General Principles of Pharmacology

1. Which of the following types of chemical bonding is the least likely to be involved in a drug-receptor interaction?
   a. Covalent bonding
   b. Hydrogen bonding
   c. Electrostatic bonding
   d. Van der Wall’s forces

2. A drug which has affinity for a particular receptor but no intrinsic activity is a(n)
   a. strong agonist.
   b. weak agonist.
   c. partial agonist.
   d. antagonist.

3. A drug that forms a reversible drug-receptor complex, which consequently is surmountable is a(n)
   a. competitive antagonist.
   b. irreversible antagonist.
   c. noncompetitive antagonist.
   d. mixed agonist-antagonist.

4. The magnitude of response obtained from optimal receptor site occupancy by an agonist is a reflection of the drug’s
   a. potency.
   b. efficacy.
   c. $K_D$.
   d. toxicity.

5. The passage of drug molecules across cell membranes along a concentration gradient is achieved by
   a. active transport.
   b. facilitated transport.
   c. passive diffusion.
   d. pinocytosis.

6. The Therapeutic Index (T.I.) of a drug is defined as:
   a. $ED_{50}/LD_{50}$.
   b. $LD_{1}/ED_{99}$.
   c. $LD_{99}/ED_{1}$.
   d. $LD_{50}/ED_{50}$. 
7. Which of the following is an example of an enteric route of drug administration?
   a. Oral
   b. Inhalation
   c. Subcutaneous
   d. Intramuscular

8. The onset of action of a drug is primarily determined by the rate of
   a. excretion.
   b. absorption.
   c. distribution.
   d. biotransformation.

9. Which fraction of a drug has the potential to produce the desired pharmacological
   effect. The fraction that is
   a. free in plasma.
   b. excreted by the kidney.
   c. detoxified in the liver.
   d. bound to plasma protein.

10. The maximal or therapeutic “ceiling” effect of a drug is a reflection of the drug’s
    a. toxicity.
    b. potency.
    c. efficacy.
    d. specificity.

11. Each of the following statements is true regarding drug biotransformation except
    one?
    a. The rate may differ significantly in various animal species.
    b. It primarily occurs in the liver microsomal enzyme system.
    c. It usually converts a drug to its more lipid-soluble, nonionized form.
    d. It generally involves alterations of the chemical structure of the drug.

12. Which of the following best explains why drugs that are highly ionized tend to be
    more rapidly excreted than those that are less ionized? The highly ionized drugs are
    a. less lipid soluble.
    b. less water soluble.
    c. more rapidly metabolized.
    d. more extensively bound to tissue.

13. What is the primary determinant of the maximum safe dose of a local anesthetic
    agent for a child?
    a. Age
    b. Weight
    c. The procedure to be accomplished
    d. The desired degree of pulpal anesthesia
14. The time required for a 50 percent decline in the plasma concentration of a drug as the drug is partitioned throughout the body is expressed as the drug’s
a. elimination half-life \((t_{1/2})\).
b. **distribution half-life \((t_{1/2})\)**.
c. latency.
d. structural activity relationship (SAR).

15. Exponential or first order kinetics implies that
a. 50 percent of a drug is eliminated from the body per unit time.
b. a constant amount of a drug is eliminated from the body per unit time.
c. 50 percent of the drug is distributed throughout the body per unit time.
d. **a constant fraction of a drug is eliminated from the body per unit time.**

16. All of the following statements relate to Phase I biotransformation except which one?
   a. In a Phase I reaction a drug is oxidized or reduced
   b. **In a Phase I reaction a drug undergoes conjugation**
   c. A Phase I reaction is inducible
   d. Hepatic microsomal enzymes are responsible for Phase I reactions

17. Drugs with which of the following characteristics tend to accumulate in higher concentrations in breast milk?
   a. Drugs with a low lipid solubility coefficient
   b. Drugs that are highly protein bound
   c. **Drugs that are weak bases**
   d. Drugs with a pKa less than 7.0

18. Which of the following statements is correct relative to pharmacokinetic changes in elderly patients? Age-related physiological changes include
   a. decreased gastrointestinal pH.
   b. increased splanchnic blood flow.
   c. decreased gastrointestinal motility.
   d. increased absorptive surface in the GI tract.

19. In the apothecary system 1 grain (gr) is equivalent to
   a. 1000 g.
   b. 1000 mg.
   c. \(1/1000\) g.
   d. **65 mg.**

20. In household measures 5 milliliter (ml) is equivalent to
   a. 1 teaspoonful (1 tsp).
   b. 1 tablespoonful (1 tbs).
   c. 15 drops (15 gtt).
   d. 1 fluid ounce (1 fl oz)
21. If you wish a patient to initiate drug therapy immediately after the prescription is filled, the instruction to the patient should specify that the drug is to be taken
   a. prn.
   b. stat.
   c. qh.
   d. qd.

22. The heading of a prescription should include all of the following components except which one?
   a. The name and address of the prescriber and of the patient
   b. The phone number of the prescriber
   c. The prescriber’s DEA number
   d. The age of the patient

23. In the body of a prescription, following the abbreviation “Disp.”, the pharmacist is instructed to give the patient
   a. a specific drug.
   b. a specific dosage unit or concentration of the drug.
   c. a specific amount (number of tablets, capsules or volume) of the drug.
   d. specific instructions about the dosage regimen of the drug.

24. The Food and Drug Act of 1906
   a. regulated interstate commerce in drugs.
   b. prohibited interstate commerce in drugs that have not been shown to be safe and effective.
   c. regulated labeling and packaging.
   d. established standards for strength and purity.

25. The law which collects and conforms most of the diverse laws related to drugs into one piece of legislation and is further designed to improve the administration and regulation of manufacturing, distribution, and the dispensing of controlled substances by providing a “closed” system for the legitimate handlers of these drugs is the
   d. Food and Drug Act of 1906.

26. Every practitioner who administers, prescribes, or dispenses controlled substances must be registered with the
   a. Food and Drug Administration (FDA).
   b. Drug Enforcement Administration (DEA).
   c. Centers for Disease Control (CDC).
   d. National Institutes of Health (NIH).
27. Drugs which have legal medical uses in the United States, but have a high abuse potential are
   a. Schedule I (C-I) drugs.
   b. **Schedule II (C-II) drugs.**
   c. Schedule III (C-III) drugs.
   d. Schedule IV (C-IV) drugs.

28. Heroin, opium derivatives, marijuana, and hallucinogens are examples of
   a. **Schedule I (C-I) drugs.**
   b. Schedule II (C-II) drugs.
   c. Schedule III (C-III) drugs.
   d. Schedule IV (C-IV) drugs.

29. All of the following statements are correct about Schedule II (C-II) drugs except which one?
   a. Schedule II (C-II) drugs require a written prescription order.
   b. **A Schedule II (C-II) prescription order may be refilled.**
   c. A practitioner may telephone a prescription order to a pharmacist for a Schedule II (C-II) drug.
   d. A Schedule II (C-II) prescription order must include the DEA registration number of the prescriber.

30. Which of the following statements is correct relative to Schedule III (C-III) drugs?
   a. **A Schedule III (C-III) drug prescription order may be refilled, up to five times within six months after the date of issue, if so authorized by the prescriber.**
   b. Oral orders for Schedule III (C-III) drugs must be followed by a written order within 72 hours.
   c. Examples of Schedule III (C-III) drugs include selected opiates (morphine and congeners, some codeine congeners (oxycodone w/APAP or w/ASA), methadone, amphetamines, and some barbiturates.
   d. A Schedule III (C-III) drug prescription order must be limited to the amount of a drug needed to treat a patient during an emergency period.

**Local Anesthetics and Analgesics**

31. All of the following are algogenic substances that occur naturally in the environment of nociceptors following acute tissue damage except which one?
   a. Histamine
   b. Bradykinin
   c. **Prostaglandin**
   d. Adenosine triphosphate
32. Which of the following is a neuropeptide found in synaptic vesicles of nerve fibers involved in pain perception and is considered to be the neurotransmitter specific for pain?
   a. Adenosine
   b. Prostaglandin
   c. Serotonin
   d. **Substance P**

33. All of the following statements are correct relative to pain perception associated with the neotrigeminothalamic tract except which one? The neotrigeminothalamic tract
   a. is composed of long A-delta fibers that connect directly to the thalamus where they synapse with fibers that project to the primary somatosensory cortex.
   b. delivers information rapidly and permits the perception of the site, intensity, and duration of the injuring stimulus.
   c. **provokes suprasegmental reflexes that modulate ventilation, endocrine function, and circulation.**
   d. delivers impulses that give rise to the perception of sharp, well-localized pain and a warning of possible progressive injury.

34. Pain, which arises slowly after injury, and is characterized as burning, aching, dull, poorly localized, and persistent, is most likely to be due to the activation of
   a. A-delta fibers.
   b. **C fibers.**
   c. B fibers.
   d. A-gamma fibers.

35. Which of the following statements is correct relative to the modulation of nociception?
   a. **Segmental reflexes that affect the environment of nociceptive receptors may amplify nociception.**
   b. Traumatic injury provokes an efferent motor reflex in the vicinity of tissue injury and inhibits nociception.
   c. Sympathetic reflexes decrease the microcirculation in injured tissue and inhibit nociception.
   d. When tissue damage occurs, simultaneous activity in adjacent large fibers amplifies small-fiber transmission.
36. All of the following statements are correct relative to the intrinsic modulation of nociception, which occurs at peripheral terminals of afferent nerves except which one?
   a. Resident immune cells in inflamed tissue express endogenous ligands, opioid peptides.
   b. In association with painful inflammatory conditions, opioid receptors on peripheral sensory afferents are unregulated.
   c. Environmental stimuli and endogenous substances, such as corticotropin-releasing hormone and cytokines, stimulate the release of opioid peptides from resident immune cells in inflamed tissue, resulting in local analgesia.
   d. Exogenous opioid agonists applied locally cannot activate peripheral opioid receptors.

37. Severe hypotension may result from toxic blood levels of each of the following local anesthetic agents except with one?
   a. Cocaine
   b. Procaine (Novocaine®)
   c. Lidocaine (Xylocaine®)
   d. Mepivacaine (Carbocaine®)

38. The use of which of the following local anesthetic agents is contraindicated in patients with a history of allergic reaction to ester-type local anesthetic agents?
   a. Lidocaine (Xylocaine®)
   b. Mepivacaine (Carbocaine®)
   c. Procaine (Novocaine®)
   d. Etidocaine (Duranest®)

39. A recently introduced local anesthetic agent is available in 0.5% buffered aqueous solution. The maximum amount recommended for anesthesia over a 4-hour period is 30 mg. This amount is contained in how many milliliters of the local anesthetic?
   a. 3
   b. 6
   c. 12
   d. 24

40. Which of the following local anesthetic agents is potentially the most cardiotoxic agent in current use?
   a. Lidocaine (Xylocaine®)
   b. Mepivacaine (Carbocaine®)
   c. Bupivacaine (Marcaine®)
   d. Prilocaine (Citanest®)
41. After receiving 1.8 cc of a local anesthetic agent, a healthy adult patient became pale, diaphoretic and experienced a brief episode of syncope. Your most likely diagnosis would be
   a. hyperventilation.
   b. **vasovagal response**.
   c. epinephrine-induced sympathetic reaction.
   d. toxic reaction.

42. The most serious consequence of systemic local anesthetic toxicity is
   a. clonic seizures.
   b. increased rate and depth of respiration.
   c. tachycardia.
   d. **central nervous system (cortical and medullary) depression**.

43. High doses of circulating adrenergic amines from inadvertent intravascular injections or potentiation of the release of endogenous catecholamines may elicit adverse effects in some patients characterized by
   a. fear, anxiety, throbbing headache, and chest pain.
   b. pallor, diaphoresis, bradycardia, and syncope.
   c. urticaria, hypotension, laryngeal edema, and bronchospasm.
   d. faintness, tightness in the chest, excessive deep sighs, and panic.

44. The rate and extent of absorption of local anesthetic agents is a function of
   a. their inherent chemical characteristics.
   b. pKa of the drug.
   c. pH at the site of injection.
   d. **all of the above**.

45. Which of the following is true regarding the mechanism of action of local anesthetics? Local anesthetic agents
   a. maintain the nerve membrane in a state of hyperpolarization.
   b. **prevent the generation of a nerve action potential**.
   c. maintain the nerve membrane in a state of depolarization.
   d. prevent increased permeability of the nerve membrane to potassium ions.

46. At a pH of 7.4, lidocaine (Xylocaine®), which has a pKa of 7.8, will exist
   a. primarily (> 90 %) in the ionized form.
   b. primarily (> 90 %) in the unionized form.
   c. in an equal mixture of the ionized and nonionized forms.
   d. **in approximately 25 % unionized form**.
47. If the toxic dose of mepivacaine (Carbocaine®) for a given patient is 300 mg, how many milliliters of 3% mepivacaine may be administered without producing toxicity?
   a. 5
   b. 10
   c. 15
   d. 20

48. Cardiovascular collapse elicited by the high plasma level of a local anesthetic is most likely caused by
   a.  syncope.
   b.  vagal stimulation.
   c.  histamine release.
   d.  **myocardial depression**.

49. Which of the following may not be attributed to the physiological effect of epinephrine?
   a.  Cardiac arrhythmias
   b.  **Bronchiolar constriction**
   c.  A rise in blood pressure
   d.  Restlessness and anxiety

50. The use of which of the following local anesthetic agents may be the most problematic in the management of children, the mentally retarded, or otherwise debilitated patients who may self-inflict injuries on anesthetized regions of the body?
   a.  Procaine (Novocaine®)
   b.  Lidocaine (Xylocaine®)
   c.  Mepivacaine (Carbocaine®)
   d.  **Bupivacaine (Marcaine®)**

51. Local anesthetic agents block nerve conduction by
   a.  reducing the permeability of nerve membrane to potassium.
   b.  increasing the permeability of nerve membrane to chloride.
   c.  increasing the permeability of nerve membrane to calcium.
   d.  **reducing the permeability of nerve membrane to sodium**.

52. Most allergic reactions to local anesthetic agents are the result of
   a.  Type I reactions or anaphylaxis.
   b.  Type II or cytotoxic reactions.
   c.  **Type IV or delayed hypersensitivity reactions**.
   d.  Type III or Arthus reactions.
53. Local anesthetic agents are converted to their salts with hydrochloric acid for clinical use because the latter are
   a. less toxic and have greater efficacy.
   b. more stable and have greater water solubility.
   c. more stable and have greater lipid solubility.
   d. more potent and cause less local tissue damage.

54. Cyclooxygenase inhibitors block the synthesis of prostaglandins, which are known to produce all of the following physiological events except which one?
Prostaglandins
   a. produce vasodilation and increase vascular permeability.
   b. modulate the inflammatory response and body temperature.
   c. increase nociception.
   d. activate platelet receptors.

55. All of the following statements are correct about the metabolism and excretion of cyclooxygenase inhibitors except which one?
   a. The metabolism of traditional therapeutic doses normally follows first-order kinetics.
   b. After larger than the traditional therapeutic doses, the enzymes responsible for their metabolism become saturated, and their half-lives increase significantly.
   c. Their metabolites are excreted primarily by the liver.
   d. In therapeutic concentrations, they have dose-dependent half-lives that vary from 2 to 12 hours.

56. Which of the following analgesics should be used with caution in patients with severe hepatic disease, vitamin K deficiency, during treatment with anticoagulants, and in patients with hemophilia because severe hemorrhage may result?
   a. Codeine
   b. Acetaminophen (Tylenol®)
   c. Acetylsalicylic acid (Aspirin®)
   d. Tramadol (Ultram®)

57. Cyclooxygenase (COX)-1 inhibitors impair platelet adhesion and aggregation primarily by inhibiting the synthesis of
   a. thromboxane A_2.
   b. prostacyclines.
   c. prostaglandins.
   d. leukotrienes.
58. Intolerance to all of the following drugs may be confirmed by a history of generalized urticaria, angioedema, bronchospasm, or severe rhinorrhea, occurring within 3 hours following drug administrations except to which one?
   a. COX-1 inhibitors
   b. COX-2 inhibitors
   c. ASA
   d. **Opioids**

59. Which of the following agents is a weak inhibitor of peripheral prostaglandin synthesis, although it does appear to be a more effective COX-3 inhibitor in the CNS?
   a. Acetylsalicylic acid (Anacin®)
   b. **Acetaminophen (Tylenol®)**
   c. Ibuprofen (Motrin®)
   d. Tramadol (Ultram®)

60. All of the following statements are correct regarding acetaminophen (Tylenol®) except which one? Acetaminophen
   a. has a significant antipyretic property.
   b. is available in combination with oxycodone.
   c. is not cross-allergenic with ASA.
   d. **has a therapeutically significant anti-inflammatory property.**

61. All of the following are adverse effects attributable to opioids except which one?
   a. Respiratory depression
   b. Emesis
   c. Constipation
   d. **Midriasis**

62. Which of the following drugs is an opioid antagonist, which may be used to reverse apnea and coma due to opioid toxicity?
   a. Pentazocine (Talwin®)
   b. Rofecoxib (Vioxx®)
   c. **Naloxone (Narcan®)**
   d. Methadone (Dolophine®)

63. Which of the following are pathognomonic signs of opioid overdose?
   a. **Miosis, respiratory depression, and coma.**
   b. Nausea, vomiting, diarrhea, anorexia, abdominal pain, hepatic necrosis, and hepatic coma.
   c. Tinnitus, dizziness, sweating, hyperventilation, dehydration, and hyperthermia.
   d. Restlessness, incoherent speech, delirium, convulsions, and coma.
64. Vigorous supportive therapy for acetaminophen overdose include
   a. induction of vomiting with syrup of ipecac.
   b. the administration of activated charcoal and gastric lavage.
   c. the administration of N-acetylcysteine (Mucomyst).
   d. all of the above.

65. Pain threshold refers to
   a. the highest level of pain a patient will tolerate.
   b. the average level of pain a patient will experience.
   c. the lowest level of pain a patient will detect.
   d. none of the above.

66. Each of the following methods can be used to control pain except which one?
   a. Cortical depression
   b. Raising the pain threshold
   c. Blocking the sensory pathway
   d. Depression of the autonomic nervous system

67. Injection of a local anesthetic agent into an inflamed area usually produces less than optimal results. Which of the following best explains why?
   a. Prostaglandins have stabilized the nerve membrane.
   b. Inflammation reduces the availability of the free base.
   c. The drug is absorbed more rapidly because of increased blood supply.
   d. The chemical mediators of inflammation produce chemical antagonism to the anesthetic agent.

68. Which of the following is the major reason for adding a vasoconstrictor to local anesthetic formulations?
   a. To decrease bleeding
   b. To reduce systemic toxicity
   c. To enhance the onset of action
   d. To prolong the duration of anesthesia

69. Of the following local anesthetic agents, which one has significant intrinsic vasoconstrictive properties?
   a. Cocaine
   b. Procaine (Novocaine®)
   c. Lidocaine (Xylocaine®)
   d. Bupivacaine (Marcaine®)
70. A patient placed an aspirin directly in the mandibular facial vestibule. Shortly afterward, a well-circumscribed white, edematous patch with subsequent desquamation appeared on the vestibular mucosa. What is your most likely diagnosis?
   a. Intolerance
   b. Local toxicity
   c. Allergic reaction
   d. Anti-thrombotic effect

71. Cyclooxygenase (COX)-1 inhibitors should be used with caution in patients
   a. taking anticoagulants.
   b. with hepatic disease.
   c. with hemophilia.
   d. All of the above

72. The analgesic activity of morphine, which (as a function of dose) is accompanied by respiratory depression and euphoria, is mediated primarily through its influence on which of the following opioid receptor subtype?
   a. Mu (OP3)
   b. Kappa (OP1)
   c. Delta (OP2)
   d. Opioid-receptor-like (OP4)

73. Nausea and vomiting that are associated with the administration of opioid analgesics is the result of direct stimulation of the
   a. limbic system.
   b. vomiting center.
   c. chemoreceptor trigger zone.
   d. opioid receptors in the G.I. tract.

74. When administered orally, which of the following opioids is considered to have the highest dependence liability?
   a. Codeine
   b. Oxycodone
   c. Propoxyphene
   d. Pentazocine

75. Each of the following side effects can occur as a result of systemic absorption of lidocaine except which one?
   a. Increased gastric motility
   b. Tonic-clonic convulsions
   c. Decreased cardiac output
   d. Respiratory depression
76. A patient has a history of significant cardiovascular impairment. Based on the functional capacity of the patient the maximum safe dose of epinephrine for this patient is 0.04 mg. All of the following formulations represent the maximum safe dose of a 2% local anesthetic agent with epinephrine except which one?
   a. 1 cc with epinephrine 1:50,000
   b. 2 cc with epinephrine 1:50,000
   c. 4 cc with epinephrine 1:100,000
   d. 8 cc with epinephrine 1:200,000

77. The only available local anesthetic agent with a thiophene nucleus is
   a. procaine (Novocaine®).
   b. articaine (Ultracaine®).
   c. lidocaine (Xylocaine®).
   d. mepivacaine (Carbocaine®).

78. Allergic reactions to local anesthetic agents and analgesics are caused by
   a. rapid absorption.
   b. slow detoxification.
   c. antigen-antibody reactions.
   d. improper administration techniques.

79. Therapy with low dose ASA prevents the formation of thromboemboli by preferentially inhibiting which of the following?
   a. Phospholipase A2 synthesis in blood vessel walls
   b. Prostacyclin synthesis in blood vessel walls
   c. Thromboxane A2 synthesis in platelets
   d. Vitamin K synthetesis in the liver

**Antimicrobial Agents**

80. Unless the patient has an allergy to beta-lactams, the empirical drug of choice for the treatment of an uncomplicated odontogenic infection is
   a. amoxicillin.
   b. **penicillin V**.
   c. amoxicillin with clavulanic acid.
   d. cephallexin.

81. Which of the following pharmacological properties is not characteristic of penicillin V?
   a. Good activity against most facultative Gram(+) cocci.
   b. Good activity against most Gram(-) oral anaerobes.
   c. Beta-lactamase resistance.
   d. Formulated for oral administration.
82. Which of the following macrolids has an extended spectrum against facultative and some obligate anaerobes and a twice a day dosage schedule?
   a. Clarithromycin
   b. Dirithromycin
   c. Erythromycin
   d. Azithromycin

83. Which of the following conditions is not an indication to empirically prescribe clindamycin?
   a. Unresolved odontogenic infection following treatment with penicillin V.
   b. The treatment of a complicated odontogenic infection.
   c. History of allergy to beta-lactam antibiotics.
   d. If significant improvement is not noted with penicillin V in 48 to 72 hours.

84. Which of the following statements is applicable to penicillin V? Penicillin V
   a. inhibits bacterial cell wall synthesis.
   b. activates bacterial autolytic enzymes.
   c. *is destroyed in the acidic environment of the stomach.*
   d. Has few toxic effects.

85. Which of the following antibacterial agents is an inhibitor of nucleic acid synthesis, is beta-lactamase resistant, has good activity against oral facultative and obligate anaerobes, and has an oral formulation?
   a. Metronidazole
   b. Vancomycin
   c. Sulfonamides and trimethoprim
   d. Chloramphenicol

86. Which of the following antibacterial agents does not target bacterial enzymes that synthesize protein from the mRNA code?
   a. Macrolids
   b. Lincosamides
   c. Tetracyclines
   d. Vancomycin

87. Which of the following antibacterial agents would be the most effective as the empirical drug of choice for the treatment of an uncomplicated odontogenic infection in an otherwise healthy patient who is allergic (anaphylaxis) to beta-lactam antibiotics?
   a. A macrolid
   b. A cephalosporin
   c. Clindamycin
   d. Chloramphenicol
88. When a patient presents with a severe odontogenic infection, the empirical antibacterial drug of choice would be
   a. Metronidazole  
   b. Vancomycin  
   c. **Clindamycin**  
   d. Azithromycin

89. The combination antibacterial agent trimethoprim/sulfamethoxazole
   a. sequentially blocks the folate pathway, produces synergism, and is bactericidal.  
   b. inhibits specific receptors on 50S ribosomal subunits and is bacteriostatic.  
   c. binds to 30S ribosomal subunits and blocks the formation of the 70S initiation complex and is bacteriocidal.  
   d. Alternates the conformation of bacterial DNA and is bactericidal.

90. Microorganisms responsible for odontogenic infections (pulpal, periodontal, pericoronal) are primarily
   a. Gram-positive facultative organisms accompanied by Gram-negative strict anaerobes.  
   b. Gram-positive aerobes cocci accompanied by Gram-negative aerobic bacilli.  
   c. Gram-negative aerobic bacilli accompanied by Gram-positive anaerobic bacilli.  
   d. Gram-positive strict anaerobes accompanied by Gram-negative aerobic bacilli.

91. All of the following antibacterial agents are bactericidal except which one?
   a. Penicillins  
   b. Cephalosporins  
   c. **Lincosamides**  
   d. Vancomycin

92. All of the following antibacterial agents are bacteriostatic except which one?
   a. Macrolids  
   b. **Metronidazole**  
   c. Tetracyclines  
   d. Chloramphenicol

93. Which of the following bactericidal antibacterial agents is effective against obligate Gram-negative anaerobes and is beta-lactamase resistant?
   a. Penicillin V  
   b. Amoxicillin  
   c. **Metronidazole**  
   d. Cephalexin
94. Which of the following beta-lactam antibacterial agents is effective against Gram-positive and Gram-negative organisms and is mostly beta-lactamase resistant?
   a. Penicillin G
   b. Penicillin V
   c. **Amoxicillin w/clavulanate**
   d. Cephadrine

95. Based on their metabolic characteristics, bacteria may be classified as
   a. cocci or bacilli.
   b. Gram-positive or Gram-negative
   c. **aerobic, anaerobic, or facultative.**
   d. bactericidal or bacteriostatic.

96. All of the following statements are true in regard to the strategies for the medical management of odontogenic infections EXCEPT which one?
   a. The history and clinical characteristics of odontogenic infections provide reliable data upon which empirical antibacterial chemotherapy may be initiated.
   b. Gram-positive facultative and Gram-negative strict anaerobes predominate in all types of odontogenic infections.
   c. The drug of choice should be the least toxic alternative among several available alternatives.
   d. **The drug of choice should be the one with the broadest spectrum among several available alternatives.**

97. All of the following statements are true relative to issues to be considered in the treatment of uncomplicated odontogenic infection, EXCEPT which one?
   a. Penicillin V has good activity against most facultative Gram-positive cocci and strict oral anaerobes.
   b. The synthesis of β-lactamase by facultative Gram-positive cocci and strict anaerobes is common.
   c. **The prescribing of penicillin V, based on statistical evidence of the identity of offending microorganisms, eliminates the need for follow-up in 48 to 72 hours.**
   d. Penicillin V is a narrow-spectrum β-lactam antibacterial agent.

98. When treating an uncomplicated odontogenic infection with penicillin V and significant improvement is not noted within 48 to 72 hours, the empirical addition of ____________ is reasonable.
   a. clindamycin
   b. **metronidazole**
   c. azithromycin
   d. clarithromycin
99. When a patient presents with an unresolved odontogenic infection following treatment with a full course of a \( \beta \)-lactam agent, the administration of \underline{_______}, a \( \beta \)-lactamase resistant drug should be considered.

a. clindamycin  
b. erythromycin  
c. azithromycin  
d. clarithromycin

100. The initial empirical drug of choice for the treatment of a severe odontogenic infection is  
a. metronidazole.  
b. amoxicillin  
c. \underline{clindamycin}  
d. azithromycin

101. Many oral Gram-negative anaerobes appear to be inherently resistant to erythromycin (a macrolide) because the structure of the outer bacterial cell membrane restricts entry of the drug. This drug resistance is an example of \underline{_______}.

a. acquired drug resistance.  
b. natural or intrinsic drug resistance.  
c. mutational drug resistance.  
d. biofilm-related drug resistance.

102. All of the following statements are true about mutational drug resistance EXCEPT which one? Mutational drug resistance \underline{_______}.

a. requires an initial exposure to the antibacterial agent.  
b. has been related to the synthesis of \( \beta \)-lactamases.  
c. has been related to changes in proteins associated with cell membrane permeability and porins affecting the uptake of \( \beta \)-lactams.  
d. has been related to modification of penicillin-binding-proteins, which preclude the \( \beta \)-lactams to interact with their receptors.

103. An acquired form of drug resistance associated with the process whereby competent bacteria acquire segments of free DNA released by dead bacteria carrying the resistance strait to an antibacterial agent is called \underline{_______}.

a. transformation.  
b. transduction.  
c. conjugation.  
d. transposition.

104. The transfer of plasmid DNA by direct cell-to-cell contact between the donor and recipient microorganism takes place by \underline{_______}.

a. transposition.  
b. \underline{conjugation}.  
c. transposons.  
d. transduction.
105. Certain bacteria block ribosomal receptor sites, a mechanism responsible for macrolide resistance, and because macrolid-related microsomal receptor sites overlap with the receptor sites for another antibacterial agent, these bacteria will also be resistant to
   a. penicillin V.
   b. clindamycin.
   c. metronidazole
   d. tetracyclines.

106. Certain bacteria may develop macrolide resistance by activating efflux pumps. These activated efflux pumps can also affect the intracellular concentration of
   a. clindamycin.
   b. metronidazole.
   c. β-lactams.
   d. β-lactamases.
   e. c and d.

107. All of the following statements are true in regard to biofilms EXCEPT which one?
   a. Once in a biofilm, bacteria appear to be 1000-fold more resistant to antibacterial agents than when they are in their planktonic form.
   b. Planktonic bacteria are recruited into the ecosystem of a biofilm by quantum sensing.
   c. Antibacterial agents fail to penetrate beyond the surface layers of the biofilm
   d. In zones of nutrient depletion or waste product accumulation within the biofilm, antibiotic action may be amplified.

108. All of the following statements are true in regard to resistance and its clinical relevance EXCEPT which one?
   a. With each dose of an antibacterial agent, the fraction of resistant bacteria in the individual, and potentially in the community, increases.
   b. With prolonged antibacterial chemotherapy there is a risk of destroying the normal flora.
   c. Following antibacterial chemotherapy, the resistant flora tends to maintain a survival advantage.
   d. The resistant flora must allocate energy to maintain resistance trait.
The antiviral agents amantadine (Symmetrel®) and rimantadine (Flumadine®), which are effective in the management of influenza A, exert their antiviral effect by

a. inhibiting transmembrane M2 protein essential for uncoating the virus, a step essential for viral penetration into a host cell.

b. inhibiting neuraminidase, an enzyme essential for mucoprotein breakdown, a step essential for the release of the virus from an infected cell.

c. preventing the cleavage of protein precursors essential for viral maturation, infection of new cells, and replication.

d. inhibiting DNA polymerase, as nucleoside analogs, and by inhibiting viral reverse transcriptase, they prevent the formation of viral DNA or RNA copies by infected cells.

The antiviral agents zanamivir (Relenza®) and oseltamivir (Tamiflu®), which are effective in the management of influenza A and B, are

a. nucleotide analogs, which inhibit reverse transcriptase and slow or prevent the formation of viral DNA or RNA copies by infected cells.

b. nonnucleotide analogs, which inhibit reverse transcriptase and slow or prevent the formation of viral DNA or RNA copies by infected cells.

c. neuraminidase inhibitors, which inhibit mucoprotein breakdown and the release of the virus from infected cells.

d. Nucleoside analogs, which inhibit viral DNA polymerase, inhibit viral reverse transcriptase and slow or prevent the formation of viral DNA or RNA copies by infected cells.

All of the following statements are correct about nucleotide or nucleotide analogs EXCEPT which one?

a. Nucleotides are phosphorilated nucleosides.

b. Nucleotide analogs inhibit viral reverse transcriptase and slow or prevent the formation of viral DNA or RNA copies by the infected cell.

c. **Nucleotides consist of purine or pyrimidine bases joined to a ribose or deoxyribose sugar.**

d. Nucleotides are the basic structural units of DNA or RNA.

All of the following are categories of antiviral agents prescribed in the management of HIV infection EXCEPT which one?

a. Protease inhibitors

b. **Neuraminidase inhibitors**

c. Nucleoside reverse transcriptase inhibitors

d. Nucleotide reverse transcriptase inhibitors
113. Which of the following drugs is considered a prodrug, which after oral administration is metabolized to acyclovir, a nucleside analog, and is effective in treating HSV infections?
   a. Trifluridine (Viroptic®)
   b. Foscarnet (Foscavir®)
   c. **Valacyclovir (Valtrex®)**
   d. Famciclovir (Famvir®)

114. Which of the following drugs is a phosphorilated derivative of famciclovir, a nucleoside analog, and may be helpful in treating recurrent herpes labialis in immunocompetent patients?
   a. **Penciclovir (Denavir®)**
   b. Acyclovir (Zovirax®)
   c. Docosanol (Abreva®)
   d. Valacyclovir (Valtrex®)

115. Which of the following antiviral agents is valuable in treating immunocompromised patients who are either intolerant to acyclovir or are infected with an acyclovir-resistant strain of HSV?
   a. Valacyclovir (Valtrex®)
   b. **Foscarnet (Foscavir®)**
   c. Famciclovir (Famvir®)
   d. Trifluridine (Viroptic®)

116. Which of the following antifungal agents is a polyene, which binds to ergosterol in the cell wall of susceptible fungi and alters membrane permeability, but is toxic for parenteral administration?
   a. Amphotericin B (Fungizone®)
   b. Ketoconazole (Nizoral®)
   c. **Nystatin (Mycostatin®)**
   d. Flucytosine (Ancobon®)

117. Which of the following antifungal agents is nephrotoxic, but is the drug of choice for the treatment of severe systemic mycoses?
   a. Fluconazole (Dilfucan®)
   b. Itraconazole (Sporanex®)
   c. **Amphotericin B (Fungizone®)**
   d. Clotrimazole (Mycelex®)

118. All of the following antifungal agents are associated with hepatotoxicity as their most serious adverse effect EXCEPT which one?
   a. Fluconazole (Dilfucan®)
   b. Itraconazole (Sporanex®)
   c. **Nystatin (Mycostatin®)**
   d. Flucytosine (Ancobon®)
119. Which of the following antifungal agents is a fluorinated pyrimidine, which is converted into 5-fluorouradine triphosphate, an inhibitor of DNA synthesis?
   a. **Flucytosine (Ancobon®)**
   b. Fluconazole (Dilfucan®)
   c. Itraconazole (Sporanex®)
   d. Clotrimazole (Mycelex®)

120. The primary line of treatment of oral candidiasis may include
   a. Fluconazole (Dilfucan®) or Itraconazole (Sporanex®)
   b. **Nystatin (Mycostatin®) or Clotrimazole (Mycelex®)**
   c. Amphotericin B (Fungizone®) or Flucytosine (Ancobon®)
   d. Ketoconazole (Nizoral®) or Fluconazole (Dilfucan®)

**Cardiovascular Drugs**

121. Which of the following diuretics inhibits both sodium reabsorption and the secretion of potassium and hydrogen ions in the collecting tubules of the kidneys?
   a. Hydrochlorothiazide
   b. **Triamterene**
   c. Furosemide
   d. Spironolactone

122. Which of the following diuretics is an aldosterone antagonist?
   a. Hydrochlorothiazide
   b. Triamterene
   c. Furosemide
   d. **Spironolactone**

123. All of the following adverse drug effects are attributable to treatment with a diuretic EXCEPT which one?
   a. Xerostomia
   b. Dehydration
   c. Hypotesion
   d. **Gingival hyperplasia**

124. All of the following conditions are indications for treatment with a diuretic EXCEPT which one?
   a. Edema due to congestive heart failure
   b. Hypertension
   c. **Thromboembolic disorder**
   d. Hepatic or renal failure
125. Which of the following drugs is a competitive β1-adrenergic receptor-blocking agent?
   a. Lisinopril (Zestril®)
   b. **Metoprolol (Toprol XL®)**
   c. Losartan (Cozaar®)
   d. Pravastatin (Pravachol®)

126. All of the following conditions are appropriate indications for the administration of a competitive β1-adrenergic receptor blocking agent EXCEPT which one?
   a. Angina pectoris
   b. Tachyarrhythmia
   c. Acute migraine
   d. Hypertension

127. All of the following adverse drug effects may be attributable to competitive β1-adrenergic receptor blocking agents EXCEPT which one?
   a. Bradycardia
   b. **Tachypnea**
   c. Heart failure
   d. Mental impairment

128. Which of the following drugs may mask hypoglycemia in diabetic patients?
   a. Competitive β1-adrenergic receptor blocking agents
   b. ACE inhibitors
   c. Calcium channel blocking agents
   d. AT2 receptor antagonists

129. Which of the following drugs inhibits the conversion of angiotensin I to angiotensin II, produces vasodilatation, suppresses aldosterone synthesis, and potentiates the vasodilating effects of bradykinins and prostaglandins?
   a. Benazepril (Lotensin®)
   b. Irbesartan (Avapro®)
   c. Diltiazem (Cartia XT®)
   d. Spironolactone

130. All of the following adverse drug effects are attributable to treatment with an ACE inhibitor EXCEPT which one?
   a. Dysgeusia
   b. Angioedema
   c. **Masking the signs and symptoms of hypoglycemia**
   d. Persistent cough
131. All of the following pharmacological effects are attributable to calcium channel blocking agents EXCEPT
   a. relaxation of vascular smooth muscle.
   b. relaxation of the myocardium.
   c. increased conduction velocity.
   d. increased myocardial oxygen delivery.

132. Adverse drug effects associated with calcium channel blocking agents include all of the following EXCEPT
   a. gingival hyperplasia.
   b. hypotension.
   c. angina pectoris (coronary steal syndrome).
   d. recurrent hypoglycemia.

133. Patients taking a calcium channel blocking agent may have all of the following medical diagnoses EXCEPT
   a. congestive heart failure.
   b. angina pectoris.
   c. hypertension.
   d. supraventricular tachycardia.

134. Which of the following drugs is an \( \alpha_2 \)-adrenergic receptor agonist, which reduces sympathetic outflow from the nervous system and decreases vascular tone and heart rate?
   a. Doxazosin
   b. Clonidine
   c. Terazosin
   d. Amlopidine (Norvase®)

135. Competitive \( \alpha_1 \)-adrenergic receptor antagonists are prescribed primarily for the treatment of
   a. angina pectoris.
   b. hypertension.
   c. congestive heart failure.
   d. cardiac arrhythmia.

136. Which of the following drugs is an HMG-CoA reductase inhibitor, a rate-limiting enzyme in the synthesis of VLDL and LDL, and increases the concentration of HDL?
   a. Gemfibrozil
   b. Simvastatin (Zocor®)
   c. Fenofibrate (Tricor®)
   d. Niacin (Niacor®)
137. All of the following drugs may be effective in the treatment of cardiac arrhythmias EXCEPT
   a. Isosorbide mononitrate
   b. Atenolol
   c. Nifedipine
   d. Digoxin

138. Which of the following drugs inhibits the sodium/potassium ATPase pump, increasing intracellular calcium ion concentrations and cardiac contractility (positive inotropic effect)?
   a. Atenolol
   b. Digoxin (Lanoxin®)
   c. Benzapril (Lotensin®)
   d. Valsartan (Diovan®)

139. The daily administration of low doses of aspirin interferes with platelet aggregation by inhibiting the
   a. release of ADP from platelet storage granules.
   b. synthesis and release of platelet thromboxane A₂.
   c. activation of fibrinogen.
   d. activation of von Willebrand factor.

140. Which of the following agents inhibits platelet aggregation induced by adenosine diphosphate?
   a. Ibuprofen (Motrin®)
   b. Clopidogrel (Plavix®)
   c. Glycoprotein IIb/IIIa antagonists
   d. Acetylsalicylic acid (Aspirin®)

141. Warfarin depresses the production (carboxylation) of inactive proenzymes of the prothrombin group of coagulation factors, which include all of the following except factor
   a. II.
   b. VIII.
   c. IX.
   d. X.

142. Which of the following agents activates plasma antithrombin III and inhibits thrombin (factor IIa) and factor Xa?
   a. Clopidogrel (Plavix®)
   b. Glycoprotein IIb/IIIa antagonists
   c. Warfarin (Coumadin®)
   d. Heparin
143. After treatment with acetylsalicylic acid is stopped, cyclooxygenase activity recovers as a function of platelet turnover in about
   a. 4 hours.
   b. 48 hours.
   c. 4 to 7 days.
   d. 24 hours.

144. The therapeutic level of warfarin (Coumadin®) is monitored using the International Normalized Ratio (INR), which requires a determination of the patient’s
   a. bleeding time.
   b. partial thromboplastin time (PTT).
   c. prothrombin time (PT).
   d. platelet count.

145. The anticoagulant therapy of patients with prosthetic heart valves is optimal when the INR is
   a. < 2.
   b. between 2 and 3.
   c. between 3 and 4.
   d. > 4.

146. Before invasive dental procedures, an assessment of the patient’s level of anticoagulation is imperative to ensure values that may preclude problematic bleeding yet maintain therapeutic anticoagulation. These goals may be achieved if on the day of the procedure the patient’s INR is
   a. < 2.
   b. between 2 and 3.
   c. between 3 and 4.
   d. > 4.

147. Which of the following coagulation factors is/are the most sensitive to heparin-antithrombin III complex inactivation?
   a. Factors II$^a$ (thrombin) and X$^a$
   b. Factors VII and IX
   c. Platelet factor 4
   d. Platelet factor 3

148. A patient who gives a history of taking potassium chloride (Klor-Con®) is predictably also taking a(n)
   a. calcium channel blocking agent.
   b. diuretic.
   c. β$_1$-adrenergic receptor antagonist.
   d. ACE inhibitor.
Endocrine and Metabolic Agents

149. All of the following statements are true in relation to the primary physiological effects of glucocorticosteroids EXCEPT which one?

Glucocorticosteroids
a. regulate cell metabolism at the level of translation and transcription.
b. promote gluconeogenesis.
c. regulate sodium retention in the distal convoluted tubule of the kidney.
d. have pronounced anti-inflammatory effects.

150. All of the following medical conditions may be treated with a glucocorticosteroid EXCEPT which one?
a. Lymphocytic leukemia
b. Cushing’s disease
c. Asthma
d. Allergic rhinitis

151. All of the following statements are true in regard to estrogen EXCEPT which one?

Estrogen
a. may inhibit the release of gonadotropin-releasing hormone (GnRH) from the hypothalamus.
b. may reduce the release of LH and FSH from the anterior pituitary.
c. may enhance the release of GnRH during the follicular phase.
d. is an effective chemotherapeutic agent in the treatment of breast carcinoma.

152. Which of the following hormones competitively binds to estrogen receptors on certain tumor cells and other target tissues and produces a nuclear complex that decreases DNA synthesis and inhibits estrogen effects?
a. Tamoxifen (Nolvadex®)
b. Estradiol (Climara®)
c. Conjugated estrogens (Premarin®)
d. Conjugated estrogen/medroxyprogesterone (Prempro®)

153. Which of the following hormones, when taken by a man, may suggest the medical diagnosis of prostatic carcinoma?
a. Medroxyprogesterone
b. Raloxifen (Evista®)
c. Conjugated estrogen (Premarin®)
d. Methylprednisolone

154. Which of the following oral contraceptive formulations more closely resemble normal physiological concentrations of progestins?
a. Monophasic
b. Biphasic
c. Triphasic
155. All of the following statements are true about anabolic steroids EXCEPT which one? Anabolic steroids
   a. are testosterone derivatives.
   b. are prescribed primarily for their masculinization effects.
   c. may be effective in the treatment of refractory anemia, wasting diseases, and corticosteroid-induced catabolism.
   d. tend to have more “building” effects than androgenic steroids.

156. All of the following statements are true in regard to thyroid hormones EXCEPT which one? Thyroid hormones
   a. act synergistically with epinephrine to enhance gluconeogenesis and hyperglycemia.
   b. enhance tissue sensitivity to catecholamines possibly by upregulation of adrenergic receptors.
   c. are involved in thermoregulation.
   d. in supraphysiological dosages produce myxedema.

157. The mechanism of action of which of the following agents, prescribed for the prevention of osteoporosis, more closely mimics the action of calcitonin?
   a. Vitamin D
   b. Parathyroid hormone
   c. Alendronate (Fosamax®)
   d. 1,25-dihydroxycholecalciferal

158. All of the following hormones are associated with a hyperglycemic effect EXCEPT which one?
   a. Prednisone
   b. Estrogen
   c. Insulin
   d. Progesterone

159. All of the following statements are true in regard to oral hypoglycemic agents EXCEPT which one?
   a. Some oral hypoglycemic agents may stimulate insulin release from pancreatic β-cells.
   b. Some oral hypoglycemic agents may increase glucose output from the liver.
   c. Some oral hypoglycemic agents may increase the sensitivity of peripheral target cells to insulin.
   d. Oral hypoglycemic agents may produce weakness, dizziness, hunger, sweating, tachycardia, tremor, visual disturbances, and altered mentation.
Respiratory Drugs

160. Obstruction of the respiratory passages may result in
   a. stagnant hypoxia.
   b. hypoxic hypoxia.
   c. anemic hypoxia.
   d. histotoxic hypoxia.

161. All of the following statements are true in relation to H₁-receptor antagonists EXCEPT which one? H₁-receptor antagonists
   a. inhibit histamine-induced vasodilatation.
   b. increase capillary permeability.
   c. produce xerostomia.
   d. are additive with CNS depressants and produce sedation.

162. In the management of reactive airway disease (asthma), the therapeutic emphasis is on prevention with
   a. Sympathomimetic bronchodilators.
   b. Leukotriene-receptor antagonists.
   c. Anticholinergic agents
   d. Inhaled glucocorticosteroids.

