AMERICAN BOARD OF OPERATIVE DENTISTRY

WRITTEN EXAM STUDY GUIDE 2024

This is a suggested framework to guide preparation for the ABOD Written Board exam by providing an overview of the relevant knowledge base. Additional appropriate didactic and teaching materials should also be reviewed in preparing for this exam.

Edited by Jan K. Mitchell, DDS, MEd
drjanmitchell@msn.com

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References (in blue) are chosen as reputable (not necessarily the best or only) sources of information. Links provided as available. Suggestions for additions or substitutions are welcome.

1. Patient topics: Medical management, examination and diagnostics, patient safety. Basics of education.

1. Patient Medical History

Ref: Miller C. Little and Falace's Dental Management of the Medically Compromised Patient. 10th Ed. Mosby, 2023

A. Medical History screening, Oral Cancer Prevalence and Screening

1) Describe how to calculate **smoking history** using pack/years. Describe the influence of tobacco history on oral disease risk and disease progression. Ref: https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/tobacco-use-and-cessation
2) Using a patient's medical history, correctly classify a patient using the American Society of Anesthesiologists (**ASA**) system. Briefly list the shortcomings of the system in outpatient dental care. Ref: https://www.asahq.org/standards-and-practice-parameters/statement-on-asa-physical-status-classification-system
3) **Head and Neck Cancer**: Describe the difference between the oral cavity and the oropharynx and the most common cancers in each, including risk factors for each. Explain the dentist's responsibility in diagnosis and treatment or referral. Describe the role of HPV-16 in the prevalence and outcomes of OPC. Ref: https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/cancer-head-and-neck ; HPV vaccine: https://jada.ada.org/article/S0002-8177(19)30737-8/fulltext?_gl=1*1uhjolm*_ga*NTI1ODAyNDQuMTY2NzY1MDQwNA..*_ga_NJ0EYRGSL1*MTY5MTI1MDM0NC40Mi4xLjE2OTEyNTE5OTAuNjAuMC4w*_ga_X8X57NRJ4D*MTY5MTI1MDM0NC4zNC4xLjE2OTEyNTE5NjUuMC4wLjA.&_ga=2.47357989.380175040.1691250364-52580244.1667650404

B. **Medical Concerns**. Describe the clinical and treatment planning implications of the following medical conditions:

1) **Allergies**- including common medications and latex. Ref on latex allergy: https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/latex-allergy
2) **"Blood thinners"** –List basic types with examples and how each affects dental treatment. Implications of various procedures: Operative injections, scaling and root planing, extraction, surgery. Ref: https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/oral-anticoagulant-and-antiplatelet-medications-and-dental-procedures
3) **Cardiovascular disease-** List associated physical findings observable in a dental visit. List major conditions and their implications for dental treatment (ex MI, CHF, hx heart procedures). Describe which conditions require **antibiotic premedication**, and which do not. Ref: https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/antibiotic-prophylaxis
4) **Diabetes**- Describe how the medications prescribed to the patient give insight into the patient's type and status of disease and may indicate the risk for in-office complications. Explain A1c and what insight it might provide on dietary habits. Ref: https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/diabetes

5) **Hypertension**- Describe parameters of importance in clinical care. Describe implication for anesthesia with hypertensive patients. Ref: https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/hypertension
6) **Joint replacement**- Need for prophylaxis based on most current evidence. Ref: https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/antibiotic-prophylaxis
7) **Obstructive sleep apnea**. List the common presenting signs and symptoms, as well common co-morbidity. Explain how the Mallampati test can provide a screening exam for OSN. Ref: https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/sleep-apnea-obstructive
8) **Pregnancy-** Describe treatment modifications, particularly local anesthetics and other medications. Ref: https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/pregnancy
9) **Renal Dialysis**- including conditions usually associated with need for dialysis and how to manage treatment scheduling around dialysis.

C. Describe the recognition and reduction in risk of **medical emergencies in the dental office:**
1) Explain how to evaluate medical history features and the role of anxiety in office emergencies.
2) List basic equipment/drugs that should be readily available int the dental office for emergencies.
3) Describe the initial measures taken in the dental office to manage these emergencies and include staff training and roles. Specifically, recognize causes for respiratory distress, chest pain, altered consciousness, seizure, allergy related emergencies, and bleeding.
Ref:
1. ADA resources: https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/medical-emergencies-in-the-dental-office
2. Malamed SF. Medical Emergencies in the Dental office, 8th ed. 2022

2. Head and Neck Anatomy and Occlusion

Ref:
1) Glossary of Prosthodontic Terms. https://www.academyofprosthodontics.org/lib_ap_articles_download/GPT9.pdf
2) Okeson J. Management of Temporomandibular Disorders, 8th Ed. 2019

A. Describe **head and neck anatomy** (bones, enervation) particularly muscles related to jaw movement.
B. Name the **structures in the TMJ** and be able to give a working diagnosis of dysfunction from symptoms.
C. Explain key concepts in **occlusion**, including centric, long centric, mutually protected occlusion, canine guidance, group function, anterior guidance. Be able to categorize a patient's static occlusion and occlusal guidance based on tooth relations, occlusal markings, observations and shim stock descriptions.
D. Explain the purpose of an **occlusal exam**. How do you determine if the **occlusal plane** is irregular? How do you determine if a patient has lost **vertical dimension of occlusion**? Explain the parameters of tooth loss due to wear and how it affects restorative treatment planning. What is the difference between an LOA (Limited Occlusal Adjustment) and a COA (Complete Occlusal Adjustment), give examples of when each might be appropriate.

3. Oral Pathology

Ref: Any good oral pathology text should provide information on the following topics.

The overall goal is *clinical* recognition and correct description of common lesions of the head and neck. From those, develop a level of concern, and a **reasonable differential diagnosis** with the goal of creating an **appropriate specialist referral**. Recognize clinical manifestations of common genetic and developmental disorders.

A. Describe common **developmental defects of teeth**, including staining and white areas. Identify the etiology when possible.
B. Describe or **recognize signs and symptoms of common oral lesions** and generalized conditions with oral manifestations and be able to associate with etiology and treatments. Identify those features are most likely to be associated with a malignant lesion. Examples:
    1) Red, white, mixed color and pigmented lesions, single or multiple.
    2) Soft tissue swellings, including gingival swelling, both localized and generalized.
    3) Ulcerations and vesiculo-bullous lesions
    4) Bony expansion
    5) Radiopaque, radiolucency and mixed lucency lesions, lesions associated with unerupted teeth
C. Recognize **diseases of bacterial origin**, including those which are a sequalae of dental treatment such as extraction, surgery or iatrogenic damage. Describe the common presentations of serious infections of the head and neck such as cavernous sinus thrombosis and Ludwigs angina. Describe signs and symptoms that indicate a referral to an Oral Surgeon is indicated.
D. Identify the many presentations of **candidiasis** and describe the appropriate treatment.
E. List common oral sequalae of **head and neck radiation** (in addition to xerostomia and caries) and currently recommended treatment regimen for those issues.

