

MACdentistry

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 Crystalline 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
Ceramic 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 (fluor-apatite glass)
- IPS e.max Ceram (nano fluor-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
Ceramik Crown and Bridge (Doxa Dental)

Cementing Zirconia and Metal Restorations

Ceramik 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

Conservative 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

Be Aware of Wear

Definitions

Attrition Tooth wear resulting from contact between opposing teeth.

Erosion A gradual tooth-surface loss process caused by an electrolytic or chemical mechanism without bacteria being involved. The acids causing the erosion may be extrinsic or intrinsic in nature.

Abrasion The wearing away of the tooth's outer covering caused by mechanical forces from a foreign object.

Definitions (cont.)

Abfraction The wedge-shaped lesions in the cemento-enamel junction area. Tooth flexure caused by eccentric occlusal forces during horizontal movements has been proposed as the etiology.

Demastication The physiologic wearing away of teeth during chewing. (functional wear)

Etiology of Tooth Wear
Daniel A. Paesani
Quintessence Publishing 2010

Abrahamsen Definitions

Abrasion

Bruxism

Toothpaste Abuse

Erosion

Regurgitation

Coke-swishing

Fruit-mulling

Thomas C Abrahamsen, D.D.S., M.S.

Dzakovich Conclusions

Laboratory studies have not been able to reproduce lateral stress induced lesions
Toothbrush without dentrifice has not been able to reproduce cervical lesions
Toothbrush with dentrifice and vertical brush strokes has not been able to reproduce cervical lesions
Toothbrush with dentrifice and horizontal brush stokes has reproduced cervical lesions identical to abfraction

Work of Abrahamsen and Dzakovich

Conclusions:

- "Toothbrush Abrasion" is an incorrect term
- "Toothbrush Recession" occurs
- "Toothpaste Abrasion" occurs
- "Abfraction" due to lateral occlusal forces is doubtful
- "Abfriction" is primarily related to toothpaste and horizontal brushing

Characteristics of Attrition

- Wear facets match
- Wear is located in areas of contact
- Wear facets have sharp edges
- Wear of enamel and dentin is even

Additional Clinical Signs

- Fractures of teeth and/or restorations
- Tooth Mobility
- Pulpal Necrosis
- Masticatory Muscle Hypertrophy
- Tongue Indentations

Characteristics of Erosion

- Wear in locations of no occlusal contact
- Wear facets are dull with dentin cupped and rounded
- Acid will erode tooth structure but not restorations

Key Point

In the presence of acid teeth are more easily abraded and wear facets may be present

Treatment Options

- Diet Counseling
- Appliance (night)
- Equilibration (with or without composite)
- Direct Composite (esp. with acid erosion)
- Trial Therapy (splint, composite, provisionals)
- Indirect Restorations

Key Points

1. Patients must recognize their tooth wear as a problem and understand the long term consequences before they will accept treatment
2. Wear cases are often difficult to treatment plan because as teeth wear they move
3. Most wear cases almost always have more than one treatment option

How To Treat

- **Diagnosis** – acid erosion caused by esophageal reflux or attrition with a vertical wear pattern due to a constricted envelope of function
- **Treatment Goals** – restore worn teeth, increase incisor length, correct gingival asymmetry, improve smile aesthetics, restore function, etc.
- **Treatment Plan** – crown lengthen to correct gingival asymmetry and increase incisor length, porcelain veneers or crowns to restore worn teeth and improve smile aesthetics and function
- **Sequencing** – perio, ortho, endo, restorative

Developing the Treatment Plan

- Aesthetic Component
- Functional Component
- Structural Component
- Biologic Component

Developing the Treatment Plan What Happens When Teeth Wear

- Aesthetics – teeth get shorter decreasing incisal display – teeth erupt causing gingival asymmetry and occlusal plane disharmony
- Function (occlusion) – in horizontal wear overbite and overjet are lost as well as anterior guidance – in vertical wear overbite increases and overjet decreases
- Structural – there is often less tooth structure available to be restored and usually a lack of room for restorations
- Biologic – periodontal health is usually good, but endodontic and crown lengthening procedures are often required

Aesthetic Component

- Incisal Edge Position
- Tooth Display
- Gingival Levels

Functional Component

- Ant. Guidance
- Overbite and Overjet
- Occlusal Planes

Structural Component (options to gain structure and/or space)

- Orthodontic Intrusion or Extrusion
- Periodontal Crown Lengthening
- Bite Opening
- Endo with Post and Core
- Orthognathic Surgery