163. Which of the following drugs relaxes bronchial smooth muscles by acting on β₂-adrenergic receptors?
   a. Albuteral (Albuterol Aerosol®)
   b. Montelukast (Singulair®)
   c. Fluticasone propionate (Flovent®)
   d. Ipratopium (Atrovent®)

164. Which of the following drugs is a selective and competitive leukotriene-receptor antagonist effective in the management of chronic asthma?
   a. Albuteral (Albuterol Aerosol®)
   b. Montelukast (Singulair®)
   c. Salmeterol/fluticasone (Advair Diskus®)
   d. Ipratopium/albuterol (Combivent®)

165. The respiratory rate of patients with which of the following diagnosis is most likely to be modulated by O₂ concentrations?
   a. Reactive airway disease (asthma)
   b. Acute bronchitis
   c. Emphysema
   d. Allergic rhinitis
166. Preventive therapy substantially reduces the risk of developing clinically active tuberculosis following exposure. The current therapeutic regimen is 6 to 12 months of daily
   a. Rifampin (Rifadin®).
   b. Isoniazid (INH®).
   c. Ethambutol (Myambutol®).
   d. Ciprofloxacin (Cipro®).

167. For the empirical treatment of immunocompetent patients with pulmonary and extrapulmonary tuberculosis likely to be caused by susceptible organisms, the initial drug regimen is with
   a. Daily isoniazid (INH®).
   b. Daily isoniazid (INH®), rifampin (Rifadin®), and pyrazinamide for two months.
   c. Daily or twice-weekly isoniazid (INH®) and rifampin (Rifadin® for four months.
   d. Daily ethambutol (Myambutol®) or streptomycin.

Gastrointestinal Drugs

168. Nausea and vomiting are induced by the activation of a number of receptors, which include all of the following EXCEPT which one?
   a. Opioid mu receptors.
   b. Dopamine (D2) receptors.
   c. Histamine (H₁) receptors.
   d. Serotonin (5-HT₃) receptors.

169. Which of the following drugs binds electrostatically to positively charged proteins in ulcerated tissue and retards acidic and proteolytic damage?
   a. Ranitidine (Zantac®).
   b. Cisapride (Propulsid®).
   c. Metoclopramide (Reglan®).
   d. Sucralfate (Carafate®).

170. Which of the following drugs is considered to be a prokinetic agent, which is effective in decreasing the contact time between the gastric acid and the esophageal tissue and is also an effective entiemetic agent?
   a. Metoclopramide (Reglan®).
   b. Omeprazole (Prilosec®).
   c. Cisapride (Propulsid®).
   d. Famotidine (Pepcid®).
171. Prostaglandin analogs such as misoprostol (Cytotec®) enhance the gastric mucosa’s resistance to injury by all of the following mechanisms EXCEPT which one? By
   a. maintaining mucosal blood flow.
   b. promoting the diffusion of acid back into cells of the epithelial lining.
   c. stimulating the secretion of mucus.
   d. stimulating the secretion of bicarbonate.

172. The medical management PUD may include all of the following agents EXCEPT which one?
   a. Antibacterial agents
   b. H₂-receptor antagonists
   c. Proton pump inhibitors
   d. COX-1 inhibitors

173. Which of the following drugs prescribed for the management of PUD suppresses gastric acid secretion by inhibiting the parietal cells’ H⁺/K⁺ ATPase?
   a. Antacids consisting of mixtures of magnesium hydroxide, aluminum hydroxide, calcium carbonate, and sodium bicarbonate compounds.
   b. Bismouth subsalycilate (Pepto-Bismol®)
   c. Lansoprazole (Prevacid®)
   d. Metronidazole (Flagyl®)

174. The medical management of patients with constipation may include the administration of an agent from any of the following major classes of drugs EXCEPT which one?
   a. Bulk forming agents
   b. Anticholinergic agents
   c. Irritants
   d. Lubricants

175. Which of the following major classes of drugs prescribed by oral health care providers is the most likely to cause acute diarrhea?
   a. COX-1 inhibitors
   b. Opioid analgesics
   c. Antibacterial agents
   d. Anxiolytic agents
176. The net effect of the interaction of benzodiazepines with their receptors is to enhance the inhibitory properties of the neurotransmitter  
   a. dopamine.  
   b. **GABA**.  
   c. serotonin.  
   d. norepinephrine.

177. Which of the following agents is available to reverse the sedative effects of benzodiazepines after anesthesia, conscious sedation for brief surgical or diagnostic procedures, or after overdose?  
   a. Midazolam  
   b. Clorazepate  
   c. **Flumazenil**  
   d. Triazolam

178. The basic mechanism for all seizures appears to be related to biochemical lesions that interrupt the synthesis, storage, release, or post-synaptic actions of the inhibitory neurotransmitter  
   a. **GABA**.  
   b. acetylcholine  
   c. dopamine.  
   d. serotonin.

179. Which of the following conditions is considered neurochemically to be a striatal dopamine deficiency?  
   a. Depression  
   b. **Parkinson’s disease**  
   c. Mania  
   d. Psychosis (schizophrenia)

180. Which of the following conditions relates to low concentrations of norepinephrine, dopamine, and/or serotonin?  
   a. **Depression**  
   b. Mania  
   c. Psychosis (schizophrenia)  
   d. Organic brain syndrome

181. Which of the following conditions is characterized by a functional excess of norepinephrine and serotonin?  
   a. Psychosis (schizophrenia)  
   b. Depression  
   c. Organic brain syndrome  
   d. **Mania**
182. An excess of dopamine and an increase in the number of dopaminergic receptors in the CNS characterize
   a. Parkinson’s disease.
   b. mania.
   c. **psychosis (schizophrenia)**
   d. organic brain syndrome.

**ANS Pharmacology**

183. Which of the following drugs may be used for the treatment of myasthenia gravis, and lead to excessive salivation, miosis, hypotension, bradycardia, and bronchospasm?
   a. Anticholinesterases
   b. Cholinergic (muscarinic)-receptor antagonists
   c. Ganglionic (nicotinic)-receptor blocking agents
   d. Neuromuscular (nicotinic)-receptor blocking agents

184. Which of the following conditions respond to treatment with cholinergic (muscarinic)-receptor agonists?
   a. Atony of the GI tract
   b. Atony of the bladder
   c. Glaucoma
   d. **All of the above**

185. Which of the following drugs may be used to decrease gastric motility to control diarrhea, to produce mydriasis, to inhibit excessive secretions, or to reduce excessive side effects of anticholinesterases?
   a. Cholinergic (muscarinic)-receptor antagonists
   b. Ganglionic (nicotinic)-receptor blocking agents
   c. Neuromuscular (nicotinic)-receptor blocking agents
   d. **All of the above**

186. Which of the following agents may be used to facilitate tracheal intubation and to obtain relaxation of skeletal smooth muscles for gastrointestinal and orthopedic procedures?
   a. Cholinergic (muscarinic)-receptor antagonists
   b. Ganglionic (nicotinic)-receptor blocking agents
   c. **Neuromuscular (nicotinic)-receptor blocking agents**
   d. Cholinergic (muscarinic)-receptor agonists
187. With an overdose of a cholinergic drug, one would expect to see each of the following signs EXCEPT which one?
   a. Sweating
   b. Mydriasis
   c. Bradycardia
   d. Copious serous saliva

Cancer Chemotherapeutic Agents

188. Which of the following therapeutic interventions is the most effective in the treatment of disseminated cancer?
   a. Surgery
   b. Chemotherapy
   c. Radiotherapy
   d. All of the above

189. In the S phase of the cell cycle
   a. RNA and other proteins are synthesized in preparation for mitosis.
   b. DNA is synthesized.
   c. RNA and other proteins are synthesized.
   d. All biochemical activities are performed except those related to cell reproduction.

190. Which of the following cancer chemotherapeutic agents are purine, pyrimidine, or folic acid analogs and, which become incorporated into DNA where they may prevent the synthesis of nucleotides or may be phosphorilated to nucleotides and result in faulty transcription and translation?
   a. Alkylating agents
   b. Antibiotics
   c. Plant alkaloids
   d. Antimetabolites

191. Which of the following cancer chemotherapeutic agents interact with tubulin, disorganize the mitotic spindle and arrest cell division?
   a. Steroid hormones
   b. L-asparaginase
   c. Plant alkaloids
   d. Alkylating agents

192. Which of the following cancer chemotherapeutic agents bind covalently to double stranded DNA and prevent DNA transcription?
   a. Antibiotic anticancer drugs
   b. Alkylating agents
   c. Hormonal anticancer drugs
   d. Antimetabolites
193. Which of the following anticancer drugs are isolated from the fungal species *Streptomyces*?
   a. Specific metabolic inhibitors such as mitotane.
   b. Antibiotic anticancer drugs
   c. Antimetabolites
   d. Alkylating agents

**Adverse Drug Effects**

194. All of the following adverse drug events are associated with the administration of therapeutic dosages of a drug, are predictable, and are, consequently, preventable EXCEPT which one?
   a. Cytotoxic reactions
   b. Idiosyncratic reactions
   c. Drug-drug interactions
   d. Drug-food interactions

195. All of the following adverse drug events are generally independent of the dose and are rarely predictable or avoidable EXCEPT which one?
   a. Immunologic/allergic reactions
   b. Pseudoallergic reactions
   c. Cytotoxic reactions
   d. Teratogenic reactions

196. All of the following mechanisms are considered to be pharmacodynamic drug-drug interactions EXCEPT which one?
   a. Pharmacological interactions
   b. Cytotoxic reactions
   c. Drug-related receptor alterations
   d. Physiological interactions

197. When drug A competes for plasma protein-binding sites with drug B, the interaction will FIRST affect
   a. drug absorption.
   b. drug distribution
   c. drug metabolism
   d. drug excretion.

198. Genetic polymorphism of cytochrome P450 enzyme activity is considered to be the primary factor responsible for
   a. drug-food interactions.
   b. drug-disease interactions.
   c. idiosyncratic reactions.
   d. allergic reactions.
199. Which of the following allergic reactions is associated with IgE antibodies fixed in tissue, mainly mast cells?
   a. Immediate hypersensitivity reactions
   b. Delayed hypersensitivity reactions
   c. Cytotoxic hypersensitivity reactions
   d. Local immune-complex reactions

200. When a drug is converted to reactive metabolites capable of covalent binding to DNA, it may produce
   a. a pseudoallergic reaction.
   b. a developmental effect
   c. an oncogenic effect
   d. an idiosyncratic reaction.
Mock Endo National Board Questions

1. To ensure better thermal and protective insulation of the pulp during a capping procedure, calcium hydroxide should be:

   A. Applied to a thickness of 3.0 mm.
   B. Placed in all cavity preparations.
   C. Covered with a stronger base.
   D. Preceded by application of a cavity varnish.
   E. Preceded by application of a zinc phosphate cement.

2. In shaping and cleansing the canal of a vital maxillary central incisor, a practitioner has inadvertently perforated the apical foramen. This error can result in each of the following EXCEPT one. Which one is this EXCEPTION?

   A. Pain to the patient
   B. Enlargement of the foramen
   C. Trauma to the apical tissue
   D. Necrotic tissue being forced into the apical tissues

3. A dentist restored an endodontically treated tooth with a case post-and-core and a metal ceramic crown. Three months later, the patient calls and complains of pain, especially on biting. Tooth mobility is normal, as are the radiographs. The most probable cause of pain is:

   A. A loose crown.
   B. Psychosomatic
   C. A vertical root fracture.
   D. A premature eccentric contact.

4. Calcium hydroxide is generally the material-of-choice in vital pulp capping because it:

   A. Is less irritating to the pulp.
   B. Encourages dentin bridge formation.
   C. Seals the cavity better than most other materials.

5. The ideal bone graft should do each of the following EXCEPT one. Which one is this EXCEPTION?

   A. Induce osteogenesis
   B. Withstand mechanical forces
   C. Produce an immunologic response
   D. Become replaced by host bone.
6. During the preparation of a Class II cavity, which of the following permanent teeth pulp horns will be the most subject to accidental exposure?

   A. Distofacial of a maxillary first molar
   B. Distofacial of a mandibular first molar
   C. Facial of a mandibular first premolar
   D. Lingual of a mandibular first premolar

7. A diagnostic test failed to identify five cases of true disease. This type of failure is known as a:

   A. False negative.
   B. False positive.
   C. Positive predictive value.
   D. Negative predictive value.

8. Which of the following is the most effective way to reduce injury to the pulp during a restorative procedure?

   A. Prepare dentin with slow-speed burs
   B. Use anesthetics without vasoconstrictors
   C. Minimize dehydration of the dentinal surface
   D. Keep the dentinal surface clean by frequent irrigation

9. Aging of the pulp is evidenced by an increase in:

   A. Vascularity.
   B. Cellular elements.
   C. Fibrous elements.
   D. Pulp stones.

10. A patient is experiencing a throbbing pain in a specific tooth. This pain is aggravated by heat and relieved by cold. The tooth is sensitive to percussion. The most likely diagnosis is:

    A. Occlusal trauma.
    B. Periodontal abscess.
    C. Irreversible pulpitis.
    D. Hyperemia of the pulp.

11. Which of the following is the most consistent finding in systemic infections?

    A. Fever
    B. Tachypnea
    C. Lymphadenopathy
    D. Abscess formation
    E. Cellulitis formation
12. When providing endodontic treatment for a patient who has a history of rheumatic heart disease, the dentist should especially avoid which of the following?

A. Underinstrumentation of a vital tooth  
B. Overinstrumentation of a vital tooth  
C. Underinstrumentation of a necrotic tooth  
D. Overinstrumentation of a necrotic tooth

13. The day after receiving an inferior alveolar nerve block, a patient experiences limited ability to open his mouth. Which of the following structures was most probably injured?

A. The medial pterygoid muscle  
B. The stylomandibular ligament  
C. The deep fibers of the masseter muscle  
D. The posterior belly of the digastric muscle  
E. The inferior head of the lateral pterygoid muscle

14. An endodontic instrument separated in the apical third of a root canal. The fragment is 3 mm long and is tightly lodged. No radiographic changes at the apex are evident. The practitioner should:

A. Extract the tooth.  
B. Resect the apical section of the root containing the broken instrument.  
C. Perform an apicoectomy and place a reverse filling.  
D. Complete the root canal filling to the level of the instrument and observe.

15. A new patient had root canal therapy performed seven months ago in another country. No historical radiographs are available. The root canal filling appears to be satisfactory, the tooth is asymptomatic, and there is no associated sinus tract. However, a small periapical radiolucency is evident. Which of the following is indicated?

A. Incision and drainage  
B. Nonsurgical retreatment  
C. Re-evaluation in six months  
D. Apicoectomy and apical amalgam  
E. Prescription of an appropriate antibiotic

16. Which of the following describes the character of dentinal tubules at the pulpal end when compared to those at the enamel end?

a. More per unit surface area and more wider in diameter.  
b. Less per unit surface area but much wider in diameter.  
c. More per unit surface area and smaller in diameter.  
d. Less per unit surface area and smaller in diameter.
17. What would be the end result and prognosis of untreated internal resorption?
   a. Perforation into external surface of root which would heal if left undisturbed.
   b. Perforation into external surface of root with a marked low prognosis for any treatment.
   c. No untoward incident would occur provided no future trauma is sustained.
   d. Calcification of the root canal system with a guarded prognosis

18. There usually is no lesion apparent radiographically in acute apical periodontitis. However, histologically bone destruction has been noted.
   a. Both statements are true
   b. Both statements are false.
   c. First statement is true, second is false.
   d. First statement is false, second is true.

19. Based solely on the sharp transient response of pulp to hot stimuli, what is the periradicular diagnosis?
   a. Acute apical periodontitis
   b. Cannot diagnose based on information provided.
   c. Acute Apical abscess
   d. Irreversible pulpitis.

20. What is the clinical ‘hallmark’ of a chronic periradicular abscess?
   a. Large periradicular lesion
   b. Sinus tract drainage
   c. Granulation tissue in the periapex.
   d. Cyst formation.

21. A periradicular radiolucent lesion of endodontic origin on the radiograph may be any of these histological diagnoses except one. Mark this exception.
   a. A cyst
   b. A granuloma
   c. An Abscess
   d. Dentigerous cyst

22. What complete endodontic diagnosis could be completely asymptomatic but should require endodontic therapy.
   a. Pulpal necrosis and acute periradicular periodontitis
   b. Normal pulp and acute periradicular periodontitis.
   c. Pulpal necrosis and chronic periradicular periodontitis.
   d. Normal pulp and normal periapex

23. Vertical root fractures are also called cracked teeth. The prognosis of cracked teeth varies with extent and depth of crack.
   a. Both statements are true
   b. Both statements are false.
   c. First statement is true, second is false.
   d. First statement is false, second is true.
24. A lesion of non-endodontic origin remains at the apex of the suspected tooth regardless of X-ray cone angulations.
   a. True
   b. False

25. While viewing a working length radiograph of #5, you discover another root on the mesial shot (x-ray cone mesial). The second root seems to be distal on the mesial shot. Which anatomic root is it?
   a. Palatal
   b. Distal
   c. Buccal
   d. Mesial

26. The X-ray beam usually displaces lingual roots in what direction on the radiograph?
   a. Same direction as beam
   b. Opposite direction of beam
   c. Does not displace Buccal roots
   d. Vertically.

27. The buccal object rule can be used for vertical angulations as well.
   a. True
   b. False

**Endodontic case**

Patient walks into your dental office for an emergency visit. He complains of a throbbing tooth ache since 5 days. He seems to point in the lower right quadrant

28. What do you do first?
   a. Clinical examination
   b. Take radiographs
   c. Medical and dental history
   d. Prescribe antibiotics and pain killers
29. On clinical and radiographic examination, you find that #31 is non-responsive to thermal and electric testing and also not responsive to percussion or palpation. You observe a radiolucency around the distal root of #31 with extensive secondary decay under a class 2 amalgam. What do you do next?
   a. Refer for endodontic therapy of #31
   b. Access the tooth yourself for pulpectomy and CaOH dressing.
   c. Prescribe antibiotics and pain killers.
   d. Look for another site as the cause of the chief complaint.

30. On further investigation, the patient admits to clenching and grinding his teeth during sleep and even at work when stressed. Further, the patient hurts worse in the mornings when he yawns and also explains that touching certain areas of the jaw evokes greater pain. What do you do next?
   a. Ignore the patient’s comments.
   b. Test the ‘areas’ which invoke the pain.
   c. Anesthetize the patient
   d. Start the root canal therapy.

31. The pain is evoked by palpating along the lateral border of the ramus of the mandible. What is most likely cause of the patient’s pain and how would you confirm this?
   a. Masseter muscle referring pain to the lower molars confirmed by palpation of the muscle.
   b. Mylohyoid referring pain to the lower molars confirmed by local anesthesia.
   c. Fracture of the ramus confirmed by digital palpation.
   d. Psychological confirmed by prescription of anti-depressants.

32. How do you advise the patient?
   a. Quit job
   b. Try and curb the grinding and use a night guard
   c. Regular use of analgesics
   d. Antibiotics for the acute symptoms

33. Does the patient still require endodontic treatment on #31?
   a. Yes
   b. No
For the radiographs below, mark the location of the Xray tube, the direction of the Xray beam and buccal-lingual position of the ‘X’ box.
Behavior Guidance in Dental Office

- Parental input (positive or negative) is by far the most important predictor of pediatric patient behavior.
- Fear is one of the most frequently experienced childhood emotion.
- In managing the fearful child, the dentist should first attempt to determine the degree of fear and the factors responsible for it.

Common Pediatric Behavior Management Techniques

- Modeling: The pedo patient views another pedo patient who is cooperative, and is used as a “model.”
- Tell/Show/Do: The dentist tells the patient what will happen (“I will look at your teeth with my mirror”), then show the patient the mirror, then does the procedure (looking at the teeth). Tell/Show/Do is not useful for injections, extractions, etc.
- Wording Choices: Using simple, pleasant words for actions and instruments can help. The acid etch “taste like lemon juice,” the cotton roll can be a “tooth pillow,” the handpiece can be a “water sprayer.” Even the injections can be a “mosquito bite.” These language choices can reduce fear and anxiety.
- Voice Control: The use of a loud authoritarian voice tone is useful for limiting and for stopping dangerous behavior.
- HOME (Hand over Mouth Exercise): May return the patient to a calmer state. The hand is placed over the mouth, and the patient is told in a stern voice, that the hand will be removed when the undesirable behavior stops.

The First-Time Dental Patient

- Time of the Appointment: Time may influence the behavior. Early morning hours are reserved for young children.
- Length of Appointment: The apprehensive or fearful child should have relatively short appointments (less than 45 minutes) until the child becomes fully indoctrinated and gains confidence in himself or herself and the dentist.
- First Visit Procedures: If active pain or infection does not exist, a first visit is often limited to procedures that are reasonably comfortable of the child (exam, prophy, fluoride, x-ray, and possible sealants).

Premedication

- Often useful for long surgical and operative procedures and for fearful, nervous, and apprehensive children.
- May be indicated for children with behavioral problems.
- Ataraxic drugs have proved to be effective in reducing anxiety and tension without putting the patient in a hypnotic state.
- The drug acts indirectly on the autonomic nervous system by upsetting the balance of the sympathetic and parasympathetic mechanisms.
- Many dentist have found it effective to prescribe ataraxic drugs the night before the appointment and repeat the dose 30-45 min. prior to the appt.
- Ataraxic drugs (promethazine-Phenergan, chlorpromazine-Thorazine). Both are phenothiazine derivatives, and hydroxyzine (Atarax), a cortical depressant chemically unrelated to most others.

Indications for use of General Anesthesia

- Children with developmental disability to the degree that communication is impossible
- Children in whom all other methods have proven unsuccessful
- Patients allergic to other anesthetics
- Patients who suffer from hemophilia
- Patients with involuntary movement
- Patients with systemic disorders and/or congenital anomalies
Clinical Pedodontics

Cavity Preparation Principles in Primary Teeth
- In general - Primary teeth preparations are smaller, more delicate, and more rounded than their permanent counterparts
- Specifics (Class II preparation)
  - Axial-pulpal line angle should be rounded to reduce the stresses and the buccal and lingual walls should parallel the external crown outline form of the tooth
  - Rounded internal line angles will result in...
    - Less concentration of stresses
    - Reduced restoration fracture
    - Permit more complete condensation of the amalgam

Cavity Preparations (cont.)
- Specifics (Class III preparation)
  - Dovetail placed on lingual or labial of prep will allow for additional retention and necessary access to insert the restorative material
  - Greater strength composite bonding systems can reduce the need for the mechanical retention

Cavity Bases and Liners
- Important Points
  - Purpose of base prior to condensation is to provide thermal insulation for the pulp.
  - Use of calcium hydroxide influences formation of secondary dentin.
    - Initiates local inflammatory response at site of contact between pulp and calcium hydroxide

Stainless Steel Crowns
- MOD preparations are difficult on primary first molars due to small tooth size and loss of tooth structure. SSC's are often indicated instead.
- Indications for use:
  1) Extensive carious lesions
  2) Hypoplastic Teeth
  3) Teeth showing dentinogenesis or amelogenesis imperfecta
  4) Restoration after pulpotomy where there is an increased danger of fracture
  5) For crown and loop space maintainer
  6) For habit-breaking appliances
  7) Restoration of fractured teeth

Indirect Pulp Cap
- Only those teeth with deep caries that are free of symptoms should be selected.
- Procedure should include:
  - Removal of gross caries
  - Allowing some caries to remain if its removal would result in an exposure
  - Calcium hydroxide or zinc oxide eugenol placed and covered by temporary filling
  - Allow process to arrest and secondary dentin to form for 6-8 weeks
  - After time has elapsed, remove arrested carious dentin, place calcium hydroxide if sound dentin found, and restore conventionally.
Pulpotomy

- Indication – coronal pulp shows evidence of inflammation or degenerative change, but radicular pulp is still healthy.
- Two common techniques:
  1. Calcium hydroxide technique – recommended for permanent teeth with incomplete root formation. Coronal pulp is removed and calcium hydroxide is placed. RCT should be completed once root formation has completed.
  2. Formocresol technique – recommended for primary teeth with carious exposure. Coronal pulp is removed, cotton pellet moistened with formocresol is placed in contact with the pulp stumps and remains for 5 minutes. Zinc oxide eugenol is placed over exposure site and the tooth is restored.

* Fistulas, PAPs in the furcation, and abscess are contraindications to both pulpcaps and pulpotomy*

Internal Resorption

- Most frequently seen evidence of abnormal response to pulpotomy.
- A destructive process believed to be caused by osteoclastic activity.
- No reason for occurrence

Alveolar Abscess

- Occasionally develop a few months after pulp therapy has been completed.
- Tooth is asymptomatic.
- Fistulous opening may be present – indicates chronic infection.
- Will appear as radiolucency radiographically.
- Primary teeth with evidence of abscess should be removed.
COMMON PATHOLOGIC LESIONS & NBDE II PATHOLOGY REVIEW

Dr. Parish P. Sedghizadeh

Test Logistics

• 2 days
  – Multiple Choice questions (200 a.m. + 200 p.m.)
  • Dental and Specialty topics admixed
  • Pathology/Radiology questions have images supplement – quality suboptimal
  – Cases with questions (10-13 cases/9-14 questions each → 200 questions a.m. then out)
    • Pathology and other specialty questions are distributed throughout the exam, including the case section. Also 1-3 histology and 4-8 general pathology questions.
    - Diagnosis and Treatment planning emphasis

Vesiculo-Ulcerative
Differential Dx:

• Lichen Planus
• Pemphigoid
• Pemphigus Vulgaris

- May present as: Desquamative Gingivitis!
- Immune-mediated conditions
- Immunofluorescent studies
DISEASES OF THE TEETH AND JAWS

Enamel Hypoplasia

• Local or systemic factors that interfere with the normal matrix formation.
• Presents enamel surface defects and irregularities.
• Causes:
  • Nutritional deficiency
  • Neurologic defects (e.g., cerebral palsy)
  • Nephrotic disorders
  • Allergies
  • Local infection and trauma
  • X-rays
  • Rubella

Dentinogenesis Imperfecta

• Hereditary developmental disturbance of the dentin in the absence of any systemic disorder.
• Similar dental changes may be seen in conjunction with systemic hereditary disorder of bone, osteogenesis imperfecta.
• After the primary dentition is complete, enamel breaks away from the incisal edge and the occlusal surface.
• Characteristics:
  • Grayish/brownish opalescent color

Dentinogenesis Imperfecta (Con't)

• Characteristics (Con't)
  • Bulbous crowns
  • Cervical constriction
  • Obliterated pulp chambers and canals
• Tx: Full coverage. Enhance esthetics and to prevent gross abrasion of the tooth structure.

Amelogenesis Imperfecta

• Group of conditions that demonstrate developmental alterations in the structure of the enamel in the absence of a systemic disorder.
• Defective tooth structure is limited to the enamel.
• Teeth are yellowish/brownish in color.
• The enamel becomes stained due to the roughness of the surface and the increased permeability.
• Tx: Depends on the severity. Mostly full coverage (since the dentin structure is normal, the teeth can be prepared for standard crowns).
  • Decrease hypersensitivity
  • Improve esthetics
  • Prevent gross abrasion of the tooth structure.

Anodontia

• Implies the complete failure of the teeth to develop.
• It is one of the manifestations of ectodermal dysplasia.
• Since the absence of teeth predisposes to a lack of growth of the alveolar process, the construction of dentures is complicated.
Oligodontia (Partial Anodontia)

- When a number of the primary teeth fail to develop.
- Other ectodermal deficiencies are usually evident.
- The size of the primary teeth that are present may be normal or reduced.
- The anterior teeth often have a conical shape, which is characteristic of oligodontia associated with an ectodermal dysplasia.
- The teeth most frequently missing are the mandibular second bicuspids, the maxillary lateral incisors, and the maxillary second bicuspids.

Additional Definitions

- Hypodontia
- Hyperdontia
- Microdontia
- Macrodontia
Part II COMPONENTS- ENDO

- Clinical Diagnosis, Case Selection, Treatment Planning, and Pt management: 14
- Basic Endodontic Treatment Procedures: 8
- Procedural Complications: 3
- Traumatic Injuries: 2
- Adjunctive Endodontic Therapy: 1
- Post-Treatment Evaluation: 2

- Approximately 60% of the questions are repeats from previous exams

BOARD REVIEW

- Pulp Biology
- Tooth Anatomy
- Pulp Diagnosis
- Root Canal Therapy
- Endodontic Success-Failure
- Miscellaneous

Pulp Biology

Pulp Composition

- In the normal dental pulp, which of the following histologic features is (are) the least likely to appear:
  A) Cell-free zone of Weil
  B) Palisade odontoblastic layer
  C) Lymphocytes and plasma cells
  D) Undifferentiated mesenchymal cells

Pulp Composition

- Which of the following cells are characteristic of chronic inflammation of the dental pulp:
  a) Neutrophils
  b) Eosinophils
  c) Lymphocytes
  d) Macrophages
  e) Plasma cells

1) a, b, c & d
2) a, b, & d only
3) a, b, & e only
4) a, c & e
5) c, d & e only
AGING OF PULP

- Aging of the pulp is evidenced by an increase in fibrous elements.

PULPAL NERVOUS SYSTEM

- Efferent nerves found in the dental pulp are:
  - sympathetic post ganglionic fibres

HYDRODAMIC THEORY

- Types of dentin:
  - PRIMARY
  - SECONDARY
  - TERTIARY
  - REACTIONARY
  - REPARATIVE
  - TUBULAR
  - PERITUBULAR
  - INERTUBULAR
  - GLOBULAR
  - INTERGLOBULAR
  - SCLEROTIC

ACCESSORY CANALS

- Studies indicated that patent blood vessels course in lateral or accessory canals connecting the coronal and/or radicular pulp with the PDL.
- They appear to be distributed at any level of the root as well as on the floor of the pulp chamber.
- Distribution of lateral canals:
  - 17% in the apical third
  - 8.8% in the middle third
  - 1.6% at the coronal portion

ACCESSORY CANALS

- A non-carious tooth with deep periodontal pockets that do not involve the apical third of the root has developed an acute pulpitis. There is no history of trauma other than a mild prematurity in lateral excursion. What is the most likely explanation for the pulpitis?
  1. Normal mastication plus toothbrushing has driven microorganisms deep into tissues with subsequent pulp involvement at the apex.
  2. During a general bacteremia, bacteria settled in this aggravated pulp and produced an acute pulpitis.
  3. Repeated thermal shock from air and fluids getting into the deep pockets caused the pulpitis.
  4. An accessory pulp canal in the gingival or the middle third of the root was in contact with the pockets.
Initial instrumentation in endodontic tx is done to:

a) Radiographic apex
b) Dentino-enamel junction
c) Cemento-dentinal junction
d) Cemento-pulpal junction

CELLULAR – APICAL THIRD OF ROOT
ACELULAR

Approximately what per cent of mandibular first molars exhibit two distal canals?

1) 0
2) 0.1
3) 0.3
4) 0.6
5) 0.75
MAX 1ST MOLAR

- Buccal hook palatal root
- 4 canals
- MB1 (MB); MB2 (ML)
- 74% 2nd canal
- Half have a separate foramen
- The most common curvature of the palatal root of the maxillary first molar is to the
  1) facial
  2) mesial
  3) distal
  4) lingual

MAX FIRST BICUSPID

- Easiest tooth to perforate
- Mesial concavity
- Canal number: 90% 2, 10% 1
- Radiograph
- SloB / Clark’s Rule/Buccal Object Rule
- Cone shift

The teeth that are easiest to perforate by slight mesial or distal deviation from proper angulations of a bur are mandibular incisors and maxillary first premolars.

MAX LATERAL INCISOR

- Possible severe distal curvature in apical 1/3
- Curve may have a palatal aspect to it

MAX LATERAL INCISOR

- Which of the following teeth are the least likely to have more than 1 canal
  1) Maxillary lateral incisors
  2) Mandibular lateral incisors
  3) Mandibular first premolars
  4) Maxillary second premolars
  5) Maxillary second molars

MOST CONSISTENT ROOT CANAL ANATOMY

- Maxillary cuspid

DIAGNOSIS
DIAGNOSIS

- PULP
- PERIRADICULAR
- ENDO-PERIO
- REFERRED PAIN
- SINUS TRACTS
- CYST AND GRANULOMA
- RESORPTION
- NON-ODONTOGENIC
- ANKYLOSIS

PULP DIAGNOSIS

- NORMAL
- REVERSIBLE PULPITIS
- IRREVERSIBLE PULPITIS
- NECROTIC

PULP DIAGNOSIS

- Which is most likely to cause pulp necrosis:
  1) Intrusion
  2) Extrusion
  3) Lateral displacement
  4) Concussion
- Prolonged, unstimulated night pain suggests which of the following conditions of the pulp?
  1) Pulp Necrosis
  2) Mild hyperemia
  3) Reversible pulpitis
  4) No specific condition

PERIRADICULAR DIAGNOSIS

- ACUTE PERIRADICULAR PERIODONTITIS
- ACUTE APICAL ABSCESS
- CHRONIC PERIRADICULAR PERIODONTITIS
- CHRONIC PERIRADICULAR ABSCESS
  - SUPPURATIVE PERIRADICULAR PERIODONTITIS
- SUBACUTE PERIRADICULAR PERIODONTITIS
- NORMAL

PERIRADICULAR DIAGNOSIS (contd)

- How to differentiate between acute apical abscess and acute periodontal abscess:
  - Pulp vitality test
  - Percussion is a dental diagnostic procedure used in determining whether periodontitis exists!
  - The pathognomonic symptom of chronic apical periodontitis is:
    1) Swelling
    2) Intermittent pain
    3) Tenderness to palpation
    4) Tenderness of percussion
    5) None of the above

PERIRADICULAR DIAGNOSIS (contd)

- Radiographs reveal a deep, distal carious lesion on the suspect tooth. The apical periodontal ligament appears normal most probable diagnosis for the condition of the pulp and the apical periodontal ligament is
  1) Vital pulp
  2) Necrotic pulp
  3) Irreversibly inflamed pulp
  4) Inflamed apical periodontal ligament
  5) Uninflamed apical periodontal ligament
  a) 1 & 4
  b) 1 & 5
  c) 3 & 4
  d) 3 & 4
  e) 3 & 5
ENDO PERIO

- PRIMARY ENDO
- PRIMARY PERIO
- PRIMARY ENDO – SECONDARY PERIO
- PRIMARY PERIO – SECONDARY ENDO
- TRUE COMBINED LESION
- PULP TEST - PROBE

ENDO PERIO

REFERRED PAIN

- SITE OF PAIN – WHERE IT IS FELT – LOCATION
- SOURCE OF PAIN – ORIGIN
- REFERED PAIN – THE SITE AND SOURCE ARE NOT THE SAME
Presence of sinus tract

- The cone should track back to the source of infection
- This will demonstrate which root of the molar is affected

1. Conventional RCT, antibiotics not needed.
2. Will heal in 2–4 weeks after conventional RCT
3. If present, post RCT do apical surgery with retrofill (answer for the board)

LATERAL PERIODONTAL CYST

- Vitality test
- Not of pulpal origin

GLOBULOMAXILLARY CYST

- Mythical lesion allegedly located between maxillary lateral incisor and cuspid
- Vitality test

GRANULOMA

Periapical Inflammation

- An extension of pulpal inflammation
- Periapical tissues will become involved before total pulpal necrosis
- Bacteria and inflammation by products leak through AF and start inflammation

APICAL CYST
CONDENSING OSTEITIS

- Confirm vitality
- History of tooth or restoration
- RCT vs No RCT

CEMENTOMA

- Vitality test
- Radiolucent/opaque lesion
- Calcifying fibroma
- Predominant location lower anteriors
- Ethnic link observed (Predominantly among African-American)

ANKYLOYSIS

- Which is the most important sign of Ankylosis:
  1) Dull sounding
  2) Resonant
  3) Cessation of eruption
  4) Cross bite

INFECTION
BACTERIA

- Kakehashi, Stanley, Fitzgerald
- 1965
- Bacteria are the problem

INFECTION SEVERITY

- Resistance of host
- Virulence
- Population/number

CHRONIC INFLAMMATION OF THE PULP

- Lymphocytes
- Macrophages
- Plasma cells

FATE OF EXTRARADICULAR INFECTION

- Some problems such as actinomycoses are extraradicular and may require surgery to resolve the infection.
- True cysts
- Osteomyelitis
- Biopsy and culture

WHY DO WE HAVE A PROBLEM

- BACTERIA!!!

CRITERIA for SUCCESS

- Eliminate bacteria
- Protect against bacteria

- Severity of the course of a periapical infection depends upon the:
  1) Resistance of the host
  2) Virulence of the organism
  3) Number of organism present
  4) All of the above
  5) Only 1 and 2
CRITERIA for SUCCESS

- What is the radiographic sign of successful pulpotomy in a permanent tooth?
  1) Open apex
  2) That the apex has formed
  3) Loss of periapical lucency
  4) No internal resorption

RESORPTION

PHYSIOLOGIC OR PATHOLOGIC LOSS OF TOOTH STRUCTURE

SURFACE RESORPTION

- A PHYSIOLOGIC PROCESS CAUSING SMALL SUPERFICIAL DEFECTS IN THE CEMENTUM AND DENTIN THAT UNDERGO REPAIR BY DEPOSITION OF NEW CEMENTUM
- USUALLY NOT DETECTABLE ON A RADIOGRAPH

PRESSURE RESORPTION

- ORTHODONTIC TOOTH MOVEMENT
- TOOTH ERUPTION
- TUMORS
Pressure Resorption-Eruption

INFLAMMATORY RESORPTION
- BACTERIA
- EXTERNAL
- INTERNAL
- PATHOLOGIC LOSS OF TOOTH STRUCTURE RESULTING IN A DEFECT IN THE ROOT AND ADJACENT BONE

REPLACEMENT RESORPTION
- ANKYLOSIS
- TRAUMA
- IDIOPATHIC
- PATHOLOGIC LOSS OF TOOTH STRUCTURE WITH THE INGROWTH OF BONE INTO THE DEFECT
- FUSION OF BONE TO CEMENTUM OR DENTIN
**External Replacement Resorption**
- Idiopathic
- Extracanal invasive resorption
- Cervical resorption—most common name
- External invasive resorption

**ETIOLOGY OF RESORPTION**
- Unknown
- Trauma
- Orthodontics
- Internal bleaching
- Bacteria

**EXTERNAL RESORPTION**
- Surface
- Pressure
- Inflammatory
- Replacement
- Inflammatory periradicular lesions always result in resorption of both bone and tooth

**EXTERNAL INVASIVE RESORPTION**

**INTERNAL RESORPTION**

**CERVICAL RESORPTION**
INTERNAL RESORPTION
- SURFACE
- INFLAMMATORY
- NECROTIC TEETH ALWAYS HAVE INTERNAL INFLAMMATORY RESORPTION
- PERFORATION

DIFFERENTIATION OF INTERNAL AND EXTERNAL RESORPTION
- INTERNAL
  - REGULAR
  - ROUND
  - CENTERED, USE SLOB RULE
- EXTERNAL
  - IRREGULAR, MOTH EATEN
  - OFF CENTER, USE SLOB RULE

EXTERNAL RESORPTION
TREATMENT

✓ INTERNAL RESORPTION
✓ ENDODONTIC TREATMENT
✓ MAY BE DIFFICULT
  - PERFORATION
  - APICAL

TREATMENT CONTINUED

✓ EXTERNAL INFLAMMATORY
✓ CALCIUM HYDROXIDE
✓ CONTROL INFECTION
✓ FILL CANALS

EXTERNAL INFLAMMATORY RESORPTION

TREATMENT CONTINUED

✓ EXTERNAL REPLACEMENT
  - CALCIUM HYDROXIDE
  - CONTROL INFECTION
  - FILL CANALS

✓ AVULSION
  - GUARDED TO HOPELESS

✓ IDIOPATHIC
  - PROGNOSIS DEPENDS ON EXTENT AND LOCATION
The objectives of the access preparation are to:

1. Provide unobstructed visibility into all canals.
2. Allow files to be passed into each canal without binding on the walls of the access preparation (straight line access to avoid ledge).
3. Allow obturation instruments to fully enter each canal without binding on the walls of the access preparation.
4. Include removal of all caries and defective restorations.
5. Make possible the removal of all pulp tissue.
6. Removal of the roof of the pulp chamber.

Which of the following can cause a ledge formation:

1) Infection
2) Remaining debris within the canal
3) No straight line access

A mandibular molar has 4 canals. How should the access opening be:

1) Round
2) Oval
3) Trapezoidal
4) Triangular

ROOT CANAL THERAPY

Access
Irrigants
Files
Sealers
Gutta Percha

ACCESS

OVAL
TRIANGULAR
TRAPEZOIDAL - Mandibular molar with 4 canals.

ACCESS

Which of the following can cause a ledge formation:

1) Infection
2) Remaining debris within the canal
3) No straight line access

A mandibular molar has 4 canals. How should the access opening be:

1) Round
2) Oval
3) Trapezoidal
4) Triangular
IRRIGANTS

<table>
<thead>
<tr>
<th>Irrigant</th>
<th>Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDTA</td>
<td>EDTA- 16-20% solution</td>
</tr>
<tr>
<td></td>
<td>Chelating agent</td>
</tr>
<tr>
<td></td>
<td>Decalcifies dentin</td>
</tr>
<tr>
<td></td>
<td>Removes smear layer</td>
</tr>
<tr>
<td>SODIUM HYPOCHLORIDE</td>
<td>5.25% NaOCl</td>
</tr>
<tr>
<td></td>
<td>Dissolves organic material</td>
</tr>
<tr>
<td></td>
<td>Kills bacteria</td>
</tr>
<tr>
<td></td>
<td>Sterilizes GP, (wipe with alcohol afterwards)</td>
</tr>
</tbody>
</table>

FILES

PRECURVE FILES

- Precurve all stainless steel files prior to placement in a canal
- Precurving files is indicated
  1. for files sizes #35 and over.
  2. in canals that are even slightly curved.
  3. as a way to negotiate past canal obstructions.
  4. All of the above
  5. Only (1) and (2) above
  6. Only (2) and (3) above
SEALERS

Zinc oxide eugenol – Kerr Sealer
Resin – AH26
Paste fill

Which of the following represents the basic constituents of most root canal sealers:
Answer: Zinc oxide

Other Root Canal Therapies

- Apexification
- Pulpotomy
- Apexogenesis
- Apicoectomy
- Pulp Cap

APEXIFICATION

- Necrotic immature tooth
- Confirm diagnosis
- Access - Debridment
- Sodium hypochlorite - Instrumentation
- Place calcium hydroxide
- Plugger, lentulo spiral, compactor, mess ing gun

- What kind of procedure should be performed on a tooth with necrotic pulp and unfinished root tip
  - Apexification

DIAGNOSE

ACCESS

DEBRID

INSTRUMENT

DISSOLVE
APEXIFICATION

APEXIFICATION

APEXIFICATION

APEXIFICATION

APEXOGENESIS

A vital pulp therapy procedure performed to encourage continued physiological development and formation of the root end. This term is frequently used to describe vital pulp therapy performed to encourage the continuation of this process.
APEXOGENESIS

- What is best sign for success of apexogenesis
  - Continuous completion of apex

MTA – Mineral Trioxide Aggregate

- Dr Mahmoud Torabinejad, Loma Linda
- Modified Portland Cement
- Bismuth oxide
- Very good seal
- Expands slightly when sets with moisture
- Long setting time

Uses for MTA

- Pulp cap
- Perforation repair
- Pulpotomy
- Apexification
- Apical barrier

Other products

- White MTA
- SOC – Silicate Oxide Compound
- USC – Universal Silicate Cement
PULPOTOMY

¿Pulp cap
- Partial/Cvek pulpotomy
- Pulpotomy
- Deep pulpotomy
- Pulpectomy

WHY PULP CAP ???

- MAINTAIN NORMAL PULP VITALITY
- RETURN PULP TO NORMAL
- AVOID ENDODONTIC TREATMENT
- AVOID EXTRACTION
- AVOID EXTENSIVE TREATMENT
- POSTPONE ENDODONTIC TREATMENT

PULP CAP

Pulp capping and pulpotomy can be more successful in newly erupted teeth than in adult teeth because:
1. a greater number of odontoblast are present
2. incomplete development of nerve endings
3. open apex allows for greater circulation

PULP CAP DIRECT

Calcium hydroxide is generally the material of choice in vital pulp capping because:
1) Encourages dentin bridge formation
2) Is less irritating to the pulp
3) Seals the cavity better
4) Adheres well to dentin
To ensure better thermal and protective insulation of the pulp during a capping procedure, CaOH should be covered with stronger base.

Pulp cap traumatic exposure.
REPLANTATION

> WHEN BOTH SURGERY AND RETREATMENT ARE DIFFICULT THEN EXTRACTION AND REPLANTATION MAY BE THE TREATMENT OF CHOICE

ENDODONTIC SUCCESS – FAILURES

FAILURE – SUCCESS REASONS

> Poor condensation, incomplete fill
> Inadequate disinfection
> The most frequent cause of failure in endodontics is
  1. split roots.
  2. root perforation.
  3. Incomplete obturation.
  4. separated instruments.
  5. filling beyond the apex.