4. Dental Exam Findings, excluding caries

A. List the current recommendations for the indication for **radiographs** based on patient needs. Explain why an "office policy" of periodic radiographs for all patients would be inappropriate. Ref: https://www.ada.org/resources/practice/practice-management/radiographic-imaging https://www.ada.org/-/media/project/ada-organization/ada/ada-org/files/resources/research/oral-health-topics/dental_radiographic_examinations_2012.pdf
B. Describe **common radiographic errors**, particularly in the pan, such as positioning errors. Identify major radiographic landmarks.
C. Identify and describe different types of **root resorption** from radiographs and clinical descriptions.
D. Explain the implications of **periapical radiolucency**, particularly in the pain patient and in evaluating previous endodontic treatment.

5. Diagnosis and Management of Pain and Trauma

A. Describe the basic screening exams for consciousness and cranial nerves for a patient with a presentation of **head trauma**.
B. Using Andreasen and AAE publications as a reference, describe signs, symptoms, and radiographic findings of **dental trauma**. Ref: https://www.aae.org/specialty/newsletter/treatment-traumatic-dental-injuries/
    1) Describe the current WHO categorization of **dental trauma** and basic treatment sequence for each using the AAE guidelines.
    2) Be able to describe emergent treatment and prognosis for each type.

3) What are the recommendations for avulsed teeth?
4) Identify the long term sequalae of trauma in an exam, such as discoloration, calcified or overly large pulp spaces.

C. Describe an algorithm for approaching a **patient in pain**, including important standard questions to elicit a good patient history. Identify the common sources of oro-facial pain other than pulpal pain. Examples: Sinus, Neurogenic, TMD, Referred pain, including angina, Periodontal

D. For patients with **orofacial pain (TMD)**, describe the currently accepted etiology. Explain what role occlusion does and does not play in this etiology. Which muscles are most likely to be a source of pain and describe common pain distribution patterns.

E. Be able to develop a **tentative diagnosis for a pain of dental origin** using signs and symptoms.
1) Describe appropriate follow up clinical tests (Ex: percussion, palpation, cold, EPT, perio probing, appropriate radiographs). Ref:
   a. https://www.aae.org/specialty/wp-content/uploads/sites/2/2017/07/ecfeacutedentalpain.pdf
   b. https://www.aae.org/specialty/wp-content/uploads/sites/2/2017/07/endodonticdiagnosisfall2013.pdf
2) Describe appropriate mitigating measures that can be taken for different pain situations, particularly when pulpotomy or pulpectomy is an appropriate operative treatment. Ref: https://www.aae.org/specialty/wp-content/uploads/sites/2/2017/10/COL041Fall2017EndodonticEmergencies.pdf
3) Identify situations when referral to an Endodontist or Periodontist is indicated. Explain why a referral to an Endodontist should include both a tentative pulpal and periapical diagnosis.

F. Describe the presentation and treatment of **dentin hypersensitivity**.

G. **Cracked tooth**. Describe the features, symptoms, pathogenesis and prognosis of each of these lesions as described by the American Association of Endodontists and describe which diagnostic tools are used to diagnose each. Ref: https://www.aae.org/specialty/wp-content/uploads/sites/2/2022/12/ecfe-fall-2022-REV5.pdf

H. Outline **appropriate use of antibiotics** in treating pain and infection of endodontic origin. Explain the concern around overuse of antibiotics, resistance, etc. Ref: https://www.aae.org/specialty/wp-content/uploads/sites/2/2019/12/ecfe-fall-2019-May-2021.pdf ; https://www.ada.org/resources/research/science-and-research-institute/evidence-based-dental-research/antibiotics-for-dental-pain-and-swelling

6. Pain Management

Ref:
1) Local Anesthesia: Malamed SF. Handbook of Local Anesthesia, 7th ed. 2019.
2) Pain Medication: Moore PA et al, *Benefits and harms associated with analgesic medications used in the management of acute dental pain: An overview of systematic reviews.* JADA 2018.
3) CDC guidance. https://www.cdc.gov/opioids/healthcare-professionals/prescribing/guideline/index.html

A. Be able to list the most common **local anesthetics** used in dentistry, their concentrations, duration of action, and any special characteristics. Be able to list the contents of any standard dental carpule in milligrams.

B. Using anatomic landmarks, describe the technique for **standard operative injections** for local anesthesia: infiltration, Inferior Alveolar block, Gow-Gates, Akinosi. Explain the advantages and disadvantages of each, as well as common risks and management of misadventure.

c. List the current recommendations for **pharmacologic agents for management of dental pain**, with a special emphasis on non-narcotic medications and their relative effectiveness compared to narcotics. List the current CDC guidance on prescription limits of narcotic agents.

7. Facial Esthetic Analysis and Smile Design.

Ref: 1) Facial esthetics**:** Machado AW. 10 Commandments of Smile Esthetics. Dental Press J Ortho 19(4) 136-157. 2014. https://na01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.ncbi.nlm.nih.gov%2Fpmc%2Farticles%2FPMC4296640%2F&data=05%7C01%7C%7C63f5766622cf46dc09ca08db77748088%7C84df9e7fe9f640afb435aaaaaaaaaaaa%7C1%7C0%7C638235114474227954%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=YAxqRb6LrDLdbjVA%2BS%2BlK%2BSfiIGNf%2BHz95PN5jwSg5Q%3D&reserved=0

2) Robbins JW Differential Diagnosis and Treatment of Excess Gingival Display. Pract Periodont Aesthet Dent 11(2) 265-272 1999 https://www.redrocksoralsurgery.com/files/2014/03/Differential-Diagnosis-and-Treatment-of-Excess-Gingival-Display.pdf

A. Overall **facial esthetics**
   1) Explain the basics of an "attractive" face and smile based on current evidence.
   2) Describe a sequence for analyzing a patient's specific esthetic concerns. Using a photograph or diagram, be able to identify facial esthetic concerns.
   3) For a patient with excess gingival display, describe Robbin's method of clinical analysis, diagnostic categories, and treatment for each.

B. **Smile Design**.
   1) List and describe the key parameters of describing how the teeth fit within the framework of the gingiva and the lips to create an attractive smile.
   2) Analyze a smile from a photograph or diagram and identify elements that are less than ideal.
   3) For specific esthetic concerns, describe a range of treatments within the scope of an Operative dentist, including referrals and both conservative and more extensive restorative treatment.

C. **Clinical esthetics analysis**
   1) Facial- Thirds, pupillary planes, occlusal plane, facial midline analysis, causes of excess gingival display
   2) Dental analysis. Smile line, tooth size (height to width, ?golden proportion), tooth midline discrepancy, tooth display at different ages, gingival esthetics, buccal corridor,
   3) Smile design. Describe methods to design and model dentition for the patient and the lab using digital and/or analog methods.

8. Bleaching

Ref:
1) ADA: https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/whitening
2) Haywood VB Tray Bleaching Status and Insights. J Esthet and Restor Dent 33: 27-38 2021 https://onlinelibrary.wiley.com/doi/epdf/10.1111/jerd.12688

A. Materials

1) Describe the current **options in bleaching agents** and explain the advantages and disadvantages of each.
2) List the components of carbamide peroxide.
3) Explain how the agents work chemically and what the time frame is for penetration of tooth structure and duration of action.

B. Clinical techniques

1) Describe the current recommendations for **tray design**, including design for bleaching a single dark tooth.
2) Describe any treatment modifications or techniques for bleaching an endodontically treated tooth, one with calcific metamorphosis and teeth with tetracycline staining.

