

SYLLABUS

COURSE: DENF 3671 Biomaterials III: Applications to Clinical Dentistry
SEMESTER: Fall
CREDIT HOUR: 0.5

REVISED: 2001
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COURSE DIRECTOR: Kathy L. O'Keefe, D.D.S., M.S.

GOAL

This course will acquaint the student with the properties of various types of alloys, ceramic and composite materials and provide an opportunity for clinical problem-solving relating to the properties and materials introduced. Special emphasis will be placed on the biomaterials currently used in a dental practice. With rapid development in technology, the practicing dentist must have a working knowledge of the fundamental physical and mechanical properties of these materials to meet the challenges of modern dentistry. Also, the practitioner along with the dental laboratory technician must understand the techniques required to control these properties in order to obtain optimal clinical results. The information presented in this course will help provide the student with both a sound basis of knowledge and problem-solving skills that will aid in making appropriate selections of materials for each patient's unique needs and to communicate more effectively with dental laboratory technicians when designing and prescribing removable and fixed prostheses.

OBJECTIVES

I. REMOVABLE PARTIAL DENTURE (RPD) AND PORCELAIN-FUSED-TO-METAL (PFM) BASE METAL ALLOYS

1. List the three major elements used in base metal alloys for removable partial dentures.
2. State which element is added to nickel and cobalt to reduce tarnish.
3. List the minor element that most affects the properties of base metal alloys.
4. State known concerns about biocompatibility of base metal alloys.
5. State why Type IV gold alloys have been replaced for usage in removable partial denture frameworks by the cast base metal alloys.
6. State why the following properties of cast alloys for removable partial dentures are important clinically:
 - 6.1 density
 - 6.2 hardness
 - 6.3 elastic modulus
 - 6.4 yield strength
 - 6.5 percent elongation
 - 6.6 tarnish resistance
7. List the three major types of base metal alloys for porcelain-fused-to-metal restorations.
8. State the four developments in ceramic-metal science that make porcelain-fused-to-metal restorations possible.
9. State why the following properties of cast alloys for porcelain-fused-to-metal restorations are important clinically:
 - 9.1 elastic modulus
 - 9.2 yield strength
10. Compare elastic modulus and yield strength for cast base metal alloys and cast noble alloys for porcelain-fused-to-metal restorations.

II. CERAMICS

1. State the three basic components in dental ceramics.
2. Describe the process of sintering and describe the difference between the crystalline and vitreous phases.
3. Describe the following types of all-ceramic systems:

- 3.1 Alumina-Based Ceramic Materials
 - 3.2 Leucite-Reinforced Feldspathic Porcelain
 - 3.3 Heat-Pressed All-Ceramic Materials
 - 3.4 Leucite-Based Ceramic Materials
 - 3.5 Lithium Disilicate-Based Ceramic Materials
 - 3.6 Slip-Cast All-Ceramic Materials
 - 3.7 Machinable All-Ceramic Materials
4. State why the following properties of ceramics are important clinically:
- 4.1 percent linear shrinkage
 - 4.2 transverse strength
 - 4.3 Knoop hardness
 - 4.4 elastic modulus
 - 4.5 coefficient of thermal expansion as compared to human teeth
 - 4.6 brittleness
5. Discuss the use of silane with porcelain.
6. Classify all-ceramic restorations by:
- 6.1 ceramic type
 - 6.2 application
 - 6.3 method of fabricating the restorations
7. Discuss types of porcelain used in metal-ceramic restorations.
8. State what determines the bond strength between porcelain and the alloy surface in a metal-ceramic restoration.
9. State the most critical property that the porcelain and the metal need to have in common.
10. State the most common location of metal-ceramic failure.

III. COLOR AND SHADE MATCHING TECHNIQUES

- 1. List and describe the three variables that determine color perception.
- 2. List and describe two methods of measuring the spectral energy distribution of a light source.
- 3. Define the term metamerism and describe the effect of this principle on dental shade matching.
- 4. Explain why the "object" involved in dental shade matching is such a complicated problem.
- 5. Describe two different shade matching techniques using the Vital Lumin Shade Guide.

