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Dedicated to
Ibn Zuhr (1094–1162)

Biography

Abu-Marwan Abd-al-Malik ibn Zuhr Al Eyadi Al-Ishbily (Avenzoar) was a Muslim Arab physician and surgeon who was influential in advancing the progress of surgery. His major work, *Al-Taysīr fil-Mudāwāt wal-Tadbīr (Book of Simplification Concerning Therapeutics and Diet)*, reflects Ibn Zuhr's reliance on his own clinical observations, skill in differential diagnosis, and interest in clinicopathologic correlations. Based on his own experience, he staged and classified diseases in a practical way relevant to their management and prognosis. Furthermore, he enriched surgical and medical knowledge by describing many diseases never described before, including pericarditis, mediastinitis, mediastinal tumors, empyema, meningitis, intracranial thrombophlebitis, inflammation of the middle ear, pharyngeal and esophageal paralysis, verrucous malignancy of the colon, fecal fistula, Peyronie's disease, purpuric skin rash, and scabies.

Contributions

1. ***Experimental surgery:*** Ibn Zuhr introduced animal testing as an experimental method of testing surgical procedures before applying them to human patients to know if they would work, performing the first experimental tracheotomy on a goat before performing it on humans. He was the first surgeon of his time to apply experimental methodology in evaluating new or controversial surgical procedures. Hence, he was given the title "The Father of Experimental Surgery."
2. ***Clinical anatomical knowledge:*** Ibn Zuhr emphasized the great importance of a practical knowledge of anatomy for the surgical trainee. Here is a translation of his words regarding the management of inflammatory swellings of the neck that are ripe and ready for bursting/drainage:

   > And in case you have mastered the science of dissection then drain by the scalpel in the way that you will not come across a vein, artery or a nerve or anything that its injury will lead to an extra harm to the patient. But if you were one of the group like me and did not practice dissection but knew it only by imitation, keep away from the knife as nothing you know by mere imagination will be the same in real life; especially in the case of small organs.

   According to Ibn Zuhr, only the practitioner who has practiced dissection himself and mastered the science is entitled to perform an operative intervention. He therefore advocated that mastering anatomy is essential training for a surgeon.
3. ***Adequate supervised training:*** Ibn Zuhr insisted on an adequately supervised and structured training program for the surgeon-to-be before allowing him to operate independently.
4. ***Established limits:*** Ibn Zuhr drew emphatic red lines at which a physician should stop during his general management of a surgical condition. This was a major step forward in the evolution of general surgery as a specialty of its own. Here is a translation of an example of Ibn Zuhr's demarcation:

   > If the wound caused by a sharp iron has taken into the bones and not extended to the interior, then the treatment I just mentioned is enough for you, so stick to it. However, if it did penetrate the bone then in such a case, the surgeon should come and see.

Legacy

Ibn Zuhr was the most well-regarded physician of his era, and his ideas about medicine and surgery helped to shape our modern concept of standard care. He is an inspiration to those of us who seek to make the best decisions for our patients and our discipline.

PREFACE

The goal of this study guide is twofold. First, it aims to serve as a comprehensive review of the topics and disciplines relevant to the field of oral implantology. The successful placement of dental implants with good long-term functional and esthetic results involves much more than just knowing the basic procedures and protocols involved in implant surgery. Of course, it is important to know what size and type of implant to choose for various clinical situations and how to drill safely into bone. But there are many other factors that influence implant treatment planning, ranging from the patient's systemic health, habits, and anatomy to pharmacology, biomechanics, and prosthodontics. Placing dental implants also requires an understanding of adjunctive methods, such as bone grafting and the use of blood concentrates and growth factors. This book synthesizes all the information a clinician must consider at each stage of oral implant treatment in order to elevate the standard of patient care they provide and round out the knowledge and skill set they bring to each dental implant case.

Second, this study guide serves as a tool for professional development, providing excellent preparation for any oral implantology certification examination. With the knowledge presented in this study guide, the dental professional can not only achieve certification but also feel confident in their ability to provide the highest level of care when treating patients.

The reason for updating this study guide, first published in 2016, is also twofold. First, many new techniques that were under development at the time the previous edition was published have now become mainstream in dental implant treatment. As a result, three new chapters have been added, covering bone grafting, zygomatic and pterygoid implants, and blood concentrates and growth factors. Knowledge of these topics is important both to provide the best and most advanced patient care and to achieve certification in oral implantology.

Second, a greater emphasis has been placed on contextualizing dental implant treatment within an understanding of the patient's general health and its influence on outcomes. For example, a systemic disease like diabetes mellitus has an enormous impact on oral implantology. Clinicians must understand and consider the biologic effects of systemic health when planning treatment in order to provide patient-centered care that achieves the highest level of success possible.

As evidenced by the advances that have occurred in the 7 years since the publication of the first edition of this guide, implant dentistry continues to evolve rapidly. Only by continuously updating our knowledge base will we be able to keep pace with current trends. This book provides an overview of the discipline of oral implantology as it is practiced today. It is my hope that it will not only prepare future implantologists to pass certification examinations but also improve the patient care provided by all practicing implantologists.

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To God, who made everything I have accomplished possible through his guidance and gracious love.

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To my colleagues and students at the California Implant Institute, you and your patients are the ultimate reason for this book. Elevating the standard of care for our patients and giving the best for their well-being has always been the goal of everything I have done since I started practicing dentistry.