C. **Managing sensitivity**.

1) Predict which regimen is most likely to cause post bleaching sensitivity, and which patients are most likely to have this complication.
2) Describe the recommended technique to treat, including the most effective ingredient, including exposure time.

D. Outcomes assessment

1) Explain how and why **resin bonding** is affected by bleaching and how long bonding should be delayed.
2) Describe color changes over time after bleaching discontinued and any follow up treatment protocols

9. Dentin Hypersensitivity

Ref: Liu XX. Pathogenesis, diagnosis and management of dentin hypersensitivity: an evidence-based overview for dental practitioners. BMC Oral Health 2020 https://doi.org/10.1186%2Fs12903-020-01199-z

A. Causes

1) Explain the common causes of dentinal hypersensitivity, including which nerve fibers are involved in the pain mechanism.
2) List a differential diagnosis for conditions with a similar pain profile.

B. Treatment. Develop an algorithm for treatment options from most conservative to most complex or involved based on the cause. Describe each in detail, including duration of product use where appropriate.

C. Outcomes assessment. Predict for your patient the likelihood of success for each of these treatments.

10. Periodontics

Ref:

1) AAP Diagnostic criteria 2017. https://aap.onlinelibrary.wiley.com/doi/10.1002/JPER.18-0157 ; https://www.perio.org/wp-content/uploads/2019/08/Staging-and-Grading-Periodontitis.pdf
2) AAP Glossary of Periodontal Terms. https://members.perio.org/libraries/glossary?ssopc=1

A. Describe the basics of the current AAP perio **grading and staging of periodontitis**. See Ref (1).
B. Recognize and categorize **mucogingival defects** using Miller's classification. Integrating the patient's history and hygiene status, integrate the planned restorative treatment to determine when a periodontal referral for soft tissue surgery is appropriate.

a. Ref: https://decisionsindentistry.com/article/diagnosis-treatment-gingival-recession/

C. What are the differences between **primary and secondary occlusal trauma**? How do you diagnose it clinically? What is **fremitus** and what does it indicate? See Ref (2)

D. Explain the difference between **esthetic and functional crown lengthening** surgery and the indications for each. Analyze the tissue biotype and predict surgical outcomes for specific clinical cases.
Ref:
1) Robbins JW. Tissue Management in Restorative Dentistry. Functional Esthetics and Restorative Dentistry. 1: 3 pp 1-5.
2) Long term results on esthetic crown lengthening. https://www.robbinsdds.com/wp-content/uploads/2022/10/RobbinsECL-Article.pdf
3) Decision making in esthetic and functional crown lengthening: https://decisionsindentistry.com/article/decision-making-esthetic-functional-crown-lengthening/

11. Regulatory Concerns and Infection Control

References:
1) Infection control and sterilization: https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/infection-control-and-sterilization
2) Occupational Safety: https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/occupational-safety-and-health-administration
3) Amalgam separators: https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/amalgam-separators
4) Dental Unit Waterlines: https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/dental-unit-waterlines

A. What is the difference between **exposure control and infection control**? Who has regulatory oversight of each one?

B. What is an **engineering control**? What is a **work practice control** and how is it different from an engineering control? Be able to give examples of each.

C. Describe how **dental unit waterlines** become contaminated and the type of bacteria. Explain current mechanisms for maintaining DUW. Who has regulatory oversight of this issue?

D. What is **PPE**? Who has regulatory oversight of this issue?

E. Describe possible sources of **latex exposure**.

F. Discuss radiation hazards and protections for patients and health care workers.

G. Explain **Universal Precautions**

H. Explain the difference between **sterilization and disinfection**. Describe common agents used for disinfection and list the contact times. How long can sterile instruments be left out unwrapped before treating a patient?

I. Explain who regulates **dental waste** and describe how common clinical issues are handled. Ex: What is the difference in blood-soaked items that can be thrown in the trash vs. those that must go into infectious waste? How can you mitigate this situation so that you can legally put these in the trash? What are options for disposing of extracted teeth?

J. Describe standardized information on **hazardous material** and explain who has regulatory oversight of this.

12. Adult Education Basics. The current draft for accreditation of Operative residency programs includes training in advanced education techniques. CODA Standards are included, as dental education is informed by

the CODA definitions and framework. This is a huge and complex topic, but these references and learning outcomes are a manageable basic start. They are science based and remarkably free of jargon, with practical explanations of how to implement in higher education teaching. Unless other references are posted, these form the basis for the topics.

1) Brown, Peter C. Make it Stick: The Science of Successful Learning, Belknap Press. 2014
2) Zakrajsek T, Nilson, Linda B. Teaching at it's Best: A Research Based Resource for College Instructors, 5th Edition. Jossey-Bass, San Francisco, CA. 2023
3) CODA Predoctoral Standards: . https://coda.ada.org/-/media/project/ada-organization/ada/coda/files/predoc_standards.pdf?rev=20eabc229d4c4c24a2df5f65c5ea62c8&hash=B812B8A2FAF6D99F37703EE081B48E58

A. List and explain the basic **elements of cognitive architecture** and how it informs the development and effectiveness of instructional techniques. Ref: Artino AR, *Cognitive Load Theory and the Role of Learner Experience: An Abbreviated Review for Educational Practitioners*. AACE Journal 16(4), 425-439. 2008.
   1) **Working memory**- number of novel items that can be learned at a time, visual and auditory processing channels and how to maximize.
   2) **Long term memory**- capacity and structure of memory
   3) **Schema and schema development** and how this increases memory capacity. Explain how novice learners become overloaded without schema development. Describe how the concept of schema informs development of a learning module.
   4) **Cognitive load** and it's role in the development of long-term memory. Describe educational techniques that facilitate or handicap learning.
   5) Explain how the **expertise reversal effect** may complicate learning at the residency level.
B. Explain key **research-based concepts** in how adult students learn. Examples:
   1) People learn best from **active engagement** rather than teacher-centered teaching (i.e., passively listening to a lecture). It's not "this modern generation," research shows the brain can't keep focus for long in a passive state.
   2) Learning is most effective when new material is presented **multiple times in different ways** and in different formats.
   3) People learn best when they actively monitor their own learning and reflect on their performance using **metacognition**.
   4) Frequent **testing is more effective than reviewing** material in memory development.
C. Describe how key **teaching principles** can be implemented in dental education:
   1) **Start where students are**. Recognize that students know little about the topic, so how to develop the intellectual framework (schema) early in instruction is critical for students to see how the facts they are memorizing fit together.
   2) Teach students **how to learn your topic** and build assignments so they see the structure and decision making demanded by the topic. Show them study aids like Anki (electronic flash cards based on spaced repetition), explain importance of clinical decision trees, checklists, and algorithms.
   3) Teach in **multiple modalities**: have students read, hear, talk, write, draw, carve and wax, and develop mind maps on topics.
   4) Hold students to high, but reasonable and practical, **expectations**.
   5) **Test often**, especially low-stakes quizzes to allow students to analyze and assess their own learning.
   6) Make the material **relevant to patient care** through case examples that demonstrate the thought processes that becomes "critical thinking skills."

7) Develop **creative, practical tasks for small group learning** in class, and individual learning, such as homework. Use real life situations that require problem solving.