6. List and describe the principles that should be followed when filling out the shade diagram of a laboratory work authorization.
7. List and describe at least six techniques to improve the spectral response of the observer during the shade matching procedure.
8. Define the terms hue, value and chroma.
9. Define the term complementary color as it relates to the color wheel. Explain the importance of complementary colors in the custom staining of porcelain restorations.
10. Understand the color principles in custom staining and basic custom staining techniques.

IV. INDIRECT COMPOSITE RESTORATIVE SYSTEMS

1. State the advantages and disadvantages of indirect composite restorations as compared to direct composite restorations.
2. State how an indirect composite material differs from a direct composite material.
3. List the critical properties of an indirect composite material.
4. Discuss the contraindications of an indirect composite restoration.
5. List some of the new fiber-reinforced indirect composite products available and describe their indications/contraindications.

V. PACKABLE AND FLOWABLE COMPOSITES

1. Describe the recommended uses for both flowable and packable composites.
2. Describe the advantages and disadvantages of both of these types of systems.
3. Compare the mechanical properties of both flowable and packable composites to direct posterior composites.

VI. CASE PRESENTATIONS

1. Describe the criteria used to evaluate the clinical acceptability of an esthetic fixed partial denture.
2. Discuss treatment alternatives for patients with congenitally missing lateral incisors.
3. Explain why occlusion and anterior guidance plays such an important role in the treatment of patients with congenitally missing lateral incisors.
4. Explain how social habits, eating habits, etc. affect a dentist's decision-making process in restoring a patient's anterior teeth.

5. Critically evaluate different treatment alternatives for an anterior fixed partial denture in different types of patients.
6. Evaluate and understand the importance of the mechanical properties of the different types of materials proposed to restore these patients.
7. Critically evaluate the dental literature and other information resources to aid in the decision-making process.

RESOURCES

I. Media Resources

A. Required textbook

Craig, R. G., ed.

Restorative Dental Materials, 11th ed.

Mosby - Year Book Inc., 2002

Cast and Wrought Base Metal Alloys, Chapter 16, pp. 479-491

Ceramics, Chapter 18, pp. 552-574

Ceramic-Metal Systems, Chapter 19, pp. 576-592

Optical, Thermal, and Electrical Properties, Chapter 3, (Optical only) pp. 38-43

Composite Restorative Materials, Chapter 9, (Laboratory Composites) p. 247

Composite Restorative Materials, Chapter 9, (Packable and Flowable Composites) pp. 246-247

B. Handouts with lectures.

II. Human Resources

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STUDY PLAN AND REQUIREMENTS

The following study plan for this course is recommended:

1. Read the assignments in the required textbook before attending each lecture. The reading assignments are listed in the schedule below.
2. Please review schedule carefully; the material contained in this course is updated yearly. Because of the rapidly changing nature of the materials and procedures covered in the course, it is strongly advised to attend all lectures to obtain the most updated information. Slides of new products and clinical techniques will aid in your understanding of these new materials and procedures.

DENF 3671 BIOMATERIALS III: Applications to Clinical Dentistry 2004 Fall Semester Schedule Friday, 9-9:50 am

DATE	LECTURE / READING ASSIGNMENTS
Aug 20	Cast Base Metal Alloys <i>Read Chapter 16, pp. 479-491; Handout</i>
Aug 27	Dental Porcelains - All-Ceramic and PFM <i>Read Chapter 18, pp. 551-574, Chapter 19, pp. 576-592; Handout</i>
Sep 3	Color and Shade Matching Techniques <i>Read Chapter 3, pp. 38-43; Handout</i>
Sep 10	Custom Staining <i>Handout; material presented in lecture</i>
Sep 17	Indirect Composite Restorative Systems <i>Handout; Read Chapter 9, p. 247.</i>
Sep 24	Packable and Flowable Composites <i>Read Chapter 9, pp. 246-247; Handouts</i>
Oct 1	Case Presentation 1
Oct 8	Case Presentations 2 and 3 Course Evaluation
Oct 15	FINAL EXAMINATION Room 207

EVALUATION METHODS

Course evaluation will consist of a final examination worth 100% of the course grade. The final examination will consist of approximately 50 multiple-choice/short-answer questions and will cover the objectives. The objectives can be answered by studying reading assignments, handouts and information presented in the lectures and cases. Attendance is mandatory at all classes.