TRAUMA – FRACTURES
TRAUMA

AVULSION: Milk, replant ASAP, open apex, splint 7-10 days, endo tx 1 wk, Ca(OH)₂, resorption, replacement, inflammatory
CONCUSSION: least damaging
LUXATION: pulp necrosis likely, 60% immature apex teeth become nonvital
Intrusive luxation, necrosis, ankylossis
FRACTURES

One year ago, a 9-year-old boy fractured a central incisor. A current radiograph of the tooth is adjacent. There are no symptoms. The tooth does not respond to pulp testing; however, control teeth do respond. What is the preferred treatment?
1. Pulpotomy with Ca(OH)₂
2. Pulpotomy with formocresol
3. Conventional root canal treatment
4. Debridement of the pulp space and apexification

INTRUSION

Management
Immature teeth
- A tooth with an open apex is likely to re-erupt spontaneously
- Monitor the progress of re-eruption
- No treatment is needed if tooth re-erupts into normal position and there is no evidence of pulpal involvement
Mature teeth
- Intruded mature teeth need to be repositioned immediately
- Initial extrusion will be made orthodontically or surgically depending on degree of intrusion

Prognosis
High risk of pulp necrosis; Endodontic therapy is often indicated; possibility of resorption shows the need to follow up

Recalls
Evaluate 4-6 weeks after trauma and after 6 months; after that yearly recall are indicated

FRACTURED ROOTS

CORONAL THIRD: ENDO AND ORTHO EXTRUSION
MIDDLE THIRD: SPLINT AND OBSERVE
APICAL THIRD: ENDO TO THE FRACTURE LINE IF NECROTIC, APEX USUALLY REMAINS VITAL
FRACTURED ROOTS

- There is a root fracture in the apical third of the root of a mandibular tooth. What will be the most likely result?
  1) Root resorption
  2) Ankylosis
  3) Vitality will be preserved
  4) Teeth will show internal resorption

- There is a root fracture in the middle third of the root in an 11-year-old patient. The tooth is mobile and vital. What will you do?
  1) Extract
  2) Pulpectomy
  3) Splint and observe
  4) Do nothing

VERTICAL ROOT FRACTURES

- Failure of tooth with recently placed post and core: Vertical root fracture
- Majority of vertical root fractures of endo tx teeth result from: Condensation forces during gutta-percha filling
- Diagnose with perio probe, narrow periodontal pocket width
- Tx is extraction

SEPARATED INSTRUMENTS

- APICAL 3RD & VITAL – fill and observe, temporize, no permanent restoration for 3-6 months
- NON-VITAL – refer to endodontist
- MIDROOT – refer to endodontist
- In all cases inform patient

SURGERY AND HEALING

- Failing RCT where it is not possible (or practical) to retreat
- Disassemble?
- Post? Is it practical???
A patient has a draining sinus tract apical to a maxillary lateral incisor. The tooth, which is restored with a post and crown, received a root canal filling and apicoectomy one year ago. Radiographically, the tooth measures 19 mm in length. Adjacent teeth respond normally to pulp testing. The patient is asymptomatic. Which of the following is the most acceptable treatment?

1. Retreat and refill the canal with gutta-percha.
2. Retreat and refill the canal, then perform an apicoectomy.
3. Retreat by surgery using a retrofill amalgam.
4. No treatment is necessary unless the patient develops symptoms.

APICOECTOMY

- REVERSE FILL
- CURETTAGE

APICOECTOMY EXPECTED HEALING TIME

- 3-6 months for radiographic evidence
- Asymptomatic
- 2-4 weeks sinus tract gone
- Prognosis of a tooth with a broken instrument located 3 mm. from the apex is probably best if the tooth has a
  1) vital pulp with a periapical lesion.
  2) vital pulp without a periapical lesion.
  3) necrotic pulp with a periapical lesion.
  4) necrotic pulp without a periapical lesion.

HEALING

- BONE - yes
- PDL - yes
- DENTIN - no
- CEMENTUM - yes
- ENAMEL - no

HEALING

- Severity of the course of a periapical infection depends upon the:
  1) Resistance of the host
  2) Virulence of the organism
  3) Number of organism present
  4) All of the above
  5) Only 1 and 2

- What is the radiographic sign of successful pulpotomy in a permanent tooth?
  1) Open apex
  2) That the apex has formed
  3) Loss of periapical lucency
  4) No internal resorption

- Once the root canal is obturated, what usually happens to the organism that had previously entered periapical tissues from the canal:
  a) They persist and stimulate formulation of granuloma
  b) They are eliminated by the natural defenses of the body
  c) They re-enter and re-infect the sterile canal unless periapical surgery is performed
  d) They will have been eliminated by various medicaments that were used in the root canal
BLEACHING

TOOTH DISCOLORATION
- PULP NECROSIS
- RESTORATIVE MATERIALS
- SYSTEMIC MEDICATIONS
  - FLOURIDE
  - TETRACYCLINE
- GENETIC
- ENVIRONMENTAL

BLEACHING
- INTERNAL BLEACHING
- WALKING BLEACH
- DO NOT USE STRONG, 30%, H2O2 (Superoxol) – RESORPTION
- SODIUM PERBORATE
- Need to put cement barrier between gutta percha and bleaching material

MISCELLANEOUS

PULP TESTING
- DUPLICATE SYMPTOMS
- ADJACENT AND CONTRALATERAL TEETH
- COLD
- HEAT
- CAVITY TEST PREP

EMERGENCY TX
- SEE PATIENT
- DIAGNOSE
- TREAT APPROPRIATELY
EMERGENCY TX

- A patient of record calls late Saturday night because of severe, throbbing pain aggravated by "heat, biting and touching" in a mandibular premolar. What procedure is recommended?
  1. Instruct the patient to apply ice intermittently, take aspirin, and call Monday for an appointment.
  2. See the patient at the office and initiate endodontic treatment.
  3. See the patient at the office, remove the carious dentin and place a sedative zinc oxide-eugenol cement.
  4. Prescribe an analgesic and refer the patient to an endodontist.
  5. Refer the patient to the hospital oral surgery department for extraction.

PERFORATIONS

- MESIAL ROOT OF MANDIBULAR 1ST MOLAR
- DISTAL OF MESIAL ROOT

CORONAL PRETREATMENT

- REMOVE CARIES
- PREVENT LEAKAGE
- SECURE POSITION FOR CLAMP

ROOT SENSITIVITY

- EXPOSED DENTIN
- RECESSION
- SURGERY
- DESENSITISE

SYSTEMIC DISEASES

- Premedication- RHEUMATIC FEVER
- AHA Guidelines

OSTEOMYELITIS

- Pt has large carious lesion, toothache, submandibular facial swelling, fever of 102F. Continuous exudate through gingival sulcus, moth eaten radiolucent appearance.
  Most probable diagnosis: Acute osteomyelitis
MISCELLANEOUS

Endodontically treated posterior teeth are more susceptible to fracture than untreated posterior teeth. The best explanation for this is:
1. moisture loss.
2. loss of root vitality.
3. plastic deformation of dentin.
4. destruction of the coronal architecture.
5. increased susceptibility of the enamel to fracture.

TEMPORARY RESTORATION

ZOE is a good temporary restoration because:
1) less irritant
2) Increased strength
3) Good seal
4) Antibacterial

PULP TEST

Which of the following is least useful in children:
1) Percussion
2) Palpation
3) Electric pulp test
4) Thermal test

SLOB Rule

On a radiograph, the facial root of a maxillary first premolar would appear distal to the lingual root if the:
1) vertical angle of the cone were increased.
2) vertical angle of the cone were decreased.
3) x-ray head were angled from a distal position relative to the premolar.
4) x-ray head were angled from a mesial position relative to the premolar.

SLOB Rule

A radiograph shows a lucency that does not appear to move with application of the Clarke’s Principle/Rule. Where is the lucency situated?
1) No way of telling
2) Lingual
3) In the canal
4) Buccally
CONCLUSIONS

- Try and maintain pulp vitality
- Young pulps respond better than old pulps to trauma
- Disinfect
- Seal

GOOD LUCK
Gingivitis and Periodontal Disease
- Gingiva is normally light pink
- Surface has stippled appearance
- During eruption, gingiva is thick with rounded margins
- Severe gingivitis is uncommon in children
  - Trx: good home care, frequent check-ups, prophyl, Fltrx

Herpes Simplex Virus
- Occur in children 2 – 6 yrs
- Oral findings: yellow or white liquid filled vesicles, which rupture to form ulcers in a few days
- After initial attack, virus is inactive but reappears as cold sores. Sores appear on gingiva and attached mucous membranes
- Trx: palliative, sores heal in 7 – 10 days

Recurrent Aphthous Ulcer
- Ulceration on mucous membrane
- Can occur in school-age children and in adults
- Lesions persist for 4 – 12 days
- Found more commonly on loose mucosa

Candidiasis
- Caused by Candida albicans
- Normal inhabitant, pathogenic state when resistance is lowered
- Can be a sign of compromised immune system (i.e. AIDS)
- Trx: Nystatin topically or ketoconazole systemically

Dilantin Gingivits
- Occurs in children receiving Dilantin over a prolonged period of time
- Painless hyperplasia of gingiva
  - Hyperplasia is generalized
  - Trx: surgical removal most effective

Scarlet Fever
- Caused by Group A beta hemolytic streptococci
- After 5 day incubation period, patient develops pharyngitis, tonsillitis, headache, fever, chills, nausea, and vomiting
- Within 2-3 days, typical bright red skin rash develops
- Oral manifestation: “strawberry tongue” and then a “raspberry tongue”
- Disease ends in 7 – 10 days
Measles

- Caused by rubeola virus (paramyxovirus family)
- Portal of entry is respiratory tract
- Oral manifestations: "koplik’s spots"
  - develop on buccal mucosa and appear as small bluish white macules, surrounded by red margin
- Trx: palliative

Erythema Multiforme

- Oral manifestations: macules, papules, vesicles that become ulcerated and covered by exudate
- Trx: Corticosteroids and antibiotics
Goals

• Stages in evaluating an oral lesion
• Process to develop a differential diagnosis based on the normal anatomy of the site
• Procedures that can be used to refine the differential diagnosis and establish a definitive diagnosis
• Approaches to treat common oral lesions
• Clinical course of some common oral lesions with and without treatment

Stages for Evaluation of Oral Lesions

• Recognition of Tissue Alteration
• Generation of Differential Diagnosis
• Definitive Diagnostic Procedures
• Recommendation for Treatment
• Clinical Follow-up

Step 1. Recognition of Oral Lesions:

The Process

• History of the condition
• Observation of lesion parameters
  – location
  – color
  – size
  – shape
  – texture or consistency
  – growth pattern

Which one of these two lesions would cause you to be most concerned?

Which one of these two lesions would cause you to be most concerned?

Which one of these two lesions would cause you to be most concerned?
Which one of these two lesions would cause you to be most concerned?

B ___________________ A ___________________

Stages for Evaluation of Oral Lesions

• Recognition of tissue alteration
• Generation of Differential Diagnosis
• Definitive Diagnostic Procedures
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Step 1. Recognition Phase
What is the one best question that you could ask this patient?

How long have you had this on the palate? DX - Blue Nevus

Step 1. Recognition Phase
What is the one best question that you could ask this patient?

Are you taking medications for hypertension? DX - Gingival Hyperplasia 2° to Ca++ Channel Blocker
Step 1. Recognition Phase
What is the one best question that you could ask this patient?

- What kind of gum do you chew? **DX - Cinnamon Chewing Gum reaction**
- Do you put anything beneath your tongue? **DX - Aspirin Burn**
- Are you in a risk group for HIV infection? **DX - HIV Gingivitis**
- Do you habitually chew or bite your lip? **DX - Lip chewing**
- What toothpaste or rinse do you use? **DX - Moderate Epithelial Dysplasia, Viadent Leukoplakia**

**Stages for Evaluation of Oral Lesions**
- Recognition of Tissue Alteration
- Generation of Differential Diagnosis
- Definitive Diagnostic Procedures
- Recommendation for Treatment
- Clinical Follow-up
Differential Diagnosis:
The Objective

The objective of developing a list of differential diagnoses is to make sure that all significant conditions that could present in a specific manner are considered. The initial differential diagnosis should include ALL the potential lesions so that an important condition will not be missed.

Step 2. Differential Diagnosis:
The Process (Pindborg Paradigm)

Impression of the etiology of the condition
- Developmental or Congenital
- Reactive - Inflammatory/Infectious
- Neoplastic
- Traumatic
- Local Manifestation of a Systemic Disease

Step 2. Differential Diagnosis Phase
What is your impression of the etiology of this lesion?

Developmental  DX - Varix

Reactive - Inflammatory?  DX - Erosive Lichen Planus

Reactive - Infectious  DX - Hairy Leukoplakia

Neoplastic  DX - Lymphoma
Step 2. Differential Diagnosis Phase
What is your impression of the etiology of this lesion?

Reactive-Inflammatory & Trauma  
DX - Pyogenic Granuloma

Reactive - Infectious  
DX - Recurrent Herpes

Step 2. Differential Diagnosis Phase
What is your impression of the etiology of this lesion?

Developmental  
DX - Amelogenesis Imperfecta

Step 2. Differential Diagnosis: *The Process*

- Normal Anatomy at the Site
- Tissue types contributing to the normal anatomy
- Lesions that could develop from the different tissues

Normal Anatomy/Histology as a prompt for Differential Diagnosis

The delivery of oral healthcare is continuously involved with the normal head, neck and intraoral anatomy and histology. Frequent encounters with normal soft and hard tissues provides a ready framework for approaching differential diagnosis.
Step 2. Differential Diagnosis Phase
What is the normal anatomy/histology at the site?

Mucosa, Minor Salivary Glands, Periosteum, Bone, Nerves
DX - Fibrous Hyperplasia

Mucosa, Connective tissue
DX - Speckled Leukoplakia

Mucosa, PDL, Periosteum
DX - Peripheral Ossifying Fibroma

Epithelium, Connective tissue, Muscle, Nerve, Blood Vessel
DX - Chronic Ulcer

Stages for Evaluation of Oral Lesions

• Recognition of tissue alteration
• Generation of Differential Diagnosis
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Step 3. Definitive Diagnosis: The Procedures

NON-INVASIVE
• Diascopy
• Culture
• Exfoliative Cytology
  – scrapings, touch preps, Brush Biopsy®

INVASIVE
• Aspiration / Sounding
• FNA biopsy (cytology)
• Biopsy (surgical, punch)
NON-INVASIVE MODALITIES

62 yo White Female with a Vascular Anomaly on the Alveolar Mucosa

Non-Invasive Diagnostic Procedures

Occlusion of the blood vessel filling the lesion blanches the site and proves that the pigmented lesion is the result of blood pooling.

Description

The harvested cells are smeared on a glass slide and immediately fixed with alcohol
They are then mailed to the OralCDx® laboratory
There, the slide is stained and examined by computer-interfaced microscopy

Brush biopsy kit
Computer Analysis

Computer identifies the worst cells and photographs them.
Pathologist then examines the images of the most atypical cells and determines whether the changes observed are significant or not (quality control issue similar to PAP smear diagnosis years ago).

Description

Reading of "normal", "atypical", "positive" or "inadequate sample" is returned.
"Inadequate sample" is repeated at no additional charge.
Atypical or positive – scalpel biopsy is recommended.
Normal still requires follow-up, with scalpel biopsy if it appears suspicious.

INVASIVE MODALITIES

FINE NEEDLE ASPIRATION BIOPSY – ACTUALLY CYTOLOGY

FNA
Fluids
- peripheral blood, marrow, urine, sputum, discharge...
Pap smears

CYTOLOGY
Surgical Biopsy - Considerations

- Obtain a sample of tissue that has a representation of the pathologic process under investigation.
- Biopsy of ulcerative or erosive conditions requires sampling of surrounding clinically uninvolved tissues.
- If there is a suspicion of a neoplastic/malignant process an incisional biopsy should leave sufficient original tissue to allow the ultimate treating doctor to assess the extent of the lesion.
- Biopsies can be done by all dentists and generally do not require any special equipment or instruments.

Invasive Diagnostic Procedure

21 yo white male with asymptomatic white lesion of dorsum of tongue for weeks-months duration

Infiltration of local anesthetic at the biopsy site

Elliptical incision circumscribing the lesion region of interest

Dissection of specimen below the mucosal junction

Mucosal specimen fixed extended to prevent distortion in subsequent processing
Invasive Diagnostic Procedure

Fixation of specimen in neutral buffered formalin supplied by Oral Pathology Lab

Invasive Diagnostic Procedure

Biopsy site closed with sutures to be removed at follow-up appointment with diagnosis

Diagnosis - Lichen Planus

21 yo white male with asymptomatic white lesion of dorsum of tongue for weeks-months duration

Invasive Diagnostic Procedure

Incision to expose nodule embedded deep in the structure of the lip

Invasive Diagnostic Procedure

31 African-American male with asymptomatic rubbery firm lump in upper lip of months-years duration

Nodule exposed and released by blunt dissection through original incision site
Invasive Diagnostic Procedure

Nodule removed for submission to oral pathologists with capsule intact

Diagnosis - Pleomorphic Adenoma

You judge the case?
Stages for Evaluation of Oral Lesions

- Recognition of tissue alteration
- Generation of Differential Diagnosis
- Definitive Diagnostic Procedures
- Recommendation for Treatment
- Clinical Follow-up
Treatment

Treatment will be based on the definitive diagnosis of the oral lesion and correlated with the etiology of the lesion: Developmental, Reactive or Neoplastic

Common Oral Lesion: Candidiasis

- Recognition: Red or white change of mucosa
- Differential Diagnosis: Other red or white lesions
- Definitive Diagnosis: Culture, Exfoliative cytology
- Treatment: Topical antifungals, Mycelex troches 5x/day for 14 days, dissolve in mouth with dentures out, treat dentures with dilute bleach to remove the microorganisms
- Follow-up: Recurrence common

Common Oral Lesion: Aphthous Ulcer

- Recognition: Soft ulceration on mucosa not bound to bone
- Differential Diagnosis: Other oral ulcerations
- Definitive Diagnosis: History, Observation, Palpation
- Treatment: Tincture of time, Zithostin, Aphthasol, topical steroid may have a prophylactic role in recurrent aphthae
- Follow-up: Recurrences are common with a typical presentation pattern

Prescription

RX: Mycelex troches (clotrimazole)

Disp: 70 (seventy)

Sig: Dissolve one tablet in mouth five times per day with dentures out, for 14 days

Disp: 500 ml

RX: Nystatinsuspension 100,000 U/ml

Sig: Soak partial dentures nightly

Address: ____________________________
Common Oral Lesion
Amalgam Tattoo
• Recognition - Black macule in mucosa near region in which amalgam has been used
• Differential Diagnosis - Pigmented oral lesions
• Definitive Diagnosis - Clinical examination
• Treatment - None required
• Follow-up - Periodic intraoral examination

Common Oral Lesion
Irritation Fibroma
• Recognition - Firm, raised nodule, freely movable
• Differential Diagnosis - Nodular lesions
• Definitive Diagnosis - History, Palpation, Biopsy
• Treatment - Excisional biopsy
• Follow-up - Very low recurrence rate

Common Oral Lesion
Mucocele
• Recognition - Soft, raised, sensitive nodule in region of minor salivary gland
• Differential Diagnosis - Mucosal cystic conditions
• Definitive Diagnosis - History, Palpation, Biopsy
• Treatment - Excisional Biopsy with removal of all minor salivary glands in region of excision
• Follow-up - Very low rate of recurrence

Common Oral Lesion
Pyogenic Granuloma
Recognition - Red enlargement of gingival papilla
Differential Diagnosis - Other gingival bumps
  – The 4 P’s
  • Pyogenic Granuloma
  • Peripheral Giant Cell Granuloma
  • Parulis
  • Peripheral Ossifying Fibroma
• Definitive Diagnosis - Biopsy
• Treatment - Excisional biopsy
• Follow-up - Recurrence common if etiology remains

Common Oral Lesion
Varix
• Recognition - Soft, blue-black nodule or macule
• Differential Diagnosis - Pigmented oral lesions
• Definitive Diagnosis - Diascopy
• Treatment - None, unless patient concerned for esthetics
• Follow-up - Periodic evaluation

### Prescription

| Name: __________________ | Date: _________ |
| Address: ______________________________________________ |
| RX: Aphthasol | Disp: One tube |
| Sig: Apply topical to oral mucosal ulcers qid until ulcers are healed |
| Doctor: ____________________________________ | DEA #: __________________ | License #: ________ |
Common Oral Lesion
Leukoplakia
- Recognition - White, plaque-like change of mucosa, well defined usually not sensitive
- Differential Diagnosis - White lesions and squamous cell carcinoma
- Definitive Diagnosis - Incisional/Excisional biopsy
- Treatment - Excisional biopsy
- Follow-up - Depending on the histopathology of the lesion variable recurrence and/or progression potential

Common Oral Lesion
Herpetic
Gingivostomatitis
- Recognition - Painful, 1-2 mm ulcers on multiple oral mucosae including those bound to bone
- Differential Diagnosis - Other oral ulcerations
- Definitive Diagnosis - History, Observation, Exfoliative Cytology
- Treatment - Supportive and topical analgesics, Valtrix/Valacyclovir
- Follow-up - Recurrent herpes limited to a particular nerve track

Common Oral Lesion
Lichen Planus
- Recognition - White striae, erythema, erosion, history
- Differential Diagnosis - Vesiculo-bullous conditions, erythematosus lesions
- Definitive Diagnosis - History, Clinical Exam, Biopsy
- Treatment - Topical steroids
- Follow-up - Chronic condition, no known etiology, frequent symptomatic recurrences

Diagnosis - Traumatic Ulcerative Granuloma
- Diagnosis - Traumatic Ulcerative Granuloma
- Treatment - Topical application of corticosteroid gel on blotted dry mucosa that has no superimposed infections

65 yo white female with non-healing ulcer on ventral tongue of several months duration
Cinnamon reaction before treatment and after treatment

Stages for Evaluation of Oral Lesions

- Recognition of tissue alteration
- Generation of Differential Diagnosis
- Definitive Diagnostic Procedures
- Recommendation for Treatment
- Clinical Follow-up

Value of Follow-up

- Recurrence risk varies for different diagnoses
- Many oral lesions are by nature a chronic process
- Avoid missing diagnosis of a more critically important condition
- Rapid treatment intervention

Seminar Goals

- Stages in evaluating an oral lesion
- Process to develop a differential diagnosis based on the normal anatomy of the site
- Procedures that can be used to refine the differential diagnosis and establish a definitive diagnosis
- Approaches to treat common oral lesions
- Clinical course of some common oral lesions with and without treatment

Normal Anatomy/Histology as a prompt for Differential Diagnosis

The delivery of oral healthcare is continuously involved with the normal head, neck and intraoral anatomy and histology. Frequent encounters with normal soft and hard tissues provides a ready framework for approaching differential diagnosis.

Differential Diagnosis: The Objective

The objective of developing a list of differential diagnoses is to make sure that all significant conditions that could present in a specific manner are considered. The initial differential diagnosis should include ALL the potential lesions so that an important condition will not be missed.
How were your impressions of the matched lesions presented at the beginning of the session?

How frequently were the most severe lesions identified on first impression?
Which features led you to select a particular lesion as more severe?
What are the consequences of missing the critical lesions?

Which one of these two lesions would you be most concerned?

A. BC Powder Burn
B. Moderate Epithelial Dysplasia

Which one of these two lesions would cause you to be most concerned?

A. Major Aphthous Ulcer
B. Squamous Cell Carcinoma

Which one of these two lesions would cause you to be most concerned?

A. Lichen Planus
B. Erythroplakia, CA in situ

Which one of these two lesions would cause you to be most concerned?
Which one of these two lesions would cause you to be most concerned?

A. Mucoepidermoid Carcinoma  
B. Fibroma

Which one of these two lesions would cause you to be most concerned?

A. Hairy Leukoplakia  
B. Fibroma

Which one of these two lesions would cause you to be most concerned?

A. Factitial Injury  
B. Leukemia

Remember

**Differential Diagnosis:**

*The Objective*

The initial differential diagnosis should include ALL the potential lesions so that an important condition will not be missed.

It is not necessary to achieve the correct diagnosis at first glimpse, but it is necessary to consider all the critical diagnoses.
KEY CONCEPTS IN 0MFS

Mgt. of patients with Adrenal Suppression
A. If pt. currently on steroids
   1. Day before
   2. Day of Surgery Double the dose
   3. Day after
   4. 2 days after - Return to normal dose
B. If pt. not now on steroids but received at least 20 mg. for more than 2 wks in the past year
   1. Day before
   2. Morning of Surgery
   3. First 2 postsurgical days - 40 mg.
   4. Next 3 days - 20 mg.
   5. 6 days after surgery - discontinue steroids

Mgt of patients receiving Coumadin

1. Obtain a PT -
   a. If INR between 1-1.5, precede wth surgery
   b. If INR greater than 1.5 - stop Coumadin for 2 days
      When INR FALLS TO 1.5 - precede with surgery
      Restart coumadin on day of surgery

Classification of physical status

ASA 1 - Normal healthy person
ASA II - A pt. with mild systemic disease
ASA III - A pt. with severe systemic disease

3 types of nerve injuries

1. Neuropraxia - contusion of a nerve (continuity of epineural sheath & axons)
2. Axontmesis - a. Continuity of axon but lost
   b. Continuity of sheath
3. Neurotmesis - Complete loss of nerve continuity

Hepatitis viruses

1. Hep A - spread through contact with feces
2. Hep B - spread through contact with secretions
   has the most serious risk of transmission
3. Hep C- spread through contaminated feces or blood
4. Hep D- spread through contact with secreti
Definitions used in preventing infection

1. Sepsis - The breakdown of living tissue by microorganisms
2. Antiseptic - prevents multiplication of microorganisms (applied to living tissue)
3. Disinfectant - prevents multiplication of microorganisms (applied to inanimate objects)
4. Sterility - Freedom from viable organisms
5. Sanitization - Reduction of the number of organisms to a safe level
6. Decontamination - similar to sanitization

Local Anesthesia

Typical anesthesia molecule has 3 parts
1. Aromatic group - Confers lipophilic properties
   - Lipid solubility essential for penetration of various anatomic barriers between the drug and its site of action
2. Intermediate chain has 2 purposes
   a. Separates the lipophilic from hydrophilic ends
   b. Classification
      - Ester COO----
      - Amide NHCO ---
3. Tertiary Amino terminus - Furnishes H2O solubility - ensures once injected, the drug will not precipitate in the interstitial fluids

Gow-Gates Technique

1. With a single injection, anesthetizes inferior alveolar, lingual & buccal nerves
2. Advantage - 98% complete anesthesia as opposed to 84%
3. Disadvantage - technique more difficult to learn; slightly longer induction time; may require greater quantity of solution
4. Differs from other injection techniques
   a. Relies on extra oral landmarks
   b. Not adjacent to the nerve to be anesthetized but 10mm away from condylar neck just below insertion of the lateral pterygoid muscle
ACE inhibitor - Angiotensin Converting Enzyme
1. Blocks the conversion of angiotensin to a substance that increases salt and H₂O retention, ie. - treats high blood pressure

Osteoradionecrosis
1. A devitalization of bone secondary to radiotherapy and due to an endarteritis
2. Is not an infection

Why antibiotics fail
1. Lack of pt. compliance
2. Failure to treat the infection locally
3. Inadequate dose or length of treatment
4. Presence of resistant organisms
5. Nonbacterial infection

Signs of a Mandibular Fracture
1. Alteration in occlusion
2. Lower lip numbness
3. Pain or submucosal hemorrhage at fracture site

Stages of wound healing
1. Inflammatory
2. Fibroplastic
3. Remodeling

Trigeminal neuralgia (aka Tic douloureux)
1. Severe paroxysmal pain
2. Usually unilateral
3. V₂ & V₃ most affected
4. An anticonvulsant such as Tegretol

Classification of TMJ Disorders
1. Myofascial pain - the source of the pain is muscular
2. Disk Displacement - aka internal derangement
3. Degenerative joint disease
4. Chronic recurrent dislocation
4. Ankylosis

Technique of administration of N₂O - O₂ anesthesia
1. Place nasal mask and start 6 L. of 100% O₂
2. Start N₂O (approx. 20 %)
3. Increase flow of N₂O 10% q. 1 min. until sedation is adequate
4. After procedure - terminate N₂O but continue O₂ for 3-5 min.
Preprosthetic Surgery
A. Simple Alveoplasty
   1. Establish an envelope flap (add a vertical releasing if site is not adequate)
   2. Use rongeur & bone file
   3. Suture
B. Intraseptal Alveoplasty
   1. Reflect mucoperiosteum (minimally)
   2. With rongeur remove intraseptal bone
   3. Fracture the labio cortical plate inward

Advantages
1. Height of ridge maintained
2. Periosteum to underlying bone is maintained

Minimal dimensions of bone for endosteal implants
1. Vertical dimension - 8mm. (2mm of bone from apex to inf. alv. canal)
2. Bone width - 1 mm on buccal and 1mm lingual to implant

Two main types of Implants
1. Endosteal
2. Trans mandibular

Midface fractures and osteotomies - Classification
1. LeFort I - Separates inferior portion of maxilla in a horizontal fashion
2. LeFort II - Separates maxilla & nasal complex from cranial base
3. LeFort III - Craniofacial separation (extends through orbits)
Behavior Guidance in Dental Office

- Parental input (positive or negative) is by far the most important predictor of pediatric patient behavior.
- Fear is one of the most frequently experienced childhood emotion.
- In managing the fearful child, the dentist should first attempt to determine the degree of fear and the factors responsible for it.

Common Pediatric Behavior Management Techniques

- **Modeling:** The pediatric patient views another pediatric patient who is cooperative, and is used as a “model.”
- **Tell/Show/Do:** The dentist tells the patient what will happen (“I will look at your teeth with my mirror”), then show the patient the mirror, then does the procedure (looking at the teeth). Tell/Show/Do is not useful for injections, extractions, etc.
- **Wording Choices:** Using simple, pleasant words for actions and instruments can help. The acid etch “taste like lemon juice,” the cotton roll can be a “tooth pillow,” the handpiece can be a “water sprayer.” Even the injections can be a “mosquito bite.” These language choices can reduce fear and anxiety.
- **Voice Control:** The use of a loud authoritarian voice tone is useful for limit-setting and for stopping dangerous behavior.
- **HOME (Hand over Mouth Exercise):** May return the patient to a calmer state. The hand is placed over the mouth, and the patient is told in a stern voice, that the hand will be removed when the undesirable behavior stops.

The First-Time Dental Patient

- **Time of the Appointment:** Time may influence the behavior. Early morning hours are reserved for young children.
- **Length of Appointment:** The apprehensive or fearful child should have relatively short appointments (less than 45 minutes) until the child becomes fully indoctrinated and gains confidence in himself or herself and the dentist.
- **First Visit Procedures:** If active pain or infection does not exist, a first visit is often limited to procedures that are reasonably comfortable of the child (exam, prophy, fluoride, x-ray, and possible sealants).

Premedication

- Often useful for long surgical and operative procedures and for fearful, nervous, and apprehensive children.
- May be indicated for children with behavioral problems.
- Ataraxic drugs have proved to be effective in reducing anxiety and tension without putting the patient in a hypnotic state.
- The drug acts indirectly on the autonomic nervous system by upsetting the balance of the sympathetic and parasympathetic mechanisms.
- Many dentists have found it effective to prescribe ataraxic drugs the night before the appointment and repeat the dose 30-45 min. prior to the appointment.
- Ataraxic drugs (promethazine-Phenergan, chlorpromazine-Thorazine). Both are phenothiazine derivatives, and hydroxyzine (Atarax), a cortical depressant chemically unrelated to most others.

Indications for use of General Anesthesia

- Children with developmental disability to the degree that communication is impossible.
- Children in whom all other methods have proven unsuccessful.
- Patients allergic to other anesthetics.
- Patients who suffer from hemophilia.
- Patients with involuntary movement.
- Patients with systemic disorders and/or congenital anomalies.
Clinical Pedodontics

Cavity Preparation Principles in Primary Teeth
- In general - Primary teeth preparations are smaller, more delicate, and more rounded than their permanent counterparts.
- Specifics (Class II preparation)
  - Axial-pulpal line angle should be rounded to reduce the stresses and the buccal and lingual walls should parallel the external crown outline form of the tooth.
  - RoundedRectangle angles will result in:
    - Less concentration of stresses.
    - Reduced restoration fracture.
    - Permit more complete condensation of the amalgam.

Cavity Preparations (cont.)
- Specifics (Class III preparation)
  - Dovetail placed on lingual or labial of prep will allow for additional retention and necessary access to insert the restorative material.
  - Greater strength composite bonding systems can reduce the need for the mechanical retention.

Cavity Bases and Liners
- Important Points
  - Purpose of base prior to condensation is to provide thermal insulation for the pulp.
  - Use of calcium hydroxide influences formation of secondary dentin.
    - Initiates local inflammatory response at site of contact between pulp and calcium hydroxide.

Stainless Steel Crowns
- MOD preparations are difficult on primary first molars due to small tooth size and loss of tooth structure. SSC's are often indicated instead.
- Indications for use:
  1) Extensive carious lesions
  2) Hypoplastic Teeth
  3) Teeth showing dentinogenesis or amelogenesis imperfecta
  4) Restoration after pulpotomy when there is an increased danger of fracture.
  5) For crown and loop space maintainer
  6) For habit-breaking appliances
  7) Restoration of fractured teeth

Indirect Pulp Cap
- Only those teeth with deep caries that are free of symptoms should be selected.
- Procedure should include:
  - Removal of gross caries
  - Allowing some caries to remain, if its removal would result in an exposure.
  - Calcium hydroxide or zinc oxide eugenol placed and covered by temporary filling.
  - Allow process to arrest and secondary dentin to form for 6-8 weeks.
  - After time has elapsed, remove arrested carious dentin, place calcium hydroxide if sound dentin found, and restore conventionally.
Pulpotomy

• Indication – coronal pulp shows evidence of inflammation or degenerative change, but radicular pulp is still healthy.
• Two common techniques:
  1) Calcium hydroxide technique – recommended for permanent teeth with incomplete root formation. Coronal pulp is removed and calcium hydroxide is placed. RCT should be completed once root formation has completed.
  2) Formocresol technique – recommended for primary teeth with carious exposure. Coronal pulp is removed, cotton pellet moistened with formocresol is placed in contact with the pulp stumps and remains for 5 minutes. Zinc oxide eugenol is placed over exposure site and the tooth is restored.

*Fistulas, PAPs in the furcation, and abscess are contraindications to both pulpctomy and pulpotomy*

Internal Resorption

• Most frequently seen evidence of abnormal response to pulpotomy.
• A destructive process believed to be caused by osteoclastic activity.
• No reason for occurrence

Alveolar Abscess

• Occasionally develop a few months after pulp therapy has been completed.
• Tooth is asymptomatic.
• Fistulous opening may be present – indicates chronic infection.
• Will appear as radiolucency radiographically.
• Primary teeth with evidence of abscess should be removed.
Test Logistics

- arc 2 days
- Multiple Choice questions (200 a.m. + 200 p.m.)
  - Dental and Specialty topics admixed
  - Pathology/Radiology questions have images supplement – quality suboptimal
- Cases with questions (10-13 cases/9-14 questions each → 200 questions a.m. then out)
  - Pathology and other specialty questions are distributed throughout the exam, including the case section. Also 1-3 histology and 4-8 general pathology questions.
  - Diagnosis and Treatment planning emphasis

A Vesiculo-Ulcerative Differential Dx:
- Lichen Planus
- Pemphigoid
- Pemphigus Vulgaris
- May present as: Desquamative Gingivitis!
- Immune-mediated conditions
- Immunofluorescent studies
DISEASES OF THE TEETH AND JAWS

Enamel Hypoplasia
- Local or systemic factors that interfere with the normal matrix formation.
- Presents enamel surface defects and irregularities.
- Causes:
  - Nutritional deficiency
  - Neurologic defects (e.g., cerebral palsy)
  - Nephrotic disorders
  - Allergies
  - Local infection and trauma
  - X-rays
  - Rubella

Dentinogenesis Imperfecta
- Hereditary developmental disturbance of the dentin in the absence of any systemic disorder.
- Similar dental changes may be seen in conjunction with systemic hereditary disorder of bone, osteogenesis imperfecta.
- After the primary dentition is complete, enamel breaks away from the incisal edge and the occlusal surface.
- Characteristics:
  - Grayish/brownish opalescent color

Dentinogenesis Imperfecta (Con’t)
- Characteristics (Con’t)
  - Bulbous crowns
  - Cervical constriction
  - Obliterated pulp chambers and canals
- Tx: Full coverage. Enhance esthetics and to prevent gross abrasion of the tooth structure.

Amelogenesis Imperfecta
- Group of conditions that demonstrate developmental alterations in the structure of the enamel in the absence of a systemic disorder.
- Defective tooth structure is limited to the enamel.
- Teeth are yellowish/brownish in color.
- The enamel becomes stained due to the roughness of the surface and the increased permeability.
- Tx: Depends on the severity. Mostly full coverage (since the dentin structure is normal, the teeth can be prepared for standard crowns).
  - Decrease hypersensitivity
  - Improve esthetics
  - Prevent gross abrasion of the tooth structure.

Anodontia
- Implies the complete failure of the teeth to develop.
- It is one of the manifestations of ectodermal dysplasia.
- Since the absence of teeth predisposes to a lack of growth of the alveolar process, the construction of dentures is complicated.
Oligodontia (Partial Anodontia)

- When a number of the primary teeth fail to develop.
- Other ectodermal deficiencies are usually evident.
- The size of the primary teeth that are present may be normal or reduced.
- The anterior teeth often have a conical shape, which is characteristic of oligodontia associated with an ectodermal dysplasia.
- The teeth most frequently missing are the mandibular second bicuspids, the maxillary lateral incisors, and the maxillary second bicuspids.

Additional Definitions

- Hypodontia
- Hyperdontia
- Microdontia
- Macrodontia
Part II COMPONENTS-ENDO

🌞 Clinical Diagnosis, Case Selection, Treatment Planning, and Pt management 14
🌞 Basic Endodontic Treatment Procedures 8
🌞 Procedural Complications 3
🌞 Traumatic Injuries 2
🌞 Adjunctive Endodontic Therapy 1
🌞 Post- Treatment Evaluation 2

อริยะ 60% of the questions are repeats from previous exams

BOARD REVIEW

🌞 PULP BIOLOGY
🌞 TOOTH ANATOMY
🌞 PULP DIAGNOSIS
🌞 ROOT CANAL THERAPY
🌞 ENDODONTIC SUCCESS-FAILURE
🌞 MISCELLANEOUS

PULP BIOLOGY

PULP COMPOSITION

🌞 In the normal dental pulp, which of the following histologic features is (are) the least likely to appear:
A) Cell-free zone of Weil
B) Palisade odontoblastic layer
C) Lymphocytes and plasma cells
D) Undifferentiated mesenchymal cells

PULP COMPOSITION

🌞 Which of the following cells are characteristic of chronic inflammation of the dental pulp:
a) Neutrophils
b) Eosinophils
c) Lymphocytes
d) Macrophages
e) Plasma cells

1) a,b,c & d 2) a,b, & d only 3) a,b, & e only 4) a, c & e 5) c, d & e only
AGING OF PULP

- Aging of the pulp is evidenced by an increase in fibrous elements.

PULPAL NERVOUS SYSTEM

- Efferent nerves found in the dental pulp are:
  - sympathetic post ganglionic fibres

HYDRODAMIC THEORY

- Dentine fluid flow and A-fiber activation
- Hydrodynamic stimuli
- Nociceptive thermal stimulation
- Inflammatory mediators
- C-fiber activation

TYPES OF DENTIN

- PRIMARY
- SECONDARY
- TERTIARY
  - REACTIONARY
  - REPARATIVE
- TUBULAR
- PERITUBULAR
- INTERTUBULAR
- GLOBULAR
- INTERGLOBULAR
- SCLEROTIC

ACCESSORY CANALS

- Studies indicated that patent blood vessels course in lateral or accessory canals connecting the coronal and/or radicular pulp with the PDL.
- They appear to be distributed at any level of the root as well as on the floor of the pulp chamber.
- Distribution of lateral canals
  - 17% in the apical third
  - 8.8% in the middle third
  - 1.6% at the coronal portion

ACCESSORY CANALS

- A non-carious tooth with deep periodontal pockets that do not involve the apical third of the root has developed an acute pulpitis. There is no history of trauma other than a mild prematurity in lateral excursion. What is the most likely explanation for the pulpitis?
  1) Normal mastication plus toothbrushing has driven microorganisms deep into tissues with subsequent pulp involvement at the apex.
  2) During a general bacteremia, bacteria settled in this aggravated pulp and produced an acute pulpitis.
  3) Repeated thermal shock from air and fluids getting into the deep pockets caused the pulpitis.
  4) An accessory pulp canal in the gingival or the middle third of the root was in contact with the pockets.
Initial instrumentation in endodontic tx is done to:

- Radiographic apex
- Dentino-enamel junction
- Cemento-dentinal junction
- Cemento-pulpal junction

CELLULAR – APICAL THIRD OF ROOT
ACELLULAR

Approximately what per cent of mandibular first molars exhibit two distal canals?

1) 0
2) 0.1
3) 0.3
4) 0.6
5) 0.75
MAX 1ST MOLAR

- BUCCAL HOOK PALATAL ROOT
- 4 CANALS
- MB1 (MB); MB2 (ML)
- 74% 2nd canal
  - Half have a separate foramen
- The most common curvature of the palatal root of the maxillary first molar is to the
  1) facial
  2) mesial
  3) distal
  4) lingual

MAX FIRST BICUSPID

- EASIEST TOOTH TO PERFORATE
- MESIAL CONCavity
- CANAL NUMBER: 90% 2, 10% 1
- RADIOGRAPH
- SLOB / Clark’s Rule/BUCCAL OBJECT
- RULE
- CONE SHIFT

The teeth that are easiest to perforate by slight mesial or distal deviation from proper angulations of a bur are mandibular incisors and maxillary first premolars.

MAX LATERAL INCISOR

- POSSIBLE SEVERE DISTAL CURVATURE IN APICAL 1/3
- CURVE MAY HAVE A PALATAL ASPECT TO IT

MAX LATERAL INCISOR

- Which of the following teeth are the least likely to have more than 1 canal
  1) Maxillary lateral incisors
  2) Mandibular lateral incisors
  3) Mandibular first premolars
  4) Maxillary second premolars
  5) Maxillary second molars

MOST CONSISTENT ROOT CANAL ANATOMY

- MAXILLARY CUSPID

DIAGNOSIS
DIAGNOSIS

- PULP
- PERIRADICULAR
- ENDO-PERIO
- REFERRED PAIN
- SINUS TRACTS
- CYST AND GRANULOMA
- RESORPTION
- NON-ODONTOGENIC
- ANKYLOSIS

PULP DIAGNOSIS

- NORMAL
- REVERSIBLE PULPITIS
- IRREVERSIBLE PULPITIS
- NECROTIC

PULP DIAGNOSIS

- Which is most likely to cause pulp necrosis:
  1) Intrusion
  2) Extrusion
  3) Lateral displacement
  4) Concussion

- Prolonged, unstimulated night pain suggests which of the following conditions of the pulp?
  1) Pulp Necrosis
  2) Mild hyperemia
  3) Reversible pulpitis
  4) No specific condition

PERIRADICULAR DIAGNOSIS

- ACUTE PERIRADICULAR PERIODONTITIS
- ACUTE APICAL ABSCES
- CHRONIC PERIRADICULAR PERIODONTITIS
- CHRONIC PERIRADICULAR ABSCES
  - SUPPURATIVE PERIRADICULAR PERIODONTITIS
- SUBACUTE PERIRADICULAR PERIODONTITIS
- NORMAL

PERIRADICULAR DIAGNOSIS (contd)

- How to differentiate between acute apical abscess and acute periodontal abscess:
  - Pulp vitality test

  - Percussion is a dental diagnostic procedure used in determining whether periodontitis exists!

  - The pathognomonic symptom of chronic apical periodontitis is:
    1) Swelling
    2) Intermittent pain
    3) Tenderness to palpation
    4) Tenderness of percussion
    5) None of the above

PERIRADICULAR DIAGNOSIS (contd)

- Radiographs reveal a deep, distal carious lesion on the suspect tooth. The apical periodontal ligament appears normal. Most probable diagnosis for the condition of the pulp and the apical periodontal ligament is:
  1) Vital pulp
  2) Necrotic pulp
  3) Irreversibly inflamed pulp
  4) Inflamed apical periodontal ligament
  5) Uninflamed apical periodontal ligament

  a) 1 & 4
  b) 1 & 5
  c) 3 & 4
  d) 3 & 4
  e) 3 & 5
ENDO PERIO

- PRIMARY ENDO
- PRIMARY PERIO
- PRIMARY ENDO – SECONDARY PERIO
- PRIMARY PERIO – SECONDARY ENDO
- TRUE COMBINED LESION
- PULP TEST - PROBE

ENDO PERIO

PULP TEST - PROBE

ENDO PERIO

REferred PAIN

- SITE OF PAIN – WHERE IT IS FELT
  - LOCATION
- SOURCE OF PAIN – ORIGIN
- REFERED PAIN – THE SITE AND SOURCE ARE NOT THE SAME
**SINUS TRACT**

Presence of sinus tract

- The cone should track back to the source of infection
- This will demonstrate which root of the molar is affected

**GLOBULOMAXILLARY CYST**

- Mythical lesion allegedly located between maxillary lateral incisor and cuspid
- Vitality test

**LATERAL PERIODONTAL CYST**

- Vitality test
- Not of pulpal origin

**GRANULOMA**

Periapical Inflammation

- An extension of pulpal inflammation
- Periapical tissues will become involved before total pulpal necrosis
- Bacteria and inflammation by products leak through AF and start inflammation

**APICAL CYST**

SINUS TRACT

1. Conventional RCT, antibiotics not needed.
2. Will heal in 2-4 weeks after conventional RCT
3. If present, post RCT do apical surgery with retrofill (answer for the board)
NON-ODONTOGENIC

CONDENSING OSTEITIS
- Confirm vitality
- History of tooth or restoration
- RCT vs No RCT

CEMENTOMA
- Vitality test
- Radiolucent/opaque lesion
- Calcifying fibroma
- Predominant location lower anteriors
- Ethnic link observed (Predominantly among African-American)

CEMENTOMA

ANKYOLOSIS
- Which is the most important sign of Ankylosis:
  1) Dull sounding
  2) Resonant
  3) Cessation of eruption
  4) Cross bite

INFECTION
BACTERIA
- Kakehashi, Stanley, Fitzgerald
- 1965
- Bacteria are the problem

INFECTION SEVERITY
- Resistance of host
- Virulence
- Population/number

CHRONIC INFLAMMATION OF THE PULP
- Lymphocytes
- Macrophages
- Plasma cells

FATE OF EXTRARADICULAR INFECTION
- Some problems such as actinomycoses are extraradicular and may require surgery to resolve the infection.
- True cysts
- Osteomyelitis
- Biopsy and culture

WHY DO WE HAVE A PROBLEM

BACTERIA!!!