D. Diagram **Blooms taxonomy** of learning and assessment. Within the limitations of this schema, recognize how to categorize the level of learning activities and assessment items using it. Ref: https://socialsci.libretexts.org/Under_Construction/Purgatory/Book%3A_Instructional_Methods_Strategies_and_Technologies_to_Meet_the_Needs_of_All_Learners_(Lombardi)/01%3A_Chapters/1.08%3A_Blooms_Taxonomy

E. CODA outlines the need for a "**humanistic learning environment**- where graduates are prepared to join a learned and a scholarly society of oral health professionals. A humanistic pedagogy inculcates respect, tolerance, understanding, and concern for others and is fostered by mentoring, advising and small group interaction." Describe some steps to create this in your teaching. Ref: Zakrajsek Part 2: The Human Side of Teaching.

F. Explain what **CODA means by "competency"** and recognize how these are integrated into a curriculum. Describe how CODA's emphasis on students' development of "knowledge, skills and attitudes" influences curriculum and module design. Ref: CODA Standards for Undergraduate Dental Education

G. Construct a good set of **Learning Outcomes** for a course, module and class session using active verbs appropriate to define the "levels of knowledge, skills and values required by the new graduates to begin independent, unsupervised dental practice" of a competency. Zakrajsek Part 1, Ch 2: Designing Outcomes-Centered Courses

H. Explain the advantages and shortcomings of lecture as a teaching method, including the evidence on student attention span during lecture and the "forgetting curve" for material learned through lecture. Ref: Cantillon P, *ABC of learning and teaching in medicine: Teaching Large Groups.* BMJ 326: 437-40. 2003.

I. Describe the elements of an **effective lecture**, including good visual techniques. Explain how **active breaks** can make a lecture somewhat interactive. Ref: Cantillon P, *ABC of learning and teaching in medicine: Teaching Large Groups.* BMJ 326: 437-40. 2003; Zakrajsek Part 3, Ch 13,14. Examples:
   1) Think-Pair-Compare (or Share)
   2) Reflexion/reaction
   3) Creating a multiple choice item
   4) Reorder the steps

J. Describe some of the most common **active learning techniques** in adult education and the rationale for using them. Examples:
   1) **Flipped classroom**. Content delivery prior to class to freeing up class time for active learning
   2) **Team-Based Learning**. Powerful tool for modeling and developing an applied schema and critical thinking skills in clinical practice. Concepts for "backward design" of course, creating small group work within a large classroom, designing lessons to model critical thinking processes. Ref: Michaelsen, Larry K. Team-Based Learning: A Transformative Use of Small Groups in College Teaching. Routledge, 2004

K. Explain the difference between **formative and summative assessment** and the value and appropriate use of each.

L. Describe and construct a good **rubric** for assessment of practical skills. Ref: *O'Donnell, J et al, Rubrics 101: A Primer for Rubric Development in Dental Education. JDE, 75:9 pp 1163-1175 2011*

M. List, define, explain and assess a full **range of assessment options** in dental education and plan where they are appropriate. Ex: Written Exam, Standardized Oral Exam, Standardized patients, simulation, Triple Jump, Objective Structured Clinical Exam (OSCE), portfolio). Ref: Kramer G et al. *Dental Student Assessment Toolbox.* JDE 73:1 12-35 2009; Zakrajsek Part 5: Assessment and Grading

N. Be able to recognize and construct **good written exam assessment items** using best practices for commonly used multiple choice and multiple response options. Zakrajsek Part 5: Assessment and Grading
O. Analyze the common **educational statistics** that are available when tests are given in an electronic format, including acceptable ranges for good test items. Ex: p-value or correct response %, Upper and Lower 27%, Point Biserial, Discrimination Index. Recognize which items need review or deletion based on these analytical tools. https://examsoft.com/resources/item-analysis-with-examsoft/

Section mentored by Dr. Jan Mitchell.

Contributors: Dr. Kristi Erickson, Dr. Justin Watson.

2. Cariology: Saliva, Microbiology, Caries Risk Assessment, Clinical caries detection appearance, and progression. Prevention and non-surgical treatment.

1. Salivary factors

A. Salivary glands: Flow rates and chemistry

1) List and explain the salivary glands with their normal flow rates both stimulated and unstimulated.
2) Compare saliva composition (and clinical significance of this) from different glands.
3) Explain the buffering capacity of saliva
4) List and describe other key components of saliva and their function in caries

B. Clinical salivary testing and patient perception

1) Define the terms and explain the difference between: "dry mouth", xerostomia, hyposalivation. Ref: https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/xerostomia
2) Describe common classes of medications that reduce salivary flow. Explain if they restrict stimulated, unstimulated saliva or both, and how this can affect patient perception of dry mouth.
3) Describe, on average, how much salivary flow is lost before a patient notices, and how patient efforts to mitigate sub-clinical dry mouth sensation can affect caries rate.
4) List and explain the current options for testing salivary flow and composition.
5) Explain how the results of these tests can inform caries prevention or treatment planning.
6) Explain the implications of clinical hyposalivation on acid clearance in plaque.
7) Briefly describe how saliva may serve as a diagnostic fluid for systemic diseases. Ref: https://jada.ada.org/article/S0002-8177(23)00280-5/fulltext?_gl=1*u2wjfn*_ga*NTI1ODAyNDQuMTY2NzY1MDQwNA..*_ga_NJ0EYRGSL1*MTY5MjQ3MjMwOS40OC4xLjE2OTI0NzMzMzIuMjUuMC4w*_ga_X8X57NRJ4D*MTY5MjQ3MjMwOS40MC4xLjE2OTI0NzMzMzIuMC4wLjA.&_ga=2.114888655.992691417.1692472325-52580244.1667650404&_gac=1.127341055.1692472310.Cj0KCQjw0IGnBhDUARIsAMwFDLmEIGBiIHZbYssmbcUUPGvlp0A-OnGBFVpw8kV0AYOWf-MfFFHfhMEaAsXwEALw_wcB

C. Treatment options

1) Describe over the counter options (including product components) for stimulating salivary flow.
2) Explain an algorithm for prescription options for stimulating salivary flow.

D. Pellicle and Plaque

1) Describe the process of pellicle formation.
2) Describe how dental plaque biofilm forms and changes over time
3) Explain the effect of a high sucrose environment on plaque

E. Post-radiation patients

1) Describe the non-surgical treatment planning sequence for a patient with a diagnosis of head and neck cancer.
2) For patients who have undergone head and neck radiation or chemotherapy for cancer, list and describe the common oral complications.
3) Develop a caries plan for a patient with severe hyposalivation post radiation.

2.Diet and Effect on Caries Microflora

A. Pathogenic Caries Bacteria

1) List the common bacteria responsible for caries activity.
2) Assess the virulence factors of different bacteria in caries

3) Briefly describe how bacterial populations change and interact over time.

B. Dietary Factors

1) Explain which types of carbohydrates are most responsible for caries activity, including their effect on pH.
2) List foods that are cariostatic and caries protective.
3) Describe successful strategies for supporting patient behavioral change around individual caries risk factors

C. Oral Biome

Ref: Wade W. Resilience of the oral microbiome. Perio 2000 2021 https://doi.org/10.1111/prd.12365

1) Describe the resilience of the oral biome and what factors can affect it over time.
2) Briefly explain how pH affects the overall interaction of bacteria, diet, saliva and caries.

