DEN7717C: Clinical Use of Dental Materials
Spring 2020

Course Description:
This course focuses on the development of the relationships between properties and composition of six categories of dental materials which are most often used in dental practice. Each sub-objective will allow the student to describe the effect of variations in the manufacturer's recommended manipulation procedures for a given material system on potential clinical outcome, basing the decision on the fundamental physical, chemical and mechanical properties of each specific material.

I. General Information
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Course Credits: 1
Semester: Spring

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II. Course Goals
The goal of this course is to expand and assess your knowledge of relationships between the mechanical properties, material's handling and composition of six dental materials commonly used in the dental office.

III. Course Overview
This is a rotational course that meets in Jr./Sr. Lab and deals with the properties and handling characteristics of dental materials where you will be required to:

1. Identify the principal composition and properties (physical and chemical) of elastomeric impression materials, gypsum products, dental adhesives, dental cements, restorative dental materials substrates, resin-based composites and light curing units. You will be asked questions on the proper manipulation and application of these materials and devices.

2. Demonstrate the proper techniques for manipulation of elastomeric impression materials, gypsum products, dental cements, composites and for use of light curing units. A faculty member will observe your manipulation technique of the materials and devices. When appropriate, you will be asked to justify each step of your manipulation technique. For the other materials where demonstration is not required, the manipulation technique and/or justification of particular step may also be asked.

The course is divided into three modules that reflect the focus of the subjects:
Module 1 – Elastomeric Impression Materials and Gypsum Products;
IV. Course Outline

First, there will be a quiz to assess the basic knowledge regarding biomaterials principles.

Quiz: Fundaments and Basic Principles in Dental Biomaterials; Auxiliary, Direct and Indirect Restorative Materials

Overview of Preventive and Restorative Materials
   a) General Categories of Biomaterials Properties
   b) Applications of Dental Materials
   c) Standards for Dental Materials
Structure of Matter, Physical and Chemical Properties of Dental Biomaterials
   a) Interatomic Bonds
   b) Atomic Arrangement
   c) Interatomic Bond Distance and Thermal Energy
   d) Diffusion
   e) Terminology, Rheology, Thermal Properties and Electrochemical Properties
Mechanical Properties
   a) Stress and Strain
   b) Elastic and Plastic Properties
   c) Strength and Toughness Properties
   d) Hardness
   e) Stress Concentration Effects
Dental Polymers
   a) Components and Composition
   b) Chemistry of Polymerization
Biocompatibility
   a) Adverse Effects and Allergic Reaction from exposure to Dental Materials
   b) Occupational Hazards for Dental Personnel
   c) Biocompatibility Tests
   d) Clinical Guidelines for Selecting Biocompatible Materials

Then, for each module the following topics will be covered in the lab session.

Module 1: Elastomeric Impression Materials and Gypsum Products
   - Impression Materials
      a) Classification of Impression Materials
Module 1: Impression and Restoration Materials

b) Elastomeric Impression Materials
c) Making Impressions using different techniques

- Gypsum Products
  a) Production of Gypsum Products
  b) Setting of Gypsum Products
  c) Setting Expansion
  d) Strength of Set Gypsum Products
  e) Types of Gypsum Products
  f) Manipulation of Gypsum Products

Module 2: Adhesive Systems, Cements and Substrates

- Adhesive Systems
  a) Principles of Adhesion
  b) Dental Substrate
  c) Smear Layer
  d) Physicochemical and acid-based treatment of dental substrates
  e) Dentin bonding agents
  f) Biological and Clinical Considerations

- Dental Cements
  a) Cements for Luting, Pulp Protection and Restoratives
  b) Calcium Phosphate Cements
  c) Mineral Trioxide Aggregate Cements
  d) Zinc Oxide-Eugenol Cement
  e) Zinc Phosphate Cement
  f) Glass Ionomer Cements
  g) Resin-modified Glass Ionomers
  a) Cements for Luting
  e) Zinc Phosphate Cement
  f) Glass Ionomer Cements
  g) Resin-modified Glass Ionomers
  h) Resin-based Cements

- Dental Casting Alloys and Metal Joining
  a) Classification of Dental Casting Alloys
  b) Properties of Dental Casting Alloys
  c) Mechanical Properties of Casting Alloys
  d) Alloys for All-Metal Prostheses
  e) Alloys for Metal-Ceramic Prostheses
  f) Alloys for Removable Partial Dentures

- Dental Ceramics
  a) Classification of Dental Ceramics
  b) Metal-Ceramic Systems: Composition and Properties
  c) All-Ceramic Systems
  d) CAD-CAM Processing of Ceramics
  e) Abrasiveness of Dental Ceramics
  f) Clinical Performance of All-Ceramic Restoration