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1 MEDICAL EVALUATION OF THE IMPLANT PATIENT

An accurate and thorough medical evaluation is a critical component of implant therapy. This chapter discusses the many medical factors that must be considered when a patient presents for treatment, including pathologic conditions, bleeding risk, allergy, and medical contraindications. Implant therapy is not without risk, and medical emergencies can occur even when the proper precautions are followed; it is therefore imperative that all clinicians understand what to do in such situations, especially for individuals already compromised by certain medical conditions.

1. What key medical considerations must the clinician take into account when formulating a treatment plan for a dental implant patient?

a. Hemostasis
b. Drug actions and/or interactions
c. Predisposition to infection
d. All of the above

d: All of these could have a profound effect on the healing response and thereby compromise the treatment result. If there is a hemostasis problem, excessive bleeding may result. Drug actions may interfere with proper healing, and drug interactions may affect cardiovascular integrity. A compromised immune system could lead to postoperative infections.

2. The risk of a dental practitioner encountering a medical emergency during placement of a dental implant is related to:

a. The clinician's medical training
b. The patient's medical health
c. Staff training
d. Complexity of the procedure
e. All of the above

b: The patient's systemic health will dictate how well he or she will be able to sustain the stress of the procedure and the response to administered medications.

3. Which of the following are essential components of a medical history? (MULTIPLE ANSWERS)

a. Medications
b. Previous hospitalizations, illnesses, and/or surgeries
c. Information regarding prosthetic joint replacements
d. Childhood immunizations
e. All of the above

a, b, c: A complete medical history should include an organ systems review, height, weight, exercise tolerance, present illnesses, as well as any medications the patient is taking, any previous hospitalizations or illnesses, and information regarding prosthetic joint replacements. The medical history can be done as an interview of the patient or as a printed questionnaire that the clinician reviews with the patient.

4. According to the ASA (American Society of Anesthesiologists) Physical Status (PS) classification, what would the classification be for a patient who can walk up a flight of stairs or the equivalent of two city blocks but has to stop along the way because of distress or shortness of breath?

a. ASA I
b. ASA II
c. ASA III
d. ASA IV

c: ASA III is defined as a patient with severe systemic disease. A consultation with this patient's physician is recommended prior to initiating dental treatment for this individual. Perioperative sedation and special monitoring may be necessary in the treatment of ASA III patients.

5. What would the ASA classification be for a patient who is able to walk up a flight of stairs or the equivalent of two city blocks but has to rest at the end of the walk because of distress?

a. ASA I
b. ASA II
c. ASA III
d. ASA IV

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b: ASA II is defined as a patient with mild systemic disease.

6. A healthy 38-year-old woman presents for a dental implant. She takes no medications and is not anxious about the treatment. What is her ASA classification?

a. ASA I
b. ASA II
c. ASA III
d. ASA IV

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a: ASA I is defined as a normal healthy patient.

7. What would the ASA classification be for a patient with well-controlled diabetes who is insulin dependent?

a. ASA I
b. ASA II
c. ASA III
d. ASA IV

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c: ASA III

8. What would the ASA classification be for a patient whose diabetes is well controlled with diet and oral hypoglycemic agents?

a. ASA I
b. ASA II
c. ASA III
d. ASA IV

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b: ASA II

9. What percentage of patients, when asked "Are you in good health?", respond "yes" but are actually found to be medically compromised on closer examination?

a. 10%
b. 20%
c. 30%
d. 40%

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c: Studies reveal that 30% of patients who respond in the affirmative are actually deemed medically compromised by the treating clinician. (Source: Brady WF, Martinoff JT. Validity of health history data collected from dental patients and patient perception of health status. J Am Dent Assoc 1980;101:642–645.)

10. When a patient presents with a burning mouth or tongue, which of the following could be the possible medical cause?

a. Alcoholism
b. Neoplasm
c. Renal failure
d. Primary or secondary neuropathy

d: Patients with primary or secondary neuropathy often present with the symptom of a burning mouth or tongue.

11. When a patient presents with gingival overgrowth, which of the following could be a possible medical cause?

a. Leukemia
b. Gastroesophageal reflux disease (GERD)
c. Immune suppression from HIV
d. Mouth breathing

a: Gingival overgrowth can be a sign of leukemia.

12. When a patient presents with rampant dental caries, which of the following could be a possible medical cause?

a. Addison's disease
b. Sjögren's syndrome
c. Vitamin deficiency
d. Liver cirrhosis

b: Patients with Sjögren's syndrome often present with a dry mouth that leads to rampant dental caries. In elderly patients, it often presents as root caries.

13. When a patient presents with ptosis of the chin, which of the following could be a possible medical cause?

a. Anemia
b. Use of skeletal muscle relaxants
c. Scleroderma
d. Myasthenia gravis

d: Myasthenia gravis is a neuromuscular disease that results in muscle fatigue and weakness. Patients with myasthenia gravis will have decreased muscle tone that can result in ptosis.

14. When a patient presents with a radiographic finding of reduced cortical bone density, which of the following could be a possible medical cause?

a. Primary hyperparathyroidism
b. Scleroderma
c. Osteoarthritis
d. Multiple myeloma

a: Hyperparathyroidism results in the secretion of excess parathyroid hormone, which stimulates osteoclast catabolic effects on bone, resulting in the loss of calcium and density.

