

## STUDY GUIDE

<b>PROGRAM</b>	<b>BDS</b>
<b>COURSE TITLE</b>	<b>Dental Materials</b>
<b>ACADEMIC YEAR</b>	<b>First Year, 2024</b>
<b>INTRODUCTION</b>	This course intends to teach basic science involving the materials that are used in dentistry. It is taught to second year BDS students. Dental Materials is the study of material composition, properties, and the manner in which they interact with their surroundings.
<b>RATIONALE</b>	The knowledge of Dental materials is important to make optimal selection of various materials, understand their behavior, use, handling and manipulation and safety considerations. It's important to learn about basic chemistry, properties and uses of the materials in the starting year of dental sciences so that students are able to imply the knowledge of these materials in future years when they will have to work on patients.
<b>OUTCOMES</b>	Students must be competent in the utilization of different dental materials while managing the patients requiring different dental treatments. <ul style="list-style-type: none"> <li>● Distinction of its academic programs.</li> <li>● High standards of patient care and service.</li> </ul>
<b>DEPARTMENT INVOLVED</b>	Science of Dental Materials
<b>COURSE OBJECTIVES</b>	<p><b>Physical and Mechanical Properties</b></p> <p>Introduction to the Subject</p> <ul style="list-style-type: none"> <li>● Describe the importance of materials in Dentistry</li> <li>● Define Abrasion, abrasion resistance, viscosity, creep, flow, color and colour perception, hue, value, chroma and metamerism.</li> <li>● Define thermal conductivity, thermal diffusivity, coefficient of thermal expansion, heat of fusion and specific heat.</li> <li>● Define dielectric constant, EMF series.</li> <li>● Define Tarnish and Corrosion.</li> <li>● Classification and types of corrosion prevention of tarnish and corrosion.</li> <li>● Application of physical properties in dental materials.</li> <li>● Define stress, types of stress, strain.</li> <li>● Explain the stress strain curve.</li> <li>● Define elastic deformation (proportional limit, elastic limit, elastic limit, young's modulus, resilience).</li> <li>● Define yield strength, ultimate strength, flexural strength, fracture toughness, fatigue strength, impact strength, tear strength.</li> </ul>

- Define hardness and types of hardness wear.
- Application of mechanical properties in dental materials.

#### **DENTAL CEMENTS**

- Classify dental cements.
- Differentiate between temporary and permanent cements.
- Difference between liners and bases.
- Discuss the setting chemistry associated with Zinc Phosphate, Zinc Oxide Eugenol, Calcium Hydroxide and Zinc Polycarboxylate.
- Discuss properties of dental cements.
- Describe the composition and properties of GIC.
- Describe the setting reaction of GIC.
- Discuss the significance of modified GIC constituents, the influence on properties and the impact on the material's clinical performance.
- Discuss the requirement of dental cements for cavity lining, luting, endodontic and orthodontic purposes.
- Discuss the various uses of dental cements in different applications.

#### **DENTAL COMPOSITES**

- Describe historical pretext of dental composites.
- Describe components and composition of dental composites.
- Classify dental composites.
- Discuss the setting chemistry associated with composites.
- Discuss properties of Dental composites.
- Describe the methods of curing composites and minimizing polymerization shrinkage.
- Correlate filler particle size, setting reaction and method of manufacture of dental composite resin based restorative materials with properties and behavior of the material in situ.
- Discuss the use of composites in vivo.
- Describe new resin based restorative materials variants available in the market.
- Compare the types of dental composites according to their clinical use.

#### **Adhesive Restorative Materials**

- Describe Adhesion, acid etching, conditioning and priming.
- Describe enamel and dentin bonding agents, bonding systems, generations of bonding systems.
- Discuss the importance of smear layer as a determinant of the clinical success of dental composites.
- Describe hybridization in relation to dental composites.
- Discuss the dental composite adhesion to tooth structure based on the principles of micro mechanical attachment.

#### **Dental Amalgam**

- Discuss the requirements and historical perspective of direct filling/restorative materials.
- Describe the primary purpose of each component of amalgam alloy.
- Relate the importance of the role of mercury/alloy ratio and its

influence/effect on the setting reaction and restorative procedures.

- Describe the manufacturing technique for amalgam production.
- Discuss properties of amalgam and high copper amalgam.
- Discuss ideology of black's cavity design, cavity design and matrices with regard to properties of the material, importance of varnishes and correlate the manipulative parameters of amalgam with the properties of the final restoration.
- List the hazards of incorrect handling of mercury.
- Discuss the importance of mercury hygiene, mercury/amalgam scrap handling and disposal at chair side.
- Perform the mixing of amalgam alloy powder and mercury.
- Learn manipulation of amalgam (Trituration, Condensation, Carving & Finishing)

### **Metals**

- Define and classify direct filling gold
- Define manipulation, advantages, disadvantages and uses.
- Discuss the basic concepts related to processing and solidification of dental alloys.
- Understand different types of metal and alloys used in fabrication of dental prosthesis.
- Describe the alloy phase diagrams.
- Explain the types, processing and clinical applications of base metal alloys.
- Describe the casting procedures for metal alloys.
- Discuss the types, processing and clinical applications of wrought metal alloys.
- Discuss the types of processing and clinical applications of stainless steel in dentistry.
- Explain the casting procedure for titanium and its alloys.
- Describe the properties and composition of various orthodontic wires.
- Describe the objective and uses of soldering and welding in dentistry.
- Differentiate between soldering, brazing and welding.
- Describe the components of dental solder and welding.
- Describe the history of implants in dentistry.
- Define osseointegration and factor affecting it.
- Classification of dental implants.
- Discuss different materials used as dental implants.

