidelines advise reducing the dosage and lengthening the time between epinephrine injections. Nonsteroidal anti-inflammatory medicines (NSAIDs) may counteract the hypotensive effects of diuretics, beta-blockers, alpha-blockers, vasodilators, and ACE inhibitors. [4] However, a clinically significant effect of short-term administration can be avoided by taking paracetamol.

New high blood pressure guidelines that lowered the threshold for hypertension were published by the American College of Cardiology and the American Heart Association in November 2017 (Image 1).² With this revised cutoff, issues that could happen at lower numbers are taken into account, allowing for earlier intervention. More persons will be diagnosed with hypertension as a result of the decreased diagnostic threshold for the condition.

Blood Pressure Categories



| BLOOD PRESSURE CATEGORY | SYSTOLIC mm Hg (upper number) | | DIASTOLIC mm Hg (lower number) |
|--|----------------------------------|---------------|-----------------------------------|
| NORMAL | LESS THAN 120 | and | LESS THAN 80 |
| ELEVATED | 120 – 129 | and | LESS THAN 80 |
| HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 1 | 130 – 139 | or | 80 – 89 |
| HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 2 | 140 OR HIGHER | or | 90 OR HIGHER |
| HYPERTENSIVE CRISIS (consult your doctor immediately) | HIGHER THAN 180 | and/or | HIGHER THAN 120 |

Prehypertension is no longer a classification under the new guidelines, which now classify people as having Elevated (120–129 mm Hg systolic and less than 80 mm Hg diastolic) or Stage I hypertension (130–139 mm Hg systolic or 80–89 mm Hg diastolic) hypertension. The new guidelines classify 140/90 mm Hg as Stage 2 hypertension, whereas the prior guidelines defined this level as Stage 1 hypertension.² Age, race/ethnicity, family history of hypertension, genetic predisposition, and sex are the key risk factors for hypertension that cannot be changed.

A patient's only regular care appointment can be to the dentist. Dental appointments are the ideal time to check for hypertension and recommend patients for additional testing to their primary care physician.

Monitoring a patient's blood pressure can help with early hypertension detection, management, and treatment. The oral healthcare professional can obtain the data necessary to decide on a course of treatment by checking blood pressure measurements. Before choosing the best anesthetic for dental treatments, blood pressure readings must be taken into account.

All dental healthcare professionals should become involved in the identification and treatment of hypertension, according to the American Dental Association (ADA). The American Dental Association (ADA) advises oral health practitioners to take blood pressure readings from all new patients, from all current patients at least once a year, and from patients who have been diagnosed with hypertension.¹⁰

2) Congestive Cardiac Failure

In congestive heart failure, the demand for blood and the supply of the organs are out of balance. The circumstances requiring contraindications for elective treatments are angina and a recent myocardial infarction of less than six months'

duration; however, emergency endodontic procedures can be performed in a dentist office connected to a hospital with the approval of a cardiologist. [5]

The following factors need to be taken into account: [6]

- 1) To lessen anxiety, take 2 to 5 mg of diazepam one hour before the surgery.
- 2) Procedures requiring anesthesia can be performed without vasoconstrictors
- 3) Short appointments, a semi - supine position in the chair, and the availability of nitroglycerin in sublingual form must be adhered to as safety precautions.
- 4) Patients using aspirin can be thought of as normal, albeit there may be a link to increased bleeding.

3) Infective Endocarditis

Due to transitory bacteremia, patients who have a history of rheumatic heart disease, congenital heart disease, prosthetic heart valves and grafts, and pacemakers are more likely to develop infective endocarditis (IE) during dental treatments. Intravenous drug users are a further crucial risk category to be aware of, and recurrent IE is also widespread in these populations. [7] According to Rose et al. 's review work, 3 to 40% of individuals experienced endocarditis as a result of recent dental care. [8]

When patients with artificial valves experience simultaneous beginnings of heart murmurs and an unidentified fever lasting more than seven days after receiving dental treatment, IE should be suspected. The accompanying symptoms, which commonly appear two weeks after the endodontic operation with periapical instrumentation or perforation, can include chills, nighttime sweating, decreased appetite, fatigue, and discomfort. The presence of petechiae with a pale centre on the hard palate, supraclavicular site, lower conjunctival mucosa, and flexure surfaces of the extremities is the typical clinical sign. [9]