15. When a patient presents with a radiographic finding of degenerative damage to the condyle or temporomandibular joint (TMJ), which of the following could be a possible medical cause?

a. Osteonecrosis
b. Paget disease
c. Hyperparathyroidism
d. Rheumatoid arthritis

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d: Rheumatoid arthritis has an unknown etiology; however, genetic, environmental, hormonal, and immunologic factors as well as infection are possibly involved in the process. A genetic susceptibility may provoke an autoimmune reaction that leads to hypertrophy of the synovial lining of the TMJ and endothelial cell activation that result in an uncontrolled inflammatory response and destruction of the bone.

16. When a patient presents with a radiographic finding of carotid artery calcification, which of the following could be a possible medical cause?

a. Cardiac disease
b. Sickle cell anemia
c. Hyperparathyroidism
d. Renal disease

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a: Carotid artery calcium deposits have been identified as an independent predictor of coronary heart disease events. Therefore, clinicians should be surveying panoramic radiographs and computed tomography (CT) scans that are obtained for dental reasons for these calcium deposits in the coronary artery.

17. When assessing the bleeding risk for a dental implant procedure, the clinician must consider which of the following?

a. Inherited defects of hemostasis
b. Medications
c. Acquired defects of hemostasis
d. All of the above

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d: Each of these factors can interfere with coagulopathy.

18. On review of the medical history, you find that the patient has severe Addison's disease. Why is severe adrenal insufficiency significant?

a. The stress of an extensive dental implant surgical procedure may induce cardiovascular collapse.
b. Soft tissue healing will be severely compromised.
c. Implants may not integrate.
d. The patient may experience a hypertensive crisis with the administration of more than 72 µg of epinephrine within a 10-minute time period.

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a: A patient with Addison's disease will not be able to release the extra cortisol needed to deal with the stress of the surgical procedure. Cortisol is a glucocorticosteroid that is responsible for glucose metabolism as well as potentiation of catecholamines that assist in maintaining circulatory pressure.

19. What oral clinical finding may indicate that a patient has adrenal insufficiency?

a. Severe tooth erosion
b. Sloughing of the buccal mucosal tissues
c. Hyperpigmentation of the buccal or labial mucosal tissues
d. Gingival hyperplasia

c: Increased diffuse melanin pigmentation is a documented sign of Addison's disease.

20. What is a medical reason for a patient to take long-term systemic glucocorticosteroids?

a. Liver, lung, or heart transplant recipient
b. Lupus erythematosus
c. Inflammatory bowel disease
d. All of the above

d: Long-term glucocorticosteroid therapy is indicated for each of these conditions. Dental clinicians should consider increasing the patient's normal daily steroid dose when the patient undergoes a surgical or stressful dental procedure.

21. Which of the following blood tests are generally thought to identify a patient with a possible bleeding disorder? (MULTIPLE ANSWERS)

a. Complete blood count (CBC) and platelet count
b. Prothrombin time (PT) and partial thromboplastin time (PTT)
c. Lipoprotein panel
d. Bleeding time
e. White blood cell (WBC) count
f. All of the above

a, b, d: Each of these laboratory tests will act as a screening test for possible bleeding disorders. The sum of these tests will measure platelet activity and coagulation factors.

22. Classic hemophilia (type A) is a deficiency of which clotting factor?

a. Factor VII
b. Factor VIIa
c. Factor VIII
d. Factor VIIIa

c: Factor VIII

23. Type B hemophilia is a deficiency of which clotting factor?

a. Factor IX
b. Factor IXb
c. Factor X
d. Factor Xb

a: Factor IX

24. The dental implant patient who presents with chronic liver failure should have which of the following hematology tests performed prior to the surgical procedure?

a. CBC, platelet count, PT
b. CBC, bleeding time, PTT
c. Platelet activation study (PAS), platelet count, WBC
d. PAS, bleeding time, PTT

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a: Patients with chronic liver failure are likely to have problems with blood coagulation. The CBC, platelet count, and PT will evaluate the coagulation factors that can be affected by the liver. The CBC and platelet count will screen for anemia and thrombocytopenia, while the PT will confirm a deficiency of vitamin K.

25. "Ageusia" refers to which of the following?

a. Diminished taste
b. Altered or distorted taste
c. Salty taste
d. Absence of taste

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d: The tongue loses the ability to taste sweetness, sourness, bitterness, and saltiness. Complete or true ageusia is rare, and what patients most often have is the partial loss of taste, known as hypogeusia.

26. "Dysgeusia" refers to which of the following?

a. Diminished taste
b. Altered or distorted taste
c. Salty taste
d. Absence of taste

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b: Altered or distorted taste

27. What are the most common reasons for alteration in taste? (MULTIPLE ANSWERS)

a. Autoimmune disease
b. Periodontal disease
c. Infection
d. Poor oral hygiene
e. GERD
f. All of the above

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b, c, d: Periodontal disease, infection, and poor oral hygiene are known to alter the sensation of taste.

28. "Tic douloureux" is also known as which of the following?

a. Idiopathic trigeminal neuralgia
b. Bell's palsy
c. Facial paralysis
d. Trigeminal dysesthesia

a: Tic douloureux, or idiopathic trigeminal neuralgia, is a condition that creates episodes of acute-onset, severe facial pain. It is most frequently found in patients of middle to old age. Intraoral or facial trigger points initiate the pain, which can be excruciating but is usually not long lasting. The trigeminal nerve's mandibular branch is most often involved, but the etiology is unknown.

29. Which of the following endogenous pigmentation sources is the most common?

a. Melanin
b. Bilirubin
c. Iron
d. Heavy metals

a: Melanin is a term used to describe natural pigments in the body. It is produced by melanocytes via the oxidation of tyrosine.