CRITERIA for SUCCESS
- Eliminate bacteria
- Protect against bacteria
- Severity of the course of a periapical infection depends upon:
  1) Resistance of the host
  2) Virulence of the organism
  3) Number of organism present
  4) All of the above
  5) Only 1 and 2
**CRITERIA for SUCCESS**

- What is the radiographic sign of successful pulpotomy in a permanent tooth?
  1) Open apex
  2) *That the apex has formed*
  3) Loss of periapical lucency
  4) No internal resorption

**RESORPTION**

**PHYSIOLOGIC OR PATHOLOGIC LOSS OF TOOTH STRUCTURE**

**SURFACE RESORPTION**

- A PHYSIOLOGIC PROCESS CAUSING SMALL SUPERFICIAL DEFECTS IN THE CEMENTUM AND DENTIN THAT UNDERGO REPAIR BY DEPOSITION OF NEW CEMENTUM
- USUALLY NOT DETECTABLE ON A RADIOGRAPH

**PRESSURE RESORPTION**

- ORTHODONTIC TOOTH MOVEMENT
- TOOTH ERUPTION
- TUMORS

Pressure Resorption - Orthodontics
INFLAMMATORY RESORPTION

✓ BACTERIA
✓ EXTERNAL
✓ INTERNAL
✓ PATHOLOGIC LOSS OF TOOTH STRUCTURE RESULTING IN A DEFECT IN THE ROOT AND ADJACENT BONE

REPLACEMENT RESORPTION

✓ ANKYLOSIS
✓ TRAUMA
✓ IDIOPATHIC
✓ PATHOLOGIC LOSS OF TOOTH STRUCTURE WITH THE INGROWTH OF BONE INTO THE DEFECT
✓ FUSION OF BONE TO CEMENTUM OR DENTIN
**External Replacement Resorption**
- Idiopathic
- Extracanal invasive resorption
- Cervical resorption-most common name
- External invasive resorption

**ETIOLOGY OF RESORPTION**
- UNKNOWN
- TRAUMA
- ORTHODONTICS
- INTERNAL BLEACHING
- BACTERIA

**EXTERNAL RESORPTION**
- SURFACE
- PRESSURE
- INFLAMMATORY
- REPLACEMENT
- INFLAMMATORY PERIRADICULAR LESIONS ALWAYS RESULT IN RESORPTION OF BOTH BONE AND TOOTH

**EXTERNAL INVASIVE RESORPTION**

**INTERNAL RESORPTION**

External Invasive Resorption

CERVICAL RESORPTION
INTERNAL RESORPTION

- SURFACE
- INFLAMMATORY
- NECROTIC TEETH ALWAYS HAVE INTERNAL INFLAMMATORY RESORPTION
- PERFORATION

DIFFERENTIATION OF INTERNAL AND EXTERNAL RESORPTION

- INTERNAL
  - REGULAR
  - ROUND
  - CENTERED, USE SLOB RULE
- EXTERNAL
  - IRREGULAR, MOTH EATEN
  - OFF CENTER, USE SLOB RULE

EXTERNAL RESORPTION
TREATMENT

- INTERNAL RESORPTION
- ENDODONTIC TREATMENT
- MAY BE DIFFICULT
  - PERFORATION
  - APICAL

EXTERNAL INFLAMMATORY RESORPTION

TREATMENT CONTINUED

- EXTERNAL INFLAMMATORY
- CALCIUM HYDROXIDE
- CONTROL INFECTION
- FILL CANALS

- AVULSION
  - GUARDED TO HOPELESS

- IDIOPATHIC
  - PROGNOSIS DEPENDS ON EXTENT AND LOCATION

<table>
<thead>
<tr>
<th>Type</th>
<th>Differential Diagnosis</th>
<th>Treatment</th>
<th>Prognosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Internal resorption</td>
<td>- Intra-occlusal resorption with no canal involvement</td>
<td>Regard as seal</td>
<td>Excellent</td>
</tr>
<tr>
<td>2. Pathologic</td>
<td>- Resorption due to periapical lesion</td>
<td>1. Root canal therapy</td>
<td>Excellent</td>
</tr>
<tr>
<td>3. Inflammatory</td>
<td>- Resorption due to inflammation</td>
<td>1. Root canal therapy</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

B. Intra-occlusal resorption

1. Resorption due to periapical lesion
2. Root canal therapy
3. Excellent

C. Pathologic

1. Resorption due to periapical lesion
2. Root canal therapy
3. Excellent

D. Idiopathic

1. Resorption due to periapical lesion
2. Root canal therapy
3. Excellent

E. External inflammatory resorption

1. Resorption due to periapical lesion
2. Root canal therapy
3. Excellent

F. Avulsion

1. External replacement
2. Calcium hydroxide
3. Excellent

G. Idiopathic

1. Prognosis depends on extent and location
2. Calcium hydroxide
3. Excellent
The objectives of the access preparation are to:

1. Provide unobstructed visibility into all canals.
2. Allow files to be passed into each canal without binding on the walls of the access preparation (straight line access to avoid ledge).
3. Allow obturation instruments to fully enter each canal without binding on the walls of the access preparation.
4. Include removal of all caries and defective restorations.
5. Make possible the removal of all pulp tissue.
6. Removal of the roof of the pulp chamber.

Which of the following can cause a ledge formation:
1) Infection
2) Remaining debris within the canal
3) No straight line access

A mandibular molar has 4 canals. How should the access opening be:
1) Round
2) Oval
3) Trapezoidal
4) Triangular
**IRRIGANTS**
- **EDTA**
  - Chelating agent
  - Decalcifies dentin
  - Removes smear layer
- **SODIUM HYPOCHLORITE**
  - 5.25% NaOCl
  - Dissolves organic material
  - Kills bacteria
  - Sterilize GP, (wipe with alcohol afterwards)

**FILES**
- **PRECURVE FILES**
  - Precurve all stainless steel files prior to placement in a canal
  - Precuring files is indicated
    1 for files sizes #35 and over.
    2 in canals that are even slightly curved.
    3 as a way to negotiate past canal obstructions.
    4 All of the above
    5 Only (1) and (2) above
    6 Only (2) and (3) above
SEALERS

Zinc oxide eugenol – Kerr Sealer
Resin – AH26
Paste fill

Which of the following represents the basic constituents of most root canal sealers:
Answer: Zinc oxide

Other Root Canal Therapies
- Apexification
- Pulpotomy
- Apexogenesis
- Apicoectomy
- Pulp Cap

APEXIFICATION

APEXIFICATION
- NECROTIC IMMATURE TOOTH
- CONFIRM DIAGNOSIS
- ACCESS - DEBRIDMENT
- SODIUM HYPOCHLORITE - INSTRUMENTATION
- PLACE CALCIUM HYDROXIDE
- PLUGGER, LENTULO SPIRAL, COMPACTOR, MESSING GUN
- What kind of procedure should be performed on a tooth with necrotic pulp and unfinished root tip
  - apexification

DIAGNOSE ACCESS DEBRID INSTRUMENT DISSOLVE
APEXIFICATION

A vital pulp therapy procedure performed to encourage continued physiological development and formation of the root end. This term is frequently used to describe vital pulp therapy performed to encourage the continuation of this process.
APEXOGENESIS

- What is best sign for success of apexogenesis
  - Continuous completion of apex

APEXOGENESIS

MTA – Mineral Trioxide Aggregate

- Dr Mahmoud Torabinejad, Loma Linda
- Modified Portland Cement
- Bismuth oxide
- Very good seal
- Expands slightly when sets with moisture
- Long setting time

Uses for MTA

- Pulp cap
- Perforation repair
- Pulpotomy
- Apexification
- Apical barrier

Other products

- White MTA
- SOC – Silicate Oxide Compound
- USC – Universal Silicate Cement
PULPOTOMY

- Pulp cap
- Partial/Cvek pulpotomy
- Pulpotomy
- Deep pulpotomy
- Pulpectomy

WHY PULP CAP ???

- MAINTAIN NORMAL PULP VITALITY
- RETURN PULP TO NORMAL
- AVOID ENDODONTIC TREATMENT
- AVOID EXTRACTION
- AVOID EXTENSIVE TREATMENT
- POSTPONE ENDODONTIC TREATMENT

PULP CAP

- Pulp capping and pulpotomy can be more successful in newly erupted teeth than in adult teeth because:
  1. a greater number of odontoblast are present
  2. incomplete development of nerve endings
  3. open apex allows for greater circulation

PULP CAP DIRECT

- Calcium hydroxide is generally the material of choice in vital pulp capping because:
  1) Encourages dentin bridge formation
  2) Is less irritating to the pulp
  3) Seals the cavity better
  4) Adheres well to dentin
To ensure better thermal and protective insulation of the pulp during a capping procedure, CaOH should be covered with stronger base.
REPLANTATION

- When both surgery and retreatment are difficult, then extraction and replantation may be the treatment of choice.

FAILURE – SUCCESS REASONS

- Poor condensation, incomplete fill
- Inadequate disinfection
- The most frequent cause of failure in endodontics is
  1. split roots.
  2. root perforation.
  3. Incomplete obturation.
  4. separated instruments.
  5. filling beyond the apex.

ENDODONTIC SUCCESS – FAILURES

TRAUMA – FRACTURES
TRAUMA

AVULSION: Milk, replant ASAP, open apex, splint 7-10 days, endo tx 1wk, Ca(OH)2, resorption, replacement, inflammatory
CONCUSSION: least damaging
LUXATION: pulp necrosis likely, 60% immature apex teeth become nonvital
Intrusive luxation, necrosis, ankylosis
FRACTURES

TRAUMA

An 8-year-old boy received a traumatic injury to a maxillary central incisor. One day later, the tooth failed to respond to electric and thermal vitality tests. This finding dictates
1. pulpectomy.
2. apexification.
3. calcium hydroxide pulpotomy.
4. delay for the purpose of re-evaluation.

TRAUMA

One year ago, a 9-year-old boy fractured a central incisor. A current radiograph of the tooth is adjacent. There are no symptoms. The tooth does not respond to pulp testing; however, control teeth do respond. What is the preferred treatment?
1. Pulpotomy with Ca(OH)2
2. Pulpotomy with formocresol
3. Conventional root canal treatment
4. Debridement of the pulp space and apexification

INTRUSION

Management
 IMMATURE TEETH
A tooth with an open apex is likely to re-erupt spontaneously
Monitor the progress of re-eruption
No treatment is needed if tooth re-erupts into normal position and there is no evidence of pulpal involvement
MATURE TEETH
Intruded mature teeth need to be repositioned immediately
Initial extrusion will be made orthodontically or surgically depending on degree of intrusion

Prognosis
High risk of pulp necrosis; Endodontic therapy is often indicated; possibility of resorption shows the need to follow up
Recalls
Evaluate 4-6 weeks after trauma and after 6 months; after that yearly recall are indicated

FRACTURED ROOTS

CORONAL THIRD:
ENDO AND ORTHO EXTRUSION
MIDDLE THIRD: SPLINT AND OBSERVE
APICAL THIRD: ENDO TO THE FRACTURE LINE IF NECROTIC, APEX USUALLY REMAINS VITAL
FRACTURED ROOTS

There is a root fracture in the apical third of the root of a mandibular tooth. What will be the most likely result?
1) Root resorption
2) Ankylosis
3) Vitality will be preserved
4) Teeth will show internal resorption

There is a root fracture in the middle third of the root in an 11 year old patient. The tooth is mobile and vital. What will you do?
1) Extract
2) Pulpectomy
3) Splint and observe
4) Do nothing

VERTICAL ROOT FRACTURES

Failure of tooth with recently placed post and core: Vertical root fracture

Majority of vertical root fractures of endo tx teeth result from: Condensation forces during gutta-percha filling

Diagnose with perio probe, narrow periodontal pocket width

Tx is extraction

SEPARATED INSTRUMENTS

APICAL 3RD & VITAL – fill and observe, temporize, no permanent restoration for 3-6 months
NON-VITAL – refer to endodontist
MIDROOT – refer to endodontist
In all cases inform patient

SURGERY AND HEALING

INDICATIONS FOR SURGICAL ENDODONTIC TREATMENT

Failing RCT where it is not possible (or practical) to retreat
Disassemble?
Post? Is it practical???
A patient has a draining sinus tract apical to a maxillary lateral incisor. The tooth, which is restored with a post and crown, received a root canal filling and apicoectomy one year ago. Radiographically, the tooth measures 19 mm in length. Adjacent teeth respond normally to pulp testing. The patient is asymptomatic. Which of the following is the most acceptable treatment?
1. Retreat and refill the canal with gutta-percha.
2. Retreat and refill the canal, then perform an apicoectomy.
3. Retreat by surgery using a retrofill amalgam.
4. No treatment is necessary unless the patient develops symptoms.

APICOECTOMY EXPECTED HEALING TIME

- 3-6 months for radiographic evidence
- Asymptomatic
- 2-4 weeks sinus tract gone

Prognosis of a tooth with a broken instrument located 3 mm. from the apex is probably best if the tooth has a:
1) vital pulp with a periapical lesion.
2) vital pulp without a periapical lesion.
3) necrotic pulp with a periapical lesion.
4) necrotic pulp without a periapical lesion.

Once the root canal is obturated, what usually happens to the organism that had previously entered periapical tissues from the canal:
a) They persist and stimulate formulation of granuloma
b) They are eliminated by the natural defenses of the body
c) They re-enter and re-infect the sterile canal unless periapical surgery is performed
d) They will have been eliminated by various medicaments that were used in the root canal
BLEACHING

- INTERNAL BLEACHING
- WALKING BLEACH
- DO NOT USE STRONG, 30%, H2O2 (Superoxol) – RESORPTION
- SODIUM PERBORATE
- Need to put cement barrier between gutta percha and bleaching material

TOOTH DISCOLORATION

- PULP NECROSIS
- RESTORATIVE MATERIALS
- SYSTEMIC MEDICATIONS – FLOURIDE
- – TETRACYCLINE
- GENETIC
- ENVIRONMENTAL

MISCELLANEOUS

PULP TESTING

- DUPLICATE SYMPTOMS
- ADJACENT AND CONTRALATERAL TEETH
- COLD
- HEAT
- CAVITY TEST PREP

EMERGENCY TX

- SEE PATIENT
- DIAGNOSE
- TREAT APPROPRIATELY
EMERGENCY TX

✔ A patient of record calls late Saturday night because of severe, throbbing pain aggravated by "heat, biting and touching" in a mandibular premolar. What procedure is recommended?
1. Instruct the patient to apply ice intermittently, take aspirin, and call Monday for an appointment.
2. See the patient at the office and initiate endodontic treatment.
3. See the patient at the office, remove the carious dentin and place a sedative zinc oxide-eugenol cement.
4. Prescribe an analgesic and refer the patient to an endodontist.
5. Refer the patient to the hospital oral surgery department for extraction.

PERFORATIONS

✔ MESIAL ROOT OF MANDIBULAR 1ST MOLAR
- DISTAL OF MESIAL ROOT

CORONAL PRETREATMENT

✔ REMOVE CARIES
✔ PREVENT LEAKAGE
✔ SECURE POSITION FOR CLAMP

ROOT SENSITIVITY

✔ EXPOSED DENTIN
✔ RECESSION
✔ SURGERY
✔ DESENSITISE

SYSTEMIC DISEASES

✔ Premedication- RHEUMATIC FEVER
✔ AHA Guidelines

OSTEOMYELITIS

✔ Pt has large carious lesion, toothache, submandibular facial swelling, fever of 102F. Continuous exudate through gingival sulcus, moth eaten radiolucent appearance.
Most probable diagnosis: Acute osteomyelitis
Endodontically treated posterior teeth are more susceptible to fracture than untreated posterior teeth. The best explanation for this is:

1. moisture loss.
2. loss of root vitality.
3. plastic deformation of dentin.
4. destruction of the coronal architecture.
5. increased susceptibility of the enamel to fracture.

ZOE is a good temporary restoration because:

1) less irritant
2) Increased strength
3) Good seal
4) Antibacterial

Which of the following is least useful in children:

1) Percussion
2) Palpation
3) Electric pulp test
4) Thermal test

On a radiograph, the facial root of a maxillary first premolar would appear distal to the lingual root if the:

1) vertical angle of the cone were increased.
2) vertical angle of the cone were decreased.
3) x-ray head were angled from a distal position relative to the premolar.
4) x-ray head were angled from a mesial position relative to the premolar.

A radiograph shows a lucency that does not appear to move with application of the Clarke’s Principle/Rule. Where is the lucency situated?

1) No way of telling
2) Lingual
3) In the canal
4) Buccally
CONCLUSIONS

- Try and maintain pulp vitality
- Young pulps respond better than old pulps to trauma
- Disinfect
- Seal

GOOD LUCK
Gingivitis and Periodontal Disease

- Gingiva is normally light pink
- Surface has stippled appearance
- During eruption, gingiva is thick with rounded margins
- Severe gingivitis is uncommon in children
  - Tx: good home care, frequent check-ups, prophylaxis, Fl tx

Herpes Simplex Virus

- Occur in children 2 – 6 yrs
- Oral findings: yellow or white liquid filled vesicles, which rupture to form ulcers in a few days
- After initial attack, virus is inactive but reappears as cold sores. Sores appear on gingiva and attached mucous membranes
- Tx: palliative, sores heal in 7 – 10 days

Recurrent Aphthous Ulcer

- Ulceration on mucous membrane
- Can occur in school-age children and in adults
- Lesions persist for 4 – 12 days
- Found more commonly on loose mucosa

Candidiasis

- Caused by Candida albicans
- Normal inhabitant, pathogenic state when resistance is lowered
- Can be a sign of compromised immune system (i.e. AIDS)
- Tx: Nystatin topically or ketoconazole systemically

Dilantin Gingivits

- Occurs in children receiving Dilantin over a prolonged period of time
- Painless hyperplasia of gingiva
  Hyperplasia is generalized
  - Tx: surgical removal most effective

Scarlet Fever

- Caused by Group A beta hemolytic streptococci
- After 5 day incubation period, patient develops pharyngitis, tonsillitis, headache, fever, chills, nausea, and vomiting
- Within 2-3 days, typical bright red skin rash develops
- Oral manifestation: "strawberry tongue" and then a "raspberry tongue"
- Disease ends in 7 – 10 days
Measles

- Caused by rubeola virus (paramyxovirus family)
- Portal of entry is respiratory tract
- Oral manifestations: "koplik’s spots"
  - develop on buccal mucosa and appear as small bluish white macules, surrounded by red margin
- Trx: palliative

Erythema Multiforme

- Oral manifestations: macules, papules, vesicles that become ulcerated and covered by exudate
- Trx: Corticosteroids and antibiotics
Goals

• Stages in evaluating an oral lesion
• Process to develop a differential diagnosis based on the normal anatomy of the site
• Procedures that can be used to refine the differential diagnosis and establish a definitive diagnosis
• Approaches to treat common oral lesions
• Clinical course of some common oral lesions with and without treatment

Stages for Evaluation of Oral Lesions

• Recognition of Tissue Alteration
• Generation of Differential Diagnosis
• Definitive Diagnostic Procedures
• Recommendation for Treatment
• Clinical Follow-up

Step 1. Recognition of Oral Lesions: The Process

• History of the condition
• Observation of lesion parameters
  — location
  — color
  — size
  — shape
  — texture or consistency
  — growth pattern

Which one of these two lesions would cause you to be most concerned?

A ___ B ___

Which one of these two lesions would cause you to be most concerned?

A ___ B ___

Which one of these two lesions would cause you to be most concerned?
Stages for Evaluation of Oral Lesions

- Recognition of tissue alteration
- Generation of Differential Diagnosis
- Definitive Diagnostic Procedures
- Recommendation for Treatment
- Clinical Follow-up

Step 1. Recognition Phase
What is the one best question that you could ask this patient?

How long have you had this on the palate? DX - Blue Nevus

Are you taking medications for hypertension? DX - Gingival Hyperplasia
2* to Ca++ Channel Blocker
Step 1. Recognition Phase

What is the one best question that you could ask this patient?

What kind of gum do you chew?  
DX - Cinnamon Chewing Gum reaction

Do you put anything beneath your tongue?  
DX - Aspirin Burn

Are you in a risk group for HIV infection?  
DX - HIV Gingivitis

Do you habitually chew or bite your lip?  
DX - Lip chewing

What toothpaste or rinse do you use?  
DX - Moderate Epithelial Dysplasia

Viadent Leukoplakia

Stages for Evaluation of Oral Lesions

- Recognition of Tissue Alteration
- Generation of Differential Diagnosis
- Definitive Diagnostic Procedures
- Recommendation for Treatment
- Clinical Follow-up
Differential Diagnosis:
The Objective

The objective of developing a list of differential diagnoses is to make sure that all significant conditions that could present in a specific manner are considered. The initial differential diagnosis should include ALL the potential lesions so that an important condition will not be missed.

Step 2. Differential Diagnosis:
The Process (Pindborg Paradigm)

Impression of the etiology of the condition
• Developmental or Congenital
• Reactive - Inflammatory/Infectious
• Neoplastic
• Traumatic
• Local Manifestation of a Systemic Disease

Step 2. Differential Diagnosis Phase
What is your impression of the etiology of this lesion?

Developmental
DX - Varix

Reactive - Inflammatory?
DX - Erosive Lichen Planus

Reactive - Infectious
DX - Hairy Leukoplakia

Neoplastic
DX - Lymphoma
Step 2. Differential Diagnosis Phase
What is your impression of the etiology of this lesion?
Reactive-Inflammatory & Trauma  DX - Pyogenic Granuloma

Reactive -Infectious  DX - Recurrent Herpes

Step 2. Differential Diagnosis Phase
What is your impression of the etiology of this lesion?
Developmental  DX - Amelogenesis Imperfecta

Step 2. Differential Diagnosis: 
The Process
• Normal Anatomy at the Site
• Tissue types contributing to the normal anatomy
• Lesions that could develop from the different tissues

Normal Anatomy/Histology as a prompt for Differential Diagnosis
The delivery of oral healthcare is continuously involved with the normal head, neck and intraoral anatomy and histology. Frequent encounters with normal soft and hard tissues provides a ready framework for approaching differential diagnosis.

Step 2. Differential Diagnosis Phase
What is the normal anatomy/histology at the site?
Mucosa, Connective Tissue, Minor Salivary Glands  DX - Fibroma with Pigmentation
Step 2. Differential Diagnosis Phase
What is the normal anatomy/histology at the site?

Mucosa, Minor Salivary Glands, Periosteum, Bone, Nerves
DX - Fibrous Hyperplasia

Step 2. Differential Diagnosis Phase
What is the normal anatomy/histology at the site?

Mucosa, Connective tissue
DX - Speckled Leukoplasia

Step 2. Differential Diagnosis Phase
What is the normal anatomy/histology at the site?

Mucosa, PDL, Periosteum
DX - Peripheral Ossifying Fibroma

Step 2. Differential Diagnosis Phase
What is the normal anatomy/histology at the site?

Epithelium, Connective tissue, Muscle, Nerve, Blood Vessel
DX - Chronic Ulcer

Stages for Evaluation of Oral Lesions

• Recognition of tissue alteration
• Generation of Differential Diagnosis
• Definitive Diagnostic Procedures
• Recommendation for Treatment
• Clinical Follow-up

Step 3. Definitive Diagnosis: The Procedures

NON-INVASIVE
• Diascopy
• Culture
• Exfoliative Cytology
  – scrapings, touch preps, Brush Biopsy®

INVASIVE
• Aspiration / Sounding
• FNA biopsy (cytology)
• Biopsy (surgical, punch)
NON-INVASIVE MODALITIES

62 yo White Female with a Vascular Anomaly on the Alveolar Mucosa

Non-Invasive Diagnostic Procedures

Occlusion of the blood vessel filling the lesion blanches the site and proves that the pigmented lesion is the result of blood pooling.

Description

The harvested cells are smeared on a glass slide and immediately fixed with alcohol. They are then mailed to the OralCDx® laboratory. There, the slide is stained and examined by computer-interfaced microscopy.

Brush biopsy kit
**Computer Analysis**

Computer identifies the worst cells and photographs them.
Pathologist then examines the images of the most atypical cells and determines whether the changes observed are significant or not.

(quality control issue similar to PAP smear diagnosis years ago)

**Description**

Reading of “normal”, “atypical”, “positive” or “inadequate sample” is returned.
“Inadequate sample” is repeated at no additional charge.
Atypical or positive – scalpel biopsy is recommended.
Normal still requires follow-up, with scalpel biopsy if it appears suspicious.

**INVASIVE MODALITIES**

**FINE NEEDLE ASPIRATION BIOPSY – ACTUALLY CYTOLOGY**

**CYTOLOGY**

FNA
Fluids
- peripheral blood, marrow, urine, sputum, discharge...
Pap smears
Surgical Biopsy - Considerations

- Obtain a sample of tissue that has a representation of the pathologic process under investigation.
- Biopsy of ulcerative or erosive conditions requires sampling of surrounding clinically uninvolved tissues.
- If there is a suspicion of a neoplastic/malignant process an incisional biopsy should leave sufficient original tissue to allow the ultimate treating doctor to assess the extent of the lesion.
- Biopsies can be done by all dentists and generally do not require any special equipment or instruments.

Invasive Diagnostic Procedure

21 yo white male with asymptomatic white lesion of dorsum of tongue for weeks-months duration

Invasive Diagnostic Procedure

Infiltration of local anesthetic at the biopsy site

Elliptical incision circumscripting the lesion region of interest

Invasive Diagnostic Procedure

Dissection of specimen below the mucosal junction

Invasive Diagnostic Procedure

Mucosal specimen fixed extended to prevent distortion in subsequent processing.
Diagnosis - Lichen Planus

21 yo white male with asymptomatic white lesion of dorsum of tongue for weeks-months duration

31 African-American male with asymptomatic rubbery firm lump in upper lip of months-years duration

Incision to expose nodule embedded deep in the structure of the lip

Nodule exposed and released by blunt dissection through original incision site
Invasive Diagnostic Procedure

Nodule removed for submission to oral pathologists with capsule intact

Diagnosis - Pleomorphic Adenoma

You judge the case?
Stages for Evaluation of Oral Lesions

• Recognition of tissue alteration
• Generation of Differential Diagnosis
• Definitive Diagnostic Procedures
• Recommendation for Treatment
• Clinical Follow-up
Treatment

Treatment will be based on the definitive diagnosis of the oral lesion and correlated with the etiology of the lesion: Developmental, Reactive or Neoplastic

Common Oral Lesion
Candidiasis

- Recognition: Red or white change of mucosa
- Differential Diagnosis: Other red or white lesions
- Definitive Diagnosis: Culture, Exfoliative cytology
- Treatment: Topical antifungals, Mycelex troches 5x/day for 14 days, dissolve in mouth with dentures out, treat dentures with dilute bleach to remove the microorganisms
- Follow-up: Recurrence common

Candidiasis

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  - Red or white change of mucosa
- Differential Diagnosis: Other red or white lesions
- Definitive Diagnosis: Culture, Exfoliative cytology
- Treatment: Topical antifungals, Mycelex troches 5x/day for 14 days, dissolve in mouth with dentures out, treat dentures with dilute bleach to remove the microorganisms
- Follow-up: Recurrence common

Aphthous Ulcer

- Recognition: Soft Ulceration on mucosa not bound to bone
- Differential Diagnosis: Other oral ulcerations
- Definitive Diagnosis: History, Observation, Palpation
- Treatment: Tincture of time, Zilactin, Aphthasol, topical steroid may have a prophylactic role in recurrent aphthae
- Follow-up: Recurrences are common with a typical presentation pattern

Aphthous Ulcer

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  - Soft Ulceration on mucosa not bound to bone
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- Treatment: Tincture of time, Zilactin, Aphthasol, topical steroid may have a prophylactic role in recurrent aphthae
- Follow-up: Recurrences are common with a typical presentation pattern

Prescription

Name: __________________ Date:_________ Address:________________________

RX: Mycelex troches (clotrimazole)

Disp: 70 (seventy)

Sig: Dissolve one tablet in mouth five times per day with dentures out, for 14 days

Doctor:_________________________ DEA #:________________ License #:________________

Prescription

Name: __________________ Date:_________ Address:________________________

RX: Mycelex troches (clotrimazole)

Disp: 70 (seventy)

Sig: Dissolve one tablet in mouth five times per day with dentures out, for 14 days

Doctor:_________________________ DEA #:________________ License #:________________

Prescription

Name: __________________ Date:_________ Address:________________________

RX: Nydstatin suspension 100,000 U/ml

Disp: 500 ml

Sig: Soak partial dentures nightly

Doctor:_________________________ DEA #:________________ License #:________________

Prescription

Name: __________________ Date:_________ Address:________________________

RX: Mycelex troches (clotrimazole)

Disp: 70 (seventy)

Sig: Dissolve one tablet in mouth five times per day with dentures out, for 14 days

Doctor:_________________________ DEA #:________________ License #:________________

Prescription

Name: __________________ Date:_________ Address:________________________

RX: Nydstatin suspension 100,000 U/ml

Disp: 500 ml

Sig: Soak partial dentures nightly

Doctor:_________________________ DEA #:________________ License #:________________
### Prescription

Name: __________________
Date: ___________

Address: ______________________________________________

RX: Aphthasol
Disp: One tube
Sig: Apply topical to oral mucosal ulcers qid until ulcers are healed

Doctor: ________________________________________
DEA #: ____________________ License #: ___________

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### Common Oral Lesion

- **Amalgam Tattoo**
  - Recognition - Black macule in mucosa near region in which amalgam has been used
  - Differential Diagnosis - Pigmented oral lesions
  - Definitive Diagnosis - Clinical examination
  - Treatment - None required
  - Follow-up - Periodic intraoral examination

- **Irritation Fibroma**
  - Recognition - Firm, raised nodule, freely movable
  - Differential Diagnosis - Nodular lesions
  - Definitive Diagnosis - History, Palpation, Biopsy
  - Treatment - Excisional biopsy
  - Follow-up - Very low recurrence rate

- **Mucocele**
  - Recognition - Soft, raised, sensitive nodule in region of minor salivary gland
  - Differential Diagnosis - Mucosal cystic conditions
  - Definitive Diagnosis - History, Palpation, Biopsy
  - Treatment - Excisional Biopsy with removal of all minor salivary glands in region of excision
  - Follow-up - Very low rate of recurrence

- **Pyogenic Granuloma**
  - Recognition - Red enlargement of gingival papilla
  - Differential Diagnosis - Other gingival bumps
    - The 4 P’s
      - Pyogenic Granuloma
      - Peripheral Giant Cell Granuloma
      - Parulis
      - Peripheral Ossifying Fibroma
  - Definitive Diagnosis - Biopsy
  - Treatment - Excisional biopsy
  - Follow-up - Recurrence common if etiology remains

- **Varix**
  - Recognition - Soft, blue-black nodule or macule
  - Differential Diagnosis - Pigmented oral lesions
  - Definitive Diagnosis - Diascopy
  - Treatment - None, unless patient concerned for esthetics
  - Follow-up - Periodic evaluation
Common Oral Lesion

Leukoplakia

- Recognition - White, plaque-like change of mucosa, well defined usually not sensitive
- Differential Diagnosis - White lesions and squamous cell carcinoma
- Definitive Diagnosis - Incisional/Excisional biopsy
- Treatment - Excisional biopsy
- Follow-up - Depending on the histopathology of the lesion variable recurrence and/or progression potential

Herpetic Gingivostomatitis

- Recognition - Painful, 1-2 mm ulcers on multiple oral mucosae including those bound to bone
- Differential Diagnosis - Other oral ulcerations
- Definitive Diagnosis - History, Observation, Exfoliative Cytology
- Treatment - Supportive and topical analgesics, Valtrex/Valacyclovir
- Follow-up - Recurrent herpes limited to a particular nerve track

Lichen Planus

- Recognition - White striae, erythema, erosion, history
- Differential Diagnosis - Vesiculo-bullous conditions, erythematous lesions
- Definitive Diagnosis - History, Clinical Exam, Biopsy
- Treatment - Topical steroids
- Follow-up - Chronic condition, no known etiology, frequent symptomatic recurrences

Traumatic Ulcerative Granuloma

Diagnosis - 65 yo white female with non-healing ulcer on ventral tongue of several months duration

Treatment

Topical application of corticosteroid gel on blotted dry mucosa that has no superimposed infections
Cinnamon reaction before treatment and after treatment

Treatment may just mean removing the offending agent to which the tissue is reacting

Stages for Evaluation of Oral Lesions

- Recognition of tissue alteration
- Generation of Differential Diagnosis
- Definitive Diagnostic Procedures
- Recommendation for Treatment
- Clinical Follow-up

Value of Follow-up

- Recurrence risk varies for different diagnoses
- Many oral lesions are by nature a chronic process
- Avoid missing diagnosis of a more critically important condition
- Rapid treatment intervention

Seminar Goals

- Stages in evaluating an oral lesion
- Process to develop a differential diagnosis based on the normal anatomy of the site
- Procedures that can be used to refine the differential diagnosis and establish a definitive diagnosis
- Approaches to treat common oral lesions
- Clinical course of some common oral lesions with and without treatment

Normal Anatomy/Histology as a prompt for Differential Diagnosis

The delivery of oral healthcare is continuously involved with the normal head, neck and intraoral anatomy and histology. Frequent encounters with normal soft and hard tissues provides a ready framework for approaching differential diagnosis.

Differential Diagnosis:
The Objective

The objective of developing a list of differential diagnoses is to make sure that all significant conditions that could present in a specific manner are considered. The initial differential diagnosis should include ALL the potential lesions so that an important condition will not be missed.
How were your impressions of the matched lesions presented at the beginning of the session?

How frequently were the most severe lesions identified on first impression?
Which features led you to select a particular lesion as more severe?
What are the consequences of missing the critical lesions?

A. BC Powder Burn  B. Moderate Epithelial Dysplasia

Which one of these two lesions would cause you to be most concerned?

A. Major Aphthous Ulcer  B. Squamous Cell Carcinoma

Which one of these two lesions would cause you to be most concerned?

A. Lichen Planus  B. Erythroplakia, CA in situ

Which one of these two lesions would cause you to be most concerned?
Which one of these two lesions would cause you to be most concerned?

A. Mucoepidermoid Carcinoma
B. Fibroma

Which one of these two lesions would cause you to be most concerned?

A. Hairy Leukoplakia
B. Fibroma

Which one of these two lesions would cause you to be most concerned?

A. Factitial Injury
B. Leukemia

Remember

Differential Diagnosis:

The Objective

The initial differential diagnosis should include ALL the potential lesions so that an important condition will not be missed.

It is not necessary to achieve the correct diagnosis at first glimpse, but it is necessary to consider all the critical diagnoses.
KEY CONCEPTS IN 0MFS

*Mgt. of patients with Adrenal Suppression*

A. If pt. currently on steroids
   1. Day before
   2. Day of Surgery Double the dose
   3. Day after
   4. 2 days after - Return to normal dose

B. If pt. not now on steroids but received at least 20 mg. for more than 2 wks in the past year
   1. Day before
   2. Morning of Surgery
   3. First 2 postsurgical days - 40 mg.
   4. Next 3 days - 20 mg.
   5. 6 days after surgery - discontinue steroids

*Mgt of patients receiving Coumadin*

1. Obtain a PT -
   a. If *INR* between 1-1.5, precede with surgery
   b. If *INR* greater than 1.5 - stop Coumadin for 2 days
      When *INR* FALLS TO 1.5 - precede with surgery
      Restart coumadin on day of surgery

*Classification of physical status*

ASA I - Normal healthy person
ASA II - A pt. with mild systemic disease
ASA III - A pt. with severe systemic disease

*3 types of nerve injuries*

1. Neuropraxia - contusion of a nerve (continuity of epineural sheath & axons)
2. Axontmesis - a. Continuity of axon but lost
   b. Continuity of sheath
3. Neurotmesis - Complete loss of nerve continuity

*Hepatitis viruses*

1. Hep A - spread through contact with feces
2. Hep B - spread through contact with secretions
   has the most serious risk of transmission
3. Hep C - spread through contaminated feces or blood
4. Hep D - spread through contact with secreti
Definitions used in preventing infection

1. Sepsis - The breakdown of living tissue by microorganisms
2. Antiseptic - prevents multiplication of microorganisms (applied to living tissue)
3. Disinfectant - prevents multiplication of microorganisms (applied to inanimate objects)
4. Sterility - Freedom from viable organisms
5. Sanitization - Reduction of the number of organisms to a safe level
6. Decontamination - similar to sanitization

Local Anesthesia

Typical anesthesia molecule has 3 parts
1. Aromatic group - Confers lipophilic properties
   Lipid solubility essential for penetration of various anatomic barriers between the drug and its site of action
2. Intermediate chain has 2 purposes
   a. Separates the lipophilic from hydrophilic ends
   b. Classification
      Ester       COO----
      Amide   NHCO ---
3. Tertiary Amino terminus - Furnishes H2O solubility - ensures once injected, the drug will not precipitate in the interstitial fluids

Gow-Gates Technique

1. With a single injection, anesthetizes inferior alveolar, lingual & buccal nerves
2. Advantage - 98% complete anesthesia as opposed to 84%
3. Disadvantage - technique more difficult to learn; slightly longer induction time; may require greater quantity of solution
4. Differs from other injection techniques
   a. Relies on extra oral landmarks
   b. Not adjacent to the nerve to be anesthetized but 10mm away from condylar neck just below insertion of the lateral pterygoid muscle
ACE inhibitor - Angiotensin Converting Enzyme
1. Blocks the conversion of angiotensin to a substance that increases salt and H₂O retention, ie. - treats high blood pressure

Osteoradionecrosis
1. A devitalization of bone secondary to radiotherapy and due to an endarteritis
2. Is not an infection

Why antibiotics fail
1. Lack of pt. compliance
2. Failure to treat the infection locally
3. Inadequate dose or length of treatment
4. Presence of resistant organisms
5. Nonbacterial infection

Signs of a Mandibular Fracture
1. Alteration in occlusion
2. Lower lip numbness
3. Pain or submucosal hemorrhage at fracture site

Stages of wound healing
1. Inflammatory
2. Fibroplastic
3. Remodeling

Trigeminal neuralgia (aka Tic douloureux)
1. Severe paroxysmal pain
2. Usually unilateral
3. V₂ & V₃ most affected
4. An anticonvulsant such as Tegretol

Classification of TMJ Disorders
1. Myofascial pain - the source of the pain is muscular
2. Disk Displacement - aka internal derangement
3. Degenerative joint disease
4. Chronic recurrent dislocation
4. Ankylosis

Technique of administration of N₂O - O₂ anesthesia
1. Place nasal mask and start 6 L. of 100% O₂
2. Start N₂O (approx. 20 %)
3. Increase flow of N₂O 10% q. 1 min. until sedation is adequate
4. After procedure - terminate N₂O but continue O₂ for 3-5 min.
**Preprosthetic Surgery**

A. Simple Alveoplasty
   1. Establish an envelope flap (add a vertical releasing if site is not adequate)
   2. Use rongeur & bone file
   3. Suture

B. Intraseptal Alveoplasty
   1. Reflect mucoperiosteum (minimally)
   2. With rongeur remove intraseptal bone
   3. Fracture the labio cortical plate inward

**Advantages**
   1. Height of ridge maintained
   2. Periosteum to underlying bone is maintained

**Minimal dimensions of bone for endosteal implants**
   1. Vertical dimension - 8mm. (2mm of bone from apex to inf. alv. canal)
   2. Bone width - 1 mm on buccal and 1mm lingual to implant

**Two main types of Implants**
   1. Endosteal
   2. Trans mandibular

**Midface fractures and osteotomies - Classification**
   1. LeFort I - Separates inferior portion of maxilla in a horizontal fashion
   2. LeFort II - Separates maxilla & nasal complex from cranial base
   3. LeFort III - Craniofacial separation (extends through orbits)
Risk Factors Associated With Dental Caries

- Susceptible tooth surface
- Acidogenic Bacteria
- Fermentable Carbohydrates (sucrose)
- Inadequate salivary flow or buffering capacity
- Low exposure to fluoride

Caries Susceptibility of Teeth

- Maxillary > mandibular arch
- First molars (upper and lower) > second molars (upper and lower) > second bicuspids (upper) > first bicuspids (upper) and second bicuspids (lower) > central and lateral incisors (upper) > canine (upper) and first bicuspids (lower) > lower anteriors
- Tooth surface: occlusal > mesial > distal > buccal > lingual

Dental Caries Classification

- Rate of progression: incipient, acute, chronic, arrested
- Hard tissue involved: enamel, dentin, cementum
- Etiology: radiation, baby bottle, rampant

Organisms Responsible for Caries

- Streptococcus Mutans
  - S. sanguis
  - S. salivarius
- Lactobacillus
- Actinomyces viscus (Root caries)
Properties of Cariogenic Bacteria

- Survive at low pH and metabolize sugars to form acids.
- Can produce glucans from dietary sucrose. (sticky matrix).
- Glucans are sticky carbohydrates that act as a matrix for the bacteria on the enamel surface.

Role of Saliva

- Adequate flow reduces plaque accumulation.
- Calcium, phosphate, hydroxyl, and fluoride ions reduce enamel solubility and remineralize early decay.
- Bicarbonate buffering capacity of saliva reduces pH fall.
- Salivary proteins form the protective acquired pellicle
- IgA, lysosomes, lactoperoxidase, and lactoferrin have antibacterial activity.

Role of Fluoride

- Anticaries effects are topical
- Inhibits enamel demineralization
- Enhances remineralization of the enamel after demineralization and increases acid resistance.
- The systemic benefits of fluoride are minimal.

Tooth Mineral Complexes

- During tooth germination is a carbonated apatite. (most soluble)
- Hydroxyapatite (less soluble)
- Fluorapatite (least soluble)
- Carbonated apatite is more acid soluble than hydroxyapatite and calcium-deficient (replaced by sodium, magnesium, and zinc)

De - Remineralization

- During demineralization carbonate is lost
- During remineralization it is replaced by OH or F ions, thereby decreasing the acid solubility.

Stephan Plot

- Experimental measurement of pH changes on enamel surfaces during exposure to fermentable carbohydrates in the presence of acidogenic bacteria (in plaque) over time
- It demonstrates the acid production of bacteria (pH decrease) with a glucose swallow and the gradual rise due to salivary buffering
**Critical pH for Enamel Dissociation**

- Hydroxyapatite is 5.3 - 5.5
- Fluoroapatite 4.5
- Carbonated beverages (Coke, Pepsi) have a pH at about 3.5.
- *Earliest visually observable macroscopic lesion is the White spot lesion.*

**Differences of Enamel and Dentinal Caries**

- Enamel caries is an acidogenic progression of tooth mineral dissolution
- Dentinal caries involves acid decalcification followed by proteolytic or enzymatic degeneration of the organic matrix.

**Incipient Lesion Treatment**

- Most early enamel lesions are capable of remineralization, or arresting, if risk factors are reduced. (diet, bacterial, and salivary analysis) followed by fluoride supplements.

**Clinical Tests for Caries Susceptibility**

- Ivoclar and Vivadent provide the essential components to culture and grade levels of *S. mutans* and *lactobacilli* in saliva as well as to measure salivary pH, flow rates, and buffering capacity.

**Progression of Caries in Dentin**

1. Infected
2. Affected
3. Translucent
4. Reparative
Caries Diagnosis

- Criteria for identification
  1. discolored softened tooth structure
  2. frank cavitation
  3. areas of radiolucency on radiographs
- Direct visual inspection with a sharp explorer and air-drying with use of magnification are the first steps of examination.
- Bitewings and periapical radiographs
- Transillumination

High-tech Diagnosis of Caries

- Quantitative light-induced fluorescence (QFL)
  KaVo’s DIAGNOdent probe uses red laser light to assess pit and fissure lesions (www.kavousa.com).
- Digital imaging fiberoptic transillumination (DIFOTI) (www.difoti.com). Images of transilluminated visible light are captured by a digital camera and computer processed.

Stabilization of Multiple Caries

1. Medical and dental history and assess risk factors.
2. Preventive measures.
3. Extraction of nonsalvageable teeth
4. Remove caries in vital teeth and Ca(OH), sealed with resins or resin-reinforced glass ionomers.
5. If frank pulpal exposures, remove pulp followed by temporization. With a suitable glass ionomer material and endodontic treatment.

Stabilization of Multiple Caries

6. In very deep carious lesions, whether symptomatic or not, where pulp exposure is to be expected, it is probably best to go directly to endodontic treatment rather than try an intermediate step of excavation and temporary stabilization.
7. Finalize a treatment plan with permanent restorations for the existing teeth and suitable provisional for replacement of missing teeth.