Table 4
Recommended Antibiotic Regimen for IE Prophylaxis

| Situation | Agent | Regimen: Single dose PO: 60 min prior to procedure IV/IM: 30 min prior to procedure | |
|---|--------------------------------------|---|--------------------|
| | | Child | Adult |
| PO | Amoxicillin | 50 mg/kg | 2 g |
| Unable to take PO | Ampicillin | 50 mg/kg IV/IM | 2 g IV/IM |
| | or cefazolin or ceftriaxone | or 50 mg/kg IV/IM | or 1 g IV/IM |
| Allergic to penicillins or ampicillin and PO | Cephalexin*† | 50 mg/kg | 2 g |
| | or | or | or |
| | clindamycin | 20 mg/kg | 600 mg |
| | or azithromycin or clarithromycin | or 15 mg/kg | or 500 mg |
| Unable to take PO and allergic to penicillins or ampicillin | Cefazolin or ceftriaxone† | 50 mg/kg IV/IM | 1 g IV/IM |
| | or clindamycin | or 20 mg/kg IV/IM | or 600 mg IV/IM |

IE: infective endocarditis; IM: intramuscular.
 * Substitutions can be made for cephalexin.
 † Cephalosporins should not be used in patients with a history of anaphylaxis, angioedema, or urticaria with penicillins or ampicillin.
 Source: Reference 1.

Valvular Diseases and Prosthetic Valves

The risk of thromboembolism is higher in prosthetic heart valves, and valves positioned in the aortic region are riskier than those positioned in the mitral region. [13] A high - risk group of patients also includes those who have a history of prior thromboembolism, continuous prolonged atrial fibrillation, valve prosthesis, advanced age, and left ventricular dysfunction. Although aspirin is the only antithrombotic option, patients with a high risk of thromboembolism are also given warfarin.

Antiplatelet and Anticoagulant Drugs

The most often prescribed drugs for patients at risk for coagulative diseases and cardiac arrest are aspirin, clopidogrel, and dipyridamole. For an additive effect, clopidogrel and aspirin are given to more vulnerable patients. The potential systemic risk should be carefully assessed before receiving cardiologists' approval to stop taking clopidogrel, and all precautions to avoid excessive instrumentation and periradicular surgeries should be taken into consideration as the best possible substitute to stop taking antiplatelets and anticoagulants.

The international normalized ratio (INR), which measures prothrombin time, is used to track how anticoagulants are impacting patients. The day before beginning endodontic therapy, the INR should be tested. The acceptable range for doing elective endodontic procedures is 2 - 4 [14].

When clopidogrel needs to be temporarily discontinued, the period of time should not exceed 5 days since after that point, the risk of stent thrombosis increases. The following protocol is suggested when deciding whether to quit antiplatelet therapy. [15]

- a) Consult the patient's cardiologist about the course of action
- b) Minimal risk endodontic operations should be performed as much as feasible before antiplatelet therapy is completely stopped.

4) Respiratory Disorders

Asthma

Clarifying the type of attack (mild, moderate, or severe), frequency of attack, and precipitating factors is crucial before beginning the endodontic operation. We should also follow the emergency protocols. [16]

It is crucial to remind patients to bring their inhaler with them to every dentist appointment if they have a history of using bronchodilator inhalers. An severe asthmatic attack can be triggered by anxiety and dental procedures frequently do so. Anxiety may be reduced by the dentist and other dental team members taking a well - thought - out and compliant approach. When conscious sedation is necessary, hydroxyzine and benzodiazepines are chosen. Procedures for serious conditions should only be carried out with the doctor's approval.

All patients must avoid the NSAID family of medications, barbiturates, and opioids, and those on theophylline must steer clear of erythromycin and ciprofloxacin. It is best to avoid products that contain vasoconstrictors because some local anesthetics may be susceptible to sulfite preservatives.

The following actions should be taken if a patient suddenly exhibits symptoms of an acute asthmatic crisis while receiving dental care: [17]

- 1) Put an end to the dental work and assist the patient in finding a comfortable position to sit up straight or lie down.
- 2) Keep the airway open and administer agonists using a nebulizer or an inhaler.
- 3) Supply oxygen via a face mask, nasal hood, or cannula.
- 4) If no beneficial outcomes were found, administering subcutaneous epinephrine (1: 1000 solution, 0.01 mg/kg of body weight up to a maximum dose of 0.3 mg) will be helpful.