30. Which of the following diseases can cause an abnormal melanin deposit in the oral mucosa?

a. Diabetes mellitus type 1
b. Acute myelogenous leukemia (AML)
c. Addison's disease
d. Thrombocytopenia purpura

c: Patients with Addison's disease frequently have bluish-black or dark-brown areas on the buccal or labial mucosa and possibly on the gingiva.

31. Which of the following laboratory tests measures the intrinsic coagulation pathway?

a. PT
b. PTT
c. International normalized ratio (INR)
d. PAS

b: The PTT is a measure of the efficacy of the intrinsic pathway that mediates fibrin clot formation. All coagulation factors are measured by this test except factor VII. Normal values are between 25 and 40 seconds. Values that are extended by 5 to 10 seconds represent a mild bleeding disorder; values beyond 10 seconds may be an indicator of a clinically significant bleeding problem.

32. What is the recommended INR therapeutic range for standard oral anticoagulant therapy?

a. 1.0 to 2.0
b. 1.5 to 2.5
c. 2.0 to 3.0
d. 2.5 to 3.5

c: A value between 2.0 and 3.0 is the recommended therapeutic range for the prevention of deep vein thrombosis, pulmonary embolism, hypercoagulable states, transient ischemic attack, atrial fibrillation, dilated cardiomyopathy, rheumatic mitral valve disease, and stroke.

33. A patient who presents with a prosthetic heart valve replacement should have an anticoagulant therapeutic range (INR) of:

a. 1.0 to 2.0
b. 1.5 to 2.5
c. 2.0 to 3.0
d. 2.5 to 3.5

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d: 2.5 to 3.5

34. Known risk factors for ischemic heart disease (IHD) include which of the following?

a. Smoking
b. Obesity
c. Diabetes mellitus
d. All of the above

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d: Each of these conditions can either decrease the oxygen supply to the heart or increase the cardiac workload.

35. An implant patient presents with a recent history of myocardial infarction (MI). At what time point post MI is the typical cardiac patient's normal reinfarction risk level back to baseline?

a. 3 months
b. 4 months
c. 5 months
d. 6 months

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d: The highest risk of reinfarction is between 0 and 3 months post MI. A lower risk is present from 3 to 6 months post MI, with the risk returning to baseline after 6 months. Naturally, this is somewhat patient dependent.

36. Stage 1 hypertension is associated with which of the following?

a. Systolic blood pressure 130–139 mm Hg, diastolic blood pressure 90–99 mm Hg
b. Systolic blood pressure 140–159 mm Hg, diastolic blood pressure 90–99 mm Hg
c. Systolic blood pressure 160–179 mm Hg, diastolic blood pressure 90–99 mm Hg
d. Systolic blood pressure 180–189 mm Hg, diastolic blood pressure 90–99 mm Hg

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b: Systolic blood pressure 140–159 mm Hg, diastolic blood pressure 90–99 mm Hg

37. Stage 2 hypertension is associated with which of the following?

a. Systolic blood pressure 170–179 mm Hg, diastolic blood pressure ≥ 100 mm Hg
b. Systolic blood pressure 180–189 mm Hg, diastolic blood pressure ≥ 100 mm Hg
c. Systolic blood pressure ≥ 160 mm Hg, diastolic blood pressure ≥ 100 mm Hg
d. Systolic blood pressure ≥ 170 mm Hg, diastolic blood pressure ≥ 110 mm Hg

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c: Systolic blood pressure ≥ 160 mm Hg, diastolic blood pressure ≥ 100 mm Hg

38. A bilateral submandibular, sublingual, and submental space infection is often referred to as which of the following?

a. Ludwig's triangle
b. Ludwig's angina
c. Ludwig's infection
d. Ludwig's metastasis

b: Ludwig's angina is a serious, frequently dentally induced cellulitis that can be life-threatening. If left untreated or treated incorrectly, it can lead to airway obstruction.

39. A patient who presents with sudden-onset substernal chest pain that radiates to the left arm, neck, jaw, and back may be experiencing which of the following?

a. Angina pectoris
b. Costochondritis
c. Herpes zoster
d. Esophageal spasm

a: The pain is due to myocardial ischemia. When it is limited to angina pectoris, there is no necrosis of the cardiac muscle. Angina is classified as stable, unstable, or Prinzmetal. Costochondritis, herpes zoster, and esophageal spasm may present with similar symptoms, but they do not usually involve the jaw.

40. Your patient informs you that he has chest pain when he exercises, but the pain is always gone in 15 minutes or less. Which of the following may he be experiencing?

a. Stable angina
b. Unstable angina
c. Prinzmetal angina
d. Kishimoto's angina

a: Angina that lasts less than 15 minutes and only occurs on exercise or exertion is classified as stable angina. Unstable angina may occur at any time for any reason and will last longer than 15 minutes, and the pain is more severe. Prinzmetal angina can occur when the patient is at rest, and there are associated changes in the electrocardiogram; it is most likely due to a coronary artery spasm.