Caries Detector Solutions

- Colored dye in propylene glycol base
- Differentiate infected and affected dentine
- It bonds to the denatured collagen in the infected dentin
- It is applied for 10 seconds and then rinsed
- Seek (Ultradent) and Snoop (Pulpdent)
- Green, Red

Cavity Disinfectants

- Bactericidal agent to reduce sensitivity and bacterial growth under a restoration
- Current products contain either benzalkonium chloride and EDTA or 2% chlorhexidine gluconate
Supplemental Sources of Topical Fluoride

- Public water supplies: 1ppm sodium fluoride (NaF)
- Toothpaste: regular brands contain 0.10-0.15% NaF
- Prescription: PreviDent 5000 Plus, 1.1% NaF
- Mouth rinses: Act, FluorGuard, Prevident Rinse, 0.2-0.5% NaF
- Brush-on gels/fluoride trays: Prevident, 1.1% NaF neutral pH

Contraindication of Acidulated or Stannous Fluoride

- 0.4% stannous fluoride (pH of 3.0)
- 0.2% sodium fluoride (pH of 7.0)
- Acidulated fluoride (APF) solutions
- Topical 0.4% stannous gels (Gel-Kam, Colgate)
- Remove the glaze from porcelain, glass ionomer, and composite restorations.

Indications for Fluoride Gel Applications

- High consumption of carbonated beverages
- Bulimic patients (10% female adolescents)
- Elderly and nursing home patients
- Gastric reflux patients
- Chemotherapy and radiation-treated patients

Loss of Tooth Structure

- Attrition
  - physiologic wear
- Erosion
  - loss of tooth structure by a chemical process
- Abfraction
  - loss of tooth substance by biomechanical forces

Principles for Cavity Preparation

1. Tooth anatomy, the tooth position, extent of caries, and properties of the filling material.
2. Gingival margins should end on enamel.
4. Occlusal contact not in interface.
5. Unsupported enamel should be removed.
6. Dry work field

Principles for Composite and Amalgam Preparations

- The classic cavity preparations, according to Black's principles, are **not** needed for contemporary bonded retained composite and amalgam restorations.
Fissurotomy
- Conservative preparation of occlusal pits and fissures using either air abrasion or special burs
- Flowable composites.
- Hybrid composites, are more difficult to place without the incorporation of voids.

Tunnel Preparation
- Conservative approach to restore class II caries
- It conserves the proximal marginal ridge
- Matrix band beforehand protects the adjacent tooth wall.

Slot Preparation
- Any narrow access to reach interproximal caries can be called a slot preparation.
- Access may be from the buccal or lingual as in a class III lesion, or from the occlusal aspect.
- *The ideal is to conserve tooth structure by removing only caries and a minimal amount of tooth structure.* !!!!!!!!!!

Micro-air Abrasion
- Pressurized abrasive powders (27-50 micron aluminum oxide) propelled at high velocity to remove tooth structure (compressed air or nitrogen tanks). The claimed advantages are less trauma and a less invasive.
- Often not requires local anesthesia.
- Conservative class I and V preparations
- Disadvantages: special high speed evacuation equipment and high cost of the units.

Air Abrasion Systems

<table>
<thead>
<tr>
<th>COMPANY</th>
<th>PRODUCT NAME</th>
<th>MODEL</th>
<th>TYPE</th>
<th>ABRASIVE</th>
<th>PARTICLE SIZE</th>
<th>TYPE OF ABRASIVE</th>
<th>COMPRESSOR PRESSURE</th>
<th>PROPELLANT TYPE</th>
<th>BUILT-IN COMPRESSOR</th>
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<tr>
<td>MAXIMUM PROPELLENT</td>
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<td>27 and 50 micron Aluminum oxide</td>
<td>High-pressure compressor</td>
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<td>PRESSURE</td>
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<td>High-pressure compressor</td>
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<td>BISCO, INC. ACCU-PREP</td>
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<td>DANVILLE ENGINEERING</td>
<td>PrepStart Tabletop</td>
<td>27 and 50 micron Aluminum oxide</td>
<td>Air or bottled gas</td>
<td>145 psi</td>
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<tr>
<td>J.MORITA USA, INC</td>
<td>AdAbrader Plus Tabletop</td>
<td>50 micron Aluminum oxide</td>
<td>Compressed air 100 psi</td>
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<td>DENTSPLY GENDEX</td>
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Operative Dentistry
DEND 427 Review for NDBE II

Dental Adhesives

Santiago Moncayo, D.D.S.
Case School Of Dental Medicine 06-23-2006
Goals of Dental Bonding

- Eliminate or minimize the contraction gap of composite polymerization
- Sustain thermal expansion and contraction cycles
- Create 20-30 MPa bond strengths to enamel and dentin
- Eliminate microleakage (Stains, sensitivity and pulpal symptoms, recurrent caries, and bond failures)

Adhesive Systems
Components

- acid etchant solution,
- hydrophilic primer,
- resin.

Types of Adhesive Systems Currently Available

- Type 1. Etchant; primer and adhesive resin applied separately as two solutions. are “all-purpose” types. They generally bond to light, dual, and self-cured composites.
- Type 2. Etchant; primer and adhesive applied as a single solution. Type 2 systems have nearly all-purpose capability.

Types of Adhesive Systems Currently Available

- Type 3. Self-etching primer (SEP) applied to dissolve smear layer and not washed off; adhesive applied separately.
- Type 4. Self-etching primer and adhesive applied as a single solution to dissolve and treat the smear layer simultaneously.

Dental Adhesives

<table>
<thead>
<tr>
<th>BRAND NAME</th>
<th>NUMBER OF COMPONENTS</th>
<th>SHEAR BOND STRENGTH ENAMEL (MPa)</th>
<th>SHEAR BOND STRENGTH DENTIN (MPa)</th>
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<tr>
<td>All Bond</td>
<td>4</td>
<td>11.9</td>
<td>12.2</td>
</tr>
<tr>
<td>Amalgambond Plus</td>
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<td>Scotchbond Multipurpose</td>
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<td>Optibond FL</td>
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<td>20.0</td>
<td>16.6</td>
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<tr>
<td>One-Up Bond</td>
<td>2</td>
<td>16.6</td>
<td>15.1</td>
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<tr>
<td>Prompt L-Pop</td>
<td>2</td>
<td>10.2</td>
<td>11.6</td>
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<tr>
<td>ClearFill SE Bond</td>
<td>2</td>
<td>21.3</td>
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<tr>
<td>ClearFill liner Bond</td>
<td>2</td>
<td>21.3</td>
<td>21.3</td>
</tr>
</tbody>
</table>

Smear Layer
Hybrid Layer
- Multilayered zone of composite resin, and dentin, and collagen

Etching Patterns
35% orthophosphoric Acid
- **Type I**: The head of the rod gets dissolved. (15 sec.).
- **Type II**: Interprismatic areas. (25 sec.).
- **Type III**: Surface enamel lost. (More than 25 sec.) 2 - 8 μm.

Etching Patterns
- **I**: 
- **II**: 
- **III**: 

Recommended etching time: 15 seconds !!!!

Bonding To Enamel

Pulpal Sensitivity
- Incomplete placement of the bonding agents
- Incomplete wetting in application of the primer agent
- Incomplete curing of the bonding agent
- Place incremental layers of wetting agent until a glossy appearance is observed
- Dentin is dried too completely

Adhesive Application Time
- In general, after applying the adhesive, 15-20 seconds should be allowed for penetration.
- Then air evaporation of the solvent (acetone or alcohol) is followed by curing (visible light-cured generally).
- This should leave a shiny dentin surface.
- If this goal is not achieved, reapplication of the adhesive should be reapplication until a shiny layer appears.
Composition of Primers

- Primers are bifunctional molecules.
  - One end is hydrophobic to bind to the adhesive
  - The hydrophilic end permeates conditioned dentin and chases the water of the moist surface, assisted by solvents (acetone or alcohol).
- Solvents evaporation need to be by air drying.
- Do not light-cure
Examples of primers are HEMA, 4-Meta, and PENTA.

Bonding Agents

- Bonding resins are unfilled BIS-GMA or UDMA
- Visible light-cured (VLC), auto-cured or dual-cured
- The latest generation (fifth generation) mixes the primer and adhesive for time savings.
- Prime and Bond NT (Dentsply/Caulk), 3M Single Bond; and OptiBond Solo (Kerr).
- There is a trend to add fillers to the adhesive bonding agents to enhance their physical properties

How Fillers Enhance Adhesives

- Increase the bond strength at the hybrid layer.
- Improve stress absorption at the tooth restoration interface, enabling better retention. Lower modulus of elasticity to impart added flexibility and thus relieve contraction stress due to polymerization shrinkage. The adhesive absorbs within itself some of the contraction stress.
- Help adhesive cover the dentin in one application rather than multiple applications.

Sixth Generation Systems

- This system combine the etchant and primer and adhesive into one step.
- Advantages are even depth of penetration into the dentin, minimal postoperative sensitivity, and saving time.
- Are highly technique-sensitive and use only VLC.

Sixth Generation Systems

- They are not shown enough strength to bond enamel and therefore should be considered mainly as dentin-bonding agents.
- Prompt L-Pop (3M ESPE), Panavia F. Touch and Bond (Parkell), and Clearfil SE Bond (Kuraray).

Adhesive Procedures

- To enamel: pumice surface; wash; etch 15”; wash; air dry; apply unfilled VLC resin only.
- To dentin and enamel: Clean surface; etch 15”; wash; leave moist; use VLC adhesive components in layers before composite; consider filled adhesives.
- For amalgam (dentin only) : Clean surface; etch 15 seconds; wash; use VLC primer to seal tubules; self-cure resin adhesive (two-component system): pack amalgam before resin sets.
1. The condition depicted in A was discovered by the patient’s hygienist. The patient is a moderate smoker. The most likely possibility to include in a differential diagnosis is:
   A. nicotinic stomatitis
   B. lichen planus
   C. mucosal dysplasia
   D. carcinoma in-situ

2. A patient states that for almost a year now she has had a rubbery, firm, painless nodule within the substance of the parotid gland that has increased in size over several months. The condition described is MOST likely a:
   A. mucocele
   B. lymph node
   C. benign mixed tumor
   D. sialolith

3. The MOST common location for a mucous retention swelling is the:
   A. tongue
   B. gingiva
   C. lower lip
   D. upper lip

4. A young boy has ulcers in his mouth, general malaise, and an oral temperature of 102°F. The MOST probable diagnosis is which of the following?
   A. candidiasis
   B. iron deficiency
   C. herpetic stomatitis
   D. vitamin B deficiency

5. The virus that causes acute herpetic gingivostomatitis is closely related to the virus that causes:
   A. measles
   B. chickenpox
   C. mumps
   D. rubella
6. The patient shown in B presents with these asymptomatic lesions on the face which have been present for years. This most likely represents which of the following conditions?

A. shingles  
B. neurofibromatosis  
C. dermatosis papulosa nigra  
D. lupus erythematosus

7. Which of the following lesions has the greatest malignant potential?

A. leukoedema  
B. lichen planus  
C. actinic keratosis  
D. white sponge nevus

8. The condition pictured in C is accompanied by a photomicrograph showing the histopathologic features of the lesion. What combination from below BEST describes the lesion clinically and histologically, respectively?

A. lichen planus and mucosal dysplasia  
B. hairy leukoplakia and mucositis  
C. leukoplakia and mucosal dysplasia  
D. squamous cell carcinoma and mucosal dysplasia

9. Carcinoma in situ, or severe epithelial dysplasia, may exhibit each of the following EXCEPT one. Which one is the EXCEPTION?

A. pleomorphism  
B. invasion  
C. hyperchromatism  
D. abnormal mitosis

10. Radiographic examination of a healthy 20-year-old woman discloses the asymptomatic lesion shown in D. The etiology of this lesion is most likely:

A. inflammatory  
B. traumatic  
C. neoplastic  
D. developmental
11. The lesion depicted in E was discovered on routine examination by the patient’s dentist. The most likely diagnosis is:

   A. squamous papilloma  
   B. lingual tonsil  
   C. traumatic ulcer  
   D. irritation fibroma

12. The patient shown in F was unaware of this palatal lesion until it was noticed by her dentist. Which of the following is the correct diagnosis?

   A. squamous cell carcinoma  
   B. verrucous carcinoma  
   C. squamous papilloma  
   D. mucous extravasation phenomena

13. The lesion shown in G was first noticed years ago by this retired lifeguard. Since then, he reports it has slightly increased in size. Upon clinical examination, the lesion is soft and blanches slightly upon diascopy. The most likely diagnosis is:

   A. melanotic macule  
   B. amalgam tattoo  
   C. focal melanosis  
   D. varix

14. Which of the following cysts is the LEAST likely to be visible radiographically?

   A. nasopalatine  
   B. lateral periodontal  
   C. dentigerous  
   D. nasolabial

15. The 46-year-old man depicted in H complains of ‘cracked’ lips that do not resolve with use of chapstick and have become more sensitive recently. Which of the following pharmacologic therapies would you recommend to help improve his condition?

   A. corticosteroid  
   B. antihistamine  
   C. antifungal  
   D. antiviral
16. The gingival lesions shown in I were noticed by this immunocompromised patient a few days ago because of increasing pain in the area and ‘bad breath’ more recently. This likely represents which of the following conditions?
   A. cicatricial pemphigoid  
   B. pemphigus vulgaris  
   C. acute necrotizing ulcerative gingivitis  
   D. chronic periodontitis  

17. What is the most likely diagnosis for the asymptomatic lesion depicted in J?
   A. osteoma  
   B. torus palatinus  
   C. pleomorphic adenoma  
   D. fibroma  

18. The 18-year-old female shown in K complains of pain upon mastication that has increased over the past few days. She is likely experiencing which of the following conditions?
   A. pericoronitis  
   B. acute necrotizing ulcerative gingivitis  
   C. cicatricial pemphigoid  
   D. erosive lichen planus  

19. The successful treatment of the asymptomatic radiographic findings shown in L should involve the administration of antibiotics and endodontic therapy. This patient’s periapical x-ray strongly suggests the presence of infection.
   A. Both statements are TRUE  
   B. Both statements are FALSE  
   C. The first statement is TRUE, the second is FALSE  
   D. The first statement is FALSE, the second is TRUE  

20. The highest incidence of fibrous gingival hyperplasia is related to:
   A. puberty  
   B. diabetes  
   C. leukemia  
   D. medications
List of Common Clinical Pathology Lesions:
(Diagnoses from Powerpoint® presentation):
Powerpoint Slide #

3. Desquamative Gingivitis
4. Lichen Planus (reticular)
6. Pleomorphic Adenoma (benign mixed tumor)
7. Nasolabial Cyst
8. Mucocele (mucous extravasation phenomena)
9. Herpes Labialis
10. Actinic Keratosis (solar keratosis)
11. Dermatosis Papulosa Nigra
12. Leukoplakia/Squamous Cell Carcinoma
13. Nasopalatine Duct Cyst (Incisive Canal Cyst)
14. Lingual Tonsils (normal anatomy)
15. Squamous Papilloma
16. Varix (varicose vein)
17. Angular Cheilitis (Candida infection)
18. ANUG
19. Palatal Torus
20. Pericoronitis
21. Periapical Cemento-Osseous Dysplasia
22. Denture Stomatitis
23. Nevus (mole)
24. Fordyce Granules (sebaceous glands)
25. Traumatic Ulcer
26. Idiopathic Osteosclerosis
27. Ephelides (freckles)
28. Dentigerous Cyst
29. Odontogenic Keratocyst histology
30. Ameloblastoma histology
31. Basal Cell Carcinoma with Linear Telangiectasia
32. Geographic Tongue (benign migratory glossitis)
33. Amalgam Tattoo
34. Seborrheic Keratosis
35. Inflammatory Papillary Hyperplasia
36. Actinic Lentigo (solar lentigo, age spot, liver spot)
37. Morsicatio Buccarum (cheek chewing, frictional keratosis)
38. Fibroma (traumatic)
39. Black Hairy Tongue
40. Melanotic Macule
41. Parulis (sinus tract)
42. Antral Pseudocyst (sinus mucocele)
43. Leukoedema
44. Aphthous Ulcer (canker sore)
45. Nicotinic Stomatitis (smoker’s palate)
46. Fissured Tongue
NBDE II Review

The Exam: Test logistics

- **Day 1**: 400 Multiple Choice Questions (200 a.m. + 200 p.m.)
  - General dental and specialty topics admixed
  - Diagnosis, treatment planning and management emphasis
  - Image booklet to supplement some of the questions

- **Day 2**: 200 multiple choice questions a.m.
  - 10-13 cases with 9-14 multiple choice questions each

Scores are shown as low, average, or high for each section but only one overall percentile is given at the end.

Study with the dental decks, supplemental review material, and old exams...but learn the concepts behind the questions! Questions change, but the concepts they test are similar over the years. The more you look over the material, the more comfortable you will be.

Pharmacology I

*Why or When* do we use drugs (clinically)?
- To control, cure, or prevent disease

*Who can prescribe drugs, and Where?*
- Licensed doctors, requires DEA registration and is state specific
- DEA regulates drug laws (legal Rx and illegal) in this country

*What can you Rx?*
- Drugs within the scope of your practice
- Must be cognizant of Controlled Substances Act
  - Drug Schedules I-V

DEA Schedules

- **Schedule I**
  - [Use illegal/restricted to research; high abuse potential; no accepted medicinal use in US]
  - Examples: hallucinogens, heroin, marijuana

- **Schedule II**
  - [Requires prescription; high abuse potential; no refills or verbal orders allowed; some states require triplicate Rx]
  - Examples: amphetamines, barbiturates, opiates (single entity, some combos)

- **Schedule III**
  - [Requires prescription; moderate abuse potential; max 5 refills/6mo; verbal orders allowed]
  - Examples: anabolic steroids, dronabinol, ketamine, opiates (some combos)

- **Schedule IV**
  - [Requires prescription; low/moderate abuse potential; max 5 refills/6mo; verbal orders allowed]
  - Examples: appetite suppressants, benzodiazepines, sedative/hypnotics

- **Schedule V**
  - [Requires prescription or may be OTC with restrictions in some states; limited abuse potential; max 5 refills/6mo; verbal orders allowed]
  - Examples: opiates or opiate-derivative antidiarrheals and antitussives
How do we use drugs?

- **Enteral** – GI tract route of administration
  - Oral → stomach → intestines → liver (portal circulation) → heart → general circulation → target tissues
  - *Sublingual or Rectal* → straight into general circulation and bypasses first-pass liver metabolism

- **Parenteral** – Non-GI route of administration
  - Intravascular, intramuscular, subcutaneous → straight into general circulation and bypasses first-pass liver metabolism

How else do we use drugs?

- **Other** –
  - *Inhalation* → i.e. anesthetics, sterols for asthma
  - *Intra-nasal* → i.e. calcitonin for osteoporosis, cocaine
  - *Intra-thecal* → i.e. analgesics, anti-neoplastics
  - *Topical* → i.e. anesthetics, antibiotics, antifungals

Key Concepts of Drug Activity

- **Pharmacokinetics** → The body’s effect on a drug
  - The onset of action of a drug is primarily determined by the rate of absorption
  - 4 factors that affect the absorption of drugs into the bloodstream:
    1. **Bioavailability** → The amount (quantity or %) that reaches the blood or plasma. Usually, a drug’s major effect is produced by the amount of drug that is free in plasma.
    2. **Stability** → Insulin is unstable in the GI tract, hence the injections for Diabetics to bypass the enteral route

Pharmacodynamics → The drug’s effect on the body

Pharmacokinetics

- The body’s effect on a drug
  - 1. Absorption
  - 2. Distribution
  - 3. Metabolism
  - 4. Elimination

- 3. **Permeability**
  - pH (acid-base interactions, protonation, pKa, Henderson-Hasselbach)
    - Coated tabs (buffered)
  - Gastric Emptying
    - Parasympathetic vs. Sympathetic
    - Food in the stomach delays gastric emptying and increases acid production to allow for proper digestion; drugs destroyed by acid should be taken without food when possible
  - Lipid solubility (hydrophobic, non-ionized, i.e. sterols)
  - Water solubility (hydrophilic, ionized or charged)
  - Transport mechanisms (passive, active, or facilitated)
  - Contact time, surface area, blood supply
First-pass hepatic metabolism

• For enteral drugs, some are inactivated by the liver before reaching systemic circulation, thus decreasing bioavailability; others drugs are activated by the liver, increasing bioavailability

• IV (intravenous) route of administration bypasses first-pass liver metabolism, also increasing bioavailability

Absorption

Can stress affect drug absorption from an enteral route?

Would you tell your patients to take Penicillin on an empty or full stomach?

Hint: Penicillin is inactivated by stomach acid. What if patient has nausea when taking it on an empty stomach?

Pharmacokinetics

- The body's effect on a drug

1. Absorption
2. Distribution
3. Metabolism
4. Elimination

Dose and Route of Administration (Input)

Circulatory System / Plasma

- Blood flow
- Capillary permeability
- Drug structure
- Affinity
- Half-life of drug ($t_{1/2}$)
- Drug volume of distribution ($V_d$)
- Hydrophobic or Hydrophilic nature of drug...

Excretion in urine, feces, bile (Output)

Target Tissues

Elimination

Test Question?

A patient is treated with drug A, which has a high affinity for albumin and is administered in amounts that do not exceed the binding capacity of albumin. A second drug, drug B, is added to the treatment regimen. Drug B also has a high affinity for albumin and is administered in amounts that are 100 times the binding capacity of albumin. Which of the following might occur after administration of drug B?

A. An decrease in tissue concentration of drug A
B. An increase in tissue concentration of drug A
C. A decrease in the half-life of drug A
D. A decrease in the volume of distribution (Vd) of Drug A
2. Distribution

Example: Blood-Brain Barrier

- Water-soluble molecules require carrier or transport mechanisms, or they must travel through gap junctions of cells if possible
- Lipid-soluble molecules pass more readily through cell membranes, but are also more likely to be distributed to fat cells

Can obesity be a factor in causing unequal drug distribution?

3. Metabolism

- Most drugs are metabolized in the liver or other tissues in a process called biotransformation, which occurs for two main reasons:
  - Inactivation of the drug for future excretion or elimination
  - Activation of the drug for desired effect
- The liver does this through:
  - Phase I reactions (cytochrome p450 red-ox, hydrolysis…) mainly activate
  - Phase II reactions (conjugation) mainly inactivate

Note: Neonates are deficient in conjugating enzymes. What implications does this have with respect to drug metabolism?

Pharmacokinetics

- The body's effect on a drug

1. Absorption
2. Distribution
3. Metabolism
4. Elimination

Test Question?

The conjugation of glucuronic acid to a drug by the liver is an example of a:

A. Cytochrome P450 reaction
B. Amination reaction
C. Phase I activation reaction
D. Phase II inactivation reaction

Test Question?

Drugs showing zero-order kinetics of elimination:

A. Are more common than those showing first-order kinetics
B. Decrease in concentration exponentially in time
C. Have a half-life that is independent of dose
D. Show a plot of drug concentration versus time that is linear
Test Question?
Which one of the following is TRUE for a drug whose metabolism or elimination from plasma shows first-order kinetics?
A. The half-life of the drug is proportional to drug concentration in plasma
B. The amount eliminated per unit time is constant
C. The amount eliminated per unit time is proportional to the plasma concentration
D. A plot of drug concentration versus time is sigmoidal

Pharmacokinetics
- The body’s effect on a drug

4. Elimination
- Excretion of drug
  – Changed (metabolized by liver)
  – Unchanged (not metabolized by liver)
- The Kidney is the primary site of drug excretion and clearance through the urine
- Lungs
  – Gases
  – Garlic
- GI
  – Emesis (i.e. alcohol), Bile, Feces
- Body fluids
  – Sweat, Saliva, Tears and Breast Milk

Test Question?
Which of the following combination of diseases would have the most deleterious effects on drug metabolism and excretion?
A. CNS degeneration and Cerebral Palsy
B. Hepatic failure and adrenal insufficiency
C. Renal failure and hepatic insufficiency
D. Hepatic insufficiency and GI malabsorption

Pharmacodynamics
- The drug’s effect on the body
- Drug-receptor interactions (forces) and biochemical cascades (G-protein, cAMP)
- Non-receptor acting drugs
  – i.e. Antacids are bases that just neutralize stomach acid (what can you treat with these?)
  – i.e. Chelating drugs just bind metallic ions (what can you treat with these?)

Pharmacodynamics
Receptor Interactions:
- Agonists (inducers)
  – Efficacy
    • The maximum response that an agonistic drug can produce
  – Potency
    • The measure of how much drug is required to produce a desired effect
Pharmacodynamics

Receptor Interactions:
- Antagonists (competitors)
  - Competitive antagonists are reversible
  - Non-competitive antagonists are irreversible

Receptor interactions are key to understanding drug effects on the systems of the body!

Pharmacodynamics

- Dose-response curves give us an idea of what minimum drug dose or quantity will produce a predetermined response in a population:
  - ED₅₀ (Effective Dose) is the dose of drug that will produce the desired effect in 50% of the population
  - TD₅₀ (Toxic Dose) is the minimum dose that produces a specific toxic effect in 50% of the population
  - LD₅₀ (Lethal Dose) is the minimum dose that kills 50% of the population
  - TI (Therapeutic Index) is a measure of drug safety and is expressed as the following ratio:
    - TI = TD₅₀/ED₅₀ or LD₅₀/ED₅₀
    - Higher TI is better, lower is worse
    (value >2 is okay, less requires patient monitoring)

Test Question?

Which of the following combinations derived from dose-response curves makes for the safest drug, or the best Therapeutic Index?

A. Low ED₅₀ and Low TD₅₀
B. High ED₅₀ and High LD₅₀
C. Low LD₅₀ and High ED₅₀
D. Low ED₅₀ and High LD₅₀

THE DRUGS!

Autonomic Nervous System Drugs

Autonomic Nervous System

Central and Peripheral

Sympathetic

Parasympathetic

Preganglionic: cholinergic
Postganglionic: adrenergic

Preganglionic: cholinergic
Postganglionic: cholinergic

Fight and flight
Rest and ruminate

CHOLINERGIC RECEPTOR AGONISTS

Acetylcholine
Neostigmine
Pilocarpine
Physostigmine
Carbachol
Edrophonium

Many of these drugs are used to treat glaucoma. Anti-cholinergic drugs are contraindicated in patients with glaucoma.

Sweat glands are innervated by acetylcholine (cholinergic), but uniquely by sympathetic post-ganglionic cholinergic receptors as opposed to parasympathetic post-ganglionic cholinergic receptors.
Atropine reduces salivary gland secretions. During what type of procedures would this be helpful clinically?

Pilocarpine, on the other hand, increases salivary secretions. This could be used to treat what common oral condition?

Test Question?
Which of the following drugs would be the most effective in treating Myasthenia Gravis?
A. Atropine
B. Scopolamine
C. Neostigmine
D. Nifedipine

Test Question?
Which one of the following drugs is useful in treating tachycardia?
A. Clonidine
B. Tyramine
C. Propanolol
D. Reserpine

Test Question?
Which of the following drugs would be the most effective in treating Myasthenia Gravis?
A. Atropine
B. Scopolamine
C. Neostigmine
D. Nifedipine

Alpha, Beta or both agonistic actions exist. Review these in detail before the exam with respect to bronchodilation, vasodilation, bronchoconstriction, bronchodilation, etc...

How do most of these drugs effect blood pressure or hypertension?
Test Question?
Systolic blood pressure is decreased after the injection of which of the following drugs?
A. Reserpine  
B. Tyramine  
C. Dopamine  
D. Clonidine

CNS Stimulants

Test Question?
Besides being a good anxiolytic, benzodiazepines are also very useful for:
A. Myasthenia gravis  
B. General anesthesia  
C. Parkinson’s disease  
D. Hypothermia

CNS Depressants
To treat Anxiety (sympathetic overflow)
– Benzodiazepines (GABA receptor-like activity, RAS) have largely replaced barbiturates
  • Clonazepam  
  • Diazepam (Valium®)  
  • Lorazepam  
  • Midazolam  
  • Triazolam  
  • Alprazolam  
  • Buspirone  
  • Hydroxyzine  
  • Zolpidem

CNS Depressants
To treat Epilepsy (over-activity)
– Antiepileptic drugs:
  • Carbamazepine  
  • Clonazepam  
  • Diazepam  
  • Gabapentin  
  • Phenobarbital  
  • Phenytoin (Gingival Hyperplasia side-effect)  
  • Primidone  
  • Valproic Acid

CNS Depressants
• To treat Schizophrenia and some Psychoses
  – Neuroleptic drugs
  – Block dopamine and serotonin receptors
    • Butyrophenones
      – Haloperidol
    • Benzisoxazoles
      – Risperidone
    • Phenothiazines
      – Chlorpromazine
      – Promethazine

CNS Depressants

88
Anti-depressants

Test Question?
The tricyclic anti-depressants work by which of the following mechanisms?
A. GABA agonist
B. GABA antagonist
C. releasing norepinephrine
D. blocking norepinephrine reuptake

CNS
Parkinson’s disease
- Levodopa (dopamine) and carbidopa are used to treat Parkinson’s to compensate for lack of endogenous dopamine in the substantia nigra
- Dopamine alone does not cross the Blood-Brain Barrier, but it can as Levodopa

Pharmacology II

Cardiovascular System Drugs
- Congestive Heart Failure (CHF)
  - Heart is unable to meet the needs of the body
  - Starling’s law: CO=CR, in CHF either output or return is impaired
  - “Congestive” because symptoms include pulmonary edema with left sided heart failure, and peripheral edema with right sided heart failure
  - Therapeutic goal is to increase cardiac output

Drugs used to treat CHF
Test Question?

All of the following classes of drugs are used to treat CHF except the following:
A. Beta-adrenergic antagonists
B. Beta-adrenergic agonists
C. Vasodilators
D. Diuretics

Anti-arrhythmic Drugs

- In arrhythmia, the heart beats too rapidly (tachycardia), too slowly (bradycardia), or responds to impulses originating from sites or pathways other than the SA node (pacemaker)
- Therapeutic goal is to normalize impulse conduction

Anti-arrhythmic Drugs

Class I (Na+ channel blockers)
- Lidocaine
- Mexiletine
- Quinidine
- Disopyramide
- Procainamide

Class II (Beta-adrenergic blockers)
- Metoprolol
- Propranolol
- Amiodarone
- Sotalol
- Bretylium

Class III (K+ channel blockers)

Class IV (Ca++ channel blockers)
- Diltiazem
- Verapamil
- Amlodipine
- Nifedipine

Anti-arrhythmic Drugs

Anti-anginal Drugs

- Angina pectoris results from coronary blood flow that is insufficient to meet the oxygen demands of the body
- Therapeutic goal is to increase perfusion to the heart (vasodilating nitrates and Ca++ channel blockers) or decrease the demand (Beta-blockers)
- Significant first-pass hepatic metabolism occurs with the nitrates

Anti-anginal Drugs

Anti-hypertensive Drugs

- HTN defined as >140/90 mmHg, affects 15% of the US population (60 million)
- Therapeutic goal is to lower BP and prevent disease sequelae, being cognizant of concomitant disease
- Multi-drug regimen may be warranted
- Compliance is the most common reason for therapy failure
  - Dentists can play an important role here
Anti-hypertensive Drugs

Anti-hypertensives

Diuretics

Alpha and Beta Blockers

Ca++ channel blockers

ACE inhibitors

Angiotensin II Antagonists

Test Question?

Which of the following class of drugs is NOT used to treat hypertension?

A. Diuretics
B. ACE inhibitors
C. Alpha agonists
D. Beta antagonists

Drugs affecting Blood

• The drugs useful in treating blood dyscrasias cover 3 important dysfunctions:
  - Thrombosis
  - Bleeding
  - Anemia

What could you use to treat each of these abnormalities based on your knowledge of physiology?

Drugs affecting Blood

Drugs affecting the Respiratory System

• What do the lungs do?
• What type of drugs can affect that?

Note: Hydroxyurea is used to treat Sickle Cell Anemia!
Drugs affecting the Respiratory System

- Drugs used to treat Allergic Rhinitis
  - Anti-histamines (H₁)
  - Corticosteroids
  - Alpha-adrenergic agonists (vasoconstricts)
- Drugs used to treat Asthma:
  - Beta-adrenergic agonists (bronchodilates)
  - Corticosteroids
  - Theophylline (coffee, tea)
- Drugs used to treat COPD:
  - Corticosteroids
  - Beta-adrenergic agonists
- Drugs used to treat Cough:
  - Opiates (suppress CNS cough centers)

Drugs affecting the Kidney

- What do the kidneys do?
- What type of drugs can affect that?

Drugs affecting the GI System

- Drugs used to treat Peptic Ulcer
  - Proton pump inhibitors
    - Omeprazole
    - Lansoprazole
  - H₂-receptor antagonists
    - Cimetidine
    - Ranitidine
    - Famotidine
- Antimicrobial
  - Amoxicillin
  - Tetracycline
  - Metronidazole
- Drugs used to treat Peptic Ulcer
  - Antacids
    - Magnesium hydroxide (milk of magnesia)
    - Calcium carbonate (Tums®, Rolaid®)
  - Aluminum hydroxide
  - Sodium bicarbonate
  - Anti-muscarinic agents
    - Hyoscyamine
    - Pirenzepine
Drugs affecting the GI System

• Drugs used to treat Diarrhea:
  – Anti-diarrheals
    • Kaolin
    • Pectin
    • Methylcellulose

• Drugs used to treat Constipation:
  – Laxatives
    • Castor oil
    • Senna
    • Aloe
    • Glycerine

Compensatory Drugs

Normal physiology is key to understanding these drug effects:

• Thyroid?
• Pancreas?
• Pituitary?
• Adrenals? (all 3 layers)

Anti-inflammatory Drugs

NSAID’s are less dangerous than chronic steroidal anti-inflammatory drugs:
• Aspirin (Bayer®)
• Diclofenac
• Etodolac
• Fenoprofen
• Ibuprofen (Advil®)
• Indomethacin
• Naproxin
• Sulindac
• Tolmetin

Test Question?

Which of the following NSAID’s is not anti-inflammatory?
A. ASA (salicyclic acid)
B. Ibuprofen
C. Naproxen
D. Acetaminophen

Anti-microbial Drugs

• Antimycobacterials
  – INH, Rifampin, Ethambutol, Dapsone

• Antivirals
  – Acyclovir, Famiclovir, Ganciclovir
  – Vidarabine, Rimantadine, Amantadine, Ribavirin
  – Interferon (Hepatitis)
  – Zidovudine, Zalcitabine, Stavudine, Didanosine (HIV)

• Antiprotozoals
  – Quinolones, Metronidazole

Test Question?

Which of the following drugs is useful for treating Hepatitis C?
A. Ganciclovir
B. Interferon
C. Acyclovir
D. Famiclovir
Anti-fungals
- Polyenes:
  - Amphotericin B (systemic)
  - Nystatin (topical)
- Imidazoles:
  - Ketoconazole (systemic)
  - Clotrimazole (systemic or topical, Mycelex®)
  - Miconazole
  - Itraconazole
  - Fluconazole
- Griseofulvin
  - Disrupts fungal mitotic spindle formation
  - Used to treat dermatophytic infections

Test Question?
A significant difference between nystatin and amphotericin B is that:
A. They are different types of antifungals
B. One is effective against candidiasis and one is not
C. One is administered topically and the other systemically
D. Only one of them acts on the fungal cell membrane

Antibiotics
- Inhibition of DNA Replication or Transcription: Quinolones, Rifampin, Doxorubicin
- Inhibition of cell wall synthesis: Penicillins, Amoxicillin, Cephalosporins
- Inhibition of Translation or Protein Synthesis: Tetracyclines, Aminoglycosides
  - Streptomycin, Neomycin, Gentamycin
- Aminoglycosides
  - Streptomycin, Neomycin, Gentamycin
- Aminoglycosides
  - Streptomycin, Neomycin, Gentamycin
- Inhibition of synthesis of essential metabolites: Sulfonamides, Trimethoprim
- Injury to cell membrane: Polymyxin B

Local Anesthetics
- Amides: [aniline derivatives] articaine, bupivacaine, dibucaine, levobupivacaine, lidocaine, mepivacaine, prilocaine, ropivacaine
- Esters: [PABA derivatives] benzocaine, butamben, chloroprocaine, cocaine, procaine, proparacaine, tetracaine
- Hypersensitivity info:
  - Ester allergy more common; cross-sensitivity between classes rare; consider paraben or bisulfite sensitivity if apparent allergy to both classes

General Anesthetics
- 3 stages:
  - Induction, Maintenance, Recovery
  - Induction and Pre-anesthetic medication regimens can use:
    - Benzodiazepines
    - Opioids
    - Anticholinergics
    - Antiemetics
    - Antihistamines
- Maintenance:
  - Today mainly volatile inhalation gases
    - Enflurane
    - Halothane
    - Isoflurane
    - Methoxyflurane
    - NO
- Recovery:
  - Reverse of induction, withdrawal of drugs for redistribution, counter-acting med's prn
## Antibiotic Premedication (Endocarditis Prophylaxis-Adult)

**[Timing of administration]**
Unless otherwise noted, give all PO doses 1h before procedure; all IM/IV doses within 30min of procedure.

**[Standard regimen]**
- Dose: amoxicillin 2 g PO; All ampicillin 2 g IM/IV

**[PCN allergy]**
- Dose: clindamycin 600 mg PO/IV; Alt: amoxicillin 2 g PO; cefazolin 1 g IM/IV; 2 doses of azithromycin 500 mg PO (last dose 1h before procedure)

**[High risk]**
- Dose: ampicillin 2 g IM/IV and gentamicin 1.5 mg/kg within 30min before procedure, then ampicillin 1 g IM/IV or amoxicillin 1 g PO 6h later

**[Info]**
- Prosthetic, bioprosthetic, homograft valves; previous endocarditis; complex cyanotic congenital heart disease; surgical pulmonary shunts

**[High risk, PCN allergy]**
- Dose: vancomycin 1 g IV and gentamicin 1.5 mg/kg IM/IV

**[Moderate risk]**
- Dose: amoxicillin 2 g PO; All ampicillin 2 g IM/IV

**[Info]**
- Other congenital cardiac malformation; acquired defects; rheumatic heart disease; hypertrophic cardiomyopathy; MVP with regurgitation and/or thickened leaflets

**[Moderate risk, PCN allergy]**
- Dose: vancomycin 1 g IV

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## Antibiotic Premedication (Endocarditis Prophylaxis-Child)

**[Timing of administration]**
Unless otherwise noted, give all PO doses 1h before procedure; all IM/IV doses within 30min of procedure.

**[Standard regimen]**
- Dose: amoxicillin 50 mg/kg (max 2 g) PO; All ampicillin 50 mg/kg (max 2 g) IM/IV

**[PCN allergy]**
- Dose: clindamycin 20 mg/kg (max 600 mg) PO/IV; Alt: cephalexin 50 mg/kg (max 2 g) PO; cefazolin 25 mg/kg (max 1 g) IM/IV; azithromycin 15 mg/kg (max 1 g) PO; clarithromycin 15 mg/kg (max 600 mg) PO

**[High risk]**
- Dose: ampicillin 50 mg/kg (max 2 g) IM/IV and gentamicin 1.5 mg/kg (max 120 mg) IM/IV within 30min before procedure, then amoxicillin 25 mg/kg (max 2 g) IM/IV or amoxicillin 25 mg/kg (max 2 g) PO 6h later

**[Info]**
- Prosthetic, bioprosthetic, homograft valves; previous endocarditis; complex cyanotic congenital heart disease; surgical pulmonary shunts

**[High risk, PCN allergy]**
- Dose: vancomycin 20 mg/kg (max 1 g) IV and gentamicin 1.5 mg/kg (max 120 mg) IM/IV

**[Moderate risk]**
- Dose: amoxicillin 50 mg/kg (max 2 g) PO; All ampicillin 50 mg/kg (max 2 g) IM/IV

**[Info]**
- Other congenital cardiac malformation; acquired defects; rheumatic heart disease; hypertrophic cardiomyopathy; MVP with regurgitation and/or thickened leaflets

**[Moderate risk, PCN allergy]**
- Dose: vancomycin 20 mg/kg (max 1 g) IV

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GOOD LUCK!
PROSTHODONTICS

George Bryon Craig DDS

General Considerations (21)
- Diagnosis and treatment planning
- Preprosthodontic treatment
- Maxillomandibular relations
- Impressions and casts
- Esthetics and Phonetics
- Restorative implantology

Complete and Removable Partial Denture Prosthodontics (8)
- Design of prosthesis and mouth preparation
- Occlusion
- Dental Materials
- Insertion and postinsertion

Fixed Partial Prosthodontics (16)
- Design of Prosthesis and mouth preparation
- Occlusion
- Ceramic techniques
- Dental Materials
- Insertion and postinsertion

Complete Denture
- Crown & Bridge
- Impression Materials
- Miscellaneous
- Occlusion/Temporomandibular Joint
- Porcelain
- Removable Partial Denture
Excessive vertical dimension may result in
- poor denture retention.
- Drooping of the corners of the mouth.
- Creases and wrinkles around the lips.
- Trauma to the underlying supporting tissues. CORRECT

Overextension of a mandibular denture base in the distofacial area will cause dislodgment of the denture during function as the result of the action of the
- masseter muscle. CORRECT
- buccinator muscle.
- Pterygomandibular raphe.
- Superior pharyngeal constrictor muscle.

The distal palatal termination of the maxillary complete denture base is dictated by the
- tuberosity.
- fovea palatinae.
- Maxillary tori.
- Vibrating line. CORRECT
- Posterior palatal seal.

An excessive vertical dimension of occlusion in a patient with complete dentures will adversely affect
- retention.
- Protrusion.
- Centric relation.
- Balanced occlusion.
- Interocclusal clearance. CORRECT

Placement of maxillary anterior teeth in complete dentures too far superiority and anteriorly might result in difficulty in pronouncing
- “f” and “v” sounds. CORRECT
- “d” and “t” sounds.
- “s” and “th” sounds.
- Most vowels.

Papillary hyperplasia in a denture-wearing patient results primarily from
- overextension of the lingual flange.
- Inadequate eccentric occlusal contact.
- An inappropriate relief chamber on the maxillary denture. CORRECT
- Invasion of soft tissue by Candida albicans.
- An unpolished tissue surface on the maxillary denture.
83/64

The bearing area of the maxillary denture of an elderly patient shows hyperplastic tissue over the entire ridge. Treatment for this condition is to
- remove surgically all the hyperplastic tissue.
- Make an impression immediately in order to compress the entire area.
- Instruct the patient to leave the denture out of the mouth for several months.
- Use tissue treatment material for several weeks before making an impression. CORRECT

83/73

A generalized inflammatory condition in the stressbearing mucosa may be caused by (a) faulty occlusion; (b) ill-fitting dentures; (c) wearing the dentures for 24 hours consecutively; (d) an overclosed occlusal vertical dimension.
- (a) and (b) only
- (a), (b) and (c) CORRECT
- (a) and (c) only
- (b), (c) and (d)
- All of the above

86/29

Proper lip support for a patient with complete dentures is provided primarily by the
- convex surface of the labial flange.
- Festooned carvings on the facial surface.
- Thickness of the border in the vestibule.
- Facial surfaces of teeth and simulated attached gingiva. CORRECT

86/41

A balanced occlusion in maxillary and mandibular complete dentures exists when
- opposing teeth contact in centric occlusion.
- Opposing teeth contact in centric occlusion, working, balancing and protrusive positions. CORRECT
- Incisors contact without contact of posterior teeth in a protrusive position.
- Facial cusps touch in working position without contact on balancing cusps.

86/45

When testing the arrangement of teeth at the trial insertion of complete dentures, the lower lip should, when pronouncing the letter "f" as in fifty,
- be anterior to maxillary incisors.
- Be posterior to maxillary incisors.
- Not come near maxillary incisors.
- Contact lightly the incisal edges of maxillary incisors. CORRECT

88/04

The usual cause of contacting or clicking of posterior teeth when a patient speaks is
- decreased vertical dimension of occlusion
- increased vertical dimension of occlusion. CORRECT
- posterior teeth set too far lingually.
- Posterior teeth set too far facially.
Excessive vertical dimension of occlusion may result in:
- Poor denture retention.
- Increased interocclusal distance.
- Drooping of the corners of the mouth.
- Creases and wrinkles around the lip.
- Trauma to underlying supporting tissues. CORRECT

A patient who wears complete dentures is having trouble pronouncing the letter "C". This is probably caused by:
- Too thick a palatal seal area.
- Too thick a base in the mandibular denture.
- Incorrect positioning of maxillary incisors. CORRECT
- Improper positioning of mandibular incisors.

Proper lip support for a patient with complete dentures is provided primarily by:
- Convex surface of the labial flange.
- Rounded contours of interdental papillae.
- Proper pronunciation of sibilant sounds.
- Thickness of the border in the vestibule.
- Facial surfaces of teeth and simulated attached gingiva. CORRECT

In determining the posterior limit of a maxillary denture base, which of the following is on the posterior border?
- Hamular notch. CORRECT
- Hamular process
- Fovea palatine
- Vibrating line
- Pterygomandibular raphe

Treatment of choice for a patient with a maxillary complete denture with severe bilateral tuberosity undercuts is to:
- Remove both tuberosity undercuts.
- Reduce the tissue bilaterally.
- Reduce the tissue on one side only, if possible. CORRECT
- None of the above. No treatment is necessary

During postinsertion adjustment, errors in occlusion may be checked most accurately by:
- Having the patient leave the dentures out of the mouth for 24 hours.
- Directing the patient to close the jaws, bringing the teeth into occlusion.
- Having the patient close in occlusion and making a transfer record to the articulator.
- Remounting the dentures on the articulator using remount casts and new interocclusal records. CORRECT
88/53

The error that most frequently contributes to poor esthetics of dentures is the practice of placing maxillary anterior teeth:
- following the smile line.
- Too far below the lip line.
- Directly over the edentulous ridge. **CORRECT**
- Too far to the facial of the edentulous ridge.
- Too far to the lingual of the edentulous ridge.

97/239

When construction complete dentures, the ala tragus line must be parallel to:
- Frankfort horizontal plane **CORRECT**
- The maxillary posterior occlusal rims. **CORRECT**
- The mandibular posterior occlusal rims.