Module 3: Resin-Based Composite and Light Curing Units

- Resin-Based Composites
a) Development and Composition
b) Classification and New Formulations
c) Curing Reaction and Kinetics
e) Color, Optical Effects and Esthetics of Dental Composites
f) Biological and Clinical Considerations
- Dental Light Curing Units
  a) Radiometric Terminology
     - Radiant Exitance (Irradiance)
     - Radiant Power
     - Spectral Radiant Power
     - Light Beam Uniformity
  b) Development of Dental Curing Lights
     - Quartz-Tungsten-Halogen (QTH) Lights
     - Plasma Arc (PAC) Lights
     - Argon-Ion Lasers
     - Light-Emitting Diode (LED) Technology
     - Exposure Reciprocity
     - Curing Modes
     - Batteries
     - Curing Light Output Monitoring
  c) Clinical considerations for Light Curing Units
     - Temperature Considerations
     - The “Blue Light Hazard”
     - Light Guide Tip Diameter
     - Distance to Target
     - Ergonomics and Clinical Access
     - Infection Control
     - Effect of Training
     - Choosing a Curing Light and Clinical Recommendations

V. Course Material

Objectives and additional reading material for each subject are posted in CANVAS.

Resource: e-books to many required or recommended texts can be accessed via the HSC Dental Library Guide.

VI. Course Objectives
This course is designed to show you how the principles and techniques learned in are further applied in clinical setting.

During the session, you are expected to demonstrate the following skills:

1. Respond to questions through recall and reasoning based on previous didactic materials and clinical experiences.

2. Demonstrate adequate manipulation technique(s) based on dental material's reading materials and guidance by the supervising faculty member.
VII. Course Competencies

Domain I: Critical Thinking
1: Critical Thinking: Use critical thinking and problem-solving, including their use in the comprehensive care of patients, scientific inquiry and research methodology.
2: Evidence-Based Patient Care: Access, critically appraise, apply and communicate scientific and lay literature as it relates to providing evidence-based patient care.

Domain VI: Patient Care
B. Establishment and Maintenance of Oral Health
17: Provide oral health care within the scope of general dentistry to include restoration of teeth.
18: Provide oral health care within the scope of general dentistry to include communication and managing dental laboratory procedures in support of patient care.

VIII. Evaluation

The evaluation of the student performance will consist of:

1) Didactic Evaluation

Quizzes: There will be a total of four quizzes related to the content which has been previously covered in lecture and/or laboratory before each assigned quiz. The quiz with the lowest score will NOT be dropped from each student's accumulated quiz total when determining course final grades. Quizzes are going to remain open for 1 week in each module. There will be no make-up quizzes.

2) Psychomotor Skills Evaluation

Laboratory Session: There will be a total of three laboratory session. Completing all assigned daily projects is mandatory. At each lab session, you will be given a grade on a scale of 0 to 100% for manipulation phases, report and faculty assessment according to the Rubric for each session. You must pass each module with a score of 72%.

If you score below 72% you will be asked to repeat the assignments at a rescheduled date or to write a two-page review of the subject. The instructor will inform you of which of these two options you should pursue. After successful remediation, your grade for that subject will be 72%. You can check your grades by asking the instructor or viewing in the CANVAS grade book two days after your session.

Expectations:

1. You are expected to know major principles, not trivia. Be prepared by reading the material related to the dental material’s groups. For example: Is the strength of restorative materials an important property? The response could be as follows: "Since restorative materials fracture primarily under tensile stress or flexure stress, tensile strength and flexure strength would be of greater importance than compressive strength. The answer depends on how the material will be used. For anterior teeth where the biting forces are lower, strength is not as important a factor as it is for molar restorations." This response would represent a high score answer.
2. Show enthusiasm for your knowledge and be proactive during the session. For example: If you are asked to list the different types of impression materials and write or describe one main advantage and one main disadvantage of each material compared with condensation silicone impression material, the answer would be as follows: "Addition silicone and polyether are significantly more dimensionally stable, although one would have to wait at least one hour to pour addition silicones without palladium as a hydrogen scavenger. Polysulfide is slightly more dimensionally stable and has better tear resistance although it has an offensive odor. Polyether is too stiff because of its high elastic modulus. From a cost perspective, the most economical but least dimensionally stable material is reversible hydrocolloid followed by condensation silicone, polysulfide, polyether, and addition silicone." You should receive a high grade for this answer.