41. In preparation for the placement of a dental implant at a previously grafted maxillary right central incisor edentulous site, you administer 2 g of cefazolin intravenously. Within 3 minutes, the patient appears to be having difficulty breathing, which is worsening rapidly. This reaction is an allergic response to the cefazolin antibiotic that was just administered. What type of allergic reaction is this?

a. A type I immediate-onset reaction induced by an IgE-mediated activation of mast cells and basophils
b. A type II immediate-onset reaction induced by an IgG-mediated activation of cell destruction
c. A type III immediate-onset reaction induced by an IgG-mediated activation of the immune complex and complement system
d. A type IV immediate-onset reaction induced by T-cell activation, resulting in massive histamine release

a: A type I reaction is the only immediate-onset reaction; all others are delayed in onset. Choice *d* is also incorrect because T-cell activation leads to antibody production, activation of phagocytes, and direct cell killing.

42. For an allergic reaction to be considered an immediate allergic response, it must occur within how many minutes?

a. < 15 minutes
b. < 30 minutes
c. < 45 minutes
d. < 60 minutes

d: The World Allergy Organization defines an immunologic immediate drug reaction as one occurring within 60 minutes of the administered dose. Delayed reactions are defined as those occurring after 1 hour, although they usually occur at a time period greater than 6 hours and can occur weeks or months after the start of drug administration. (Source: Lockhart PB [ed]. Oral Medicine and Medically Complex Patients, ed 6. Hoboken, NJ: Wiley-Blackwell, 2013.)

43. Your patient presents with an infected dental implant and also reports that she currently has infectious mononucleosis caused by the Epstein-Barr virus. With this current medical history, which antibiotic should be avoided?

a. Azithromycin
b. Clindamycin
c. Amoxicillin
d. Metronidazole

c: Patients who present with the Epstein-Barr virus and are prescribed amoxicillin frequently develop a bright red, generalized morbilliform rash. The other antibiotics are not known to do this.

44. Which local anesthetic is known to have the highest incidence of allergic reactions?

a. Articaine
b. Lidocaine
c. Procaine
d. Prilocaine

c: Procaine is an ester local anesthetic, whereas the others listed are amide local anesthetics. Procaine is well documented as having the greatest incidence of allergic reactions due to its inclusion of an ester moiety in its chemical structure. The amide local anesthetics have a less than 1% confirmed allergic reaction rate.

45. A 65-year-old man with extensive tooth decay desires to be restored with a fixed implant-supported prosthesis. He reports that he lost his teeth because he was afraid of the dentist. The last time he was treated (40 years earlier), he was given a local anesthetic and became faint, nauseated, and short of breath, his heart raced, and he had to be transported to the hospital for emergency care. The clinician in attendance at that time has since retired, and the patient records have been destroyed. Which of the following is the most appropriate action to take?

a. Provide intravenous conscious sedation for the patient.
b. Review the medical history for possible drug allergies.
c. Refer the patient for allergy testing and/or desensitization before administering any local anesthetics.
d. Perform the procedure using articaine as the local anesthetic because it is unlikely that he was given this agent 40 years ago.

c: The reaction the patient had 40 years ago seems to have been a severe type I allergic reaction. Therefore, the most appropriate next step is to refer the patient for allergy testing.

46. Your implant patient provides you with a history of extensive bleeding following a previous extraction 18 months earlier. Which of the following would be appropriate as an initial screening test?

a. Platelet count
b. PT/INR
c. Activated PTT (aPTT)
d. All of the above

d: These three tests will provide the broadest survey of the clotting mechanisms. The platelet count measures the platelet concentration in whole blood. The aPTT assesses the intrinsic coagulation pathway and the final common pathway; it also monitors heparin therapy. The PT/INR assesses the extrinsic pathway of clotting. The PT and aPTT are also used to assess hemophilia A and hemophilia B.

47. If your patient presents with severe hemophilia A or B, why will the management of postoperative bleeding episodes be difficult?

a. The patient may have developed IgG antibodies against his deficient factor.
b. The deficient factors may not be available to induce coagulation.
c. The administration of postoperative antibiotics would most likely prevent coagulation.
d. The administration of postoperative narcotics would most likely prevent coagulation.

a: About 25% of patients with severe hemophilia A and 3% to 5% of patients with severe hemophilia B develop antibodies (primarily IgG) against their deficient factor. Antibodies are less likely in those with mild or moderate hemophilia A or B.

48. Which of the following medications is contraindicated in patients with hemophilia A?

a. Metronidazole
b. Ibuprofen
c. Oxycodone
d. Dexamethasone

b: Ibuprofen is a nonsteroidal anti-inflammatory drug (NSAID). All NSAIDs may interfere with clotting mechanisms, so postoperative pain should be managed with either acetaminophen or a narcotic.

49. Your patient provides you with a history of immediate severe postoperative bleeding following previous tooth extractions. This is most likely due to what bleeding disorder?

a. Thrombocytopenia or platelet dysfunction
b. Hemophilia A
c. Hemophilia B
d. Von Willebrand disease

a: Coagulation disorders usually induce delayed bleeding several hours or days after surgery, whereas patients presenting with thrombocytopenia or platelet dysfunction experience immediate bleeding after vascular injury.

50. What is the incidence of bacteremia following a tooth extraction?

a. 20%
b. 40%
c. 80%
d. 90%

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d: 90%

51. Infective endocarditis is an infection of the:

a. Pericardium outer lining and mural endocardium
b. Pericardium inner lining and septal wall
c. Endocardium and heart valves
d. Blood vessels supplying the myocardium

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c: Infective endocarditis is an infection/inflammation of the endocardium (inner surface of the heart) and may include one or more heart valves, the mural endocardium, or a septal defect.

