Dental Materials

Esthetic Restorative Materials

Direct Esthetic Restorative Materials
Indirect Esthetic Restorative Materials

Direct Esthetic Restorative Materials

- Composite
- Glass Ionomer

Composite

- A compound made up of 2 or more distinct materials with properties better than that of the individual components.

Synthetic Resins

- Composite resin
- Composition
  - Organic resin matrix
    - BIS-GMA resin
      - Dimethacrylate
    - Urethane Dimethacrylate (UDMA)
  - Activator
    - Tertiary amine (chemical activated)
    - Benzophenone (UV cure)
    - Diketone (blue light cure)
  - Initiator
    - Benzoyl peroxide
  - Inhibitor
    - Hydroquinon
  - Stabilizer
  - Pigments
  - Coupling agents
    - Bond filler & resin
  - Inorganic Filler Particles:
    - Quartz, silica, lithium aluminum silicate, barium, strontium, zinc or ytterbium glasses
    - Particles of different sizes reinforce the matrix
    - More particles, the better the properties

Properties of Composites

1. Low polymerization shrinkage
2. Low water sorption
3. Coefficient of thermal expansion similar to teeth
4. Low thermal conductivity
5. High fracture resistance  
6. High wear resistance  
7. Radiopacity  
8. High bond strength to enamel and dentin  
9. Good color match to tooth surface  
10. Ease of manipulation  
11. Ease of finishing and polishing  
12. Some qualities more important depending on whether it is an anterior or posterior composite

Types of Composites

- **Macrofilled**
  - Conventional or traditional
  - Quartz filler
  - Surface becomes rough with finishing, toothbrushing, wear
  - Discolors
  - Not suitable for posteriors

- **Microfilled**
  - Very small colloidal silica particles
  - Very smooth surface
  - Aesthetic
  - Not suitable for posterior teeth

- **Small-particle**
  - Contains quartz or glass filler
  - Smaller particle size which improves mechanical properties
  - Smooth, but not as smooth as microfilled
  - Posterior

- **Hybrid**
  - Contains glass and colloidal silica filler
  - Smooth as microfilled
  - Mechanical and physical properties between conventional and small-particle

Two Paste versus Single Paste

- **2 paste**
  - Chemically activated
  - Amine activator in one paste reacts with Peroxide initiator in another paste
  - This initiates polymerization
  - Working time limited
Dental Materials

- Single paste
  - Light cured
  - Single paste contains photo initiator and amine activator
  - Working time is unlimited

Posterior Composites
- Should be small particle or hybrid composites
- Should be radiopaque
- Clinical problems include polymerization shrinkage and occlusal wear

Purpose of using Acid Etching
- 1 minute application of 36% Phosphoric Acid liquid or gel
- Improves seal of resin by increasing retention and intimate contact between resin and tooth
  - Reduces microleakage

Use of Bonding Agents
- Low viscosity resins which flow more readily than composite material into micropores created by the acid etch
- Provides mechanical and chemical bonding with tooth structure (enamel or dentin)

Other uses of Composites
- Bonding agents
- Restoration of incisal area
- Core buildups
- Temporary bridge construction
- Repair of porcelain or composite

Glass Ionomer Restoratives
- Supplied as powders of various shades and a liquid
- Better retention in areas of cervical erosion than composites
- Composition
  - Silicate glass
  - Polyacrylic acid
Indirect Esthetic Restorative Materials

DENTAL PORCELAIN (Ceramic)

- Most common ceramic used in dentistry
  - Porcelain
    - A white translucent ceramic fired at high temperatures
  - Two types
    - Construct artificial teeth
    - Construct restorations

Porcelain Restorations

- Inlay
- Only
- Jacket crown
  - Porcelain covers entire crown of tooth
- Metal ceramic crown
  - Porcelain veneer is fused directly to a metal casting
- Laminate veneer
  - Thin layer of porcelain covering only the facial surface of a tooth

Steps in Constructing Porcelain Restorations

- Ceramic powder is mixed with water to form a paste
- Paste is formed into the desired shape and heated (fired) at a high temperature
- Grains of powder fuse to form a ceramic material
- After final adjustments are made in the mouth, the crown is removed and fired again to glaze its surface

Care of Porcelain Restorations

- Must be able to distinguish crown margins during scaling
  - Brittle crown margins can be easily damaged with sharp instruments
- Avoid use of Acidulated Phosphate Fluoride prophy pastes and topical APF treatments
  - Some research has shown pitting in the porcelain after 2 minutes of use

General Properties of Porcelain Restorations

- Excellent aesthetic qualities
- Completely insoluble in oral fluids
- Dimensionally stable once fired
- Biologically compatible with soft tissues
- Resistant to abrasion
- Adequate compressive strength
- Low tensile and shear strengths
Porcelain-Metal Restorations
- The most serious limitation of porcelain is its low tensile strength.
- When fused to a metal casting, it is reinforced so that brittle fracture is avoided.
- Use far exceeds that of porcelain jacket crowns.
- Leaving occlusal surface in metal will slow down wear on opposing natural dentition.

Castable Ceramic Materials
- Recently developed materials.
- Liquefied at high temperatures and cast directly into the investment mold.
- Most popular castable ceramic is Dicor, developed by Corning Glass Works.
  - Has low tensile and shear strengths.
  - Limits use to single units.

Acid-etched, Resin Bonded Ceramic Restorations
- Ceramic veneers.
- Ceramic inlays.
- Ceramic onlays.

CAD-CAM Technology
- Prepared tooth surfaces are reproduced as a three-dimensional digitized image stored in a computer.
- Image used to control a milling machine which makes the block of material to be cemented into the prepared tooth.
- Too expensive for average practice.
- Chair-side construction in one visit.