EMERGENCY PROTOCOL FOR MANAGING ASTHMATIC EXACERBATION IN A DENTAL SETTING.

Assessment of Severity*

Acute exacerbations are manifested by episodes of bronchospasm and resulting hypoxia and hypercarbia. Management strategy is directed at determining the level of hypoxia and correcting it. The following indicate that the exacerbation is severe:

- peak expiratory flow rate, or PEFr, is at or below 50 percent of reference value;
- oxygen saturation is below 91 percent;
- bronchodilator does not improve PEFr by at least 10 percent after two treatments;
- patient has difficulty speaking;
- patient is struggling for air.

Managing an Acute Asthmatic Attack†

1. Discontinue the dental procedure and allow the patient to assume a comfortable position.
2. Establish and maintain a patent airway and administer β_2 agonists via inhaler or nebulizer.
3. Administer oxygen via face mask, nasal hood or cannula. If no improvement is observed and symptoms are worsening, administer epinephrine subcutaneously (1:1,000 solution, 0.01 milligram/kilogram of body weight to a maximum dose of 0.3 mg).
4. Alert emergency medical services.
5. Maintain a good oxygen level until the patient stops wheezing and/or medical assistance arrives.

* Based on information from Copp.⁸²

† Based on information from Laurikainen and Kuusisto,²⁹ Lenander-Lumikari and colleagues³⁰ and Perusse and colleagues.⁷⁴

Chronic Obstructive Pulmonary Disorder

Emphysema, chronic bronchitis, and chronic obstructive airway illnesses are all referred to as having chronic obstructive pulmonary disorder (COPD). [18] Patients with COPD experience breathing difficulties mostly as a result of their narrowed airways.

Because COPD cannot be totally cured, medical care focuses on controlling the acute and chronic symptoms. The choice of local anesthetic is crucial for endodontic treatments, and epinephrine and levonordefin should be avoided since their sulfite components may produce allergic symptoms and acute asthmatic attacks. Because to the risk of methylxanthine toxicity, patients taking theophylline should avoid taking macrolides (such as erythromycin, azithromycin, and clarithromycin), ciprofloxacin, and clindamycin when antibiotic therapy is necessary. Since they do not cause bronchospasm, acetaminophen and cox - 2 inhibitors can be utilized as anti - inflammatory medications for these patients.

Diabetes Mellitus

A metabolic condition known as diabetes mellitus (DM) is characterized by increased plasma glucose levels brought on by a deficiency in insulin secretion, a dysfunctional insulin response, or both. [19] To reduce risk in endodontic practice, more should be taken into account regarding delayed wound healing and increased susceptibility to infection. The negative effects on standard endodontic practice will be minimized by morning appointments, a regular diet, taking diabetes medications, and having adequate antibiotic coverage. Insulin dose adjustment may also be taken into consideration during periapical surgical treatments.

However, in order to proceed with endodontic treatment, DM patients with related cardiac and renal issues must follow medical advice. The following test results are favourable for performing endodontic procedures: fasting blood sugar 100 mg/dl; postprandial blood sugar 200 mg/dl; and HbA1c 7%.

Patients on Corticosteroid Therapy

It is important to determine whether the patient is receiving steroid medication at the moment or has a history of using steroids for at least two weeks in the last two years. To reduce the possibility of an adrenal crisis in such a situation, the patient's doctor should be consulted to determine whether any further steroids will be required and to confirm the pre - and post - procedural steroid dosages. [20] If the daily dose of prednisolone is less than 7.5 mg, an increased dose shift is not necessary. For these patients, morning appointments should be recommended.