52. Prosthetic heart valves may be made of which of the following?

a. Synthetic (carbon alloys) or biologic (porcine in origin)
b. Synthetic (titanium alloy) or biologic (bovine in origin)
c. Recombinant porcine in origin
d. Recombinant bovine in origin

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a: Synthetic (carbon alloys) or biologic (porcine in origin)

53. Which of the following cardiac conditions DOES NOT require antibiotic prophylaxis prior to surgical implant treatment?

a. History of infective endocarditis
b. History of heart transplant with a new valvular lesion
c. Presence of a prosthetic synthetic heart valve
d. History of rheumatic fever

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d: According to the American Heart Association (AHA) 2007 recommendations, a history of infective endocarditis, a history of heart transplant with a new valvular lesion, and the presence of a prosthetic synthetic heart valve all require antibiotic prophylaxis prior to dental treatment. Given these histories of cardiac issues, these patients are at a higher risk of infective endocarditis with a potentially unfavorable outcome. A history of rheumatic fever does not warrant antibiotic prophylaxis prior to dental treatment. (Source: American Heart Association. Infective Endocarditis. http://www.heart.org/HEARTORG/Conditions/CongenitalHeartDefects/TheImpactofCongenitalHeartDefects/Infective-Endocarditis_UCM_307108_Article.jsp#.Vxjs7atX--I. Accessed 21 April 2016.)

54. Peer-reviewed literature supports making no adjustments to the warfarin therapy dosage prior to a tooth extraction or other invasive dental procedure provided the INR is equal to or below which of the following values?

a. 2.5
b. 3.0
c. 3.5
d. 4.0

c: The risk for stroke or thrombosis by discontinuing warfarin therapy when the INR is equal to or below 3.5 outweighs any risk of prolonged bleeding from a tooth extraction or other invasive dental procedure. (Sources: Lockhart PB [ed]. Oral Medicine and Medically Complex Patients, ed 6. Hoboken, NJ: Wiley-Blackwell, 2013. / Aframian DJ, Lalla RV, Peterson DE. Management of dental patients taking common hemostasis-altering medications. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2007;103[suppl 45]:1–11.)

55. The dental implant patient presents with a medical history of having an implantable cardioverter defibrillator (pacemaker) placed 18 months previously. Due to the history of an active pacemaker, which of the following does the AHA recommend regarding dental procedures?

a. Prescribe preoperative prophylaxis with appropriate antibiotics.
b. Avoid the use of ultrasonic scalers and electrosurgical units.
c. Avoid the use of an electronic automatic blood pressure cuff.
d. Avoid the use of electrocardiography during dental surgery.

b: The AHA does not recommend antibiotic prophylaxis for patients with nonvalvular cardiovascular devices prior to dental procedures because of a lack of evidence supporting an increased risk of device infection. However, the use of ultrasonic scalers, electric pulp testers, and electrosurgical units should be avoided because of possible interference with the pacemaker's function.

56. A patient presents with a history of having a coronary artery bypass graft (CABG) placed without concurrent myocardial infarction. In consultation with the physician, the patient should be cleared for dental treatment after how long?

a. 4 weeks
b. 6 weeks
c. 12 weeks
d. 6 months

b: Although it is conventionally thought that the same 6-month delay following CABG with MI should be observed before resuming dental treatment, there is not sufficient research to support the need to wait longer than 6 weeks.

57. For patients presenting with a history of angina, it is reasonable to perform elective dental treatment provided:

a. The angina is variant or Prinzmetal in type.
b. The angina is stable and well controlled by one or two nitroglycerin tablets, with at least 7 days between episodes.
c. The patient has only mild substernal pain with no radiation to the left arm.
d. The patient's resting heart rate is below 80 bpm, and the resting systolic blood pressure is below 90 mm Hg.

b: The angina is stable and well controlled by one or two nitroglycerin tablets, with at least 7 days between episodes.

58. The concerns about the need to prevent bacterial seeding of a prosthetic joint from staphylococcal bacteria originating from the oral cavity are:

a. Supported by the literature; therefore, prophylactic antibiotics prior to dental treatment should be administered in the first 6 months following placement of the prosthetic joint.
b. Supported by the literature; therefore, prophylactic antibiotics prior to dental treatment should be administered in the first 2 years following placement of the prosthetic joint.
c. Supported by the literature; therefore, prophylactic antibiotics prior to dental treatment should be administered for the lifetime of the prosthesis following placement of the prosthetic joint.
d. Not supported by the literature; therefore, prophylactic antibiotics prior to dental treatment are not necessary.

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d: The risk of a dental procedure inducing prosthetic joint infections is extremely low. Prosthetic joint infections are almost always caused by *Staphylococcus* originating from sources other than the oral cavity.

59. Hyperadrenocorticism is also known as:

a. Addison's disease
b. Beckert's disease
c. Cushing's disease
d. Kennedy's disease

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c: Hyperadrenocorticism, or Cushing's disease, is a combination of signs and symptoms caused by hyperactivity of the pituitary or adrenal glands that induces hypersecretion of cortisol from the adrenal gland or from long-term exogenous glucocorticosteroid therapy.

60. Hyperadrenocorticism symptoms include which of the following? (MULTIPLE ANSWERS)

a. Bleeding diathesis
b. Weight loss
c. Overactive bladder
d. Muscle weakness
e. Diabetes
f. All of the above

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a, d, e: Bleeding diathesis occurs because microcirculation is affected and cannot respond appropriately in aiding the clotting process. Cortisol induces gluconeogenesis and the breakdown of glycogen, thereby increasing blood glucose levels and the incidence of diabetes. The etiology of muscle weakness is poorly understood but is associated with the disease.