Biologic Component

- Periodontal Health
- Pulpal Health
- Caries Removal

— established intra-orally with mock-ups, provisionals, etc.ly

— determined with a diagnostic wax-up on mounted models

Key Points

1. Start with incisal edge position to establish aesthetic goals
2. Mounted models and diagnostic wax-up to establish functional goals

The diagnostic wax-up integrates the aesthetic goals with the functional goals

Aesthetic Goals

- Size
- Shape
- Position
- Color

Functional Goals – Stable Occlusion

- Overbite
- Overjet
- Occlusal planes
- Anterior guidance – posterior disclusion

Stable Occlusion

- Simultaneous equal intensity centric stops
- No posterior contact in excursive movements
- Anterior guidance in harmony with the patient's envelope of function

Acid Erosion

2 Types of Acid Erosion

Intrinsic (regurgitated stomach acid)

- Gastroesophageal Reflux (GERD)
- Bulimia

Extrinsic (ingested acid)

- Beverages
- Citrus Fruits

Options for Gaining Space

Crown lengthening

Orthodontic intrusion

Bite opening



Reasons for Altering Vertical Dimension

- To improve aesthetics
- To improve occlusal relationships
- To gain space for restorations



Methods for Determining New Vertical

- Trial Appliance
- Facial Proportion
- Freeway space
- Tens
- CEJ to CEJ Measurement

“Choose the vertical dimension that requires the least amount of opening to accomplish the aesthetic and functional goals of the case”

Frank Spear, DDS, MSD

Laboratory Communication for a Diagnostic Wax-up at New VDO

- Study Models
- Centric Relation Bite
- Face Bow Transfer
- Incisal Edge Position
- Length of Centrals
- Impression and Pictures of Mock-up
- Series of Photographs
- Written Rx

Ways To Find CR

- Bimanual manipulation
- Lucia jig
- Leaf gauge
- Kois Deprogrammer
- Composite ball
- Others

Clinical Signs of Extrinsic Erosion

Beverages (carbonated, sports, and energy drinks)

1. Poolers – wear on occlusals of mandibular posteriors
2. Swishers – facial erosion on maxillary anteriors

Citrus Fruits

1. Citrus
2. Fruit suckers – anterior facial and lingual erosion
3. Citrus fruit mulling – more posterior wear than anterior

Frank Spear DDS, MSD

Additional Risk Factors for Acid Erosion

- Acidic foods (healthy diets)
- Occupational hazards
- Sustained recreational drug use
- Low salivary flow

Prevention of Erosion

- Avoid or reduce direct contact with acids
- Increase acid resistance with fluoride therapy
- Utilize the benefits of calcium and phosphates
- Provide proper tooth brushing instructions
- Monitor salivary flow
- Make medical referrals when necessary

Key Point

Prognosis is very good for acid erosion cases especially when acid source can be eliminated or prevented

Dysfunctional Wear

Parafunction - grinding patterns caused by the occlusion most likely due to interferences or instability

Bruxism – grinding most likely initiated by the CNS resulting in patients that will continue to grind even after treatment

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Trial Therapy

- Appliance – check for wear patterns
- Equilibration – in conjunction with composite bonding – check for breakage
- Provisionals – patient has accepted treatment – evaluate for evidence of wear

Attrition

2 Types of Wear Patterns

1. Horizontal – wear is broad and flat with facets on incisal edges and cusp tips and a loss of overall tooth length - horizontal wear patterns are usually less predictable to treat (cow)
2. Vertical – wear is present on the facial surface of the mand. anterior teeth and the lingual of the max. anteriors and is usually associated with a deep overbite - vertical wear patterns are often more predictable to treat (rat)

Goals of Treatment for Horizontal Wear Patterns

Design an occlusion and restorations that fit the grinding patterns of the patient

- Minimize overbite
- Shallow guidance
- Group function (bruxers)

Key Point

In protrusive wear pattern, design bite to have mesial of the mandibular premolar contact the distal of the maxillary canine to help share the load so patient wont push with as much force

Goals of Treatment for Vertical Wear Patterns

Design an occlusion and restorations that fit the grinding patterns of the patient (use of an incisal guide table is often beneficial)

- Increase overjet
- Decrease overbite

Options for Leveling the Occlusal Plane



Crown lengthen and shorten

Orthodontic intrusion

Raise the posteriors



Key Point

Which teeth need restorations will often dictate the treatment plan