Renal Diseases

Patients with renal illness who are receiving conservative medicinal treatment must have their blood pressure checked throughout the process due to their frequent episodes of hypertension. Tetracyclines and aminoglycosides are two examples of nephrotoxic medications that must be completely avoided. There is no need to adjust the dosage for these people when using analgesics like paracetamol and ibuprofen, as well as antibiotics like amoxicillin/clavulanate, erythromycin, and azithromycin. [21]

For nephritic patients on hemodialysis

Heparin is used to help in blood transportation during hemodialysis by anticoagulating the patient's blood. [22]

Endodontic procedures that run the risk of bleeding should be avoided on the day of hemodialysis because of this. Protamine sulphate can be used to stop the anticoagulant effect during endodontic operations that frequently bleed. But bleeding can occur because of platelet dysfunction and possible anemia, which calls for the precaution of using hemostatic treatments. These patients are particularly vulnerable to the danger of hepatitis B, hepatitis C, and HIV infection as well as the chance of transmission. To validate the findings that certain illnesses are not present, appropriate diagnostic tests must be performed.

Renal transplant patients

Patients with kidney disease frequently receive treatment with corticosteroids, calcineurin inhibitors (Cs, tacrolimus), and inhibitors of lymphocyte proliferation (azathioprine and mycophenolate mofetil), which causes them to be immunosuppressed. Prior to an endodontic procedure, antibiotic prophylaxis in accordance with nephrologist recommendations is required.

Epileptic Patients

Epilepsy is a disease characterized by an alteration of awareness, performance, and mental activities, as well as by involuntary muscle contractions. [23] Epileptic seizures are reversible and recurrent in nature. [24] Endodontic treatment can be carried out with the knowledge to recognize the early signs of a seizure and to take precautions to avoid such incidents. For patients who are adequately controlled with medication, they can undergo endodontic management in a routine way; however, patients whose seizure activity does not decrease in intensity following anticonvulsant treatment may need additional anticonvulsant or sedative medication, hence there is a need of consultation with a neurologist prior to a dental appointment. [25]

Hepatitis C and B

These individuals can have endodontic operations if proper infection control and sterilization methods are followed. The selection of pharmaceuticals is the most important step, and drugs that are metabolized in the liver should be avoided. The antibiotics of choice include ampicillin and tetracycline, while paracetamol may be used as an analgesic. [26]

Human Immuno - Deficiencyvirus (HIV)

There is currently a lack of knowledge on the pathology, clinical development, and prognosis of an existing case of apical periodontitis or the likelihood of successful endodontic therapy in HIV - positive individuals. According to immunohistological investigations, case studies, and

fundamental immunological theories, endodontic therapy for apical periodontitis would often have a worse prognosis in immunocompromised patients, such as those who have HIV. T cells are widely known to be crucial in both the etiology and recovery of apical periodontitis. [27]

The principles of normal root canal treatment are relevant to HIV - infected individuals, including those with AIDS, even if treatment is simply palliative or to avoid root canal treatment in molars. [28] The need for antibiotic prophylaxis prior to endodontic treatment is still up for dispute, particularly in light of potential problems following surgery. The following recommendations are based on current knowledge. [29]

- During endodontic treatment, prophylactic antibiotic therapy is not indicated for patients assigned to categories A and B (Table) as long as the granulocytes count is less than 500cells/µl of blood.
- If the granulocytes count ranges above 500 cells/µl of blood, endodontic treatment should be performed under prophylactic antibiotic cover.
- The indication for the root canal treatment or the alternative of an extraction with patients with AIDS - defining diseases belonging to Category C (Table) should be carefully evaluated with respect to the general health of the patient and their immune response. In this case, antibiotic prophylaxis should be obligatory prior to treatment. The advice of the patient’s general medical practitioner or haematologist should be sought prior to treatment. The assessment should focus on the seriousness of the patient’s immune suppression and the state of the thrombocytes.
- Patients with CD4 cell counts below 200 cells/µl, those in categories A3, B3 and C3 (Table), might suffer from a disorder of blood coagulation due to thrombocytopenia. If the thrombocyte count is more than 60, 000 cells/mm³, routine dental treatment is normally allowable without the risk of massive secondary haemorrhage. Infiltration and/or intraligamentary anaesthetic is preferred in order to avoid complications associated with mandibular or maxillary block anesthesia. If the thrombocyte count is below 60, 000 cells/mm³ a specialist should be consulted before planning dental treatment, or if necessary, the patient should be referred to a specialist.
- Antimicrobial mouth - rinses 2 - 3 days before planned dental treatment is recommended (eg; chlorhexidine) in order to achieve a significant reduction of oral microorganisms and thereby reduce the risk of post - operative complications.