61. What is the most likely cause of a chronic red lesion found on the denture-bearing palatal mucosa of a patient who wears a maxillary removable dental prosthesis?

a. *Staphylococcus aureus*
b. Candidiasis (chronic atrophic type)
c. Erythroplakia (also known as speckled leukoplakia)
d. Extravasated blood

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b: The patient may be wearing the denture continuously, except for brief periods of time to clean it. *Candida* may be present in the tissues as a result of a *Candida*-positive denture base. Treatment consists of antifungal agent application to both the mucosa and the base of the prosthesis.

62. Angular cheilitis is found at the commissures of the lip and appears as fissures and scales within the folds of the tissue. What is the cause of this condition?

a. Nutritional vitamin deficiency
b. Immunosuppressive drugs
c. *Candida albicans* or *Staphylococcus aureus*
d. All of the above

d: All of these are known to cause angular cheilitis. Loss of vertical dimension and continued wetness of the area are additional known causes.

63. Which of the following statements is true regarding hypothyroidism and dental treatment?

a. Patients with exceedingly low levels of thyroxine are not candidates for usual dental treatments because they may be experiencing heart failure.
b. The administration of epinephrine may precipitate a hypertensive crisis in patients with hypothyroidism.
c. Patients with hypothyroidism may experience tachycardia with the administration of epinephrine.
d. Patients with hypothyroidism may experience a "thyroid storm" if administered epinephrine.

a: Patients with exceedingly low levels of thyroxine may be suffering heart failure and therefore should not be considered for treatment without a consultation with their physician. Choices *b, c,* and *d* apply to hyperthyroidism.

64. Which of the following medications may progress a hyperthyroid state to a thyroid crisis?

a. Azithromycin
b. Bupivacaine
c. Epinephrine
d. Oxycodone

c: Being a sympathomimetic drug, epinephrine may precipitate the progression from hyperthyroidism to a thyroid crisis. The other medications would not.

65. A thyroid crisis consists of which of the following?

a. Severe tachycardia
b. Mental disorientation
c. Presence of a precipitating factor such as an ongoing surgical procedure, diabetic ketoacidosis, or administration of a sympathomimetic agent
d. All of the above

d: A thyroid crisis consists of four items: hyperthermia, severe tachycardia, mental disorientation, and the presence of a precipitating factor.

66. What is the proper management of a patient undergoing a suspected thyroid crisis?

a. Place the patient in the Trendelenburg position and administer oxygen; the crisis should pass within 10 minutes.
b. Activate emergency medical services (EMS) and administer acetaminophen.
c. Massage the carotid artery.
d. Administer a benzodiazepine.

b: When a patient demonstrates the four signs of a thyroid crisis, EMS should be immediately activated. Acetaminophen administration will help decrease the body temperature. The other choices listed will be of no benefit.

67. Which of the following is an EARLY sign of local anesthesia overdose?

a. Lethargy
b. Decreased systolic blood pressure
c. Decreased muscle tone
d. Muscle twitching

d: The earliest signs of local anesthesia toxicity are excitatory in nature. These include talkativeness, slurred speech, tinnitus, tongue numbness, disorientation, muscle twitching, or tonic-clonic seizures.

68. What is the most common cause of local anesthetic overdose?

a. The continual administration of local anesthetic injections to patients who are complaining of pain during the dental procedure
b. The administration of local anesthesia to patients who are taking systemic sodium channel blockers such as gabapentin
c. The administration of local anesthetics at 4% concentrations as opposed to 2% concentrations
d. Injecting local anesthetic too rapidly

a: The administration of multiple local anesthetic carpules to a patient who complains of being numb but continues to feel pain is the primary reason local anesthetic overdoses occur. Clinicians must be aware of the concentration of the local anesthesia in the dental anesthesia carpule, the total amount being administered, the weight of the patient, and the importance of aspiration prior to injecting for the prevention of an intravascular injection.

69. What are the best ways to prevent local anesthetic overdose? (MULTIPLE ANSWERS)

a. Only perform one injection of anesthetic prior to the procedure.
b. Be aware of the anesthetic preparation concentration and the volume of each carpule.
c. Aspirate on injection and incremental injections.
d. Know the toxicity of the local anesthetic in milligrams and the number of carpules that represents for the patient's particular weight.
e. All of the above

b, c, d: All of these precautions will help prevent a local anesthetic overdose.

70. Which of the following is a LATE sign of local anesthesia toxicity?

a. Bradycardia and hypotension
b. Tachycardia and hypertension
c. Perfuse sweating
d. Seizures

a: Bradycardia and hypotension are late signs of local anesthesia toxicity because cardiovascular system depression is a late-stage event in the sequence of toxicity.

71. When a patient is suffering from local anesthetia toxicity, which of the following body systems are affected?

a. Respiratory and central nervous systems
b. Renal and cardiovascular systems
c. Central nervous and cardiovascular systems
d. Respiratory and renal systems

c: The body systems affected by local anesthesia toxicity are the central nervous system and the cardiovascular system. The initial responses are excitatory, followed by depression for both systems.

