Simplifying All Ceramics
-How to select, adjust and cement.

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Simplifying All Ceramics:
- Selection Criteria
- Adjustment & Polishing Techniques
- Cementation / Bonding Techniques
- Cases

Ceramic Selection Criteria
- Aesthetics
- Strength
- Placement Techniques
Indirect Restorations

METAL BASED

Full Cast Metal
- Gold Alloy
- PFM – Porcelain fused to metal
  - Many brands; high cost, being replaced by all-ceramics; FPD
  - PFI – porcelain fused to titanium
    - New; mixed success; implant supported restorations

• IPS e.max Press/CAD; Obsidian
  - High esthetics and strong
  - 360-400 MPa

• Zirconia
  - High strength non-etchable
  - Monolithic: BruxZir; LAVA Plus; KDZ Bruxer; OccluZir; ZirLux FC
    - Fastest growing; improved esthetics~1000 MPa
  - Zirconia supported: IPS e.max ZirPress; ZirCAD, LAVA DVS
    - High esthetics; may be subject to chipping, fractures; slow cooling
  - Zirconia Multi-layered:
    - IPS e.max ZirPress; LAVA DVS, ZirCAD
    - High esthetics; may be subject to chipping, fractures; slow cooling

• CAP Multi-layered: Katana HT, ST, UT
  - Translucency, esthetic and strong
  - 557-699-1125 MPa

ALL-CERAMIC

• IPS Empress Esthetic/CAD; Authentic; OPC
  - 160 MPa

• Lithium disilicate/silicate*
  - IPS e.max Press/CAD; Obsidian
  - High esthetics and strong
  - 360-400 MPa

• Monolithic: BruxZir; LAVA Plus; KDZ Bruxer; OccluZir; ZirLux FC
  - Fastest growing; improved esthetics~1000 MPa

• Polymer:
  - Resin-nano ceramic: LAVA Ultimate, VITA Enamic

Indirect Restorations

Inlay Restorations

Feldspathic (80-120mpa)
- Lithium disilicates (360-400mpa)
- Lithium silicates (373 mpa)
- Zirconia Multi-layered (557-1125mpa)

Inlay Restorations

Onlay Restorations

Feldspathic (80-120mpa)
- Lithium disilicates (360-400mpa)
- Lithium silicates (373 mpa)
- Zirconia Multi-layered (557-1125mpa)

Preparations

Lithium disilicates (360-400mpa)
- Lithium silicates (373 mpa)
- Zirconia Multi-layered (557-1125mpa)
Onlay Restorations

- Lithium disilicates (360-400 mpa)
- Lithium silicates (373 mpa)
- Zirconia Multi-layered (557-1125 mpa)

Veneer Restorations

- Feldspathic (80-120 mpa)
- Lithium disilicates (360-400 mpa)
- Lithium silicates (373 mpa)
- Zirconia Multi-layered (557-1125 mpa)

All-Ceramic Crowns

- Lithium disilicates (L.S.)
- Zirconium oxide (ZrO2)
- Multi-Layered zirconia

All-Ceramic Crowns

- 1.5 mm - 2.0 mm PFM
- 0.7 mm - 2.0 mm All Ceramic
- Zirconia (1100 mpa-1400 mpa)

Zirconia Multi-layered

- Enamel Layer
- Gradational Layer
- Body (Dentin) Layer

Zirconia Multi-layered

- ML: A Light
- ML: A Dark
- ML: B Light
- HT: HT10
- A1.5-2
- A2.5-3.5
- B1.5-2
- for all shades (white)
All-Ceramic Crowns

Zirconia Multi-layered (557-1125mpa)

High translucent for anterior restoration

Anterior and posterior crowns and inlays, Full Denture Laboratory, veneer, Crown Dental Supply.