3. Clinical Caries Detection and Diagnosis

A. Clinical detection and diagnostics

1) On smooth surface enamel, describe what color and texture indicates about caries activity.
2) Describe the ICDAS categories. Be able to categorize a surface from a description and/or clinical or radiographic image. Correlate the ICDAS category with predicted histological findings. Ref: icdas.org, Gugnani et al, International Caries Detection and Assessment System (ICDAS): A New Concept. Int J Clin Pediatr Dent. 2011 May-Aug; 4(2): 93–100. doi: 10.5005/jp-journals-10005-1089
3) Compare and contrast ICDAS systems (standard and combined) and the ADA's Caries Classification System (CCS). Ref: Young DA, Novy BB, Zeller GG, et al. The American Dental Association Caries Classification System for clinical practice: a report of the American Dental Association Council on Scientific Affairs. J Am Dent Assoc 2015;146(2):79-86. • DOI: 10.1016/j.adaj.2014.11.018
4) Explain the research evidence for caries progression to reach the DEJ, the pulp.
5) For a radiographic image of a decalcified area of enamel, predict how likely it is to represent a cavitated lesion.
6) Describe root caries clinical appearance, symptoms and progress over time.

B. Other caries detection technologies

1) Explain how DignoDent works. How clinically reliable is this technology?
2) Explain how DiFOTI works. How clinically reliable is this technology?
3) Describe any other currently available detection technologies.
4) Explain the sensitivity and reliability of caries detective technologies.
5) Describe which system, if any, can quantify the severity of a lesion.

C. Evaluating Secondary Caries, Margin Integrity

1) From a clinical description and/or photographic or radiographic image, evaluate a restorative margin for caries.
2) Be able to correlate a marginal appearance and the presence of caries. Explain a decision algorithm for repair vs replacement of the restoration.

4. Medical Model of Caries, Caries Risk Assessment

References:

a. ADA resource: https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/caries-risk-assessment-and-management

c. Featherstone, Chaffee. The evidence for Caries Management by Risk Assessment. Adv Dent Res 2018 Feb 29(1) 9-14 https://pubmed.ncbi.nlm.nih.gov/29355423/

A. Briefly describe the history of caries theory with key important researchers, up to the current theory.
B. Enamel Remineralization. Describe strategies for increasing remineralization in high risk caries patients.
C. Compare and contrast the CAMBRA and ADA systems for determining caries risk.
D. Describe the difference between Pediatric and Adult systems. What is the rationale for the differences?
E. Be able to categorize a patient from a clinical description and clinical and/or radiographic images.
F. For any particular lesion, describe surgical treatment implications of the patient's CRA.

5. Caries Prevention and Non-Surgical Management

A. **Fluorides**

References:

a. https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/fluoride-topical-and-systemic-supplements

b. Cochrane Database Syst Rev. Zipporah Iheozor-Ejiofo et al. Water fluoridation for the prevention of dental caries. 2015 Jun 18;2015(6):CD010856. doi: 10.1002/14651858.CD010856.pub2

1) Give a brief history of water fluoridation in the US and describe how to find out the level of fluoridation in a specific location. Explain the current research on the topic.
2) Explain briefly how water fluoridation levels are determined.
3) Fluoride formulations:
    a. Calculate the concentrations for various preparations (varnish, toothpastes, rinses) in ppm and percentages.
    b. List the maximum amounts of fluoride allowable in OTC preparations in the US. Is this the same in other countries?
4) List and describe the current ADA recommendations for F application for children and adults based on CRA.
5) Describe the symptoms of fluoride toxicity.

B. **Xylitol, other sweeteners**. Explain the role of xylitol and other non-nutritive sweeteners in caries management.
C. **Other non-surgical management strategies**. Describe the current research on the effectiveness of additional strategies such as arginine, ACP, gum chewing, and Silver Diamine Fluoride (SDF).
D. Describe an algorithm for non-surgical treatment of a patient's CRA based on the underlying reasons for the risk.

6. Pathophysiology of Caries

1) Normal microanatomy of enamel, dentin, pulp.
    a. Describe dentinal anatomy histopathological changes from DEJ to pulp
    b. Describe the microanatomy of enamel and composition of enamel and how it affects caries progression.
2) "Zones of demineralization in enamel and dentin." Describe how the caries process affects the histopathology of caries affected enamel and dentin progressively.
3) Pulp reaction to insult:
    a. Describe the pulpal reaction to caries, including development of tertiary dentin, and to restorative treatment.
    b. Construct a schema of strategies for "pulpal protection" in restorative care and their effectiveness.

4) Urgent Caries Management ("Caries Control"). Construct a clinical protocol for sequencing treatment of a patient with rampant caries, including preventive strategies, SDF and transitional restorations.

7. Vital Pulp Therapy

1) Case selection. Construct an evidence-based algorithm, including clinical tests, for selecting a case appropriate for vital pulp therapy as opposed to endodontic therapy.
2) Technique, materials.
   a. Construct a chart of agents and effects of common vital pulp therapy agents. Ex: CaOH, MTA
   b. Develop a sequential plan for how to do deep caries removal and management of inadvertent exposures based on clinical findings, including patient age and amount of bleeding.
   c. Outcomes assessment. Create an description of the evidence base for success in vital pulp therapy.

8. Non-carious Tooth Loss Processes

Ref: https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/dental-erosion

1) Describe the difference in micro appearance of an erosive tooth loss vs. carious lesion.
2) Recognize and diagnose a case of non-carious tooth loss based on clinical appearance and/or images.
3) Develop preventive strategies for patients at risk of non-carious tooth loss based on etiology.
4) Explain the possible etiologies in non-carious cervical lesion (NCCL) development.
5) Describe features of rapid erosion.

Section mentored by: Dr. Justine Kolker, Dr. Marcela Hernandez, Dr. Supattriya Chutinon

Contributors: Dr. Islam Al Raheam, Dr. Danika Downey, Dr. Matthew Rouse

3. Direct Restorative

1. Instrumentation and Isolation

A. **Hand Instrumentation** Describe and name hand instruments based on purpose and instrument formula. Explain the use of hand instruments in conservative tooth preparation.
B. **Rotary instrumentation** Explain the current numbering system and the system proposed by the International Dental Federation. Define rake angle and clearance angle. Describe the common usage of each shape of bur commonly used in operative dentistry. Describe the surface characteristics each major type of bur imparts to dental tissue: enamel and dentin.
C. **Field Isolation** Construct an explanation of the major options in isolation, and advantages and disadvantages of each. Explain the evidence that supports isolation as in important factor in the quality and longevity of restorations, particularly for bonded restorations.
D. **General Preparation Principles** List and describe Black's steps of preparation. Categorize any action by its intended goal. Describe the best techniques and instruments for removal of carious tissue while minimizing pulp exposure.