72. What is a clinically significant reason for administering a vasoconstrictor with a local anesthetic injection? (MULTIPLE ANSWERS)

a. To maintain the local anesthesia at the site and block the vasodilation that occurs when local anesthesia is administered
b. To maintain the local anesthesia at the site and decrease the blood level of the local anesthesia
c. To prevent the progressive diffusion of the local anesthesia to other areas
d. To hasten the onset of the local anesthesia

a, b, c: Epinephrine is a vasoconstrictor. The purpose of adding the epinephrine to the local anesthesia carpule is to induce localized vasoconstriction by activating α-receptors on the blood vessels at the site of administration. By creating an environment where there is localized vasoconstriction, the local anesthetic will remain at the site, where it is less likely to be picked up by the blood supply and carried to the central nervous system or heart. Epinephrine therefore has an effect on the depth, duration, and overall systemic uptake of the local anesthetic.

73. If you are performing an inferior alveolar nerve block and the needle breaks at the hub, which of the following should you do?

a. Have the patient sit up; use a hemostat to remove the broken needle piece.
b. Ask the patient to keep their mouth open; insert a bite block to prevent closure of the mouth, and then use a hemostat to remove the broken needle piece.
c. Ask the patient to tilt their head toward the side with the broken needle; close the jaws, retract the cheek, and use a college pliers to remove the broken needle piece.
d. Ask the patient to tilt their head upwards and towards the clinician; then use a college pliers to remove the broken needle piece.

b: The patient's mouth should be held open with a bite block or other device, and then a hemostat or college pliers should be used to remove the broken piece. If the broken needle is not visible, then the patient should be immediately referred to a maxillofacial surgeon.

74. Addison's disease is also known as:

a. Primary adrenal insufficiency
b. Secondary adrenal insufficiency
c. Tertiary adrenal insufficiency
d. Hashimoto's adrenal insufficiency

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a: Primary adrenal insufficiency can be caused by conditions that lead to the destruction of the adrenal cortex. Autoimmune idiopathic adrenal insufficiency is the most common subtype.

75. What is a primary function of cortisol in the body?

a. It increases the level of glucose in the plasma by controlling gluconeogenesis.
b. It increases the level of glucose in the plasma by stimulating the release of glucose from the liver.
c. It is anti-inflammatory by inhibiting prostaglandin production, lysosome release, and leukocyte function.
d. All of the above

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d: It is essential for maintaining homeostasis and is released daily in the body through a circadian rhythm. Stress or pathology can increase the release of cortisol.

76. Which of the following are prudent preparation steps for effectively managing medical emergencies in the dental office? (MULTIPLE ANSWERS)

a. All staff members have successfully completed a basic life support course and participate in regular practice emergency drills.
b. All staff members have been trained in advanced cardiac life support.
c. A list of emergency phone numbers is posted in a conspicuous, easily accessible location.
d. There is an appropriately stocked, routinely maintained office emergency drug kit. All office employees know its location and can retrieve it quickly.
e. One of the staff members is a licensed paramedic.
f. All of the above

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a, c, d: If the dentist is the only one who knows basic life support and the location of the emergency phone numbers and kit, patients may not receive the care they require in the event of a medical emergency.

77. Within how many minutes of ventricular fibrillation (VF) should automated external defibrillator (AED) shock delivery take place?

a. 2 minutes
b. 3 minutes
c. 4 minutes
d. 5 minutes

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b: The time from VF to shock delivery should be less than 3 minutes.

78. Once VF has occurred and EMS has been activated, the best thing to do until the AED is available is:

a. Apply a nasal cannula and administer oxygen at a rate of 4 liters per minute.
b. Determine the patient's level of consciousness.
c. Perform CPR.
d. Administer 30% nitrous oxide via a nasal hood.

c: The dental team should perform CPR once the patient has entered into VF. When VF has occurred, the myocardium quickly becomes depleted of oxygen. Chest compressions will deliver oxygen to the heart, thereby increasing the likelihood that a shock from an AED will convert an existing VF to a sinus rhythm.

79. Once the dental team has *(1)* determined that the patient is unresponsive and not breathing (or having difficulty breathing) and *(2)* activated EMS, which of the following activities should be performed?

a. Perform 30 chest compressions at a rate of at least 100 per minute.
b. Administer two quick breaths, then begin chest compressions.
c. Place an oral airway, give two quick breaths, and then begin chest compressions.
d. Perform 15 chest compressions at a rate of 60 per minute.

a: The adult sternum should be depressed a minimum of 2 inches, and the rescuer's arms should be kept straight during each compression. The rescuer should always allow for complete chest recoil after each chest compression, but interruptions should be minimized.

80. For an unconscious, nonbreathing patient with no pulse, what should happen after the first set of chest compressions?

a. The rescuer gives two long, deep breaths to the victim, which will allow for the patency of the airway to be checked.
b. The victim's airway is opened, and the rescuer gives two quick breaths to the victim. The breaths are given in approximately 1 second.
c. A non-rebreathing face mask is placed on the patient, and oxygen is administered at a rate of 15 liters per minute.
d. A nasal cannula is placed on the patient, and oxygen is administered at a rate of 6 liters per minute.

b: Excessive ventilation must be avoided. The compression-to-ventilation ratio should be 30:2 for a single rescuer of adults, children, and infant victims.

81. Cushing's syndrome is most often caused by which of the following?

a. Congenital adrenal hyperplasia
b. Hypertrophy of the hypothalamus
c. Prolonged administration of exogenous glucocorticosteroids
d. Hypertrophy of the pituitary gland

c: Cushing's syndrome, not Cushing's disease, is a syndrome that presents itself with signs and symptoms that mimic Cushing's disease. The prolonged administration of glucocorticosteroids can induce Cushing's syndrome.