97/140

Ala Tragus

A plaster index is used to:
- preserve face bow transfer **CORRECT**
- maintain vertical dimension of occlusion
- maintain bite registration

2004/161

Which on of the following is the most important factor for providing retention for complete dentures?
- cohesion
- adhesion
- peripheral seal **CORRECT**

Crown & Bridge
The retentive characteristics of a full crown may be enhanced by (a) using glass ionomer cement; (b) using zinc phosphate cement; (c) adding pinholes in the preparation; (d) adding grooves parallel to the path of draw; (e) maximizing the parallelism of the axial walls.

- (a), (c) and (d)
- (a), (d) and (e)
- (b), (c) and (d)
- (b), (c) and (e)
- (c), (d) and (e) CORRECT
- All of the above

What is the most accurate way of checking the occlusion for a fixed prosthesis?

- articulating paper
- shimstock CORRECT
- patient information

How far should implants be placed from one another?

- 3mm CORRECT
- 4mm
- 5mm
- 7mm

The ideal time to wait for osseointegration of an implant to take place is

- 3 months
- 6 months CORRECT
- 9 months
- 12 months

Impression Materials

- Impression material with least tear resistance
  - rubber base
  - irreversible hydrocolloid
  - reversible hydrocolloid CORRECT
What is the impression material with the best dimensional stability 24 hours after taking the impression?
- polyvinyl siloxane CORRECT
- reversible colloid
- irreversible colloid

At which of the following positions is sibilant sound usually produced?
- rest position
- occluding position
- open form rest position
- between rest and occluding positions. CORRECT

The lateral pterygoid muscle functions to (a) elevate the mandible; (b) protrude the mandible; (c) lift the mandible from the pterygoid plate; (d) move the mandible to the opposite side.
- (a) and (b)
- (a) and (c)
- (a) and (d)
- (b) and (c)
- (b) and (d) CORRECT
- (c) and (d)

GOLD CASTING ALLOYS
- Type I – soft gold-for inlays
- Type II – medium-inlays
- Type III – hard – onlays and crowns
- Type IV – extra hard w/low fusing temp – partial dentures
- Ceramic-metal restorations (contain iron, tin, indium)

When do you clean zinc phosphate cement from crown margins?
- immediately
- 4 hours after the cement has set
- after the cement has set completely CORRECT
- the next day
88/11
The proper zone of a gas-air blowpipe flame used for melting casting gold alloys is
- the reducing zone CORRECT
- the oxidizing zone
- the zone closest to the nozzle
- a combination of oxidizing and reducing zones

88/16
The property that most closely describes the ability of a cast gold inlay to be burnished is
- elastic limit
- ultimate strength
- percentage elongation. CORRECT
- modulus of resilience
- modulus of elasticity

88/31
In mixing zinc phosphate cement, which clinical variable has the greatest effect on the strength of the cement?
- spatulation time.
- Liquid-powder ratio CORRECT
- Temperature of the mixing slab
- Number and size of powder increments

83/68
Group function occlusion in an existing dentition is characterized by having (a) no balancing side contacts; (b) working side contacts from canine to third molar; (c) a long centric from centric relation to centric occlusion; (d) canine rise in protrusion; (e) total balance in lateral excursion.
- (a) and (b) only CORRECT
- (a), (b), (c), and (d)
- (a), (b), and (d) only
- (b), and (d) only
- (c), (d) and (e)
- (c), and (e) only

88/29
In a restorative problem involving all teeth in the mouth, the protrusive condylar path inclination has its primary influence on
- incisal guidance.
- Anterior teeth only.
- Mesial inclines of mandibular cusps and distal inclines of maxillary cusps. CORRECT
- Mesial inclines of maxillary cusps and distal inclines of mandibular cusps.
Best way to image TMJ
- CT
- MRI CORRECT
- High pan
- Lateral oblique

Class II malocclusion
- Division I: is when the maxillary anterior teeth are proclined and a large overjet is present
- Division II: is where the maxillary anterior teeth are retracted and a deep overbite exists.

Classification of malocclusion
June 2, 2004
Dr. Robert Gallois


- The overlap of the cusps helps to keep the soft tissue of the tongue and cheeks out from the occlusal tables, preventing self-injury during chewing

- The amount of horizontal (overjet) and vertical (overbite) can significantly influence mandibular movement and thus influence the cusp design of restorations.

Overjet

![Image of overjet types A, B, and C]
Overbite

The TMJ and its influence

TMJ
- Condyle
- Articular Disk (superior and inferior joint spaces)
- Articular eminences

Mandibular Movements
- Rotation (superior joint space)
- Translation (inferior joint space)
- Immediate side shift (working side in lateral excursion)

Rotation and Translation

Side Shift
Planes of Motion

- Sagital
- Frontal
- Horizontal

Sagital (Posselt’s diagram)

Types of Occlusion we use

- Canine guidance
- Group function
- Balanced occlusion

Canine Guidance
Canine Guidance

Group Function

Balanced Occlusion

- Used in denture patients
- A minimum of three point bilateral supporting contact occurs between the maxillary and mandibular teeth at all times in lateral and protrusive excursions (compensating curve)

Compensating Curve

Porcelain

The phenomenon where porcelain appears different under varying light conditions is:
- metamerism. CORRECT
- translucency.
- Transmittance
- Opacification
- Refractive optics

86/11
Which of the following are causes of separation or fracture of the porcelain from the metal in the metal-ceramic technique?  (a) Poor metal framework design; (b) Excessive porcelain condensation; (c) Centric occlusal contacts entirely on porcelain; (d) Contamination of metal prior to opaque application
- (a), (b) and (d)
- (a) and (c)
- (a) and (d) only
- (b) and (d) only  CORRECT

A properly designed rest on the lingual surface of a canine is preferred to a properly designed rest on the incisal surface because
- Less leverage is exerted against the tooth by the lingual rest.  CORRECT
- The enamel is thicker on the lingual surface.
- Visibility of as well as access to the lingual surface is better.
- The cingulum of the canine provides a natural surface for the recess.

The most important function of an indirect retainer is to prevent
- Tissue resorption.
- Occlusal interferences.
- Movement of the denture base toward the tissue.
- Movement of the teeth after orthodontic treatment.
- Movement of a distal extension base away from the tissues.  CORRECT

Clasps should be so designed that, upon insertion or removal of a removable partial denture, the reciprocal arms contact the abutment teeth when the retentive arms engage the height of contour in order to
- Permit insertion and removal without applying excessive force.  CORRECT
- Assure complete seating of the framework
- Prevent distortion of the clasps.
- All of the above.

Which of the following problems may occur in a patient with a maxillary removable partial denture if the palatal bar is made too thick?
- Difficulty in pressing food backward for swallowing.  CORRECT
- Poor dissipation of force because of excessive rigidity
- Irritation of the palatal tissues
- Distortion under occlusal stress
- Injury to the abutment teeth
In designing a retainer on a noncarious mandibular first premolar abutment with a short clinical crown, which of the following restorations is most appropriate?

- An inlay
- A full crown **CORRECT**
- An MOD onlay
- A reverse ¾ crown

The most frequent cause of tissue soreness along the mucobuccal area of a removable partial denture is

- use of anatomic teeth.
- A centric prematurity.
- Heavy balancing contact.
- Extension of the denture border. **CORRECT**
- Lack of rigidity of the major connector.

When a removable partial denture is completely seated, the retentive terminals of the retentive clasp arms should be

- passive and applying no pressure on the teeth. **CORRECT**
- contacting the abutment teeth only in the suprabulge areas.
- Resting lightly on the height of contour line on the abutment teeth.
- Applying a definite, positive force on the abutment teeth in order to prevent dislodgment of the removable partial denture.

Which of the following is likely to occur under the distal extension maxillary partial denture of a patient with Paget’s disease?

- The bone will tend to expand and the partial denture will have to be remade periodically. **CORRECT**
- The bone is like “cottonwool” and will be resorbed rapidly, thus, making frequent rebasing necessary.
- The bone will become very dense and hard, thus, soreness of the basal seat is likely to occur.
- Nothing will occur because maxillary bone is not usually affected.

Indirect retention is designed to

- stabilize tooth-borne removable partial dentures.
- Engage an undercut area of an abutment tooth.
- Help resist tissueward movement of an extension base partial denture.
- Help resist dislodgment of an extension base partial denture in an occlusal direction. **CORRECT**

**KENNEDY CLASSIFICATIONS**

- Class I – bilateral distal extension
- Class II – unilateral distal extension
- Class III – unilateral tooth borne edentulous area
- Class IV – bilateral (crossing midline) edentulous area (tooth borne)
When placing an I-clasp on a premolar for a distal extension RPD, the I-bar moves_____ and ______ under occlusal forces.
- occlusally and distally
- occlusally and mesially
- apical and distal
- apical and mesial CORRECT

A patient wearing a new bilateral RPD complains of soreness in tissue bearing areas 24 hours after insertion. The most likely cause would be
- occlusal discrepancies  CORRECT
- over extended denture
- under extended denture
- allergy
RADIOGRAPHIC PATHOLOGY

I. DEFINITIONS

- “Radiographic appearances are governed by anatomic or physiologic changes in the presence of disease processes. Radiologic ‘diagnosis’ is founded on knowledge of these alterations, the prerequisite being awareness of disease mechanisms.” H.M. Worth

II. THE RADIOGRAPHIC REPORT

- Patient name, age, ethnicity, referring physician, and date of radiographs

- Radiographic Procedure (brief but more descriptive for invasive procedures)

- Radiographic Findings (objective info: location/anatomy/structural effects)
  a. Anatomy: epicenter (above/below/in the canal), local/generalized, monostotic/polyostotic
  b. Shape: hydraulic (cysts), scalloping, regular/irregular
  c. Internal: density (opaque/lucent/mixed), trabeculation, septation, mineralization/calcification (amorphous/discrete/grainy), geographic radiolucency or hydraulic/cystic radiolucency
  d. Periphery: borders discrete or well-defined vs. blending or permeative, cortication, sclerosis, capsule
  e. Behavior: space occupying, displacing, destroying, expanding, or osteo-inducing such as in new periosteal bone formation

- Interpretation/Impression (subjective DDx: may include clinical or surgical findings, histologic findings, or other diagnostic procedures)

III. IMAGING MODALITIES (pre-biopsy preferred)

A. Panoramic and Occlusal Radiographs
  i. Together help simulate CT coronal and axial sections, especially in cases of cortical expansion/periosteal reaction.
  ii. Useful when cost or access to more advanced imaging a factor, or follow-up cases…aka: “poor man’s CT”

B. Computerized Tomography (standard)
  i. Acquired Coronal (not corrected), Axial, and Sagittal
  ii. Contrast (ie: Gadolinium) can enhance lesional features and is essential for neoplastic lesions
C. Magnetic Resonance Imaging (MRI)
   i. Soft tissue imaging modality based on proton spin and
      magnetic moments of hydrogen ions (T1 and T2 weighted)
   ii. Not good for bone pathology because hydrogen ions in bone
       are bound and not free to spin and relax.

D. Nuclear Medicine (adjunct, still evolving)
   i. Radiopharmaceutical (technetium) gamma photon detection
      system which is utilized for identifying areas of increased
      metabolic activity – such as in neoplasia, septic arthritis,
      metabolic bone disease, active condylar hyperplasia, and
      osteomyelitis (except in chronic sclerosing phase in which
      CT’s are more ideal)

E. Positron Emission Tomography (adjunct, still evolving)
   i. FDG (glucose analogue) shows increased activity in areas with
      high metabolic (glycolytic) activity – such as in osteomyelitis,
      hyperparathyroidism, or neoplasia metastases or follow-up.

F. TMJ Tomography
   i. Imaging modality for various joint conditions ranging from
      reactive to neoplastic.

IV. CONDITIONS
   -Correlate with clinical and histopathologic findings

A. Developmental
   i. Symmetry, often asymptomatic, long history, little or no change
      over time

B. Neoplastic
   i. Malignant: Infiltrative growth pattern, ragged, poorly
      demarcated or ill-defined, paresthesia
   ii. Benign: Slow growth, uniform, well-demarcated or well-
       defined

C. Reactive/Inflammatory
   i. Inflammatory symptomatology if any, shorter history, more
      common
Looking for abnormalities: Requires knowledge of normal anatomy first, what constitutes a good film or image, and why the imaging study is being done clinically.

Radiolucency, Opacity, or mixed...

Differential Diagnostic process:
Based on normal anatomy, then identifying abnormality as possibly an Odontogenic Cyst/Tumor, Neurovascular lesion, Non-Odontogenic Cyst/Tumor, or other condition...depending on the epicenter relationship to anatomic structures like the IA Canal.

Neurovascular Lesion
• Benign:
  – Neurofibroma
  – Neuroma
  – Hemangioma
• Malignant:
  – Neurofibrosarcoma
  – Neurogenic Sarcoma
  – Angiosarcoma

Differential Diagnosis:
Mandibular Radiolucencies
Within the IA Canal

Differential Diagnosis:
Mandibular Radiolucencies
Above the IA Canal (excludes infections causing apical lesion)
• Odontogenic Cysts
  – Dentigerous Cyst (often contains crown of impacted tooth)
  – Odontogenic Keratocyst (OKC)
  – Lateral Periodontal Cyst
  – Periapical Cyst
  – Calcifying Odontogenic Cyst (COC)
• Odontogenic Tumors
  – Ameloblastoma
  – Adenomatoid Odontogenic Tumor
  – Calcifying Epithelial Odontogenic Tumor (mixed lucency-opacity)
  – Odontoma (central opacification with peripheral lucency)
  – Odontogenic Myxoma (multi-locular lucency)
Dentigerous (Developmental) Cyst

Odontogenic Myxoma

Lateral Periodontal Cyst

Odontogenic Keratocyst

Residual Cyst

Calcifying Odontogenic Cyst

Odontomas (compound)
Differential Diagnosis: Mandibular Radiolucencies Below the IA Canal

- **Bone Tumors**
  - Metastatic Carcinoma
  - Osteosarcoma

- **Bone Cysts**
  - Stafne bone defect (not a true cyst, but actually a salivary gland depression in the bone – no Tx, follow)
  - Traumatic Bone Cyst
  - Aneurysmal Bone Cyst (ABC)

- **Bone Reactive / Inflammatory**
  - Osteomyelitis
  - Giant Cell Reaction

* Except for the Stafne defect, most of the lesions above often appear above the IA canal also, highlighting the fact that most lesions in the lower jaw occur above the IA canal.

**Some small but important opacities…**

**NO! CT scan or periodic radiographic evaluation**
The role of advanced imaging in differentiating bone pathoses with osteogenic potential, such as in cases demonstrating new periosteal bone formation.

Periosteal reactions in the form of new bone formation:
- Osteomyelitis
  - (proliferative periostitis)
- Osteosarcoma
- Metastatic Carcinoma
- Langerhans Cell Disease
Periosteal Reactions

- Varying etiopathogenesis
  - Ranging from reactive to neoplastic
- Result is varying osteoblastic (forming) and osteoclastic (resorbing) activity physiologically/molecularly that is evident histopathologically also
- Demonstrates radiographic appearance likened to an “onion-skin” or “hair-on-end” pattern

Periosteal Reactions

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Periosteal Reactions

- Clinically may demonstrate cortical osseous expansion, with or without tenderness depending on factors such as etiology and patients’ pain perceptions
- Definitive diagnosis may require clinical, radiographic, and histologic/immunohistochemical correlation in many cases

Conditions in which new periosteal bone formation may be a feature

- Osteomyelitis
  - Proliferative Periostitis (Garrè’s)
- Osteosarcoma
- Metastatic Carcinoma
- Langerhans Cell Disease

Osteomyelitis – Proliferative Periostitis

- Hypothesized that acute osteomyelitis, or inflammation of medullary bone, which is mainly lytic in nature, (from infection, trauma, etc.….) spreads to the periosteum
- Inflammatory cytokines then stimulate cortical resorption, while inflammatory exudate also lifts the periosteum and induces new bone formation which occurs parallel/lamellar to cortex, accounting for unique presentation
Osteosarcoma

• Periosteal, Parosteal, and Gnathic in H&N
• Rare cases associated with Paget's disease and Cemento-Osseous dysplasia
• Radiolucent, radiopaque, or mixed radiographic appearance
• Lytic, loss of lamina dura, widening of PDL, destruction of adjacent structures, and ragged and ill-defined margins may be seen classically

• Disrupted and disorganized periosteum may appear “hair-on-end” or “sunburst”
• Intact periosteum, more rarely, may show an “onion-skin” pattern, presumably mediated by molecular and chemical factors released from tumor cells and immune cells
• Bone Morphogenic Protein, Alkaline Phosphatase, Osteocalcin, Endothelin, and various growth factors
Metastatic Carcinoma

- Variable radiographic appearance, with polymorphous shape and irregular, ill-defined margins usually
- However, similar to previous conditions, metastatic carcinoma can also produce a periosteal reaction in the form of new bone formation, particularly prostate and breast cancers
- In vitro cell culture studies have shown prostatic acid phosphatase and its substrate α-glycerophosphate stimulate calcification and osteogenesis in prostatic cases

Langerhans Cell Disease

- Growing evidence indicates this is a neoplastic process, and many investigators favor malignancy of Langerhans cells as opposed to histiocytes (CD1a vs. CD68)
- Intraosseous lesions may result in radiographic appearance of teeth with unsupported bone, often termed “teeth floating in space”
- New periosteal bone formation similar to aforementioned inflammatory (cytokine) neoperiostosis may be a feature
- Mainly children and young adults affected
Management of Traumatic Injuries

Ellis' classification:

• Class I: Simple fracture of the crown involving little or no dentin
• Class II: Extensive fracture of the crown involving considerable dentin but not the pulp
• Class III: Extensive fracture of the crown with a pulpal exposure
• Class IV: A fracture in which the entire crown has been lost

Vitality tests after trauma

• Thermal test- most reliable, especially in primary incisors, failure to respond to heat is indicative of pulpal necrosis
• EPT- often unreliable
• Failure of a recently traumatized tooth to respond to the pulp test is common.
• Emergency tx should be completed and the tooth should be retested in 10-14 days.
• Darkening of the tooth is a good indication of loss of vitality of the pulp.

Types of Injuries

• Ankylosis
  – This is caused by injury to the periodontal membrane and subsequent inflammation
  – The ankylosed primary tooth in the anterior segment should be removed if there is evidence of it causing delayed or ectopic eruption of the permanent successor
  – It is often detected by a “step” with the ankylosed tooth below the plane of occlusion.

• Luxation/Intrusion
  – Displaced but not intruded primary teeth should be repositioned as soon as possible to prevent interference of occlusion
  – They can be stabilized with wire and composite splint
  – Intruded teeth are left to spontaneously re-erupt
  – Severely loosened primary teeth should be removed

• Dilaceration
  – This occasionally occurs after intrusion or displacement injuries
  – The developed portion of the tooth is twisted or bent on it self, and on this new position growth progresses
  – The resulting tooth has the crown in a significantly different position from the root
• Root Fractures
  – Root fractures at the apical half of the tooth are more likely to undergo repair often without treatment
  – In order for repair to take place, the fragments must be maintained in apposition
  – Healing should take place in 3-4 weeks

• Avulsion
  – The best prognosis is for teeth replanted within a short period of time
  – Teeth should not be cleaned, disinfected, rinsed, or scaled
  – The pt or parent can be instructed to replant the tooth, or the tooth can be stored in milk or saliva
  – Reimplanted teeth are treated endodontically later
Risk Factors Associated With Dental Caries

- Susceptible tooth surface
- Acidogenic Bacteria
- Fermentable Carbohydrates (sucrose)
- Inadequate salivary flow or buffering capacity
- Low exposure to fluoride

Caries Susceptibility of Teeth

- Maxillary > mandibular arch
- First molars (upper and lower) > second molars (upper and lower) > second bicuspids (upper) > first bicuspids (upper) and second bicuspids (lower) > central and lateral incisors (upper) > canine (upper) and first bicuspids (lower) > lower anteriors
- Tooth surface: occlusal > mesial > distal > buccal > lingual

Dental Caries Classification

- Pit and fissure: class I
- Smooth surface:
  - proximal: class II, III;
  - cervical, root surface: class V

Organisms Responsible for Caries

- Streptococcus Mutans
  - S. sanguis
  - S. salivarius
- Lactobacillus
- Actinomyces viscus (Root caries)
Properties of Cariogenic Bacteria

- Survive at low pH and metabolize sugars to form acids.
- Can produce glucans from dietary sucrose. (sticky matrix).
- Glucans are sticky carbohydrates that act as a matrix for the bacteria on the enamel surface.

Role of Saliva

- Adequate flow reduces plaque accumulation.
- Calcium, phosphate, hydroxyl, and fluoride ions reduce enamel solubility and remineralize early decay.
- Bicarbonate buffering capacity of saliva reduces pH fall.
- Salivary proteins form the protective acquired pellicle
  - IgA, lysosomes, lactoperoxidase, and lactoferrin have antibacterial activity.

Role of Fluoride

- Anticaries effects are topical
- Inhibits enamel demineralization
- Enhances remineralization of the enamel after demineralization and increases acid resistance.
- The systemic benefits of fluoride are minimal.

Tooth Mineral Complexes

- During tooth germination is a carbonated apatite. (most soluble)
- Hydroxyapatite (less soluble)
- Fluorapatite (least soluble)
  - Carbonated apatite is more acid soluble than hydroxyapatite and calcium-deficient (replaced by sodium, magnesium, and zinc)
  - maturation cycle

De - Remineralization

- During demineralization carbonate is lost
- During remineralization it is replaced by OH or F ions, thereby decreasing the acid solubility.

Stephan Plot

- Experimental measurement of pH changes on enamel surfaces during exposure to fermentable carbohydrates in the presence of acidogenic bacteria (in plaque) over time
- It demonstrates the acid production of bacteria (pH decrease) with a glucose swallow and the gradual rise due to salivary buffering
Critical pH for Enamel Dissociation

- Hydroxyapatite is 5.3 - 5.5
- Fluoroapatite 4.5
- Carbonated beverages (Coke, Pepsi) have a pH at about 3.5.
- Earliest visually observable macroscopic lesion is the White spot lesion.

Differences of Enamel and Dentinal Caries

- Enamel caries is an acidogenic progression of tooth mineral dissolution
- Dentinal caries involves acid decalcification followed by proteolytic or enzymatic degeneration of the organic matrix.

Incipient Lesion Treatment

- Most early enamel lesions are capable of remineralization, or arresting, if risk factors are reduced. (diet, bacterial, and salivary analysis) followed by fluoride supplements.

Clinical Tests for Caries Susceptibility

- Ivoclar and Vivadent provide the essential components to culture and grade levels of S. mutans and lactobacilli in saliva as well as to measure salivary pH, flow rates, and buffering capacity.

Progression of Caries in Dentin

1. Infected
2. Affected
3. Translucent
4. Reparative
Caries Diagnosis

- Criteria for identification
  1. discolored softened tooth structure
  2. frank cavitation
  3. areas of radiolucency on radiographs
- Direct visual inspection with a sharp explorer and air-drying with use of magnification are the first steps of examination.
- Bitewings and periapical radiographs
- Transillumination

High-tech Diagnosis of Caries

- **Quantitative light-induced fluorescence (QFL)**
  KaVo’s DIAGNOdent probe uses red laser light to assess pit and fissure lesions (www.kavousa.com).
- **Digital imaging fiberoptic transillumination (DIFOTI)** (www.difoti.com). Images of transilluminated visible light are captured by a digital camera and computer processed.

Stabilization of Multiple Caries

1. Medical and dental history and assess risk factors.
2. Preventive measures.
3. Extraction of nonsalvageable teeth
4. Remove caries in vital teeth and Ca(OH)₂, sealed with resins or resin-reinforced glass ionomers.
5. If frank pulpal exposures, remove pulp followed by temporization. With a suitable glass ionomer material and endodontic treatment.

Stabilization of Multiple Caries

6. In very deep carious lesions, whether symptomatic or not, where pulpal exposure is to be expected, it is probably best to go directly to endodontic treatment rather than try an intermediate step of excavation and temporary stabilization.
7. Finalize a treatment plan with permanent restorations for the existing teeth and suitable provisionals for replacement of missing teeth.

Caries Detector Solutions

- Colored dye in propylene glycol base
- Differentiate infected and affected dentine
- It bonds to the denatured collagen in the infected dentin
- It is applied for 10 seconds and then rinsed
- Seek (Ultradent) and Snoop (Pulpdent)
- Green, Red

Cavity Disinfectants

- Bactericidal agent to reduce sensitivity and bacterial growth under a restoration
- Current products contain either benzalkonium chloride and EDTA or 2% chlorhexidine gluconate
Supplemental Sources of Topical Fluoride

- Public water supplies: 1ppm sodium fluoride (NaF)
- Toothpaste: regular brands contain 0.10-0.15% NaF
- Prescription: PreviDent 5000 Plus, 1.1% NaF
- Mouth rinses: Act, FluorGuard, Prevident Rinse, 0.2-0.5% NaF
- Brush-on gels/fluoride trays: Prevident, 1.1% NaF neutral pH

Contraindication of Acidulated or Stannous Fluoride

- 0.4% stannous fluoride (pH of 3.0)
- 0.2% sodium fluoride (pH of 7.0)
- Acidulated fluoride (APF) solutions
- Topical 0.4% stannous gels (Gel-Kam, Colgate)
- Remove the glaze from porcelain, glass ionomer, and composite restorations.

Indications for Fluoride Gel Applications

- High consumption of carbonated beverages
- Bulimic patients (10% female adolescents)
- Elderly and nursing home patients
- Gastric reflux patients
- Chemotherapy and radiation-treated patients

Loss of Tooth Structure

- Attrition
  - physiologic wear
- Erosion
  - loss of tooth structure by a chemical process
- Abfraction
  - loss of tooth substance by biomechanical forces

Principles for Cavity Preparation

1. Tooth anatomy, the tooth position, extent of caries, and properties of the filling material.
2. Gingival margins should end on enamel.
4. Occlusal contact not in interface.
5. Unsupported enamel should be removed.
6. Dry work field

Principles for Composite and Amalgam Preparations

- The classic cavity preparations, according to Black's principles, are not needed for contemporary bonded retained composite and amalgam restorations.
Fissurotomy
- Conservative preparation of occlusal pits and fissures using either air abrasion or special burs
- Flowable composites.
- Hybrid composites, are more difficult to place without the incorporation of voids.

Tunnel Preparation
- Conservative approach to restore class II caries
- It conserves the proximal marginal ridge
- Matrix band beforehand protects the adjacent tooth wall.

Slot Preparation
- Any narrow access to reach interproximal caries can be called a slot preparation.
- Access may be from the buccal or lingual as in a class III lesion, or from the occlusal aspect.
- The ideal is to conserve tooth structure by removing only caries and a minimal amount of tooth structure. !!!!!!!!

Micro-air Abrasion
- Pressurized abrasive powders (27-50 micron aluminum oxide) propelled at high velocity to remove tooth structure (compressed air or nitrogen tanks). The claimed advantages are less trauma and a less invasive.
- Often not requires local anesthesia.
- Conservative class I and V preparations
- Disadvantages: special high speed evacuation equipment and high cost of the units.

Air Abrasion Systems

<table>
<thead>
<tr>
<th>COMPANY/PRODUCT NAME</th>
<th>MODEL</th>
<th>TYPE</th>
<th>ABRASSION</th>
<th>PRESSURE</th>
<th>BUILT-IN COMPRESSOR</th>
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<tbody>
<tr>
<td>Air Techniques - Air Dent II CS Chairside</td>
<td>27 and 50 micron Aluminum oxide</td>
<td>High-pressure compressor</td>
<td>160 psi</td>
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<tr>
<td>Bisco, Inc. Accu-prep</td>
<td>Deluxe Chairside</td>
<td>50 micron Aluminum oxide</td>
<td>Air 40 psi</td>
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<td>Danville Engineering PrepStart Tabletop</td>
<td>27 and 50 micron Aluminum oxide</td>
<td>Air or bottled gas</td>
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<tr>
<td>J.Morita USA, Inc AdAbrader Plus</td>
<td>Tabletop</td>
<td>50 micron Aluminum oxide</td>
<td>Compressed air 100 psi</td>
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<tr>
<td>Dentsply Gendex AirTouch Tower, Desktop</td>
<td>27 and 50 micron Aluminum oxide</td>
<td>120 psi</td>
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</table>

Operative Dentistry
DEND 427 Review for NDBE II

Dental Adhesives

Santiago Moncayo, D.D.S.
Case School Of Dental Medicine 06-23-2006
Goals of Dental Bonding

- Eliminate or minimize the contraction gap of composite polymerization
- Sustain thermal expansion and contraction cycles
- Create 20-30 MPa bond strengths to enamel and dentin
- Eliminate microleakage (Stains, sensitivity and pulpal symptoms, recurrent caries, and bond failures)

Adhesive Systems Components

- acid etchant solution,
- hydrophilic primer,
- resin.

Types of Adhesive Systems Currently Available

- **Type 1.** Etchant; primer and adhesive resin applied separately as two solutions. are “all-purpose” types. They generally bond to light, dual, and self-cured composites.
- **Type 2.** Etchant; primer and adhesive applied as a single solution. Type 2 systems have nearly all-purpose capability.

Types of Adhesive Systems Currently Available

- **Type 3.** Self-etching primer (SEP) applied to dissolve smear layer and not washed off; adhesive applied separately.
- **Type 4.** Self-etching primer and adhesive applied as a single solution to dissolve and treat the smear layer simultaneously.

Dental Adhesives

<table>
<thead>
<tr>
<th>BRAND NAME</th>
<th>COMPANY</th>
<th>NUMBER OF COMPONENTS</th>
<th>DENTIN SHEAR BOND STRENGTHMPA.</th>
<th>ENAMEL SHEAR BOND STRENGTHMPA.</th>
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<tbody>
<tr>
<td>All Bond 2</td>
<td>Amalgambond Plus</td>
<td>2</td>
<td>15.8</td>
<td>34.1</td>
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<tr>
<td>Scotchbond Multipurpose</td>
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<td>19.4</td>
<td>20.3</td>
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<tr>
<td>Optibond FL 13.9</td>
<td>Bisco</td>
<td>4</td>
<td>17.6</td>
<td>17.8</td>
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<tr>
<td>Parkell</td>
<td>3M</td>
<td>3</td>
<td>19.4</td>
<td>19.8</td>
</tr>
<tr>
<td>3M Kerr</td>
<td>4</td>
<td>22.1</td>
<td>22.1</td>
<td></td>
</tr>
</tbody>
</table>

Smear Layer

- [Image of Smear Layer]
Hybrid Layer
- Multilayered zone of composite resin, and dentin, and collagen

Etching Patterns
- 35% orthophosphoric Acid
  - **Type I**: The head of the rod gets dissolved. (15 sec.).
  - **Type II**: Interprismatic areas. (25 sec.).
  - **Type III**: Surface enamel lost. (More than 25 sec.) 2 - 8 μm.

Etching Patterns
- **Recommended etching time:** 15 seconds !!!!

Bonding To Enamel

Pulpal Sensitivity
- Incomplete placement of the bonding agents
- Incomplete wetting in application of the primer agent
- Incomplete curing of the bonding agent
- Place incremental layers of wetting agent until a glossy appearance is observed
- Dentin is dried too completely

Adhesive Application Time
- In general, after applying the adhesive, 15-20 seconds should be allowed for penetration.
- Then air evaporation of the solvent (acetone or alcohol) is followed by curing (visible light-cured generally).
- This should leave a shiny dentin surface.
- If this goal is not achieved, reapplication of the adhesive should be reapplication until a shiny layer appears.
Composition of Primers

- Primers are bifunctional molecules.
  - One end is hydrophobic to bind to the adhesive
  - The hydrophilic end permeates conditioned dentin and chases the water of the moist surface, assisted by solvents (acetone or alcohol).
- Solvents evaporation need to be by air drying.
- Do not light-cure
  - Examples of primers are HEMA, 4-Meta, and PENTA.

Bonding Agents

- Bonding resins are unfilled BIS-GMA or UDMA
- Visible light-cured (VLC), auto-cured or dual-cured
- The latest generation (fifth generation) mixes the primer and adhesive for time savings.
- Prime and Bond NT (Dentsply/Caulk), 3M Single Bond; and OptiBond Solo (Kerr).
- There is a trend to add fillers to the adhesive bonding agents to enhance their physical properties

How Fillers Enhance Adhesives

- Increase the bond strength at the hybrid layer.
- Improve stress absorption at the tooth restoration interface, enabling better retention. Lower modulus of elasticity to impart added flexibility and thus relieve contraction stress due to polymerization shrinkage. The adhesive absorbs within itself some of the contraction stress.
- Help adhesive cover the dentin in one application rather than multiple applications.

Sixth Generation Systems

- This system combine the etchant and primer and adhesive into one step.
- Advantages are even depth of penetration into the dentin, minimal postoperative sensitivity, and saving time.
- Are highly technique-sensitive and use only VLC.

Sixth Generation Systems

- They are not shown enough strength to bond enamel and therefore should be considered mainly as dentin-bonding agents.
- Prompt L-Pop (3M ESPE), Panavia F. Touch and Bond (Parkell), and Clearfil SE Bond (Kuraray).

Adhesive Procedures

- To enamel: pumice surface; wash; etch 15”; wash; air dry; apply unfilled VLC resin only.
- To dentin and enamel: Clean surface; etch 15”; wash; leave moist; use VLC adhesive components in layers before composite; consider filled adhesives.
- For amalgam (dentin only): Clean surface; etch 15 seconds; wash; use VLC primer to seal tubules; self-cure resin adhesive (two-component system): pack amalgam before resin sets.
1. The condition depicted in A was discovered by the patient’s hygienist. The patient is a moderate smoker. The most likely possibility to include in a differential diagnosis is:
   A. nicotinic stomatitis
   B. lichen planus
   C. mucosal dysplasia
   D. carcinoma in-situ

2. A patient states that for almost a year now she has had a rubbery, firm, painless nodule within the substance of the parotid gland that has increased in size over several months. The condition described is MOST likely a:
   A. mucocele
   B. lymph node
   C. benign mixed tumor
   D. sialolith

3. The MOST common location for a mucous retention swelling is the:
   A. tongue
   B. gingiva
   C. lower lip
   D. upper lip

4. A young boy has ulcers in his mouth, general malaise, and an oral temperature of 102°F. The MOST probable diagnosis is which of the following?
   A. candidiasis
   B. iron deficiency
   C. herpetic stomatitis
   D. vitamin B deficiency

5. The virus that causes acute herpetic gingivostomatitis is closely related to the virus that causes:
   A. measles
   B. chickenpox
   C. mumps
   D. rubella
6. The patient shown in B presents with these asymptomatic lesions on the face which have been present for years. This most likely represents which of the following conditions?

A. shingles
B. neurofibromatosis
C. dermatosis papulosa nigra
D. lupus erythematosus

7. Which of the following lesions has the greatest malignant potential?

A. leukoedema
B. lichen planus
C. actinic keratosis
D. white sponge nevus

8. The condition pictured in C is accompanied by a photomicrograph showing the histopathologic features of the lesion. What combination from below BEST describes the lesion clinically and histologically, respectively?

A. lichen planus and mucosal dysplasia
B. hairy leukoplakia and mucositis
C. leukoplakia and mucosal dysplasia
D. squamous cell carcinoma and mucosal dysplasia

9. Carcinoma in situ, or severe epithelial dysplasia, may exhibit each of the following EXCEPT one. Which one is the EXCEPTION?

A. pleomorphism
B. invasion
C. hyperchromatism
D. abnormal mitosis

10. Radiographic examination of a healthy 20-year-old woman discloses the asymptomatic lesion shown in D. The etiology of this lesion is most likely:

A. inflammatory
B. traumatic
C. neoplastic
D. developmental
11. The lesion depicted in E was discovered on routine examination by the patient’s dentist. The most likely diagnosis is:

   A. squamous papilloma
   B. lingual tonsil
   C. traumatic ulcer
   D. irritation fibroma

12. The patient shown in F was unaware of this palatal lesion until it was noticed by her dentist. Which of the following is the correct diagnosis?

   A. squamous cell carcinoma
   B. verrucous carcinoma
   C. squamous papilloma
   D. mucous extravasation phenomena

13. The lesion shown in G was first noticed years ago by this retired lifeguard. Since then, he reports it has slightly increased in size. Upon clinical examination, the lesion is soft and blanches slightly upon diascopy. The most likely diagnosis is:

   A. melanotic macule
   B. amalgam tattoo
   C. focal melanosis
   D. varix

14. Which of the following cysts is the LEAST likely to be visible radiographically?

   A. nasopalatine
   B. lateral periodontal
   C. dentigerous
   D. nasolabial

15. The 46-year-old man depicted in H complains of ‘cracked’ lips that do not resolve with use of chapstick and have become more sensitive recently. Which of the following pharmacologic therapies would you recommend to help improve his condition?

   A. corticosteroid
   B. antihistamine
   C. antifungal
   D. antiviral
16. The gingival lesions shown in I were noticed by this immunocompromised patient a few days ago because of increasing pain in the area and ‘bad breath’ more recently. This likely represents which of the following conditions?

A. cicatricial pemphigoid
B. pemphigus vulgaris
C. acute necrotizing ulcerative gingivitis
D. chronic periodontitis

17. What is the most likely diagnosis for the asymptomatic lesion depicted in J?

A. osteoma
B. torus palatinus
C. pleomorphic adenoma
D. fibroma

18. The 18-year-old female shown in K complains of pain upon mastication that has increased over the past few days. She is likely experiencing which of the following conditions?

A. pericoronitis
B. acute necrotizing ulcerative gingivitis
C. cicatricial pemphigoid
D. erosive lichen planus

19. The successful treatment of the asymptomatic radiographic findings shown in L should involve the administration of antibiotics and endodontic therapy. This patient’s periapical x-ray strongly suggests the presence of infection.

A. Both statements are TRUE
B. Both statements are FALSE
C. The first statement is TRUE, the second is FALSE
D. The first statement is FALSE, the second is TRUE

20. The highest incidence of fibrous gingival hyperplasia is related to:

A. puberty
B. diabetes
C. leukemia
D. medications
List of Common Clinical Pathology Lesions:
(Diagnoses from Powerpoint® presentation):

Powerpoint Slide #

3. Desquamative Gingivitis
4. Lichen Planus (reticular)
6. Pleomorphic Adenoma (benign mixed tumor)
7. Nasolabial Cyst
8. Mucocele (mucous extravasation phenomena)
9. Herpes Labialis
10. Actinic Keratosis (solar keratosis)
11. Dermatosis Papulosa Nigra
12. Leukoplakia/Squamous Cell Carcinoma
13. Nasopalatine Duct Cyst (Incisive Canal Cyst)
14. Lingual Tonsils (normal anatomy)
15. Squamous Papilloma
16. Varix (varicose vein)
17. Angular Cheilitis (Candida infection)
18. ANUG
19. Palatal Torus
20. Pericoronitis
21. Periapical Cemento-Osseous Dysplasia
22. Denture Stomatitis
23. Nevus (mole)
24. Fordyce Granules (sebaceous glands)
25. Traumatic Ulcer
26. Idiopathic Osteosclerosis
27. Ephelides (freckles)
28. Dentigerous Cyst
29. Odontogenic Keratocyst histology
30. Ameloblastoma histology
31. Basal Cell Carcinoma with Linear Telangiectasia
32. Geographic Tongue (benign migratory glossitis)
33. Amalgam Tattoo
34. Seborrheic Keratosis
35. Inflammatory Papillary Hyperplasia
36. Actinic Lentigo (solar lentigo, age spot, liver spot)
37. Morsicatio Buccarum (cheek chewing, frictional keratosis)
38. Fibroma (traumatic)
39. Black Hairy Tongue
40. Melanotic Macule
41. Parulis (sinus tract)
42. Antral Pseudocyst (sinus mucocele)
43. Leukoedema
44. Aphthous Ulcer (canker sore)
45. Nicotinic Stomatitis (smoker’s palate)
46. Fissured Tongue
NBDE II Review

The Exam: Test logistics

- **Day 1**: 400 Multiple Choice Questions
  (200 a.m. + 200 p.m.)
  - General dental and specialty topics admixed
  - Diagnosis, treatment planning and management emphasis
  - Image booklet to supplement some of the questions

- **Day 2**: 200 multiple choice questions a.m.
  - 10-13 cases with 9-14 multiple choice questions each

Scores are shown as low, average, or high for each section but only one overall percentile is given at the end.

Study with the dental decks, supplemental review material, and old exams...but learn the concepts behind the questions! Questions change, but the concepts they test are similar over the years. The more you look over the material, the more comfortable you will be.

Why or When do we use drugs (clinically)?
- To control, cure, or prevent disease

Who can prescribe drugs, and Where?
-Licensed doctors, requires **DEA registration** and is **state specific**
- DEA regulates drug laws (legal Rx and illegal) in this country

What can you Rx?
- Drugs within the scope of your practice
- Must be cognizant of Controlled Substances Act
  - Drug Schedules I-V

Pharmacology I

Why or When do we use drugs (clinically)?
- To control, cure, or prevent disease

Who can prescribe drugs, and Where?
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What can you Rx?
- Drugs within the scope of your practice
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  - Drug Schedules I-V

DEA Schedules

- **Schedule I**
  - [Use illegal/restricted to research; high abuse potential; no accepted medicinal use in US]
  - Examples: hallucinogens, heroin, marijuana

- **Schedule II**
  - [Requires prescription; high abuse potential; no refills or verbal orders allowed; some states require triplicate Rx]
  - Examples: amphetamines, barbiturates, opiates (single entity, some combos)

- **Schedule III**
  - [Requires prescription; moderate abuse potential; max 5 refills/6mo; verbal orders allowed]
  - Examples: anabolic steroids, dronabinol, ketamine, opiates (some combos)

- **Schedule IV**
  - [Requires prescription; low/moderate abuse potential; max 5 refills/6mo; verbal orders allowed]
  - Examples: appetite suppressants, benzodiazepines, sedatives/hypnotics

- **Schedule V**
  - [Requires prescription or may be OTC with restrictions in some states; limited abuse potential; max 5 refills/6mo; verbal orders allowed]
  - Examples: opiate or opiate-derivative antidiarrheals and antitussives
How do we use drugs?

- **Enteral** – GI tract route of administration
  - Oral → stomach → intestines → liver (portal circulation) → heart → general circulation → target tissues
  - *Sublingual* or *Rectal* → straight into general circulation and bypasses first-pass liver metabolism

- **Parenteral** – Non-GI route of administration
  - Intravascular, intramuscular, subcutaneous → straight into general circulation and bypasses first-pass liver metabolism

How else do we use drugs?

- **Other** –
  - *Inhalation* (i.e. anesthetics, sterols for asthma)
  - *Intra-nasal* (i.e. calcitonin for osteoporosis, cocaine)
  - *Intra-thecal* (i.e. analgesics, anti-neoplastics)
  - *Topical* (i.e. anesthetics, antibiotics, antifungals)

Key Concepts of Drug Activity

- **Pharmacokinetics** – The body's effect on a drug
  - The onset of action of a drug is primarily determined by the rate of absorption
  - 4 factors that affect the absorption of drugs into the bloodstream:
  1. **Bioavailability**
     - The amount (quantity or %) that reaches the blood or plasma. Usually, a drug's major effect is produced by the amount of drug that is free in plasma.
  2. **Stability**
     - Insulin is unstable in the GI tract, hence the injections for Diabetics to bypass the enteral route

Pharmacodynamics – The drug's effect on the body

1. Absorption

3. Permeability

- pH (acid-base interactions, protonation, pKa, Henderson-Hasselbach)
  - Coated tabs (buffered)
- Gastric Emptying
  - Parasympathetic vs. Sympathetic
  - Food in the stomach delays gastric emptying and increases acid production to allow for proper digestion; drugs destroyed by acid should be taken without food when possible
- Lipid solubility (hydrophobic, non-ionized, i.e. sterols)
- Water solubility (hydrophilic, ionized or charged)
- Transport mechanisms (passive, active, or facilitated)
- Contact time, surface area, blood supply
1. Absorption

4. First-pass hepatic metabolism
   • For enteral drugs, some are inactivated by the liver before reaching systemic circulation, thus decreasing bioavailability; others drugs are activated by the liver, increasing bioavailability
   • IV (intravenous) route of administration bypasses first-pass liver metabolism, also increasing bioavailability

Can stress effect drug absorption from an enteral route?

Would you tell your patients to take Penicillin on an empty or full stomach?

Hint: Penicillin is inactivated by stomach acid. What if patient has nausea when taking it on an empty stomach?

Pharmacokinetics

- The body’s effect on a drug

1. Absorption
2. Distribution
3. Metabolism
4. Elimination

2. Distribution

• In circulation, drugs bind to plasma proteins (mainly albumin) relatively non-specifically
• Competition for plasma protein binding sites (affinity) explains some drug-drug interactions
  – i.e. sulfonamide antibiotics and warfarin anti-coagulants are highly bound to plasma proteins, so if you give a sulfonamide to a patient on chronic warfarin therapy, the sulfonamide can displace warfarin and cause dangerously high free warfarin concentrations in the blood

Test Question?

A patient is treated with drug A, which has a high affinity for albumin and is administered in amounts that do not exceed the binding capacity of albumin. A second drug, drug B, is added to the treatment regimen. Drug B also has a high affinity for albumin and is administered in amounts that are 100 times the binding capacity of albumin. Which of the following might occur after administration of drug B?