The same level translucency as glass ceramic (e.max Press LT)
High translucent for anterior restoration

The same level translucent as glass ceramic (Lithium Disilicate Press LT)

Mechanical Properties

30% Increase Compared to Lithium Disilicate

Restoration Placement?
- Bonded
  - Margin placement
  - Moisture Control
  - Technique Sensitive
  - Materials
    - Self Adhesives
    - Bonding agent (TE or SE) & luting resin
- Cemented
  - Margin placement
  - Moisture Tolerant
  - Retention Required
  - Materials
    - RMGI
    - Ceramir

Traditional Cementation Options
- Glass Ionomers
  - Acidic pH
  - Moisture Tolerant
  - Fluoride Release
  - Degrades over time
  - Low bond strength
  - Biocompatibility: Fair
  - Bioactivity: None
  - Sealing Quality: Ok
- Resin Modified Glass Ionomers
  - Acidic pH
  - Insoluble
  - Moisture Tolerant
  - Fluoride Release
  - Stronger than Traditional GIs
  - Degrades over time
  - Improved bond strength
  - Biocompatibility: Ok
  - Bioactivity: None
  - Sealing Quality: Ok

Cement Options
- Ceramir
  - Alkaline pH
  - Moisture Tolerant
  - Self Sealing
  - Apatite Formation
  - Insoluble
  - Stronger with time
  - Semi / Translucent
  - Biocompatibility: Excellent
  - Bioactivity-Apatite formation
  - Sealing Quality: Excellent

Crown Retention
- Results Zirconia crowns (Kg/F)
Cement Selection

Cementation Technique

Cement Selection

Lithium Disilicate

Zirconia Restorations

- cleaning w/ phosphate scavengers is not necessary
- silane is contraindicated
- no bonding agent necessary

Cement Selection

Ceramic Adjustments
Adjustments
- Interproximal
- Occlusal

Chairside Interproximal Adjustment

Adjustments
- Interproximal (Rare)
- Model work or provisional cause?
- Location to be adjusted?
- Surface treatments
  - Air abrasion
  - Stone
  - Fine diamond

Chairside Interproximal Adjustment
Check margins first
- visual
- explorer
Check proximal contacts
- sprays
- paints
- Ribbon/paper
- dental floss

Articulating Papers
- Use the thinnest brands available
  - Troll Dental 8um
  - Microcopy 10um

Dura-Green DIA
- A vitrified bonded diamond abrasive ideal for contouring and finishing porcelains, zirconia, lithium disilicate and ceramic copings
- 8 Handpiece Shapes

Panadent

What is Dura-Green DIA
- The simplest answer is Dura-Green DIA is a “diamond version of a Carborundum point”.
- Dura-Green DIA is similar to Dura Green Stones, but made with diamonds rather than silicon carbide
- It consists of diamond abrasive grains, a glass binder and air holes.

Dura-Green DIA
Features of Dura-Green DIA
- High cutting ability and durability
- Minimized surface contamination
- Minimizing chipping and heating
- Smooth surface finish
- User experience similar to Carborundum points

Two Striper® ZTech™ Diamonds
- REALITY
  - Ranked 1st with 4.4 stars in 2012 & 2013
  - Zirconia cutting diamond from Premier
  - 3 CRA articles
  - CR Foundation rated Ztech diamonds as excellent in reducing the degree of micro fractures

Adjustments
- Microfractures
- Roughness
- Increased wear
- Irreversible damage
- Plaque accumulation
- Gingival inflammation
- Reduced strength

Ceramic Polishers
- Brasseler
- Axis
- Komet

Diamond Twist SCO™
Single-paste system for Ceramics & Composite
- REALITY
  - Ranked 1st with 4.3 stars in 2012
  - CRA articles
    - Sept 2009 State of the Art Polishing Systems

Aesthetics
Preparation Design
Function
Strength
Moisture Control
Cementation/Bonding

Increasing strength demands
Minimally Invasive Aesthetics Function Bonding Adhesion Feldspathic Veneers enamel bonding etch Bonded Adhesion
Ceramic Try-in

- Make sure it is etched properly from lab
- Silanate prior to try-in (unless using Ceramir)
- Ultrasonic with ethanol after try-in

- Zirconia silanate prior to try-in
  (Ultrasonic with ethanol after try-in)
  Or
- Sandblast after try-in and use a MDP based cement
THE “NO-WATER” SILANE
INSTANT ACTIVATION
LESS DEGRADATION
(More Stable 2 Year Shelf-Life)
BONDS WITH OR WITHOUT HF
ACID ETCHING

CLEARFIL CERAMIC PRIMER
UNIVERSAL ADHESION
Unique Silane that bonds to Zirconia, Alumina, Porcelain,
Micro Hybrid & Nano Filled Composite & Base Metals,
Contains Silane, ethanol & MDP
Monomer-it is the main ingredient in Panavia resin
cements which bond directly to
high strength ceramics (Zirconia & Alumina).