2. Bonding to Enamel and Dentin

A. **Principles of adhesion** Describe the history of enamel and dentin bonding and how evolving knowledge may predict the status and longevity of a restoration. Describe the important researchers responsible for each step of this evolution.
B. **Define and differentiate between surface tension and surface energy, and related how these two basic principles dictate many clinically relative aspects of bonding.**
C. **How the structure of enamel and dentin affects bonding**
    1) Explain how differences between enamel and dentin affects bonding, including differences in mineral content, tissue structure, and crystalline content.
    2) Describe enamel bonding, including the effect of acid on enamel. Explain the clinical implications if enamel is over etched or under etched. Describe physiological and physical differences between coronal enamel and cervical enamel and how the structure of marginal enamel may lead to abfraction formation and poor bond strength.
    3) Describe differences in etching different types of dentin: superficial, deep, sclerotic, secondary dentin, etching porential of interdental and peritubular dentin.
    4) Describe the hybrid layer and how dentin bonding agents work. Explain where bond strength comes from. Explain the clinical implications if over etched or under etched dentin.
D. **Bonding systems and strategies**
    1) Define the terms "total etch," "selective etch," and "self-etch."
    2) Describe in detail the specific differences in bonding systems. Explain why different systems can't be used interchangeably.
    3) Describe matrix metalloproteinases (MMPs) and their role in dentin bonding, including location, structure, and how they affect bond strength.
    4) List commercial products and the compositional strategies they employ that are used to mitigate the potential problems with MMP action.
E. **Clinical use of Bonding Agents**
    1) Explain C-factor and how that concept can be used to manage polymerization stress, particularly on marginal integrity.

2) Explain rationale for clinical use of bonding in common bonding and cementing situations.
3) Compare and contract differences in bond strength to cementum and dentin and enamel, and how these differences might lead to use of different products depending on margin location.

3. Resin Restorative Materials

A. Material considerations
1) Describe differences in **resin bonding** agents, sealants, "flowable" composites, and composite restorative materials.
2) Describe **filler particle size** and composition in commonly used materials, and address if presentation of filler content by weight or by volume is best to use for assessing clinically relevant parameters.
3) Explain the "**oxygen inhibited layer**" and its clinical ramifications.
4) Explain where N, N dimethyl-p-toludine is used and why, as well as what might be a clinical implication on the color stability of products using this component.

B. Preparation
1) Describe basic principles of preparation design for resin-based restorations in a sequential order.
2) Describe the rationale for margin design at different locations on a resin preparation, including esthetic zone and areas in occlusion.

C. Clinical techniques
1) Describe techniques for the following:
   a. Diastema closure
   b. Posterior interproximal contact—construct a chart explaining different matrix systems with advantages and disadvantages and clinical use
   c. Margin elevation
   d. Composite layering techniques
2) Describe techniques, with evidence for and against each of the following:
   a. Use of flowable composite
   b. Use of "bulk fill" composite
   c. Managing depth of cure for different materials and shades of composite

D. Indirect resin restorations
1) List indications and contraindications for an indirect resin-based restoration.
2) Describe analog and digital methods for fabricating an indirect resin restoration, including CAD-CAM and 3D printing.
3) For internal retention restorations, compare CAD-CAM resin and porcelain restorations.
4) State the materials to use and the sequence of steps to follow for cementation (or bonding) or an indirect resin restoration.
5) Provide an evidence-based strategy for use of indirect resin-based restoration as opposed to a definitive indirect ceramic or gold-based restoration.

E. Repair
1) State guidelines to follow when making the decision to repair or replace an existing resin-based restoration.
2) Describe surface treatments and materials to be used to enhance the potential of successfully repairing an intraoral resin-based restoration.

3) Provide an evidence-based strategy decision if an existing resin-based restoration needs repair or replacement.

F. Outcomes Assessment
   1) Explain why posterior resin restorations fail and state the most common site for recurrence of decay causing restoration failure.
   2) Construct a schema explaining the causes of post-operative sensitivity with resins and describe any mitigation strategies.
   3) Describe causes of and mitigation for marginal gaps, specifically when margins are in dentin such as Class V restoration.
   4) Explain the consequences of water sorption in resins.
   5) Predict the longevity of intraoral repair of resin-based restorations.
   6) State the causes of wear of a resin-based restorative material and how the wear rate of these types of restorations differs from that of enamel and is affected by different types of agonists.

4. Light curing. Generally, describe the polymerization process and the influence of different monomers, fillers, initiators and inhibitors on the polymerization process as well as explain the drawbacks and clinical outcomes of under-cured resins and strategies to improve the degree of conversion.

A. Provide the **wavelength range** needed to activate camphorquinone, and that needed to activate the "alternative photoinitiators."
B. State differences between Norrish Type 1 and Type 2 **photoinitiator**, and indicate which initiators used in dentistry fall under those classifications, and the clinical implications of each category type.
C. Define composite **"depth of cure"** and indicate factors related to the curing unit, the distance to the target material, the restorative material to be used, the material interposed between the light source and curable resin, and operator technique that might affect this parameter.
D. Define the phrase "**Monomer Conversion**" and how it relates to the properties of a polymerized restoration, and the validity of comparing this value among different commercial types of composites.
E. State the differences between blue only and multi-wave LED-based **curing lights** and provide clinical examples where each might be more suited for use than the other.
F. **Define the following terms** and provide clinical examples of their usage: radiant flux, radiant exitance, incident irradiance, radiant exposure.
G. Define the phrase "**dark cure**," indicate what specifically is happening during that time with respect to resin curing and state the clinical consequences of additional resin curing during this late stage.
H. Describe proper use of a handheld **radiometer**, how often each curing unit should be checked, and the significance and limitations of that value.
I. Explain the possible hazards to eye health of dental curing lights to dental health care workers and mitigation strategies.

5. Glass Ionomer Restorative Materials

A. Material considerations
   1) Describe the setting process for a conventional glass ionomer (GI) restorative material and what affects the set of GI, including moisture content. Explain the bonding mechanism of glass ionomers to tooth structure, including which ions are involved and when they are involved. Explain the nature of this bond to tooth structure.
   2) Explain the difference between conventional GIs and resin modified GIs in setting mechanism, bonding, and clinical properties.

3) Construct an explanation of the types of glass ionomers and explain the differences between the types. Indicate appropriate uses for each. Explain what constitutes a “glass hybrid” restorative material and how it differs from other types of material in this classification.
4) State differences in material properties and potential for bonding to tooth as one proceeds from a conventional glass ionomer, to a resin modified glass ionomer, to a compomer, to a giomer, and finally to a composite.

B. Preparation and Surface Treatment
1) Explain how to condition dentin for a GI restoration and why a weak acid is used.
2) State why phosphoric acid should not be used on a surface that is to receive a glass ionomer restoration.
3) Describe how to manage moisture levels on the surface of a completed GI restoration and explain why it is important to the material.

C. Clinical use and techniques
1) Glass ionomer can be difficult to handle. Describe some techniques to help manage this material and achieve a predictable seal.
2) Describe two methods used for the “sandwich technique” and explain the advantages and disadvantages of each.
3) Explain how glass ionomer can be used for the “margin elevation” technique.
4) Indicate why a GI-based material is contraindicated for Class I and Class II situations.

D. Outcomes Assessment
1) Describe the current evidence for the longevity and durability of glass ionomer restorations, including Class V restorations and those in occlusion.
2) Construct an chart of observations that may indicate problems with the material and any clinical methods of prevention or mitigation.
3) Explain the current evidence for or against the ability of glass ionomer to reduce the rate of recurrent caries, particularly in those patients with hyposalivation, and what is there about this product type that potentially is the contributing factor.
4) Provide an evidence-based strategy decision if an existing glass ionomer restoration needs repair or replacement.

