Material selection and color of the tooth will determine :

- Amount of tooth preparation
- Margin design and placement

Factors Affecting the Selection of an Appropriate Restorative Material

- Aesthetic goals for the patient
- Functional requirements of the restoration
- Color of the tooth or substructure being restored
- Location of the tooth (anterior vs. posterior)
- Single unit or bridge
- Cement or bond
- Previous experience

All teeth should be restored with the most conservative restoration that satisfies the patient's esthetic and functional requirements.

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Ideal Restorative Material

1. Aesthetic (ability to mimic natural tooth)
   - Translucency
   - Opalescence
   - Fluorescence
2. Strong (ability to withstand occlusal forces)
   - High flexural strength
   - High fracture toughness
   - High compressive strength
   - High tensile strength
   - High sheer strength

Ideal Restorative Material

1. Aesthetic (ability to mimic natural tooth)
2. Strong (ability to withstand occlusal forces)
3. Biocompatible
4. Color stable
5. Kind to opposing dentition
6. Not easily abraded
7. Low solubility in the presence of oral fluids
8. Ease of fabrication
9. Predictability of results
10. Versatile

Material Options

- Monolithic Restorations (uniform in structure throughout the restoration)
- Layered Restorations (requiring a core or framework and a veneering ceramic)

Monolithic Materials

Powder/Liquid Glass Ceramics (60-100 MPa)
- Ceramco 3 (Dentsply)
- Creation (Jensen)

Heat Pressed Leucite Reinforced Glass Ceramics (120-160 MPa)
- IPS Empress (Ivoclar Vivadent)
- Authentic (Microstar)

Milled Feldspathic and Leucite Reinforced Ceramics (120-160 MPa)
- Vitablocs Mark II (Vident)
- IPS Empress CAD (Ivoclar Vivadent)

Milled Resin Nano Ceramic (200 Mpa)
- Lava Ultimate (3M ESPE)

Milled and Pressed Lithium Disilicate Glass Ceramics (360-400 MPa)
- IPS emax Cad and Press (Ivoclar Vivadent)

Milled High Strength Crystaline Ceramics (900-1200 MPa)
- BruxZir solid zirconia (Glidewell)
- Lava Plus (3M ESPE)

Characteristics of Monolithic Materials

- Aesthetic
- Often require less tooth reduction
- Often can be used with supragingival margins
- Possess a glass matrix that enables them to be bonded to tooth structure (except zirconia)
- Glass ceramics more translucent but poor at masking
- Zirconia and lithium disilicate have ability to mask dark teeth

Advantages of Minimal Preparation

- Most conservative
- Predictability of bond to enamel
- Less risk of sensitivity
- Supragingival margins can be utilized
- Less flexibility under loading

Situations Requiring Enamel and Dentin Replacement

- Interproximal restorations or decay
- Discoloration
- Malposition of teeth
- Loss of tooth structure due to wear, erosion, or fracture

Clinical Situations for Using Monolithic Materials (Anterior and Posterior)

- Enamel Replacement (minimal or no prep veneer)
- Enamel and Dentin Replacement (3/4 crown or veneer-crown)
- Anterior Crown
- Posterior Crowns and Anterior 3-unit Bridges (Lithium Disilicate)
- Posterior crowns and bridges (zirconia)

Advantages of Lithium Disilicate as a Monolithic Material

- Strength (360-400 Mpa)
- Can be pressed or milled
- Versatility - can be used for veneers,thin veneers, crowns, anterior bridges, inlays, onlays, and implant restorations
- Ease of fabrication
- Can be bonded or cemented
- Most aesthetic of the higher strength materials especially when cut back and layered

Advantages of Zirconia as a Monolithic Material

- Strength (900- 1200 Mpa)
- Less occlusal clearance necessary
- Can be used with feather edge margins
- More aesthetic than metal
- Functions well under heavy occlusal loads
- Ease of fabrication
- Can be cemented or bonded for increased retention

Cementing And Adhesive Bonding Options

- Zinc Phosphate
  - Hy-Bond (Shofu Dental)
- Zinc Polycarboxylate
  - Durelon (3M ESPE)
- Glass Ionomer
  - Ketac Cem (3M ESPE)
- Resin-Modified Glass Ionomer
  - RelyX Luting Plus (3M ESPE)
  - FugiCEM Automix (GC America)
- Bioceramic Luting Cement
  - Ceramir Crown and Bridge (Doxa Dental)
- Resin Cements

Resin Cements

- Self Adhesive
  - RelyX Unicem 2 Automix (3M ESPE)
  - Clearfil SA Cement (Kuraray)
- Dual Cure with Paired Self Etching Primers
  - Multilink Automix (Ivoclar Vivadent)
  - Panavia F 2.0 (Kuraray)
- Dual Cure with Total Etch or Self Etch Capability
  - Duo-Link Universal (Bisco)
  - RelyX Ultimate ARC (3M ESPE)
- Light Cure with Dual Cure Capability
  - Variolink II (Ivoclar Vivadent)
  - NX3 (Kerr)
- Light Cure Only
  - Variolink Veneer (Ivoclar Vivadent)
  - RelyX Veneer Cement (3M ESPE)