A. An decrease in tissue concentration of drug A
B. An increase in tissue concentration of drug A
C. A decrease in the half-life of drug A
D. A decrease in the volume of distribution (Vd) of Drug A

2. Distribution

• Other factors affecting drug distribution:
  – Blood flow
  – Capillary permeability
  – Drug structure
  – Affinity
  – Half-life of drug (t1/2)
  – Drug volume of distribution (Vd)
  – Hydrophobic or Hydrophilic nature of drug...
2. Distribution

**Example: Blood-Brain Barrier**

– Water-soluble molecules require carrier or transport mechanisms, or they must travel through gap junctions of cells if possible

– Lipid-soluble molecules pass more readily through cell membranes, but are also more likely to be distributed to fat cells

Can obesity be a factor in causing unequal drug distribution?

---

Pharmacokinetics

- The body's effect on a drug

1. Absorption
2. Distribution
3. Metabolism
4. Elimination

---

3. Metabolism

- Most drugs are metabolized in the liver or other tissues in a process called biotransformation, which occurs for two main reasons:
  - **Inactivation** of the drug for future excretion or elimination
  - **Activation** of the drug for desired effect

- The liver does this through:
  - Phase I reactions (cytochrome P450 red-ox, hydrolysis...) mainly activate
  - Phase II reactions (conjugation) mainly inactivate

*Note:* Neonates are deficient in conjugating enzymes. What implications does this have with respect to drug metabolism?

---

**Test Question?**

The conjugation of glucuronic acid to a drug by the liver is an example of a:

A. Cytochrome P450 reaction
B. Amination reaction
C. Phase I activation reaction
D. Phase II inactivation reaction

---

3. Metabolism

**Drug Metabolism - Pharmacokinetics**

- Zero-order (constant and independent of drug dose)
- First-order (proportional to drug dose or concentration)

**Test Question?**

Drugs showing zero-order kinetics of elimination:

A. Are more common than those showing first-order kinetics
B. Decrease in concentration exponentially in time
C. Have a half-life that is independent of dose
D. Show a plot of drug concentration versus time that is linear
Test Question?
Which one of the following is TRUE for a drug whose metabolism or elimination from plasma shows first-order kinetics?
A. The half-life of the drug is proportional to drug concentration in plasma
B. The amount eliminated per unit time is constant
C. The amount eliminated per unit time is proportional to the plasma concentration
D. A plot of drug concentration versus time is sigmoidal

Pharmacokinetics
- The body’s effect on a drug

4. Elimination
- Excretion of drug
  - Changed (metabolized by liver)
  - Unchanged (not metabolized by liver)
- The Kidney is the primary site of drug excretion and clearance through the urine
- Lungs
  - Gases
  - Garlic
- GI
  - Emesis (i.e. alcohol), Bile, Feces
- Body fluids
  - Sweat, Saliva, Tears and Breast Milk

Test Question?
Which of the following combination of diseases would have the most deleterious effects on drug metabolism and excretion?
A. CNS degeneration and Cerebral Palsy
B. Hepatic failure and adrenal insufficiency
C. Renal failure and hepatic insufficiency
D. Hepatic insufficiency and GI malabsorption

What lab tests or values could you use to help you clinically if prescribing medications to this population?
For kidney, creatinine clearance is a good measure of excretory function, or lack thereof. For liver, AST/ALT, although not really reliable clinically.

Pharmacodynamics
- The drug’s effect on the body
- Drug-receptor interactions (forces) and biochemical cascades (G-protein, cAMP)
- Non-receptor acting drugs
  - i.e. Antacids are bases that just neutralize stomach acid (what can you treat with these?)
  - i.e. Chelating drugs just bind metallic ions (what can you treat with these?)

Pharmacodynamics
Receptor Interactions:
- Agonists (inducers)
  - Efficacy
    - The maximum response that an agonistic drug can produce
  - Potency
    - The measure of how much drug is required to produce a desired effect
Receptor Interactions:
- Antagonists (competitors)
  - Competitive antagonists are reversible
  - Non-competitive antagonists are irreversible

Pharmacodynamics
- Dose-response curves give us an idea of what minimum drug dose or quantity will produce a predetermined response in a population:
  - ED$_{50}$ (Effective Dose) is the dose of drug that will produce the desired effect in 50% of the population
  - TD$_{50}$ (Toxic Dose) is the minimum dose that produces a specific toxic effect in 50% of the population
  - LD$_{50}$ (Lethal Dose) is the minimum dose that kills 50% of the population
  - TI (Therapeutic Index) is a measure of drug safety and is expressed as the following ratio:
    \[ TI = \frac{TD_{50}}{ED_{50}} \text{ or } \frac{LD_{50}}{ED_{50}} \]
    - Higher TI is better, lower is worse (value >2 is okay, less requires patient monitoring)

Test Question?
Which of the following combinations derived from dose-response curves makes for the safest drug, or the best Therapeutic Index?
A. Low ED$_{50}$ and Low TD$_{50}$
B. High ED$_{50}$ and High LD$_{50}$
C. Low LD$_{50}$ and High ED$_{50}$
D. Low ED$_{50}$ and High LD$_{50}$

THE DRUGS!
Autonomic Nervous System Drugs
- CHOLINERGIC RECEPTOR AGONISTS
  - Direct Acting
    - Acetylcholine
    - Pilocarpine
    - Carbachol
    - Edrophonium
  - Indirect Acting
    - Neostigmine
    - Physostigmine

Many of these drugs are used to treat glaucoma. Anti-cholinergic drugs are contraindicated in patients with glaucoma.
Sweat glands are innervated by acetylcholine (cholinergic), but uniquely by sympathetic post-ganglionic cholinergic receptors as opposed to parasympathetic post-ganglionic cholinergic receptors.
Atropine reduces salivary gland secretions. During what type of procedures would this be helpful clinically?

Pilocarpine, on the other hand, increases salivary secretions. This could be used to treat what common oral condition?

Test Question?
Which of the following drugs would be the most effective in treating Myasthenia Gravis?
A. Atropine
B. Scopolamine
C. Neostigmine
D. Nifedipine

Test Question?
Which one of the following drugs is useful in treating tachycardia?
A. Clonidine
B. Tyramine
C. Propanolol
D. Reserpine

How do most of these drugs effect blood pressure or hypertension?
Systolic blood pressure is decreased after the injection of which of the following drugs?

A. Reserpine
B. Tyramine
C. Dopamine
D. Clonidine
Anti-depressants

Test Question?
The tricyclic anti-depressants work by which of the following mechanisms?
A. GABA agonist
B. GABA antagonist
C. releasing norepinephrine
D. blocking norepinephrine reuptake

CNS
Parkinson’s disease
- Levodopa (dopamine) and carbidopa are used to treat Parkinson’s to compensate for lack of endogenous dopamine in the substantia nigra

Pharmacology II

Cardiovascular System Drugs
- Congestive Heart Failure (CHF)
  - Heart is unable to meet the needs of the body
  - Starling’s law: CO=CR, in CHF either output or return is impaired
  - “Congestive” because symptoms include pulmonary edema with left sided heart failure, and peripheral edema with right sided heart failure
  - Therapeutic goal is to increase cardiac output

Drugs used to treat CHF
Test Question?
All of the following classes of drugs are used to treat CHF except the following:
A. Beta-adrenergic antagonists
B. Beta-adrenergic agonists
C. Vasodilators
D. Diuretics

Anti-arrhythmic Drugs
- In arrhythmia, the heart beats too rapidly (tachycardia), too slowly (bradycardia), or responds to impulses originating from sites or pathways other than the SA node (pacemaker)
- Therapeutic goal is to normalize impulse conduction

Anti-arrhythmic Drugs
- Class I (Na+ channel blockers)
  - Lidocaine
  - Mexiletine
  - Quinidine
  - Disopyramide
  - Procainamide
- Class II (Beta-adrenergic blockers)
  - Metoprolol
  - Propranolol
- Class III (K+ channel blockers)
  - Amiodarone
- Class IV (Ca++ channel blockers)
  - Sotalol
  - Bretylium
  - Diltiazem
  - Verapamil
  - Amlodipine
  - Nifedipine

Anti-anginal Drugs
- Angina pectoris results from coronary blood flow that is insufficient to meet the oxygen demands of the body
- Therapeutic goal is to increase perfusion to the heart (vasodilating nitrates and Ca++ channel blockers) or decrease the demand (Beta-blockers)
- Significant first-pass hepatic metabolism occurs with the nitrates

Anti-anginal Drugs
- Organic Nitrates
  - Isosorbide dinitrate
  - Nitroglycerin
- Beta-blockers
  - Propranolol
- Ca++ channel blockers
  - Nifedipine (Gingival Hyperplasia side-effect)
- Diltiazem
- Verapamil

Anti-hypertensive Drugs
- HTN defined as >140/90 mmHg, affects 15% of the US population (60 million)
- Therapeutic goal is to lower BP and prevent disease sequelae, being cognizant of concomitant disease
- Multi-drug regimen may be warranted
- Compliance is the most common reason for therapy failure
  - Dentists can play an important role here
Anti-hypertensive Drugs

Anti-hypertensives

- Diuretics
- Alpha and Beta Blockers
- Ca++ channel blockers
- ACE inhibitors
- Angiotensin II Antagonists

Test Question?

Which of the following class of drugs is NOT used to treat hypertension?

A. Diuretics
B. ACE inhibitors
C. Alpha agonists
D. Beta antagonists

Drugs affecting Blood

- The drugs useful in treating blood dyscrasias cover 3 important dysfunctions:
  - Thrombosis
  - Bleeding
  - Anemia

What could you use to treat each of these abnormalities based on your knowledge of physiology?

Drugs affecting Blood

Drugs affecting Blood

- Thrombosis Tx
  - Thrombolytic Agents
  - Anti-coagulants
  - Platelet Inhibitors
- Bleeding Tx
  - Vitamin K
  - Protamine Sulfate
  - Aminocaproic Acid
- Anemia Tx
  - Iron
  - Folic Acid
  - Vitamin B12
  - Erythropoietin

Note: Hydroxyurea is used to treat Sickle Cell Anemia!

Drugs affecting the Respiratory System

- What do the lungs do?
- What type of drugs can affect that?
Drugs affecting the Respiratory System

- Drugs used to treat Allergic Rhinitis
  - Anti-histamines (H₁)
  - Corticosteroids
  - Alpha-adrenergic agonists (vasoconstricts)
- Drugs used to treat Asthma:
  - Beta-adrenergic agonists (bronchodilates)
  - Corticosteroids
  - Theophylline (coffee, tea)

- Drugs used to treat COPD:
  - Corticosteroids
  - Beta-adrenergic agonists

- Drugs used to treat Cough:
  - Opiates (suppress CNS cough centers)

Drugs affecting the Kidney

- What do the kidneys do?
- What type of drugs can affect that?

Drugs affecting the GI System

- Drugs used to treat Peptic Ulcer
  - Proton pump inhibitors
    - Omeprazole
    - Lansoprazole
  - H₂-receptor antagonists
    - Cimetidine
    - Ranitidine
    - Famotidine
  - Antimicrobial
    - Amoxicillin
    - Tetracycline
    - Metronidazole

- Drugs used to treat Peptic Ulcer
  - Antacids
    - Magnesium hydroxide (milk of magnesia)
    - Calcium carbonate (Tums®, Rolaid®)
    - Aluminum hydroxide
    - Sodium bicarbonate
  - Anti-muscarinic agents
    - Hyoscyamine
    - Pirenzepine
### Drugs affecting the GI System

- **Drugs used to treat Diarrhea:**
  - Anti-diarrheals
    - Kaolin
    - Pectin
    - Methylcellulose
- **Drugs used to treat Constipation:**
  - Laxatives
    - Castor oil
    - Senna
    - Aloe
    - Glycerine

### Compensatory Drugs

Normal physiology is key to understanding these drug effects:

- Thyroid?
- Pancreas?
- Pituitary?
- Adrenals? (all 3 layers)

### Anti-inflammatory Drugs

NSAID's are less dangerous than chronic steroidal anti-inflammatory drugs:

- Aspirin (Bayer®)
- Diclofenac
- Etodolac
- Fenoprofen
- Ibuprofen (Advil®)
- Indomethacin
- Naproxin
- Sulindac
- Tolmetin

**Non-narcotic analgesics:**
- Acetaminophen (Tylenol®)
- Phenacetin

### Test Question?

Which of the following NSAID's is not anti-inflammatory?

A. ASA (salicyclic acid)  
B. Ibuprofen  
C. Naproxen  
D. Acetaminophen

### Anti-microbial Drugs

- **Antimycobacterials**
  - INH, Rifampin, Ethambutol, Dapsone
- **Antivirals**
  - Acyclovir, Famiclovir, Ganciclovir
  - Vidarabine, Rimantadine, Amantadine, Ribavirin
  - Interferon (Hepatitis)
  - Zidovudine, Zalcitabine, Stavudine, Didanosine (HIV)

- **Antiprotozoals**
  - Quinolones, Metronidazole

### Test Question?

Which of the following drugs is useful for treating Hepatitis C?

A. Ganciclovir  
B. Interferon  
C. Acyclovir  
D. Famiclovir
Anti-microbial Drugs

- **Antifungals**
  - **Polyenes:**
    - Amphotericin B (systemic)
    - Nystatin (topical)
  - **Imidazoles:**
    - Ketoconazole (systemic)
    - Clotrimazole (systemic or topical, Mycelex®)
    - Miconazole
    - Itraconazole
    - Fluconazole
  - **Griseofulvin**
    - Disrupts fungal mitotic spindle formation
    - Used to treat dermatophytic infections

Test Question?

A significant difference between nystatin and amphotericin B is that:

A. They are different types of antifungals
B. One is effective against candidiasis and one is not
C. One is administered topically and the other systemically
D. Only one of them acts on the fungal cell membrane

Antibiotics

- **Inhibition of Translation or Protein Synthesis:**
  - Chloramphenicol, Erythromycin , Tetracyclines
- **Inhibition of DNA Replication or Transcription:**
  - Quinolones, Rifampin, Doxorubicin
- **Injury to cell membrane:**
  - Polymyxin B
- **Cidal Static**

Local Anesthetics

- **Amides:** [aniline derivatives]
  - articaine, bupivacaine, dibucaine, levobupivacaine, lidocaine, mepivacaine , prilocaine, ropivacaine
- **Esters:** [PABA derivatives]
  - benzocaine, butamben, chloroprocaine, cocaine, procaine, proparacaine, tetracaine
- **Hypersensitivity info:**
  - Ester allergy more common; cross-sensitivity between classes rare; consider paraben or bisulfite sensitivity if apparent allergy to both classes

General Anesthetics

- **3 stages:**
  - Induction, Maintenance, Recovery
  - Induction and Pre-anesthetic medication regimens can use:
    - Benzodiazepines
    - Opioids
    - Anticholinergics
    - Antiemetics
    - Antihistamines

- **Maintenance:**
  - Today mainly volatile inhalation gases
    - Enflurane
    - Halothane
    - Isoflurane
    - Methoxyflurane
    - NO
- **Recovery:**
  - Reverse of induction, withdrawal of drugs for redistribution, counter-acting med's prn
### Antibiotic Premedication (Endocarditis Prophylaxis-Adult)

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#### Standard regimen

**For orodental, respiratory, esophagogastric:**

- **Dose:** amoxicillin 2 g PO; Amoxicillin 2 g IM/IV

**For GU, GI (not esoph):**

- **Dose:** ampicillin 2 g PO, cephalexin 1.5 g IM/IV, azithromycin 600 mg PO, clarithromycin 900 mg PO

**For orodental, respiratory, esophagogastric, GU, GI:**

- **Dose:** amoxicillin 2 g PO, cephalexin 1.5 g IM/IV, azithromycin 600 mg PO, clarithromycin 900 mg PO

#### PCN allergy

- **Dose:** clindamycin 600 mg PO/IV; Cefuroxime 500 mg PO, cefazolin 1 g IM/IV, azithromycin 500 mg PO, clarithromycin 500 mg PO

#### High risk

- **Dose:** ampicillin 2 g IM/IV and gentamicin 1.5 mg/kg within 30min before procedure, then ampicillin 1 g IM/IV or amoxicillin 1 g PO 6h later.

- Info: prosthetic, bioprosthetic, homograft valves; previous endocarditis; complex cyanotic congenital heart disease; surgical pulmonary shunts

#### High risk, PCN allergy

- **Dose:** vancomycin 1 g IV, gentamicin 1.5 mg/kg IM/IV

#### Moderate risk

- **Dose:** amoxicillin 2 g PO, cephalexin 2 g PO, cefuroxime 1.5 g IM/IV, azithromycin 500 mg PO, clarithromycin 500 mg PO

#### Moderate risk, PCN allergy

- **Dose:** clindamycin 600 mg PO/IV; Cefuroxime 500 mg PO, cefazolin 1 g IM/IV, azithromycin 500 mg PO, clarithromycin 500 mg PO

#### Moderate risk, PCN allergy

- **Dose:** clindamycin 600 mg PO/IV; Cefuroxime 500 mg PO, cefazolin 1 g IM/IV, azithromycin 500 mg PO, clarithromycin 500 mg PO

### Antibiotic Premedication (Endocarditis Prophylaxis-Child)

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#### Standard regimen

**For orodental, respiratory, esophagogastric:**

- **Dose:** amoxicillin 50 mg/kg (max 2 g) PO; Amoxicillin 50 mg/kg (max 2 g) IM/IV

**For GU, GI (not esoph):**

- **Dose:** ampicillin 50 mg/kg (max 2 g) PO; cephalexin 50 mg/kg (max 2 g) PO, cefuroxime 25 mg/kg (max 1 g) IM/IV, azithromycin 15 mg/kg (max 600 mg) PO, clarithromycin 15 mg/kg (max 600 mg) PO

**For orodental, respiratory, esophagogastric, GU, GI:**

- **Dose:** amoxicillin 50 mg/kg (max 2 g) PO, cephalexin 50 mg/kg (max 2 g) PO; cefuroxime 25 mg/kg (max 1 g) IM/IV, azithromycin 15 mg/kg (max 600 mg) PO, clarithromycin 15 mg/kg (max 600 mg) PO

#### PCN allergy

- **Dose:** clindamycin 20 mg/kg (max 600 mg) PO/IV; Cefuroxime 50 mg/kg (max 2 g) PO, cefazolin 25 mg/kg (max 1 g) IM/IV, azithromycin 15 mg/kg (max 600 mg) PO, clarithromycin 15 mg/kg (max 600 mg) PO

#### High risk

- **Dose:** ampicillin 50 mg/kg (max 2 g) IM/IV and gentamicin 1.5 mg/kg (max 120 mg) IM/IV within 30min before procedure, then ampicillin 25 mg/kg (max 2 g) IM/IV or amoxicillin 25 mg/kg (max 2 g) PO 6h later.

- Info: prosthetic, bioprosthetic, homograft valves; previous endocarditis; complex cyanotic congenital heart disease; surgical pulmonary shunts

#### High risk, PCN allergy

- **Dose:** vancomycin 20 mg/kg (max 1 g) IV and gentamicin 1.5 mg/kg (max 120 mg) IM/IV

#### Moderate risk

- **Dose:** amoxicillin 50 mg/kg (max 2 g) PO; Amoxicillin 50 mg/kg (max 2 g) IM/IV

#### Moderate risk, PCN allergy

- **Dose:** clindamycin 20 mg/kg (max 600 mg) PO/IV; Cefuroxime 50 mg/kg (max 2 g) PO, cefazolin 25 mg/kg (max 1 g) IM/IV, azithromycin 15 mg/kg (max 600 mg) PO, clarithromycin 15 mg/kg (max 600 mg) PO

#### Moderate risk, PCN allergy

- **Dose:** vancomycin 20 mg/kg (max 1 g) IV.
PROSTHODONTICS
George Bryon Craig DDS

General Considerations  (21)
- Diagnosis and treatment planning
- Preprosthodontic treatment
- Maxillomandibular relations
- Impressions and casts
- Esthetics and Phonetics
- Restorative implantology

Complete and Removable Partial Denture Prosthodontics (8)
- Design of prosthesis and mouth preparation
- Occlusion
- Dental Materials
- Insertion and postinsertion

Complete Denture
- Crown & Bridge
- Impression Materials
- Miscellaneous
- Occlusion/Temporomandibular Joint
- Porcelain
- Removable Partial Denture

Fixed Partial Prosthodontics (16)
- Design of Prosthesis and mouth preparation
- Occlusion
- Ceramic techniques
- Dental Materials
- Insertion and postinsertion
Excessive vertical dimension may result in:
- poor denture retention.
- Drooping of the corners of the mouth.
- Creases and wrinkles around the lips.
- Trauma to the underlying supporting tissues. CORRECT

Overextension of a mandibular denture base in the distofacial area will cause dislodgment of the denture during function as the result of the action of the:
- masseter muscle. CORRECT
- buccinator muscle.
- Pterygomandibular raphe.
- Superior pharyngeal constrictor muscle.

The distal palatal termination of the maxillary complete denture base is dictated by the:
- tuberosity.
- fovea palatinae.
- Maxillary tori.
- Vibrating line. CORRECT
- Posterior palatal seal.

An excessive vertical dimension of occlusion in a patient with complete dentures will adversely affect:
- retention.
- Protrusion.
- Centric relation.
- Balanced occlusion.
- Interocclusal clearance. CORRECT

Placement of maxillary anterior teeth in complete dentures too far superiority and anteriorly might result in difficulty in pronouncing:
- “f” and “v” sounds. CORRECT
- “d” and “t” sounds.
- “s” and “th” sounds.
- Most vowels.

Papillary hyperplasia in a denture-wearing patient results primarily from:
- overextension of the lingual flange.
- Inadequate eccentric occlusal contact.
- An inappropriate relief chamber on the maxillary denture. CORRECT
- Invasion of soft tissue by Candida albicans.
- An unpolished tissue surface on the maxillary denture.
The bearing area of the maxillary denture of an elderly patient shows hyperplastic tissue over the entire ridge. Treatment for this condition is to
- remove surgically all the hyperplastic tissue.
- Make an impression immediately in order to compress the entire area.
- Instruct the patient to leave the denture out of the mouth for several months.
- Use tissue treatment material for several weeks before making an impression. CORRECT

A generalized inflammatory condition in the stressbearing mucosa may be caused by (a) faulty occlusion; (b) ill-fitting dentures; (c) wearing the dentures for 24 hours consecutively; (d) an overclosed occlusal vertical dimension.
- (a) and (b) only
- (a), (b) and (c) CORRECT
- (a) and (c) only
- (b), (c) and (d)
- All of the above

Proper lip support for a patient with complete dentures is provided primarily by the
- convex surface of the labial flange.
- Festooned carvings on the facial surface.
- Thickness of the border in the vestibule.
- Facial surfaces of teeth and simulated attached gingiva. CORRECT

A balanced occlusion in maxillary and mandibular complete dentures exists when
- opposing teeth contact in centric occlusion.
- Opposing teeth contact in centric occlusion, working, balancing and protrusive positions. CORRECT
- Incisors contact without contact of posterior teeth in a protrusive position.
- Facial cusps touch in working position without contact on balancing cusps.

When testing the arrangement of teeth at the trial insertion of complete dentures, the lower lip should, when pronouncing the letter "f" as in fifty,
- be anterior to maxillary incisors.
- Be posterior to maxillary incisors.
- Not come near maxillary incisors.
- Contact lightly the incisal edges of maxillary incisors. CORRECT

The usual cause of contacting or clicking of posterior teeth when a patient speaks is
- decreased vertical dimension of occlusion
- increased vertical dimension of occlusion. CORRECT
- posterior teeth set too far lingually.
- Posterior teeth set too far facially.
Excessive vertical dimension of occlusion may result in
- poor denture retention.
- Increased interocclusal distance.
- Drooping of the corners of the mouth.
- Creases and wrinkles around the lip.
- Trauma to underlying supporting tissues. CORRECT

A patient who wears complete dentures is having trouble pronouncing the letter "C". This is probably caused by
- too thick a palatal seal area.
- Too thick a base in the mandibular denture.
- Incorrect positioning of maxillary incisors. CORRECT
- Improper positioning of mandibular incisors.

Proper lip support for a patient with complete dentures is provided primarily by the
- convex surface of the labial flange.
- Rounded contours of interdental papillae.
- Proper pronunciation of sibilant sounds.
- Thickness of the border in the vestibule.
- Facial surfaces of teeth and simulated attached gingiva. CORRECT

In determining the posterior limit of a maxillary denture base, which of the following is on the posterior border?
- Hamular notch. CORRECT
- Hamular process
- Fovea palatine
- Vibrating line
- Pterygomandibular raphe

Treatment of choice for a patient with a maxillary complete denture with severe bilateral tuberosity undercuts is to
- remove both tuberosity undercuts.
- Reduce the tissue bilaterally.
- Reduce the tissue on one side only, if possible. CORRECT
- None of the above. No treatment is necessary

During postinsertion adjustment, errors in occlusion may be checked most accurately by
- having the patient leave the dentures out of the mouth for 24 hours.
- Directing the patient to close the jaws, bringing the teeth into occlusion.
- Having the patient close in occlusion and making a transfer record to the articulator.
- Remounting the dentures on the articulator using remount casts and new interocclusal records. CORRECT
The error that most frequently contributes to poor esthetics of dentures is the practice of placing maxillary anterior teeth
- following the smile line.
- Too far below the lip line.
- Directly over the edentulous ridge. CORRECT
- Too far to the facial of the edentulous ridge.
- Too far to the lingual of the edentulous ridge.

When constructing complete dentures, the ala tragus line must be parallel to
- Frankfort horizontal plane
- The maxillary posterior occlusal rims. CORRECT
- The mandibular posterior occlusal rims.

A plaster index is used to
- preserve face bow transfer CORRECT
- maintain vertical dimension of occlusion
- maintain bite registration

Which one of the following is the most important factor for providing retention for complete dentures?
- cohesion
- adhesion
- peripheral seal CORRECT
The retentive characteristics of a full crown may be enhanced by (a) using glass ionomer cement; (b) using zinc phosphate cement; (c) adding pinholes in the preparation; (d) adding grooves parallel to the path of draw; (e) maximizing the parallelism of the axial walls.

- (a), (c) and (d)
- (a), (d) and (e)
- (b), (c) and (d)
- (b), (c) and (e)
- (c), (d) and (e) CORRECT
- All of the above

What is the most accurate way of checking the occlusion for a fixed prosthesis?

- articulating paper
- shimstock CORRECT
- patient information

How far should implants be placed from one another?

- 3mm CORRECT
- 4mm
- 5mm
- 7mm

The ideal time to wait for osseointegration of an implant to take place is

- 3 months
- 6 months CORRECT
- 9 months
- 12 months

Impression Materials

Impression material with least tear resistance

- rubber base
- irreversible hydrocolloid
- reversible hydrocolloid CORRECT
What is the impression material with the best dimensional stability 24 hours after taking the impression?
- polyvinyl siloxane CORRECT
- reversible colloid
- irreversible colloid

At which of the following positions is sibilant sound usually produced?
- rest position
- occluding position
- open form rest position
- between rest and occluding positions. CORRECT

The lateral pterygoid muscle functions to (a) elevate the mandible; (b) protrude the mandible; (c) lift the mandible from the pterygoid plate; (d) move the mandible to the opposite side.
- (a) and (b)
- (a) and (c)
- (a) and (d)
- (b) and (c)
- (b) and (d) CORRECT
- (c) and (d)

GOLD CASTING ALLOYS
- Type I – soft gold-for inlays
- Type II – medium- inlays
- Type III – hard – onlays and crowns
- Type IV – extra hard w/low fusing temp – partial dentures
- Ceramic-metal restorations (contain iron, tin, indium)

When do you clean zinc phosphate cement from crown margins?
- immediately
- 4 hours after the cement has set
- after the cement has set completely CORRECT
- the next day
The proper zone of a gas-air blowpipe flame used for melting casting gold alloys is
- the reducing zone **CORRECT**
- the oxidizing zone
- the zone closest to the nozzle
- a combination of oxidizing and reducing zones

The property that most closely describes the ability of a cast gold inlay to be burnished is
- elastic limit
- ultimate strength
- percentage elongation. **CORRECT**
- modulus of resilience
- modulus of elasticity

In mixing zinc phosphate cement, which clinical variable has the greatest effect on the strength of the cement?
- spatulation time.
- Liquid-powder ratio **CORRECT**
- Temperature of the mixing slab
- Number and size of powder increments

Group function occlusion in an existing dentition is characterized by having (a) no balancing side contacts; (b) working side contacts from canine to third molar; (c) a long centric from centric relation to centric occlusion; (d) canine rise in protrusion; (e) total balance in lateral excursion.
- (a) and (b) only **CORRECT**
- (a), (b), (c), and (d)
- (a), (b), and (d) only
- (b), and (d) only
- (c), (d) and (e)
- (c), and (e) only

In a restorative problem involving all teeth in the mouth, the protrusive condylar path inclination has its primary influence on
- incisal guidance.
- Anterior teeth only.
- Mesial inclines of mandibular cusps and distal inclines of maxillary cusps. **CORRECT**
- Mesial inclines of maxillary cusps and distal inclines of mandibular cusps.
Best way to image TMJ
- CT
- MRI CORRECT
- High pan
- Lateral oblique

Class II malocclusion
- Division I: is when the maxillary anterior teeth are proclined and a large overjet is present
- Division II: is where the maxillary anterior teeth are retruded and a deep overbite exists.

Classification of malocclusion
June 2, 2004
Dr. Robert Gallois


- The overlap of the cusps helps to keep the soft tissue of the tongue and cheeks out from the occlusal tables, preventing self-injury during chewing.

Overjet

- The amount of horizontal (overjet) and vertical (overbite) can significantly influence mandibular movement and thus influence the cusp design of restorations.
Overbite

The TMJ and its influence

- Condyle
- Articular Disk (superior and inferior joint spaces)
- Articular eminences

TMJ

Mandibular Movements

- Rotation (superior joint space)
- Translation (inferior joint space)
- Immediate side shift (working side in lateral excursion)

Rotation and Translation

Side Shift
Planes of Motion

- Sagital
- Frontal
- Horizontal

Sagital (Posselt's diagram)

Frontal

Horizontal

Types of Occlusion we use

- Canine guidance
- Group function
- Balanced occlusion

Canine Guidance
Canine Guidance

Group Function

Balanced Occlusion
- Used in denture patients
- A minimum of three point bilateral supporting contact occurs between the maxillary and mandibular teeth at all times in lateral and protrusive excursions (compensating curve)

Compensating Curve

Porcelain

86/11

The phenomenon where porcelain appears different under varying light conditions is
- metamerism. CORRECT
- translucency.
- Transmittance
- Opacification
- Refractive optics
Which of the following are causes of separation or fracture of the porcelain from the metal in the metal-ceramic technique? (a) Poor metal framework design; (b) Excessive porcelain condensation; (c) Centric occlusal contacts entirely on porcelain; (d) Contamination of metal prior to opaque application
- (a), (b) and (d)
- (a) and (c)
- (a) and (d) only
- (b) and (d) only CORRECT

A properly designed rest on the lingual surface of a canine is preferred to a properly designed rest on the incisal surface because
- less leverage is exerted against the tooth by the lingual rest. CORRECT
- The enamel is thicker on the lingual surface.
- Visibility of as well as access to the lingual surface is better.
- The cingulum of the canine provides a natural surface for the recess.

The most important function of an indirect retainer is to prevent
- tissue resorption.
- Occlusal interferences.
- Movement of the denture base toward the tissue.
- Movement of the teeth after orthodontic treatment.
- Movement of a distal extension base away from the tissues. CORRECT

Clasps should be so designed that, upon insertion or removal of a removable partial denture, the reciprocal arms contact the abutment teeth when the retentive arms engage the height of contour in order to
- permit insertion and removal without applying excessive force. CORRECT
- assure complete seating of the framework
- prevent distortion of the clasps.
- All of the above.

Which of the following problems may occur in a patient with a maxillary removable partial denture if the palatal bar is made too thick?
- Difficulty in pressing food backward for swallowing. CORRECT
- Poor dissipation of force because of excessive rigidity
- Irritation of the palatal tissues
- Distortion under occlusal stress
- Injury to the abutment teeth
In designing a retainer on a noncarious mandibular first premolar abutment with a short clinical crown, which of the following restorations is most appropriate?

- An inlay
- A full crown **CORRECT**
- An MOD onlay
- A reverse ¾ crown

The most frequent cause of tissue soreness along the mucobuccal area of a removable partial denture is

- use of anatomic teeth.
- A centric prematurity.
- Heavy balancing contact.
- Extension of the denture border. **CORRECT**
- Lack of rigidity of the major connector.

When a removable partial denture is completely seated, the retentive terminals of the retentive clasp arms should be

- passive and applying no pressure on the teeth. **CORRECT**
- contacting the abutment teeth only in the suprabulge areas.
- Resting lightly on the height of contour line on the abutment teeth.
- Applying a definite, positive force on the abutment teeth in order to prevent dislodgment of the removable partial denture.

Which of the following is likely to occur under the distal extension maxillary partial denture of a patient with Paget's disease?

- The bone will tend to expand and the partial denture will have to be remade periodically. **CORRECT**
- The bone is like "cottonwool" and will be resorbed rapidly, thus, making frequent rebasing necessary.
- The bone will become very dense and hard, thus, soreness of the basal seat is likely to occur.
- Nothing will occur because maxillary bone is not usually affected.

Indirect retention is designed to

- stabilize tooth-borne removable partial dentures.
- Engage an undercut area of an abutment tooth.
- Help resist tissueward movement of an extension base partial denture.
- Help resist dislodgment of an extension base partial denture in an occlusal direction. **CORRECT**

**KENNEDY CLASSIFICATIONS**

- Class I – bilateral distal extension
- Class II – unilateral distal extension
- Class III – unilateral tooth borne edentulous area
- Class IV – bilateral (crossing midline) edentulous area (tooth borne)
When placing an I-clasp on a premolar for a distal extension RPD, the I-bar moves and under occlusal forces.
- occlusally and distally
- occlusally and mesially
- apical and distal
- apical and mesial CORRECT

A patient wearing a new bilateral RPD complains of soreness in tissue bearing areas 24 hours after insertion. The most likely cause would be
- occlusal discrepancies CORRECT
- over extended denture
- under extended denture
- allergy
RADIOGRAPHIC PATHOLOGY

I. DEFINITIONS

- “Radiographic appearances are governed by anatomic or physiologic changes in the presence of disease processes. Radiologic ‘diagnosis’ is founded on knowledge of these alterations, the prerequisite being awareness of disease mechanisms.”  
  H.M. Worth

II. THE RADIOGRAPHIC REPORT

- Patient name, age, ethnicity, referring physician, and date of radiographs

- Radiographic Procedure (brief but more descriptive for invasive procedures)

- Radiographic Findings (objective info: location/anatomy/structural effects)
  a. Anatomy: epicenter (above/below/in the canal), local/generalized, monostotic/polyostotic
  b. Shape: hydraulic (cysts), scalloping, regular/irregular
  c. Internal: density (opaque/lucent/mixed), trabeculation, septation, mineralization/calcification (amorphous/discrete/grainy), geographic radiolucency or hydraulic/cystic radiolucency
  d. Periphery: borders discrete or well-defined vs. blending or permeative, cortication, sclerosis, capsule
  e. Behavior: space occupying, displacing, destroying, expanding, or osteo-inducing such as in new periosteal bone formation

- Interpretation/Impression (subjective DDx: may include clinical or surgical findings, histologic findings, or other diagnostic procedures)

III. IMAGING MODALITIES (pre-biopsy preferred)

A. Panoramic and Occlusal Radiographs
  i. Together help simulate CT coronal and axial sections, especially in cases of cortical expansion/periosteal reaction.
  ii. Useful when cost or access to more advanced imaging a factor, or follow-up cases…aka: “poor man’s CT”

B. Computerized Tomography (standard)
  i. Acquired Coronal (not corrected), Axial, and Sagittal.
  ii. Contrast (ie: Gadolinium) can enhance lesional features and is essential for neoplastic lesions
C. **Magnetic Resonance Imaging (MRI)**
   i. Soft tissue imaging modality based on proton spin and magnetic moments of hydrogen ions (T1 and T2 weighted)
   ii. Not good for bone pathology because hydrogen ions in bone are bound and not free to spin and relax.

D. **Nuclear Medicine** (adjunct, still evolving)
   i. Radiopharmaceutical (technetium) gamma photon detection system which is utilized for identifying areas of increased metabolic activity – such as in neoplasia, septic arthritis, metabolic bone disease, active condylar hyperplasia, and osteomyelitis (except in chronic sclerosing phase in which CT’s are more ideal)

E. **Positron Emission Tomography** (adjunct, still evolving)
   i. FDG (glucose analogue) shows increased activity in areas with high metabolic (glycolytic) activity – such as in osteomyelitis, hyperparathyroidism, or neoplasia metastases or follow-up.

F. **TMJ Tomography**
   i. Imaging modality for various joint conditions ranging from reactive to neoplastic.

IV. **CONDITIONS**

- Correlate with clinical and histopathologic findings

A. **Developmental**
   i. Symmetry, often asymptomatic, long history, little or no change over time

B. **Neoplastic**
   i. Malignant: Infiltrative growth pattern, ragged, poorly demarcated or ill-defined, paresthesia
   ii. Benign: Slow growth, uniform, well-demarcated or well-defined

C. **Reactive/Inflammatory**
   i. Inflammatory symptomatology if any, shorter history, more common
RADIOGRAPHIC PATHOLOGY OF THE HEAD AND NECK

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Looking for abnormalities: Requires knowledge of normal anatomy first, what constitutes a good film or image, and why the imaging study is being done clinically.

Radiolucency, Opacity, or mixed…

Differential Diagnostic process: Based on normal anatomy, then identifying abnormality as possibly an Odontogenic Cyst/Tumor, Neurovascular lesion, Non-Odontogenic Cyst/Tumor, or other condition…depending on the epicenter relationship to anatomic structures like the IA Canal.

Differential Diagnosis: Mandibular Radiolucencies Within the IA Canal

Neurovascular Lesion
• Benign:
  – Neurofibroma
  – Neuroma
  – Hemangioma
• Malignant:
  – Neurofibrosarcoma
  – Neurogenic Sarcoma
  – Angiosarcoma

Differential Diagnosis: Mandibular Radiolucencies Above the IA Canal (excludes infections causing apical lesion)

• Odontogenic Cysts
  – Dentigerous Cyst (often contains crown of impacted tooth)
  – Odontogenic Keratocyst (OKC)
  – Lateral Periodontal Cyst
  – Periapical Cyst
  – Calcifying Odontogenic Cyst (COC)

• Odontogenic Tumors
  – Ameloblastoma
  – Adenomatoid Odontogenic Tumor
  – Calcifying Epithelial Odontogenic Tumor (mixed lucency-opacity)
  – Odontoma (central opacity with peripheral lucency)
  – Odontogenic Myxoma (multi-locular lucency)
Dentigerous (Developmental) Cyst

Odontogenic Myxoma

Lateral Periodontal Cyst

Residual Cyst
Calcifying Odontogenic Cyst

Odontomas (compound)
**Differential Diagnosis:**

**Mandibular Radiolucencies Below the IA Canal**

- **Bone Tumors**
  - Metastatic Carcinoma
  - Osteosarcoma
- **Bone Cysts**
  - Stafne bone defect (not a true cyst, but actually a salivary gland depression in the bone – no Tx, follow)
  - Traumatic Bone Cyst
  - Aneurysmal Bone Cyst (ABC)
- **Bone Reactive / Inflammatory**
  - Osteomyelitis
  - Giant Cell Reaction

* Except for the Stafne defect, most of the lesions above often appear above the IA canal also, highlighting the fact that most lesions in the lower jaw occur above the IA canal.

Some small but important opacities…

**NO! CT scan or periodic radiographic evaluation**
THE ROLE OF ADVANCED IMAGING IN DIFFERENTIATING BONE PATHOSES WITH OSTEOGENIC POTENTIAL, such as in cases demonstrating new periosteal bone formation

PERIOSTEAL REACTIONS IN THE FORM OF NEW BONE FORMATION
- Osteomyelitis
  - (proliferative periostitis)
- Osteosarcoma
- Metastatic Carcinoma
- Langerhans Cell Disease
Periosteal Reactions

- Varying etiopathogenesis
  - Ranging from reactive to neoplastic
- Result is varying osteoblastic (forming) and osteoclastic (resorbing) activity
  - Physiologically/molecularly that is evident histopathologically also
- Demonstrates radiographic appearance likened to an "onion-skin" or "hair-on-end" pattern

Conditions in which new periosteal bone formation may be a feature

- Osteomyelitis
  - Proliferative Periostitis (Garrè’s)
- Osteosarcoma
- Metastatic Carcinoma
- Langerhans Cell Disease

Osteomyelitis – Proliferative Periostitis

- Hypothesized that acute osteomyelitis, or inflammation of medullary bone, which is mainly lytic in nature, (from infection, trauma, etc…) spreads to the periosteum
- Inflammatory cytokines then stimulate cortical resorption, while inflammatory exudate also lifts the periosteum and induces new bone formation which occurs parallel/lamellar to cortex, accounting for unique presentation
Osteosarcoma

• Periosteal, Parosteal, and Gnathic in H&N
• Rare cases associated with Paget's disease and Cemento-Osseous dysplasia
• Radiolucent, radiopaque, or mixed radiographic appearance
• Lytic, loss of lamina dura, widening of PDL, destruction of adjacent structures, and ragged and ill-defined margins may be seen classically

• Disrupted and disorganized periosteum may appear “hair-on-end” or “sunburst”
• Intact periosteum, more rarely, may show an “onion-skin” pattern, presumably mediated by molecular and chemical factors released from tumor cells and immune cells
• Bone Morphogenic Protein, Alkaline Phosphatase, Osteocalcin, Endothelin, and various growth factors
Metastatic Carcinoma

- Variable radiographic appearance, with polymorphous shape and irregular, ill-defined margins usually
- However, similar to previous conditions, metastatic carcinoma can also produce a periosteal reaction in the form of new bone formation, particularly prostate and breast cancers
- *In vitro* cell culture studies have shown prostatic acid phosphatase and its substrate α-glycerophosphate stimulate calcification and osteogenesis in prostatic cases

Langerhans Cell Disease

- Growing evidence indicates this is a neoplastic process, and many investigators favor malignancy of Langerhans cells as opposed to histiocytes (CD1a vs. CD68)
- Intraosseous lesions may result in radiographic appearance of teeth with unsupported bone, often termed “teeth floating in space”
- New periosteal bone formation similar to aforementioned inflammatory (cytokine) neoperiostosis may be a feature
- Mainly children and young adults affected
Management of Traumatic Injuries

Ellis’ classification:

- Class I: Simple fracture of the crown involving little or no dentin
- Class II: Extensive fracture of the crown involving considerable dentin but not the pulp
- Class III: Extensive fracture of the crown with a pulpal exposure
- Class IV: A fracture in which the entire crown has been lost

Vitality tests after trauma

- Thermal test- most reliable, especially in primary incisors, failure to respond to heat is indicative of pulpal necrosis
- EPT- often unreliable
- Failure of a recently traumatized tooth to respond to the pulp test is common.
- Emergency tx should be completed and the tooth should be retested in 10-14 days.
- Darkening of the tooth is a good indication of loss of vitality of the pulp.

Types of Injuries

- Ankylosis
  - This is caused by injury to the periodontal membrane and subsequent inflammation
  - The ankylosed primary tooth in the anterior segment should be removed if there is evidence of it causing delayed or ectopic eruption of the permanent successor
  - It is often detected by a “step” with the ankylosed tooth below the plane of occlusion.

- Luxation/Intrusion
  - Displaced but not intruded primary teeth should be repositioned as soon as possible to prevent interference of occlusion
  - They can be stabilized with wire and composite splint
  - Intruded teeth are left to spontaneously re-erupt
  - Severely loosened primary teeth should be removed

- Dilaceration
  - This occasionally occurs after intrusion or displacement injuries
  - The developed portion of the tooth is twisted or bent on it self, and on this new position growth progresses
  - The resulting tooth has the crown in a significantly different position from the root
• Root Fractures
  – Root fractures at the apical half of the tooth are more likely to undergo repair often without treatment
  – In order for repair to take place, the fragments must be maintained in apposition
  – Healing should take place in 3-4 weeks

• Avulsion
  – The best prognosis is for teeth replanted within a short period of time
  – Teeth should not be cleaned, disinfected, rinsed, or scaled
  – The pt or parent can be instructed to replant the tooth, or the tooth can be stored in milk or saliva
  – Reimplanted teeth are treated endodontically later
DIAGNOSIS

1. **What is the proper role of the pulp tester in clinical diagnosis?**
   The pulp tester excites the nervous system of the pulp through electrical stimulation. However, the pulp tester suggests only whether the tooth is vital or nonvital: the crucial factor is the vascularity of the tooth. The pulp test alone is not sufficient to allow a diagnosis and must be combined with other tests.

2. **What is the importance of percussion sensitivity in endodontic diagnosis?**
   Percussion sensitivity is a valuable diagnostic tool. Once the infection or inflammatory process has extended through the apical foramen into the periodontal ligament (PDL) space and apical tissues, pain is localizable with a percussion test. The PDL space is richly innervated by proprioceptive fibers, which make the percussion test a valuable tool.

3. **Listening to a patient's complaint of pain is a valuable diagnostic aid. What differentiates reversible from irreversible pulpitis?**
   In general, with **reversible pulpitis pain** is elicited only on application of a stimulus (i.e., cold, sweets). The pain is sharp and quick but disappears on removal of the stimulus. Spontaneous pain is absent. The pulp is generally noninflamed. Treatment usually is a sedative dressing or a new restoration with a base. **Irreversible pulpitis** is generally characterized by pain that is spontaneous and lingers for some time after stimulus removal. There are various forms of irreversible pulpitis, but all require endodontic intervention.

4. **What are the clinical and radiographic signs of an acute apical abscess?**
   Clinically an acute apical abscess is characterized by acute pain of rapid onset. The affected tooth is exquisitely sensitive to percussion and may feel “elevated” because of apical suppuration. Radiographic examination may show a totally normal periapical complex or a slightly widened PDL space, because the infection has not had enough time to demineralize the cortical bone and reveal a radiolucency. Electric and thermal tests are negative.