6. Amalgam

A. Material Considerations
1) Describe different amalgam options currently available.
2) Describe the basic manufacturing process for spherical and lathe-cut amalgams.
3) Describe the amalgamation reaction and related phases. Describe the weakest and strongest phases.

B. Preparation
1) Describe standard design for all types of amalgam preparations and explain which features are important in retention and resistance. Explain difference between an amalgam and gold foil preparations in situations where either may be used.
2) Describe preparations for special circumstances, such as Ex: slot preparation and mandibular premolars. Describe when additional retentive features are appropriate and describe the location for them.

3) Describe features of preparation design associated with fracture of amalgam and how to mitigate that risk.

C. Clinical techniques
   1) Explain the differences in clinical use of different types of amalgam in terms of placement, condensation processes, setting characteristics, and outcomes assessment.
   2) Describe how to minimize creep in amalgam.
   3) Explain galvanism in clinical use of amalgam, including when it occurs and techniques to mitigate it.

D. Auxiliary retention, including pins
   1) Construct an explanation of the current evidence-based indications for use of pins with amalgam.
   2) Describe the landmarks used to achieve correct angulation for pin placement and describe the likely complications of deviating from these recommendations.
   3) List the sizing system for TMS pins and describe their features.
   4) Describe the current evidence for stresses in dentin induced by pins.

E. Mercury in Dentistry
   1) Explain which clinical procedures generate the greatest mercury release from amalgam and how to mitigate risk to operator and patient.
   2) Describe which form of mercury is of most concern in dentistry. Explain common physiological concerns around mercury.
   3) Explain the history and basic content of the Minamata Treaty and its implications for amalgam use.
   4) Explain the use of amalgam traps and state protocols for storing and disposing of excess, set amalgam and of extracted teeth having amalgam restorations.
   5) Explain why clinical areas should not be carpeted if dental amalgam is used.

F. Outcomes Assessment
   1) List indications for amalgam, specifically where it is arguably the best material for the indication.
   2) Construct an explanation for the causes of post-operative sensitivity in amalgam, including any age or previous treatment factors, and describe mitigation strategies.
   3) Describe the most common reasons for failure of amalgam restorations.
   4) Describe reasons for extrusion of amalgam restorations.
   5) Describe an evidence-based algorithm for deciding if an amalgam restoration should be repaired, refinished, or replaced.
   6) State the longevity potential for large amalgam, pin-retained restorations compared to large bonded direct composites.

7. Gold Foil

A. **Material considerations.** Describe the features of gold foil that make it a good restorative material, including coefficient of thermal expansion and cold welding at room temperature.
B. **Preparation.** Explain why the classic Ferrier Class V preparation takes advantage of gold's physical properties. Describe which wall is the primary retentive feature.
C. **Clinical techniques.** Describe the basic steps in preparing the gold foil and placing it. What happens if the material is under-heated or over-heated?
D. **Treatment Planning.** While this material is not used often, list several indications for a gold foil restoration.

8. Restoration of Endodontically Treated Teeth

A. Structure of endodontically treated teeth

1) Explain the reasons why endodontically treated teeth are more likely to fracture than untreated teeth.
2) Describe location of common areas for perforations and near-perforations in endodontic therapy and explain how this affects restorative treatment.
3) State criteria for evaluating is an endodontically treated tooth needs indirect coronal coverage or not.

B. Treatment planning, post selection

1) Discuss how to evaluate the success of previous root canal therapy. In the case of questionable periapical health (either by clinical or radiographic tests, including CBCT), explain the possible causes. Develop reasonable treatment options to present to the patient.
2) From a clinical presentation, based on restorability and patient factors, determine if retaining a tooth is in the best interests of the patient. https://www.aae.org/specialty/wp-content/uploads/sites/2/2017/07/ecfe_spring2017_retreatment.pdf
3) Explain the need for retreatment when the endo provisional has been lost over various time frames.
4) Construct a chart describing the current options for endodontic post material and describe the indications, advantages, and disadvantages of each. Describe which options cause the most and least stress and which type does the evidence indicate has the best clinical longevity.
5) Describe the indications, advantages, and disadvantages of the endocrown technique.

C. Clinical techniques

1) State the sequential steps in preparing a post space and in cementation of the different types of endo posts.
2) State the options available (advantages/disadvantages) of materials used for core buildup around the endodontic post.

D. **Outcomes Assessment**

1) Explain the most common reasons for failure of endodontically treated teeth.
2) Discuss the evidence addressing various post options and their success rates over time.

9. Treatment Planning Direct Restorations

A. Comparative material options

1) Construct a chart describing the antibacterial effects of current direct restorative materials and explain the clinical significance of these characteristics.
2) Create a ranking of key physical properties of current direct restorative materials including coefficient of thermal expansion and compressive and shear bond strengths.
3) Compare and contrast the relative opacity/translucency capability of composite and glass ionomer materials and state limitations of each product for purposes of providing highly esthetic outcomes.

B. Sequencing treatment

1) Develop an evidence-based scheme for treatment planning a complex case having multiple planned direct restorations. For this scheme, consider lesion depth, anterior vs. posterior, and how patient preference should be factored.

2) Describe sequence treatment when pre-restorative periodontal surgery is required, including delay time after surgery.

10. Research Basics

A. Explain a strategy for reading, interpreting, and critically analyzing a research article.
B. Describe the hierarchy of evidence and the decision-making process for research
C. Describe the key necessary content of components of each section of a well-written research paper: Structured Abstract, Introduction, purpose, Research Hypothesis, Materials and Methods, Statistical reporting, Results, Discussion, Conclusion, Bibliography.

Section mentored by Dr. Blaine Cook, Dr. Richard Adcook

Contributors: Dr. Rana Al Kattan, Dr. Fatema Alqudaihi, Dr. Jaren May

4. Indirect Restorative

1. General procedural topics

A. **Hemostatic agents.** Construct a chart explaining the categories of hemostatic agents (including putty options) currently in common use, with their advantages, disadvantages, and recommended use. List whether or not the hemostatic agents are potential inhibitors of resin polymerization.

B. **Electrosurgery vs. lasers**. Describe the use of these options in tissue management when taking impressions and list their advantages and disadvantages.

C. Provisional materials

1) Describe the use of putty in fabricating provisionals, including best materials for this use.
2) Construct a description of materials currently in use for fabricating provisionals and their advantages and disadvantages
3) Describe strategies for temporizing a non-retentive preparation, ie, ceramic onlay.
4) Describe possible outcomes and complications of a provisional with inadequate contact and/or occlusion.
5) Describe how provisional restorations can be used to modify subgingival contours for implant placement

D. **Forces of Mastication**. Describe factors indicative of excessively heavy masticatory forces and how those forces influences material choice in indirect restorations.

2. Impression Materials

A. **Material considerations**. Construct a chart of current commonly used impression materials (including alginate) with their comparative physical properties including tear strength, reproductive quality, wettability

B. **Material selection.** Based on their physical properties, select a material for specific clinical situations. Describe the best tray design for each material, and any agents needed to retain the material in the tray.

C. **Clinical procedures**. Explain the role of isolation, tissue retraction, and need to maintain a dry field in impression techniques. Describe specific techniques for using each impression material. List recommended disinfection procedure for each type of material. Include best methods for removal from the mouth to optimize tear strength, but minimize stress on remaining teeth.