3. Demonstrate your knowledge of controversial issues if appropriate. For example: Is it safe to use amalgam or composite in children or pregnant women? You could state that no material is absolutely safe, although there is little evidence to demonstrate a health concern for either material. This is an example of an essential question for which there is no absolute right or wrong answer.


ASSIGNING GRADES
The final grade will be determined based on the following didactic and psychomotor components*:  
1. Didactic component - 40%
   - Quiz 1: 10%
   - Quiz 2: 10%
   - Quiz 3: 10%
   - Quiz 4: 10%

2. Psychomotor component - 60%
   - Lab session 1: 20%
   - Lab session 2: 20%
   - Lab session 3: 20%

*The final grade can be affected by academic variance(s), as described below:

Professional Conduct
The College of Dentistry expects all dental students to be professional in their dealings with patients, colleagues, faculty and staff. Professional and ethical conduct is a mandatory qualification for every practicing dentist.

Attendance and adherence to the dress code are mandatory. In addition, for each lecture and laboratory session, students are expected to be prepared, complete the self-assessment forms, follow all guidelines and instructions (which includes use of iPods, headphones, etc.), and put forth an excellent effort (work the entire lab session, work diligently and make every effort to get the most out of every session). Professional misconduct observed during lectures, exams,
quizzes, and laboratory sessions will result in an **Academic Variance** (see Pre-doctoral Student Handbook). **Five percentage points will be deducted from the final course grade for each academic variance issued.**

**Attendance**

- 5 percentage points will be deducted from the final grade for each lecture or lab missed without an excused absence.
- 5 percentage points will be deducted from the final grade for every three unexcused instances of tardiness.
- 5 percentage points will be deducted from the final grade if the routine sheet is not returned complete by the date established by the course director.

**Adherence to the Dress Code.** Students must adhere to the dress code as spelled out in the Pre-doctoral Student Handbook and Clinic Procedure Manual while enrolled in any course in the Division of Operative Dentistry. It is applicable at ALL times including, lectures, exams, quizzes, and laboratory sessions. Failure to comply with the dress code will result in a reduction in your final course grade as follows:

- **1st Offense** - You will be asked to leave the class and warned
- **2nd Offense** - You will be asked to leave the class and a 5% reduction in your final course percentage will be imposed
- **3rd Offense** - You will be asked to leave the class and a 10% reduction in your final course percentage will be imposed
- **4th Offense** - You will be asked to leave the class and a 15% reduction in your final course percentage will be imposed
- **5th Offense** - You will be issued an "E" grade in the course

The grade scale can be found in the Grades section.

**In order to pass this course, you must have:**

1. A final grade of 72% or above (The grades for each component will be calculated based on the percentages given for each exam as listed above).
2. The didactic component must be passed independently with 72% or above. If the student fails to reach 72% or above will have to remediate.

**Remediation:** Students failing the course will be awarded an "E" grade, referred to the Student Performance Evaluation Committee (SPEC), and automatically placed on academic probation. The student must meet with the course director to develop a remediation plan within one week of receiving the failing final grade. The remediation activities are at the discretion of the course director. Faculty are available to assist students preparing for this examination, but the responsibility for learning the material resides with the student. The time and place of the remediation examination will be arranged individually. **Please note that if the course director determines that the student failed the coursework to such an extent that remedial activities would be inadequate to attain an acceptable level of academic achievement in the course material, the course director can recommend that the student repeat the course as the remedial activity.**
The course director will determine the grade required to pass the remediation program; however, the highest grade attainable in a remediated course is a remediated "D/R." Students failing to satisfactorily complete the remediation program will maintain the "E" grade and be referred to SPEC for consideration for dismissal or retracting. For more information refer to the Administrative Practices, Section K: Remediation.

IX. Administrative Practices
Administrative practices for all UFCOD courses are universally applied. Exceptions to or deviations from these practices are stated in the individual syllabi by the course director. When not individually stated in the syllabus, course administrative practices default to those identified under "Administrative Practices" in the ECO sidebar for each electronic syllabus. These practices include: Professional Behavior, Student Responsibilities in the Classroom, Attendance, Dress Code, Email Policy, Tutoring, Academy Honesty and the Student Honor Code, Student Accommodations, Post-exam Review, Grading System, Remediation, Student Evaluation of Instruction, Student Complaints, University Counseling Services and Mental Health Services and Electronic Course Material and Social Media.

X. Grade Scale
DEN7717C Grade Scale
Method          Letter Grade
Scale          100
A              95 - 100
A-             90 – 94.99
B+             86 – 89.99
B               82 – 85.99
B-              80 – 81.99
C+              74 – 79.99
C               72 – 73.99
E               0 – 71.99