5. **Discuss the importance of inflammatory resorption.**
   Resorption after avulsion injuries depends on the thickness of cementum. When the PDL does not repair and the cementum is shallow, resorption penetrates to the dentinal tubules. If the tubules contain infected tissue, the toxic products pass into the surrounding alveolus to cause severe inflammatory resorption and potential loss of the tooth.
6. A patient presents with a “gumboil” or fistula. What steps do you take to diagnose the cause or to determine which tooth is involved?
   All fistulas should be traced with a gutta percha cone, because the originating tooth may not be directly next to the fistula. Fistulas positioned high on the marginal gingiva, with concomitant deep probing and normal response of teeth to vitality testing, may have a periodontal etiology.

7. Why is it often quite difficult to find the source of pain in endodontic diagnosis when a patient complains of radiating pain without sensitivity to percussion or palpation?
   Teeth are quite often the source of referred pain. Percussion or palpation pain may be lacking in a tooth in which the inflammatory process has not reached the proprioceptive fibers of the periodontal ligament. The pulp contains no proprioceptive fibers.

8. What is the anatomic reason that pain from pulpitis can be referred to all parts of the head and neck?
   In brief, nerve endings of cranial nerves VII (facial), IX (glossopharyngeal), and X (vagus) are profusely and diffusely distributed within the subnucleus caudalis of the trigeminal cranial nerve (V). A profuse intermingling of nerve fibers creates the potential for referral of dental pain to many sites.

9. Is there any correlation between the presence of symptoms and the histologic condition of the pulp?
   No. Several studies have shown that the pulp may actually degenerate and necrose over a period of time without symptoms. Microabscess formation in the pulp may be totally asymptomatic.

10. Describe the process of internal resorption and the necessary treatment.
    Internal resorption begins on the internal dentin surface and spreads laterally. It may or may not reach the external tooth surface. The process is often asymptomatic and becomes identifiable only after it has progressed enough to be seen radiographically. The etiology is unknown. Trauma is often but not always implicated. Resorption that occurs in inflamed pulps is characterized histologically by dentinoclasts, which are specialized, multinucleated giant cells similar to osteoclasts. Treatment is prompt endodontic therapy. However, once external perforation has caused a periodontal defect, the tooth is often lost.

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12. **What is the significance of the intact lamina aura in radiographic diagnosis?**
   The lamina aura is the cribiform plate or alveolar bone proper, a layer of compact bone lining the socket. Because of its thickness, an x-ray beam passing through it produces a white line around the root on the radiograph. Byproducts of pulpal disease, passing from the apex or lateral canals, may degenerate the compact bone; its loss can be seen on a radiograph. However, this finding is not always diagnostic, because teeth with normal pulps may have no lamina aura.

13. **Which radiographic technique produces the most accurate radiograph of the root and surrounding tissues?**
   The paralleling or right-angle technique is best for endodontics. The film is placed parallel to the long axis of the tooth and the beam at a right angle to the film. The technique allows the most accurate representation of tooth size.

14. **What is the definition of a true combined lesion?**
   A true combined lesion is due to both endodontic and periodontal disorders that progress independently. The lesions may join as the periodontal lesion progresses apically. Such lesions, if any chance of healing is to occur, require both endodontic therapy and aggressive periodontal therapy. Usually, the prognosis is determined more by the extent of the periodontal lesion.

15. **What is the reason that radiographic examination does not show periapical radiolucencies in certain teeth with acute abscesses?**
   One study showed that 30-50% of bone calcium must be altered before radiographic evidence of periapical breakdown appears. Therefore, in acute infection apical radiolucencies may not appear until later, as treatment progresses.

16. **Why do pulpal-periapical infections of mandibular second and third molars often involve the submandibular space?**
   Extension of any infection is closely tied to bone density, the proximity of root apices to cortical bone, and muscle attachments. The apices of the mandibular second and third molars are usually below the mylohyoid attachment; therefore infection usually spreads to the lingual and submandibular spaces; often the masticator space is also involved.
17. **A patient presents with a large swelling involving her chin. Diagnostic tests reveal that the culprit is the lower right lateral incisor. What factor determines whether the swelling extends into the buccal fold or points facially?**
   A major determining factor in the spread of an apical abscess is the position of the root apex in relation to local muscle attachments. In this particular case, the apex of the lateral incisor is below the level of the attachment of the mentalis muscle; therefore, the abscess extends into the soft tissues of the chin.

18. **A middle-aged woman has been referred for diagnosis of multiple radiolucent lesions around the apices of her mandibular incisor. The patient is asymptomatic, the teeth are normal on vitality tests, no cortical expansion is noted, and the periodontium is normal. What is your diagnosis?**
   The most likely diagnosis is periradicular cemental dysplasia or cementoma. This benign condition of unknown etiology is characterized by an initial osteolytic phase in which fibroblasts and collagen proliferate in the apical region of the mandibular incisors, replacing medullary bone. The teeth remain normal to all testing. Eventually, cementoblasts differentiate to cause reossification of the area. Treatment is to monitor over time.


**CLINICAL ENDODONTICS (TREATMENT)**

19. **What is the current thinking on use of the rubber dam?**
   The dam is an absolute necessity for treatment. It ensures a surgically clean operating field that reduces chance of cross-contamination of the root canal, retracts tissues, improves visibility, and improves efficiency. It protects the patient from aspiration of files, debris, irrigating solutions, and medicaments. From a medicolegal standpoint, use of the dam is considered the standard of care.

20. **What basic principles should be kept in mind for proper access opening?**
   Proper access is a crucial and overlooked aspect of endodontic practice. The root canal system is usually a multicanaled configuration with fins, loops, and accessory foramina. When possible, the opening must be of sufficient size, position, and shape to allow straight-line access into the canals. Access of inadequate size and position invites inadequate removal of caries, compromises proper instrumentation, and inhibits proper obturation. However, overzealous access leads to perforation, weakening of tooth structure, and potential fracture.

21. **What are the current concepts on irrigating solutions in endodontics?**
   The type of irrigant is of minor importance in relation to the volume and frequency. The crucial factor is constant irrigation to remove dentinal debris, to prevent blockage, and to lessen the chance of apical introduction of debris. Several studies have shown the efficacy of saline, distilled water, sodium hypochlorite, hydrogen peroxide, combinations of the above, and many other agents. The results show no advantage to chemomechanical preparation of the root canal system.

22. **Of what material are endodontic files currently made?**
   Hand-operated instruments, including broaches, H-files, K-files, reamers, K-flex files, and S-files, are made of stainless steel as opposed to carbon steel, which was used in the past. Stainless steel bends more easily, is not as brittle, is less likely to break compared with carbon steel, and can be autoclaved without dulling. In addition, hand and rotary files are now being made of nickel-titanium.

23. **What are the characteristics of a K-file?**
   The K-file is made by machine grinding of stainless steel wire into a square shape (some companies produce a triangular shape). The square wire is then twisted by machines in a
counterclockwise direction to produce a tightly spiraled file.

24. **What are the characteristics of a reamer?**
   The reamer is made by machine twisting of a triangular stainless steel stock wire in a counterclockwise direction but into a less tightly spiraled instrument than the K-file.

25. **How does the K-flex file differ?**
   The K-flex file is produced from a rhomboid or a diamond-shaped stainless steel stock wire twisted to produce a file. However, the two acute angles of the rhombus produce a cutting edge of increased sharpness and cutting efficiency. The low flutes made from the obtuse angles form an area for debris removal.

26. **How does filing differ from reaming?**
   Filing establishes its cutting action upon withdrawal of the instrument. The instrument is removed from the canal without turning. Thus it uses basically a push-pull motion. Reaming is done by placing the instrument in the canal, rotating, and withdrawing.

27. **What is the recommended use for Gates-Glidden and Reeso drills?**
   These two types of engine-driven instruments, especially the Gates-Glidden drills, are useful in the new recommended instrumentation technique of step-down preparation. They are efficient in initial coronal preparation of the canal, thereby allowing easier, more efficient, and less traumatic apical preparation.

28. **What is RC-prep? How is it used?**
   RC-prep is composed of ethylene diamine tetraacetic acid (EDTA) and urea peroxide in a carbowax base. Its use as a canal lubricant is also enhanced by combination with sodium hypochlorite, which produces much bubbling action, allowing enhanced removal of dentinal debris and permeability into the tubules.

29. **Why is nickel-titanium becoming a material of choice for endodontic hand and rotary instruments?**
   The newer hand and rotary instruments made from nickel-titanium have excellent flexibility and strength after repeated sterilization, are quite anticorrosive, and resist fracture quite well.

30. **What types of hand-operated implements for root canal instrumentation are currently available?**
   A detailed discussion of the various properties and differences in file-reamer types is beyond the scope of this chapter. K-type files and reamers are still widely used because of their strength and flexibility. H-type Hedstrom files are quite popular because of their aggressive ability to cut dentin. S-files are highly efficient for cutting dentin on the withdrawal stroke and for filing and reaming. Flex-it files are a new modification with a noncutting tip design. This design allows guidance of the tip through curvatures and reduces the risk of ledging, perforation, and transportation of the apex. For an excellent discussion of instrumentation devices and techniques, the reader is referred to Cohen S. Burns RC (eds): Pathways of the Pulp, 6th ed. St. Louis, Mosby, 1994.

31. **What is the current status on acceptability of root canal obturation materials?**
   Gutta percha remains the most popular and accepted filling material for root canals. Numerous studies have demonstrated that it is the least tissue-irritating and most biocompatible material available. Although differences occur among manufacturers, gutta percha contains transpolyisoprene, barium sulfate, and zinc oxide, which provide an inert, compactible, dimensionally stable material that can adapt to the root canal walls.
   N-2 pastes and other paraformaldehyde-containing pastes are not approved by the Food and Drug Administration (FDA). Several studies have shown conclusively that such root-filling pastes are highly cytotoxic in tissue culture; reactions to bone include chronic inflammation, necrosis, and bone
sequestration. Compared with gutta percha, the pastes are highly antigenic and perpetuate inflammatory lesions. For these reasons they are not considered the standard of endodontic care.

32. **What is the proper apical extension of a root canal filling?**

   The proper apical extension of a root canal filling has been discussed extensively for years, and the debate continues. In the past recommendations were made to fill a root canal to the radiographic apex in teeth that exhibited necrosis or areas of periapical breakdown and to stop slightly short of this point in vital teeth. Currently, however, it is generally recommended that a root canal be filled to the dentinocementum junction, which is 0.5-2 mm from the radiographic apex. Filling to the radiographic apex is usually overfilling or overextending and increases the chance of chronic irritation of periapical tissues.

33. **Describe the walking bleach technique.**

   The walking bleach technique is used to bleach nonvital teeth with roots that have been obturated. The technique involves the placement of a thick white paste composed of sodium perborate and Superoxol in the tooth chamber with a temporary restoration. Several repetitions of this procedure, along with the in-office application of heat to Superoxol-saturated cotton pellets in the tooth chamber, work quite well.

34. **Several authors report extensive cervical resorption after bleaching of pulpless teeth with the walking bleach technique using Superoxol, sodium perborate, and heat. What is the cause?**

   In approximately 10% of all teeth, defects at the cementoenamel junction allow dentinal tubules to communicate from the root canal system to the PDL. These tubules remain open, without sclerosis, if the tooth becomes pulpless at a young age. It is thought that the bleaching agents may leach through the open tubules to cause the resorption. Therefore, a barrier of some type is recommended, such as zinc, phosphate cement, or some type of light canal bonding agent.


35. **List four useful tools in the diagnosis of a vertical crown-root fracture.**

   1. Transillumination with fiberoptic light
   2. Persistent periodontal defects in otherwise healthy teeth
   3. Wedging and staining of defects
   4. Radiographs rarely show vertical fractures but do show a radiolucent defect laterally from sulcus to apex (which can be probed).

36. **Describe the crown-down pressureless technique of root canal instrumentation.**

   With the crown-down pressureless technique the canal is prepared in a coronal to apical direction
by initially instrumenting the coronal two-thirds of the canal before any apical preparation. This technique, popularized by Marshall-Pappin, minimizes apically extruded debris and eliminates binding of instruments coronally, thereby making apical preparation more difficult.

37. **What is the balanced-force concept of root canal instrumentation and preparation?**
   The balanced-force concept, proposed by Roane and Sabala, is based on the idea of balancing the cutting forces over a greater area of the canal and focusing less force on the area where the file tip engages the dentin. The technique is done with the Flex-it file with a noncutting tip and a triangular cross-section. By using this type of file in a counterclockwise reaming motion, ledging is minimized, more inner canal curvature is accomplished, and less zipping of the apex occurs.
   

38. **What is the frequency of fourth canals in mesial roots of maxillary first molars?**
   In an extensive study of maxillary first molars, 59% of the mesiobuccal roots contained either a larger buccal and smaller lingual canal or two separate canals and foramina. This finding shows the importance of searching for a fourth canal to ensure clinical success.

39. **What is the current thinking about the manner of storage of an avulsed permanent tooth and its relationship to post-replantation success?**
   After 15-12 minutes of extraoral exposure, the cell metabolites in the periodontal ligament have been depleted and need to be reconstituted before replantation. Research by Cvek has shown that soaking the tooth in a physiologic solution for 30 minutes before replanting reduces the chance of post-replant resorption. The media of choice are Hank’s balanced salt solution (found in Save-A-Tooth) and Visapan (used for storage of transplant organs). If neither is available, milk or saline may be used, but not as successfully.

40. **What is the current guideline for the length of time to splint an avulsed tooth, with and without alveolar fracture?**
   The current recommendation is to splint an avulsed tooth for 7-14 days (3-5 weeks with alveolar fracture). If an avulsed tooth is replanted fairly quickly (within 1 hour) and some of the fibroblasts of the periodontal ligament (PDL) and cementoblasts of the root surface remain viable, initial PDL repair may occur in 7-14 days.

41. **When an avulsed tooth is replanted, what are the current recommendations concerning rigid or functional splinting?**
   Recent studies show that early functional stimulus may improve the healing of luxated teeth. It is advantageous to reduce the time of fixation to the time necessary for clinical healing of the periodontium, which may take place in a few weeks. Andreasen has shown that prolonged rigid immobilization increases the risk of ankylosis; thus the splint should allow some vertical movement of the involved teeth.
   
   
42. **What is the physiologic basis for the use of calcium hydroxide pastes for resorptive defects or avulsed teeth?**
   The theory behind the use of calcium hydroxide pastes is that areas of resorption have an acidic pH of approximately 4.5-5.0. Such areas are more acidic than normal tissue because of the effects of inflammatory mediators and tissue breakdown products. The basic pH of calcium hydroxide neutralizes the acidic pH, thereby inhibiting the resorptive process of osteoclastic hydrolases.

43. **What is the current thinking on the use of medicaments in endodontic practice?**
   Formerly, medicaments were in wide use in endodontics to kill bacteria in the canal. However, current thinking stresses thorough debridement of canals and the use of irrigating solutions to clean canals. Medicaments are not stressed, because all have been shown to be cytotoxic in tissue culture. In addition, several medicaments have been shown to elicit immunologic reactions in animal studies. Mechanical canal cleaning sufficiently lowers microbial levels to allow the local defense mechanisms to heal endodontic periapical lesions.

44. **Discuss the variations of postoperative pain in one-visit vs. two-visit endodontic procedures.**
   Several studies show no difference in postoperative pain in one-visit vs. two-visit endodontic procedures. In fact, one study found that single-visit therapy resulted in postoperative pain approximately one-half as often as multiple-visit therapy.

45. **What is the treatment of choice for an intruded maxillary central incisor with a fully formed apex?**
   Repositioning or surgical extrusion should be done immediately with splinting for 7-10 days. Because pulpal necrosis is the usual outcome, pulpectomy within 2 weeks and placement of calcium hydroxide are recommended. Close observation every few months is needed.

46. **What is the desired shape of the endodontic cavity (root canal) for obturation in both lateral and vertical condensation techniques?**
   The canal should be instrumented and shaped so that it has a continuously tapering funnel shape. The narrowest diameter should be at the dentinocemental junction (0.5-1.0 mm from apex) and the widest diameter at the canal opening.

47. **Are electronic measuring devices for root canal of any clinical value in everyday endodontic practice?**
   Yes. Electronic measuring devices have been shown by several investigators to be quite accurate. In general, they work by measuring gradients in electrical resistance when a file passes from dentin (insulator) to conductive apical tissues. They are quite useful when the apex is obscured on a radiograph by sinus superimposition, other roots, or osseous structures.

48. **What is the accepted material of choice for pulp-capping procedures?**
   The literature has reports, of many drugs, medicaments, and anti-inflammatory agents used for pulp capping, but the material of choice remains calcium hydroxide. Calcium hydroxide, applied to the pulp tissue, seems to cause necrosis of the underlying tissue, but the continuous tissue often forms calcific bridges.

49. **Describe the process of apexification.**
   Apexification involves the placement of agents in the pulpless permanent tooth, with an incompletely formed apex, to stimulate continued apical closure. Calcium hydroxide pastes are the accepted agents for use in the canals.

50. **What is the accepted treatment for carious exposures in primary teeth?**
   For carious exposures in primary teeth in which the tissue appears vital and the inflammation is
only in the coronal pulp, the formocresol pulpotomy is still widely accepted. When a carious exposure shows total pulpal degeneration (necrosis), full pulpectomy is indicated with placement of a resorbable zinc oxide-eugenol (ZOE) paste.

51. **What is the role of sealer-cements in root canal obturation?**

Sealer-cements are still widely recommended for use with a semisolid obturating material (gutta percha). The sealers fill discrepancies between the root filling and canal wall, act as a lubricant, help to seat cones of gutta percha, and fill accessory canals and/or foramina apically.

52. **What biologic property is shared by all sealer-cements used in endodontics?**

Studies of biocompatibility have shown that all sealer-cements are highly toxic when freshly mixed, but the toxicity is reduced on setting. Chronic inflammatory responses, which usually persist for several days, are often cited as a reason not to avoid apical overextension of the sealer. Several studies have recommended the use of sealers that are more biocompatible, such as AH-26 and the newer calcium hydroxide-based sealers (Sealapex and CRCS).

53. **In using Cavit as an interappointment temporary seal, what precautions must be taken?**

Cavit, which is a hygroscopic single paste containing zinc oxide, calcium and zinc phosphate, polyvinyl and chloride acetate, and triethanolamine, requires placement of at least 3 mm of material to ensure a proper seal and fracture resistance.

54. **What materials or devices are of use in removing gutta percha for retreatment?**

Initial removal should be done with endodontic drills (Gates-Glidden or Peezo) or by using a heated plugger to remove the coronal portion of the gutta percha. This procedure allows space in the canal for placement of solvents to dissolve remaining material. Solvents include chloroform, xylene, methyl chloroform, and eucalyptol. Chloroform is the most effective, although it has been used less because of reported carcinogenic potential. Xylene and eucalyptol are the least effective. Once the remaining gutta percha has been softened, it often can be removed by files or reamers.

55. **What are the cause, histologic characteristics, and treatment for internal resorption?**

The exact cause is unknown, but internal resorption is often seen after trauma that results in hemorrhage of vessels in the pulp and infiltration of chronic inflammatory cells. Macrophages have been shown to differentiate into dentinoclastic-type cells. With this proliferation of granulation tissue, resorption can occur. Treatment is to remove the pulpal tissues as soon as possible so that tooth structure is not perforated.

56. **Does preparation of the post immediately on obturation have a different effect on the apical seal of a root canal filling from delayed preparation?**

Dye leakage studies have shown no difference and no effect on the apical seal whether post preparation is immediate or delayed.

57. **What temperature and immersion time are needed to sterilize endodontic files in a bead sterilizer?**

At the proper temperature of 220°C (428°F) in the bead sterilizer, an endodontic file should be immersed for 15 seconds. However, because of the potential for a wide variation of temperatures in the transfer medium (beads or salt), this technique should be secondary to other, more reliable techniques of sterilization.

58. **What is the best and easiest technique for sterilization of gutta percha cones?**

Immersion of the cone in a 5.25% solution of sodium hypochlorite for 1 minute is quite effective in killing spores and vegetative organisms.


59. **What simple techniques should be used to avoid apical ledging and perforation?**
   Overly aggressive force should not be used in the apical area. A light touch with a precurved file to negotiate apical curvature is necessary to maintain proper canal curvature.

60. **Which type of file is the strongest and cuts least aggressively?**
   K-files are the strongest of all files. Because they cut the least aggressively, they can be used with quarter-turn pulling motion, rasping, or clockwise-counterclockwise motions.

61. **List four criteria that must be met before obturation of a canal.**
   1. The patient must be asymptomatic; the tooth in question must not be sensitive to percussion or palpation.
   2. No foul odor should emanate from the tooth.
   3. The canal should not produce exudate.
   4. The temporary restoration should be intact, i.e., no leakage has contaminated the canal.

62. **How does preparation of the canal for filling techniques that use injection of gutta percha differ from that for conventional techniques?**
   All injection techniques require a more flared canal body and a definite apical construction to prevent flow of softened gutta percha into periapical tissues.

63. **What is the treatment of choice for a primary endodontic lesion in a mandibular molar with secondary periodontal involvement (including furcation lucency) in a periodontally healthy mouth?**
   Treatment generally consists solely of endodontic therapy. Necrotic pulpal tissue that causes furcation and lateral root or apical breakdown also may cause periodontal pockets through the sulcus, but these are actually fistulas rather than true pockets. Endodontic therapy alone often heals this secondary periodontal involvement.

64. **What is the current thinking on the prognosis of pulp capping and partial pulpectomy procedures on traumatically exposed pulps?**
   In a study of traumatically exposed pulps, including both mature teeth and teeth with immature apices, Cvek found that pulp capping or partial pulpectomy procedures were successful in 96% of cases. In all teeth the superficial pulp in the traumatized area was carefully excised. Cvek and others agree that such procedures are generally more successful in vital teeth with immature root formation.

65. **What is the current thinking on ideal treatment for carious exposure of a mature permanent tooth?**
   There is general agreement that carious exposure of a mature permanent tooth generally requires endodontic therapy. Carious exposure generally implies bacterial invasion of the pulp, with toxic products involving much of the pulp. However, partial pulpotomy and pulp capping of a carious exposure in a tooth with an immature apex have a higher chance of working.

66. **You have elected to perform partial pulpotomy and to place a calcium hydroxide cap on a maxillary permanent central incisor with blunderbuss apex in a young boy. What follow-up is necessary?**
   Close monitoring of the tooth is necessary. First, it is important to see whether any pathology develops. If necrosis occurs with apical pathology, extirpation with apexification is needed. On the other hand, if vitality is maintained in such teeth, root formation continues, along with dystrophic calcification.

67. **What is the recommended technique for the access opening in endodontic therapy for maxillary primary incisors?**
   A facial approach is generally recommended for such teeth, which need pulpectomy with a filling
of zinc oxide-eugenol paste. Because of esthetic problems and the difficulty in bleaching, endodontic therapy is followed by composite facial restoration.

68. **Can infections of deciduous teeth cause odontogenesis of the permanent teeth?**
In one study, local infections of deciduous teeth for up to 6 weeks did not influence odontogenesis of the permanent central incisors. However, longstanding infections may have a profound effect on permanent tooth buds because of direct communication between the pulpal and periodontal vasculature of the deciduous tooth and the plexus surrounding the developing permanent tooth.

69. **Describe the characteristics of the Profile Rotary Instrumentation Series.**
This series of nickel-titanium rotary files has a rounded, guided tip and a U-shaped flute for collecting debris. It is available in a .04 and .06 taper series; the .06 taper is used in a sequential series, allowing for a crown-down preparation.

70. **Thermafil endodontic obturators are now widely used. What is the basic methodology?**
Pre-notched stainless steel files coated with alpha-phase gutta percha are used to obturate the canal. Selection of the Thermafil device depends on the last carrier and condenser for the thermally plasticized alpha-phase gutta percha. Alpha-phase rather than the more common beta-phase gutta percha is used because, when heated, it has superior flow properties and adheres well to the metal carrier.

71. **What is the major difference between the two main thermoplasticized gutta percha techniques on the market?**
In the Obtura II system, gutta percha heated to 160°C is injected through a silver needle tip at a temperature of about 65°C. The Ultrafil system is a low-temperature technique that heats the gutta percha to 70°C for injection. Both techniques stress the importance of maintaining constriction at the cementodentinal junction to prevent flow of gutta percha beyond the apex.

72. **What is the “dentin-chips apical-plug filling technique”?**
This technique consists of filling the last 1-2 mm of the apex of the canal with dentin chips to seal the apical foramen. Above this is placed a seal of gutta percha. This so-called biologic seal of dentin chips should be made only after proper debridement of the canal to avoid apical placement of infected chips. The efficacy of this technique is controversial.

73. **In treating a maxillary lateral incisor, what particular care must be taken in instrumenting the apical portion?**
The apical root portion usually curves toward the distal palatal space; this configuration must be negotiated carefully.

74. **Should the smeared layer of dentinal debris be removed from canal walls?**
Yes. Removal of the smeared layer is recommended because of the possibility that it harbors bacteria.

75. **What is considered the most reliable technique to remove the smeared layer of organic and inorganic dentinal debris from canal walls?**
The recommended technique is the use of a chelating agent, such as EDTA with sodium hypochlorite, during instrumentation.

76. **What is the single most important factor in determining the degree and severity of the pulpal response to a tooth preparation (cutting) procedure?**
Research has shown that the remaining dentin thickness between the floor of the cavity preparation and the pulp chamber is the most crucial determinant of the pulpal response. In general, a 1-mm thickness of dentin provides a sufficient degree of protection from the trauma of high-speed drills and restorative materials. With a thickness less than 2 mm, the inflammatory response in the pulp seems to
increase dramatically. Neither age nor tooth size has as significant an effect.

77. In restoring a tooth with a deep carious lesion, clinicians often excavate the caries and place a temporary sedative restoration to allow symptoms to subside. What is the rationale behind this procedure in relation to pulpal physiology?
A deep carious lesion produces an inflammatory response in the pulp tissue adjacent to the dentinal tubules in the area of the caries. Removal of the irritation to the pulp and placement of a sedative filling allow new odontoblasts to differentiate and to produce a reparative dentin in the involved area. This process usually requires approximately 20 days for odontoplastic regeneration and 80 days for reparative dentin formation.

78. What is the most common reason for failure of root canals?
Although an endodontically treated tooth may fail for various reasons, including fracture, periodontal disease, or prosthetic complication leading to one of the above, the most common cause of failure is incompletely and inadequately debrided and disinfected root canals. The time-honored saying that what you take out of the canal is not as important as what you put in has much merit. The chemomechanical debridement of the root canal system, which is necessary to remove all irritants to the surrounding apical and periodontal tissues, is still the crucial aspect of root canal treatment.

PULP AND PERIAPICAL BIOLOGY

79. What is the dental pulp? Describe in a brief paragraph the ultrastructural characteristics of this remarkable tissue.
The dental pulp is a matrix composed of ground substance, connective cells and fibers, nerves, a microcirculatory system, and a highly specialized and differentiated cell called the odontoblast. The dental pulp is similar to other connective tissues in the body, but its ability to deal with injury and inflammatory reactions is severely limited by the mineralized walls that surround it. Therefore, its ability to increase blood supply during vasodilation is impaired.

80. The odontoblast is a remarkable and unique cell. Briefly describe its major characteristics.
The odontoblast is a highly differentiated cell that forms a pseudostratified layer of cells along the periphery of the pulp chamber. It is a highly polarized cell with synthesizing activity in its cell body and secretory activity in the odontoblastic process, which forms the predentin matrix. Because it is the main cell for dentin formation, injury by caries or restorative procedures may affect this activity.

81. Give a brief description of the most accepted theory about the mechanism of dentin sensitivity.
The most plausible theories are based on the fact that the dentinal tubule acts as a capillary tube. The tubule contains fluid, or a pulpal transudate, that is displaced easily by air, heat, cold, and explorer tips. This rapid inward or outward movement of fluid in tubules may excite odontoblastic processes, which
have been shown to travel within the tubules, or sensory receptors in the underlying pulp.


82. A 45-year-old woman presents for consultation. She is asymptomatic. Radiographs reveal a radiolucent lesion apical to teeth 24 and 25 with no swelling or buccal plate expansion. The dentist diagnosed periapical cemental dysplasia. How is this diagnosis confirmed?

Periapical cemental dysplasia or cementoma presents as a radiolucent lesion in its early stages. It is a fibroosseous lesion developing from cells in the periodontal ligament space. The teeth involved respond normally to vitality testing.

83. What is the effect of orthodontic tooth movement on the pulp?

In progressive, slow orthodontic movement, the minor circulatory changes and inflammatory reactions are reversible. However, with excessively severe orthodontic forces, disruption of pulpal vascularity may be irreversible, leading to disruption of odontoblasts and fibroblasts and possible pulpal necrosis. Rupture of blood vessels in the periodontal ligament also may affect pulpal vascularity. In addition, orthodontic tooth movement is associated with excessive root resorption and blunted roots, both of which may occur with continued vitality.

84. Inflammatory mediators cause vasodilation of blood vessels. How does vasodilation in the pulp differ from that in other tissues?

Vasodilation in all tissues is a defense mechanism, controlled by various inflammatory mediators, to allow tissue survival during inflammation. The pulp responds differently, with an increase in blood flow followed by a sustained decrease. This secondary vasoconstriction often leads to the demise of the pulp.


85. Is it possible to differentiate a periapical cyst from a periapical granuloma on the basis of radiographic appearance alone?

No. radiographic appearance is not diagnostic. Often a sclerotic border may be present, but its absence does not preclude cystic formation. An exhaustive study indicates that lesions greater than 200 mm³ are usually cystic in nature.


86. A patient presents with a maxillary central incisor that has a history of trauma. The patient is asymptomatic, and the radiograph is normal. Because the tooth gives no response to an electric pulp tester, you elect to do endodontic therapy without anesthesia. However, with access and instrumentation the patient feels everything. Explain the inconsistency.

The electric pulp tester excites the A8 fibers in the tooth. The pulp contains A8 and C nociceptive fibers; the A8 fibers have a lower stimulation threshold than the C fibers. The C fibers are more resistant to hypoxia and can function long after the A8 fibers are inactivated by injury to pulp tissue. The electric pulp tester does not stimulate C fibers.

87. List six normal changes in pulp tissue due to age.

(1) Decrease in size and volume of pulp, (2) increase in number of collagen fibers, (3) decreased number of odontoblasts (4) decrease in number and quality of nerves, (5) decreased vascularity, and (6) overall increase in cellularity.


88. What is the meaning of the term dentinal pain?

Dentinal pain is due to the outflow of fluid in dentinal tubules that stimulates free nerve endings, most likely A8 fibers. Dentinal pain is usually associated with cracked teeth (into the dentin), defective fillings, or hypersensitive dentin. The pain produced by such stimulation does not usually signify that the pulp is inflamed or the tissue injured, whereas pulpal pain is due to true tissue injury associated with stimulation of C fibers.

89. Do the odontoblastic processes extend all the way through the dentin?

This controversial topic has been studied extensively by several investigators. The process is
basically an extension of the cell body of the odontoblast. It is the secretory portion of the odontoblast and contains large amounts of microtubules and microfilaments. Light microscopic studies have generally shown odontoblastic processes only in the inner one-third of dentin; this finding agrees with scanning electron microscope studies and transmission electron microscope studies, which showed processes mainly in the inner one-third of dentin.


90.  **Describe briefly the circulatory system of the dental pulp.**

The pulp contains a true microcirculatory system. The major vessels are arterioles, venules and capillaries. The capillary network in the pulp is extensive, especially in the subodontoblastic region, where the important functions of transporting nutrients and oxygen to pulpal cells occurs and waste products are removed. The pulpal microcirculation is under neural control and also under the influence of chemical agents, such as catecholamines, that exert their effects at the alpha and beta receptors found in pulpal arterioles.


91.  **Have immunoglobulins and immunocompetent cells been found in the dental pulp?**

Yes. Numerous studies have demonstrated that the pulp and periapical tissues are able to mount an immune response against injury to the pulp and apical tissues. All classes of immunoglobulins have been identified in the dental pulp, and microscopic examination of damaged pulpal tissue reveals the presence of leukocytes, macrophages, plasma cells, lymphocytes, giant cells, and mast cells.

**MICROBIOLOGY AND PHARMACOLOGY**

92.  **What types of bacteria are the predominant pathogens in endodontic-periapical infections?**

Many well-done studies have shown definitively the predominant role of gram-negative obligate anaerobic bacteria in endodontic-periapical infections. Earlier studies generally implicated facultative organisms (streptococci, enterococci, lactobacilli), but improved culturing techniques established the
predominance of obligate anaerobes. A recent study further demonstrated the important role of *Porphyromonas endodontalis* (formerly *Bacteroides endodontalis*) in endodontic infections.


93. **What is considered the antibiotic of choice in treatment of orofacial infections of endodontic origin?**

In light of all the new microbiologic research implicating the predominance of obligate anaerobes, drug sensitivity tests still show the penicillins to be the drugs of choice. Penicillin is highly effective against most of the obligate anaerobes in endodontic infections, and because the infections are of a mixed nature with strict substrate interrelations among various bacteria, the death of several strains has a profound effect on the overall population of an endodontic-periapical infection.

94. **What antibiotics are considered most effective in treatment of orofacial infections of endodontic origin that do not respond to the penicillins?**

For infections not responding to the penicillins, clindamycin is often recommended. It produces high bone levels and is highly effective against anaerobic bacteria, but it must be used with caution because of the potential for pseudomembranous colitis. A second choice is metronidazole, which also is quite effective against gram-negative obligate anaerobes.

95. **What is the current status of culturing and sensitivity testing for endodontic-periapical infections?**

Culturing and sensitivity testing have been a controversial topic in endodontic practice for years. According to current thinking, if the proper clinical guidelines are followed, including use of rubber dam, proper chemomechanical cleaning of the root canal system, and proper use of correct antibiotics as indicated, culturing and sensitivity testing are not required. Proper culturing for both facultative and anaerobic bacteria is expensive, time-consuming, and not cost-effective, given the high success rate of properly done endodontic therapy.

96. **The role of gram-negative anaerobic bacteria is an established fact in the pathogenesis of endodontic lesions. What role does the bacterial endotoxin play?**

Endotoxins are highly potent lipopolysaccharides released from the cell walls of gram-negative bacteria. They are able to resorb bone via stimulation of osteoclastic activity, activation of complement cascades, and stimulation of lymphocytes and macrophages. Various studies have demonstrated their presence in pulpless teeth (with necrotic tissue) and apical lesions.

97. **What roles do nonsteroidal anti-inflammatory drugs (NSAIDs) have in endodontic practice?**

NSAIDs have a significant role in endodontic practice. Many patients require postoperative medication to control pericementitis, which can be quite painful after pulpectomy and may persist for several days. The NSAIDs are quite effective; their mechanism of action is to inhibit synthesis of prostaglandins. One study showed that ibuprofen, when given preoperatively to symptomatic and asymptomatic patients, significantly reduces postoperative pericementitis.


98. **What is the latest thinking on the role of black-pigmented anaerobic rods in the etiology of infected root canals and periapical infection?**

Black-pigmented anaerobic rods have been shown to play an essential role in the etiology of endodontic infections when present in anaerobic mixed infections. The most strongly implicated organism is *Porphyromonas endodontalis*, which, because of its need for various growth factors, is directly related to the presence of acute periapical inflammation, pain, and exudation.

99. **A patient presents with swelling, in obvious need of endodontic therapy. His medical history is significant for penicillin allergy and asthma, for which he is taking Theo-Dur. What precautions should you exercise?**

By no means should erythromycin be used as an alternative to penicillin. Theo-Dur is a form of theophylline used for chronic reversible bronchospasm associated with bronchial asthma and
erythromycin has been shown to elevate significantly serum levels of theophylline.

100. **For years it was taught that any bacteria left behind in an obturated canal would die and therefore cause no problems. What are the latest findings about this controversy?**
   The most recent electron micrograph studies have shown persistence of bacteria in the apical portion of roots in therapy-resistant lesions. The result is persistent periapical pathosis.

101. **What efficacy do the cephalosporins have in treating acute pulpal-periapical infections?**
   Although the cephalosporins are broad-spectrum antibiotics, their activity is limited in pulpal-periapical infections, which are mixed infections predominantly due to obligate anaerobic bacteria. The cephalosporins are not highly effective against such bacteria and actually have less activity against many anaerobes than penicillin. For serious infections that are penicillin or erythromycin-resistant, clindamycin is much more effective because of its activity against the obligate and facultative organisms in pulpal-periapical infections.

102. **What precautions should be taken in prescribing antibiotics to a female patient who takes birth control pills?**
   The dentist should warn the patient that oral antibiotics may decrease the effectiveness of birth control pills and that they may be ineffective during the course of antibiotic therapy. The most often implicated antibiotic is the penicillin class, although erythromycin, cephalosporin, tetracyclines, and metronidazole also have been implicated.

103. **The quinolone class of antibiotics, which includes ciprofloxacin, are becoming quite popular. Do they have any role in treating alveolar infections?**
   Very little, if any. Most anaerobes implicated in endodontic-alveolar abscesses are resistant to the quinolones.

104. **What is the physiologic basis of the difficulty in achieving proper pulpal anesthesia in the presence of inflammation or infection?**
   Attaining effective pulpal anesthesia in the presence of pulpal-alveolar infection or inflammation is often quite difficult because of changes in tissue pH. The normal tissue pH of 7.4 decreases to 4.5-5.5. This change in pH due to pulpal-periapical pathology favors a shift to a cationic form of the local anesthesia molecule, which cannot diffuse through the lipoprotein neural sheath. Therefore, anesthesia is ineffective.

105. **What is the significance of the mylohyoid nerve in successful anesthesia of the mandibular first molar?**
   The mylohyoid nerve is often implicated in unsuccessful anesthesia of the first molar. This nerve branches off the inferior alveolar nerve above its entry into the mandibular foramen. The mylohyoid nerve then travels in the mylohyoid groove in the lingual border of the mandible to the digastric and mylohyoid muscles. However, because it often carries sensory fibers to the mesial root of the first molar, lingual anesthetic infiltration may be required to block it.

106. **What is the method of action of injection into the periodontal ligament?**
   Injection into the periodontal ligament is not a pressure-dependent technique. The local anesthetic works by traveling down the periodontal ligament space and shutting off the pulpal microcirculation. To be effective, this technique requires the use of a local anesthetic with a vasoconstrictor.

107. **The Gow-Gates block is an effective alternative to the inferior alveolar block. When is it indicated? Briefly describe how it works.**
   In patients in whom the traditional inferior alveolar block is ineffective or impossible to perform because of infection or inflammation, the Gow-Gates block has a high success rate. It is a true mandibular block that anesthetizes all of the sensory portions of the mandibular nerve. The injection site
is the lateral side of the neck of the mandibular condyle; thus, it is effective when intraoral swelling contraindicates the inferior alveolar block.

108. **What is the reason for attempting to anesthetize the mylohyoid nerve for endodontic treatment of a symptomatic lower first molar?**

   The mylohyoid nerve has been shown to supply sensory innervation to mandibular molars, especially the mesial root of first molars. Infiltration of this nerve as it courses along the medial surface of the mandible is often helpful.

109. **A drug salesman has convinced you to use propoxycaine hydrochloride as a local anesthetic. Is there any true or absolute contraindication to use of an ester anesthetic?**

   Yes. Patients who have a hereditary trait known as atypical pseudocholinesterase have an inability to hydrolyze ester-type local anesthetics. Therefore, toxic reactions may result. Only amide anesthetics should be use.

110. **A patient presents with an extremely painful lower molar requiring endodontic therapy. You have already used six cartridges of lidocaine with epinephrine to achieve anesthesia. The patient begins to react differently. In brief, what are the signs of local anesthetic toxicity?**

   Local anesthetic toxicity depends on the blood level and the patient’s status. In general, a mild toxic reaction manifests as agitation, talkativeness, and increased vital parameters (blood pressure, heart rate, and respiration). A massive reaction manifests as seizures, generalized collapse of the central nervous system, and possible myocardial depression and vasodilation.

**SURGICAL ENDODONTICS**

111. **What is the purpose of the apicoectomy procedure in surgical endodontics?**

   Perpetuation of apical inflammation or infection often is due to poorly obturated canals, tissue left in the canal, or quite often an apical delta of accessory foramina containing remnants of necrotic tissue. The removal of this apical segment via apicoectomy usually removes the nidus of infection.

112. **A patient presents for apicoectomy on a maxillary central incisor with failed endodontic therapy. A well-done porcelain-to-gold crown is present, with the gold margin placed in the gingival sulcus for esthetic purposes. What flap design is most appropriate?**

   A full mucoperiosteal flap involving the marginal and interdental gingival tissues may potentially cause loss of soft-tissue attachments and crestal bone height, thereby causing an esthetic problem with the gold margin of the crown. Instead, a submarginal rectangular (Luebke-Ochsenbein) flap that preserves the marginal and interdental gingiva, is recommended.

113. **What is the material of choice for root end fillings in surgical endodontics?**

   Histologic studies have compared several materials, including amalgam, EBA cement, resins, polycarboxylate cements, glass ionomers, and gold foils. Although no study has shown a definitive superiority of one over another, the most commonly used today are amalgam and EBA cements. The type of material is properly secondary in importance to the root resection technique, apical preparation, curettage of the lesion, and technique in placement.

114. **What type of scalpel is best used for intraoral incision and drainage of an endodontic abscess?**

   A pointed no. 11 or no. 12 blade is preferred over a rounded no. 15 blade.

115. **In performing apical surgery on the mesial root of maxillary molars, what mistake is commonly made?**

   It is important to look for unfilled mesiolingual canals in such roots. Therefore, a proper long bevel is necessary to expose this commonly unfilled fourth canal.
116. Numerous studies have addressed the success rates of endodontic surgery. Most agree, however, on certain basic conclusions. Can you name the most common conclusions?
   All of the success studies share certain basic conclusions. First, the success of endodontic surgery is closely related to the standard of treatment of the root canal. Second, orthograde (conventional) root fills are preferred, if possible. Thirdly, the success rate is about 20% lower for retrograde fills than for properly done orthograde fills.


117. What is the recommended surgical approach for apical surgery on palatal roots of maxillary molars?
   The palatal approach is recommended; with proper flap design and size, proper reflection is not a difficult procedure. The buccal approach is potentially too damaging to supporting bone of the molar and may actually cause more risk of postoperative sinus problems.

118. Why is a “slot preparation” often recommended in preparation of root end filling for mesial roots of maxillary or mandibular roots?
   The slot preparation is a trough-type preparation that extends from one canal orifice to another canal orifice in the same root. This procedure is accomplished with undercuts in the adjacent walls. The slot preparation allows not only sealing of the canal orifices but also small anastomoses between the main canals.

119. Has the ideal retrosurgical material been developed?
   No. Many research studies have been published about a myriad of materials. However, the ideal is not yet determined. Most likely the material itself is not as important as the surgical preparation, the depth of the preparation, and how it is placed.

120. After root end resection during endodontic surgery, many practitioners apply citric acid to the exposed dentin surface. What is the rationale behind this practice?
   A desired result of root end surgery (apicoectomy) is to achieve, if possible, a functional apical dentoalveolar apparatus with cementum deposition on the root end. However, the resected root end is covered with a smeared layer of dentin from the high-speed bur, which does not allow reattachment of newly deposited cementum. Applying citric acid for 2 or 3 minutes dissolves the smear layer and causes a small degree of demineralization of dentin. This, in turn, exposes collagen fibrils of the dentinal organic matrix and allows a proper area for attachment of collagen fibrils from newly formed cementum.


121. Several studies have shown that resected mandibular molars fail twice as often as resected maxillary molars. What are the major etiologic reasons for failure?
   The most common cause of failure is root fracture, followed in order by cement washouts around restorations, undermining caries, and recurrent periodontal pathoses around remaining roots.


122. In performing apical surgery, what is the current thinking about the angle of the apical bevel during apicoectomy and how it relates to depth of retrograde fillings?
   Recent studies have shown that increasing the angle of the apical bevel increases the potential for apical leaking due to exposure of more dentinal tubules. A level as close to zero degrees as possible is ideal. In addition, increasing the depth of retrograde preparation and filling decreases apical leaking by sealing more dentinal tubules.

123. Why, in the past, have the mesial roots of maxillary first molars and mandibular first molars failed so commonly after endodontic surgery?
   Before the advent of enhanced illumination and magnification with surgical loupes and the operating microscope, the isthmus between the mesial canals was commonly not prepared. The isthmus may contain necrotic tissue that can perpetuate the apical lesion.
124. **Why are ultrasonic techniques becoming the most popular instruments for retropreparation during apical surgery?**

The ultrasonic systems available today are a huge improvement over techniques in the past. They allow retropreparations that align properly with the long axis of the tooth, and they can be sufficiently deep to conform to the true shape of the apical root canal system.

125. **During apical surgery in the past, teeth with extensive periodontal defects were extracted because of the poor prognosis. Today, however, guided tissue regeneration can save many of these teeth. How does it work?**

An inert barrier is placed over the periodontal defects. These membranes allow proliferation of undifferentiated cells of the PDL and surrounding bone to grow across the wound, potentially forming a new attachment, and prevent the downgrowth of epithelial cells to form a junctional epithelium.

126. **What is the ultimate goal of apical surgery?**

The goal is to eliminate the source of periapical irritation emanating from the root canal, which perpetuates apical infection. In addition, it is important to allow reformation of cementum around the apex, to reestablish a functioning PDL, and to allow alveolar bone repair. If these goals are not possible, we aim at least to allow repair scar tissue, which is less than ideal but still a form of repair.

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