D. **Laboratory Procedures.** Describe optimal times to remove set stone and impression according to material, accuracy of impression materials after a 24 hr delay in pouring. What errors or issues with the stone material would you expect to see in this situation?

E. **Digital impressions**. Describe clinical techniques for achieving the best results in making digital impressions. Describe the factors that are considered when analyzing the accuracy of digital impressions.

F. **Outcomes Assessment.** Compare the accuracy of analog against digital impressions with respect to types of tissues and preparations being scanned.

3. Cast Gold, including PFM (Porcelain Fused to Metal)

A. **Material considerations**. Construct an explanation of the different types of dental gold, differences among their general physical properties, and indications for use. Explain how added metallic elements affect important characteristics such as porcelain bonding and heat-hardening. Explain how metal ductility is related to marginal adaptation and what types of alloys and treatments can be used to optimize marginal adaptation.

B. **Treatment planning.** Describe clinical situations where a cast gold or PFM crown is indicated, and where it is the best option, absent significant esthetic concerns.

C. **Preparation**.
   1) Describe preparation design for a gold crown: taper, factors and features to increase retention, functional and non-functional cusp reduction design, margin design.
   2) Describe preparation modifications needed for PFM, including margins and contacts (in metal or porcelain?)
   3) Describe how to provisionalize a gold inlay/onlay preparation.

D. **Laboratory procedures.** Describe how basic lab steps affect the cast material. Examples: Location of sprue, quenching. Troubleshoot common laboratory errors such as fins, rounded margins.

4. Ceramic Restorations

A. Material characteristics.
   1) Construct a chart of the components of feldspathic porcelain and the effects of each on physical properties.
   2) Describe the differences between feldspathic porcelain, a leucite-reinforced porcelain, a glass-ceramic, and a totally ceramic restorative material.
   3) Define the classification of resin-hybrid ceramics and what advantage/disadvantages they have with respect to other types of ceramics.
   4) Describe zirconia as a ceramic material.
   5) Construct a chart of the categories of zirconia materials currently being used based on their composition and describe differences their clinical characteristics resulting from these compositional differences.
   6) Explain transformational toughening, what compositions of ceramic allow this phenomenon, and describe how manipulation of a finalized restoration can be affected by this type phase transformation prior to cementation.
   7) Describe how and where ceramic restorations (both monolith and layered) fail, including chipping and why.

B. **Material selection**. Explain how a ceramic material is selected considering the following factors: occlusal forces, esthetic requirements (including darkness of tooth structure), retentive ability of preparation.

C. **Preparation design**.
   1) Describe the preparation design for ceramic inlay and onlay. Describe how this type preparation differs from a preparation for cast gold.
   2) Describe differences in preparation design for milled vs. pressed ceramics.

D. **Clinical procedures**.
   1) Develop a chart of the sequence of steps from laboratory fabrication to final evaluation after cementation, including cleaning procedures and materials for each of each currently available ceramic-based restorative material.
   2) State the difference between luting and bonding a ceramic restoration, and the correlation between axial taper and these two cement categories.
   3) State why the concentration of glass in a ceramic restoration is a primary factor in consideration of bonding strategies between the restorative material and a resin cement.

E. **Outcomes Assessment.**
   1) Explain current evidence for comparative longevity of different materials.
   2) Describe the most common reasons why ceramic restorations fail.

5. Ceramic Veneers

A. Case selection, material selection, treatment planning.

1) Choose the best material for a case based on amount of color blockage needed, patient esthetic demands, occlusion, and other clinical factors. Ex: planning for veneer on a single dark tooth.
2) Describe techniques to make a restoration appear wider, narrower, etc.

B. Preparation.

1) Describe best evidence for preparation design including standard depths, incisal clearance, contact design.
2) Explain the process for how to prepare teeth using a design mockup.

C. Laboratory procedures.

1) Describe the general process for fabrication of ceramic veneers using current common materials.
2) Describe the staining options available for different materials.

D. Clinical procedures.

1) List the procedural steps for cementation of veneers, including cleaning agents after try-in
2) Describe the bonding process for enamel and dentin in the cementation process
3) Explain the current evidence for choosing a cement for veneers
4) Explain why some resin cements discolor over time

6. Implants

A. **Case selection and treatment planning**.

1) Describe differences in bone type and classifications with respect to placement of dental iimplants.
2) Construct a chart explaining the parameters for characteristics and amount of bone and occlusal clearance for planning implants, including space between implants, and explain the evidence for these parameters. Using radiographs and images of casts with measurements, develop a treatment plan for implant placement.
3) Explain the anatomic concerns and risks related to implant placement in the maxilla and mandible.
4) Predict gingival architecture that can be anticipated after implant placement. Explain what a periodontist can do to improve the overall result where needed.
5) Describe the digital workflow involved in developing a surgical guide.

B. **Occlusion.** Describe the ideal occlusion for an implant, including occlusal force direction and amount. Explain how occlusal force is evaluated clinically.

C. **Outcomes assessment.**

1) Construct an explanation on the parameters for normal bone loss around an implant during the first year from placement.
2) Describe a protocol for evaluating the successful integration of an implant at routine recall appointments.
3) Describe the current evidence on success rates of various abutment materials and design, including tissue health.
4) State the definition of the term “periimplantitis” and its rate of occurrence, list the most common reasons for the condition, and methods used for treatment of the condition.

7. Cements

A. **Material characteristics and material selection**.

1) Describe the basic setting reaction of conventional cements such as glass ionomer.
2) Construct a chart of the categories of resin cements and basic indications and contraindication of each. For a given case, indicate the best cement type.
3) Explain how bonding vs. luting effects the fracture resistance of ceramic restorations

4) State compositional differences in restorative material surfaces and the need for surface modification or priming agents in order to optimize bonding of a resin cement to each type material surface.

B**. Clinical procedures**. Explain the current best practices for preparing materials and the tooth structure for commonly used cements.

C. **Outcomes assessment.**

1) Describe the current evidence for success rates for basic cement categories.
2) Explain the common causes of post op sensitivity attributable to cementing procedures and clinical treatments to provide should this happen.

8. Laboratory procedures

A. **Laboratory materials**. Describe basic material handling and troubleshooting of errors when using common lab materials such as model stone, die stone, and casting investment.

B. **Occlusal transfer, articulator procedures**.

1) Describe the functionally generated path technique and explain when it is indicated.
2) Analog methods: Describe common facebow, recording procedures, and articulator settings.
3) Digital methods: Describe how the digital work flow process captures occlusion and arch movement. Describe how patient photos and intraoral scans may be used for the functional and sthetic requirements of a facially generated treatment plan.

C. **CAD-CAM processes**. Describe the process of fabricating restorations using currently available techniques.

9. Restoration repair

A. **Clinical decision.** Construct a decision tree to assist in determining if an existing broken ceramic restoration should be repaired or replaced.

B. **Clinical techniques**. Describe commonly used techniques for preparing a ceramic restoration surface for repair, including any bonding agents or surface modifications.

C**. Outcomes assessment**. Explain current evidence on the success rates and duration of restoration repair, including factors that may predict better outcomes.

Section mentored by Dr. Jeff Nordin

Contributors: Dr. Sarah Alhalees, Dr. Mohammed Al-Mazedhi, Dr. Elizabeth Griffis, Dr. Stephen Wade