Classification of HIV infection as proposed by the American Centers for Disease Prevention

| Category | CD4 Cell Count (cells/µl) | Clinical Symptoms |
|----------|---|--|
| A | A1: ≥ 500 A2: 200 - 499 A3: < 200 | <ul style="list-style-type: none"> • Symptomatic HIV - infection, or • Persisting generalized lymphadenopathy, or • Acute, primary HIV - infection without presence of AIDS - defining diseases. |
| B | B1: ≥ 500 B2: 200 - 499 B3: < 200 | <ul style="list-style-type: none"> • ARC - symptoms (e. g.; oral candidiasis) without AIDS - defining diseases [ARC = AIDS - related complex; a suspicion of a clinical picture justifying AIDS] |
| C | C1: ≥ 500 C2: 200 - 499 C3: < 200 | <ul style="list-style-type: none"> • AIDS - defining diseases: e. g. candidiasis of the oesophagus, the trachea, respiratory tract, and the lungs, Kaposi’s sarcoma, repeated pneumonia, repeated Salmonella septicaemia, Pneumocystis jieoveci pneumonia, lymphoma |

Pregnancy

Prenatal oral health is critical for both the general health and wellbeing of pregnant women as well as the development of their unborn infants. Pregnant women have dental pain frequently, especially after the first trimester, and hormonal changes may exacerbate the inflammatory condition or raise the risk of painful pulp symptoms during the gestational period.

A pregnant woman is not physically challenged, thus dental therapy is permissible. However, great care must be taken because managing them may require adjusting the scheduling of some procedures, the types of dental treatments utilised, and the medications to be prescribed.

Radiographic exposure, local anaesthetic agents, irrigation, intra - canal medicines, and medications such analgesics and antibiotics are typically needed for RCT [30]. However, radiographs are thought to be safe for mother and foetus when used with proper positioning of the radiograph towards the mouth and avoiding the abdomen, using high - speed film, wearing a lead apron, and wearing a thyroid protecting collar [31]. Carcinogenesis is the major biological risk from radiation exposure. Additionally, local anaesthesia is generally secure when administered appropriately and in controlled doses during pregnancy.

The latest evidence - based recommendation on Root Canal Treatment (RCT) for pregnant women.

| Item | Evidence Base from Literature |
|---|--|
| RCT | Second trimester is the preferred time for RCT, with a semi - reclined position with a pillow under the patient's right side. Nevertheless, guidelines about safe endodontic procedures usually do not specify procedures by trimester, |
| Dental x - ray | There is no evidence linking dental x - rays used with appropriate precaution to fetal complications, even for panoramic radiograph. |
| Local Anesthesia: | |
| a) Lidocaine and prilocaine, with or without epinephrine | They are not contraindicated for pregnant patients or fetuses, even in the first trimester. |
| b) Bupivacaine and mepivacaine. | Contraindicated, as found to be associated with embryocide in rabbits when using the maximum daily dose. |
| Inter - appointment medications: dental irrigation, obturation materials, root sealer, and interappointment | Most probably safe, because they do not pass beyond the root and are apparently safe, but no clear study has investigated the long - term effects on the fetus. |
| Antibiotics | The most common antibiotics, such as amoxicillin, clindamycin, metronidazole, and penicillin, are safe for pregnant patients |
| Acetaminophen (paracetamol) | The safest analgesic for pregnant patients and with breastfeeding. However, some studies showed associated with Attention Deficit Hyperactivity Disorder (ADHD), behavioral complications for the fetus and reduced frequency of hematopoietic stem cells. |
| NSAIDs | NSAIDs are not recommended because studies have linked NSAIDs to embryonic implantation disturbance and contraction ductus arteriosus. |

2. Conclusion

This comprehensive review highlights the systemic problems and their management in endodontics. It underscores the importance of understanding the patients systemic health status, particularly in elderly patients and those with pre - existing conditions like heart disease, diabetes, and hypertension. The review emphasizes the need for a complete medical history, careful medication management, and risk assessment in providing dental care. It also discusses the implications of various systemic conditions such as cardiac disorders, respiratory disorders, diabetes mellitus, renal diseases, epilepsy, hepatitis, HIV, and pregnancy on endodontic treatment. The paper concludes that a thorough understanding of these systemic conditions and their management is crucial for dental professionals to provide safe and effective endodontic care.

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