### **Dental Ceramics**

- Describe the historical evolution of dental ceramics.
- Classify dental ceramics.
- Discuss the composition and properties of dental ceramics.
- Correlate the different types of ceramics and mechanisms of manufacturing.
- Describe the metal fused to ceramic system, properties and bonding.
- Explain the methods of strengthening ceramics.

### **Dental Polymers**

- Discuss the terminologies used in dental polymers.
- Describe the major components(MMA/PMMA) composition along with its role in dental polymer.
- Describe and explain the mechanism and its properties(Mechanical and Physical).
- Enumerate types of polymerization reactions.
- Discuss the role of co-polymerization.
- Explain acrylic resin according to types of setting reaction along with its composition(Heat,chemical,microwave & light)
- Classify denture base materials.
- Describe manipulation and steps involved in fabrication of the denture base in the laboratory.
- Enumerate the advantages and disadvantages of packing of Denture Base Resins in different manipulating Physical stages.
- Differentiate between various fabrication techniques used in Denture base resins.
- Enlist Physical properties of Denture base resin.
- Explain Biocompatibility and Infection Control of Denture base materials in medically compromised patients.
- Enlist Denture Base Cleansers.
- Perform Mixing/ Manipulation Of powder and liquid of Denture Base Materials.
- Identify The Five physical stages in mixed acrylic resin.
- Describe different techniques used to repair Acrylic Resins.
- Discuss the concept of Relining and Rebasing.
- Explain the conditions in which Relining and Rebasing is preferable.
- Differentiate between the concept of using soft tissue Liners / Tissue Conditioner And hard tissue liners.
- Enlist different separating media used in dentistry.
- Discuss the clinical and laboratory indications of using Separating media.
- Identification of separating media.

### **Casting**

- Explain various steps involved in the casting procedure.
- Describe sprue design
- Describe the causes of defective casting.
- Discuss measures to overcome defective casting.
- Demonstrate Casting Procedure in the lab.

### **Investments**

- Classify investment materials used in dentistry.
- Describe the composition, setting reaction and properties of different types of investment materials used in dentistry.
- Identify different types of investment materials.

### **Cutting,Grinding,Finishing and Polishing Materials**

- Explain benefits of finishing and polishing restorative materials in dentistry.
- Explain the principles of cutting,grinding,finishing and polishing processes.

- Discuss abrasion and erosion in detail and the hardness of abrasive used.
- List the types of abrasives used.
- Describe dentifrices and their composition.

#### **Impression Materials**

- Discuss the significance of impression material in dentistry.
- Enlist the ideal requirements of impression materials.
- Classify impression materials according to their properties and characteristics.
- Discuss the properties of elastic and non-elastic impression materials.
- Comparison of properties & clinical application of different types of impression materials.
- Describe the concept of digital impressions to fabricate and mill restorations in single chair side appointments.
- Perform mixing and handling of Alginate impression materials.
- Manipulation and handling of impression compound techniques
- Manipulation of elastomeric impression materials.

#### **Waxes**

- Classify types of waxes used in dentistry.
- Describe the composition based properties and uses of different types of dental waxes.
- Identify different types of dental waxes i.e sticky, ortho, inlay, carding wax.
- Manipulate modelling wax, inlay wax.

#### **Gypsum products**

- Describe the methods of manufacturing of gypsum.
- Classify gypsum products.
- Describe the setting reaction of gypsum products.
- Explain the factor affecting setting time.
- Discuss the physical and mechanical properties of gypsum products.
- Describe methods to test setting of gypsum and disinfection of gypsum models and study casts.
- Explain expansion of gypsum products & control of setting expansion.
- Perform the mixing of gypsum powder in the correct powder/liquid ratio.
- Make plaster slabs with the correct dimensions.

#### **Endodontic Materials**

- Enlist the steps involved in root canal treatment.
- Discuss the types and clinical aspects of root canal obturating materials and root canal sealers.
- Explain about the types, indication and mode of action of intracanal medicaments in endodontic.
- Describe the types and indication of intracanal irrigants.
- Describe the role of conventional and advanced pulp capping agents (Calcium Hydroxide, MTA and Bio dentine)
- Enlist endodontic solvents for removal of obturating

materials(xylol,orange oil.chloroform,halothane,rectified turpentine,eucalyptus).

**Biocompatibility**

- Define the term biocompatibility and the factors affecting the biocompatibility of dental materials.
- Discuss the adverse effects from dental materials including local and systemic effects.
- Describe the test used to measure biocompatibility.
- Describe the guidelines for selecting biocompatibility materials.