Protocol for Total Etch Adhesive Bonding of Glass Ceramics with Light Cure Resin Cement

- Isolate with rubber dam and disinfect prepared teeth
- Place phosphoric acid gel, rinse, leave teeth moist
- Apply bonding agent, evaporate solvent, and light cure
- Place resin cement on teeth and seat all the restorations
- Clean excess cement with gauze, cotton rolls, and brushes
- Tack restorations at gingival margins
- Floss interproximal contacts and light cure
- Remove cured cement on facial with scaler
- Polish interproximal contacts with finishing strips
- Adjust occlusion where necessary and polish with rubber points and polishing paste

Steps For Preparing Restorations

- Place phosphoric acid on internal surface
- Rinse, dry and apply silane coupler
- Allow to sit for 1 min. then dry
- Paint silanated surface with bonding agent
- Set aside in a safe place organized by tooth number

Unique Features/Benefits Of All Bond Universal

- Flexibility of Technique: self etch, total-etch, or selective-etch procedures
- 

- High bond strengths to all indirect substrates, including metal, glass ceramics, zirconia, alumina, and lithium disilicate.
- Designed to be fully compatible with light-cured, self-cured and dual-cured composite and luting cements
- Low film thickness (less than 10µm)
- No additional activator required

Protocol for Adhesive Resin Bonding of Solid Zirconia and Resin Nano Ceramic

- Disinfect prepared teeth with chlorhexidine
- Rinse and lightly air or blot dry
- Apply self etching primers
- Lightly air dry to evaporate solvent and light cure
- Inject dual cure resin cement in automix syringe directly into restorations
- Seat restorations and while applying finger pressure light cure excess resin for 1-2 seconds
- Remove gelled excess with scaler/explorer and floss contacts
- Light cure, adjust occlusion, and polish

Layered Core Materials

Lithium Disilicate (350-400 MPa)

- IPS Eris (Ivoclar)
- OPC 3G (Jeneric Pentron)

Alumina (500-650 MPa)

- In-Ceram (Vita/Vident)
- Procera (Nobel Biocare)

Zirconia (900-1200 MPa)

- Cercon (Dentsply)
- Lava (3M ESPE)
- Zeno (Wieland Dental)

Metal Ceramics

- Captek (Precious Chemical Co.)
- Goldtech Bio 2000 (Argen)

Clinical Situations for Using Layered Core or Framework Materials

- Full crown when tooth color is dark
- Metal post and core
- Metal implant abutment
- Long span and posterior bridges

Characteristics of Layered Core Ceramics

- Require more tooth reduction
- Usually will be brighter and more reflective
- Ability to mask dark teeth
- Can be used for bridges
- Can be cemented conventionally

Zirconia Restorations

Advantages of Zirconia

- High flexural strength (900-1200 MPa)
- High fracture toughness
- Biocompatible
- Excellent fit (cad-cam technology)
- Can be used anywhere in the mouth (not ideal anterior)
- Can be used as implant abutments
- Can be used in long span bridges
- Can be used with dark substructures
- Cementable

IPS e.max System

- IPS e.max Press (lithium disilicate)
- IPS e.max Cad (lithium disilicate)
- IPS e.max ZirCad (zirconium oxide)
- IPS e.max ZirPress (flour-apatite glass)
- IPS e.max Ceram (nano flour-apatite layering ceramic)
- IPS e.max Cad-on (lithium disilicate press to zirconia framework)

Cementing Zirconia and Metal Restorations

Resin Modified Glass Ionomers (RMGI)

- RelyX Luting Plus (3M ESPE)
- FujiCEM Automix (GC America)

Self Adhesive Resin Cements

- RelyX Unicem (3M ESPE)
- Maxcem (Kerr)

Bioceramic Luting Cement

- Ceramir Crown and Bridge (Doxa Dental)

Cementing Zirconia and Metal Restorations

Ceramir Crown and Bridge (Doxa Dental)

Capsules containing glass ionomer powder, calcium aluminate powder, and water
Self adhesive (no bonding agents or primers required)
Self curing with easy clean-up in gel state
Excellent retention due to formation of hydroxyapatite crystals
Biocompatible
Antibacterial
No post-op sensitivity

Anterior Inlay (Maryland) Bridges

nservative Approach When Implants Are Contra-indicated

- Fiber-reinforced resin framework with ceramic veneer (two piece)
- Zirconia wings with layered ceramic pontic (one piece)
- Temporary or transitional with Ribbond