Silane:
- Silica based ceramics
- Lucite based ceramics
- Glass Fiber Posts
- Composite Restorations

MDP:
- High-Strength Ceramics (Zirconia & Alumina)
- Base Metals

Resin Cement Options
Self Adhesive Resin
- Acidic/Neutral pH
- Not moisture tolerant
- Low moderate initial bond strengths
- Decreased bond strength over time
- Water sorption
- Biocompatibility-Ok
- Bioactivity-None
- Sealing Quality-Ok

Bonding Agent w/ Resin
- Acidic/Neutral pH
- Not moisture tolerant
- Best initial bond strengths but can decreases w/time
- Decreased bond strength over time
- Water sorption
- Biocompatibility-Ok
- Bioactivity-None
- Sealing Quality Good but technique sensitive

What substrate are we treating?
- Composite Preparation
Class I or II
- 3x Tubule Density Equals Higher Fluid & Increased Difficulty for Bonding
- %30 Decrease in Bond Strengths with most bonding systems.

Factors that compromise bond durability in restorative dentistry


Resin-dentin bonds are not as durable as was previously thought. Microtensile bond strengths often fall 30% to 40% in 6 to 12 months.
The Bonding Agents

<table>
<thead>
<tr>
<th>Generation</th>
<th>Etchant</th>
<th>Primer</th>
<th>Adhesive</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>3</td>
<td>2</td>
<td>2</td>
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<tr>
<td>2nd</td>
<td>2</td>
<td>2</td>
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</tbody>
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When bonding to enamel, an etch & rinse approach is definitely preferred, indicating that simple micro-mechanical interaction appears sufficient to achieve a durable bond to enamel. When bonding to dentin, a mild self-etch approach is superior, as it involves (like with glass-ionomers) additional ionic bonding with residual HA. This additional primary chemical bonding definitely contributes to bond durability. Altogether, when bonding to both enamel and dentin, selective etching of enamel followed by the application of the 2-step self-etch adhesive to both enamel and dentin currently appears the best choice to effectively and durably bond to tooth tissue.


InstroN

Ultra Tester (Ultradent)
Ultra Jig (Ultadent)

Shear Bond Test Results - 2012
Maximum/Minimum Shear Bond Strength per Bonding Material

Courtesy Pacific University (Dr Marc Guisberger)

MDP Adhesion Monomer:
Developed by Kuraray 1983
- Acidic Monomer Activates Silanes & Chemically Bonds to Metal Oxide Ceramics (Zirconia & Alumina).
  (Key Ingredient to make a Silane Universal)
- Hydrophilic & Hydrophobic
- Very Durable Dentin Bond
  (Creates An Insoluble, calcium Salt with Dentin)
- Is The Most Copied Monomer in Dentistry
- The Most Researched Monomer in Dentistry
- 20 + Years Of Research On Metal Oxide Ceramics (Zirconia & Alumina)
- Strongest & Most Durable Bond to Metal Oxide (Zirconia & Alumina) Ceramics

Courtesy Pacific University (Dr Marc Guisberger)
Adhesive Functional Monomers

Self-Adhesive Resin Cements

Shear bond strength to Zirconia (Lava)

Bond strength to Tooth structure

Bond strength to Zirconia (Lava)

All porcelain cementation use a bonding agent and resin cement

Self-Adhesive Resin Cements

No Primer or Bond? Gel State?

All porcelain cementation use a bonding agent and resin cement

Self-Adhesive Resin Cements Without a Primer or Bonding Agent have less:
- Wettability
- Which Results in Less Contact to the Tooth
- Which May Result in a Less Durable Bond

Convenience

No Primer or Bond

Shear bond strength of self-adhesive resin cement to zirconia (Lava™)

(N. Iwamoto, S. Urasaki, M. Ikeda, M. Nakajima J. Tagami, Tokyo Medical and Dental University, 2008, Japan)
After simulated aging through cyclic loading (1.2 million) and dye penetration test to detect Microleakage. LSU Dental School. IADR 2006, Abstract #2090.

- **All Ceramic Crown Microleakage**
  - MDP Resin Cement
  - SE Auto Resins

- **High Performance MDP Resin Cement**
  - Universal
  - Clear: White
  - Brown
  - White
  - Opalescent

- **High Performance Cement**

- **Zirconia Ceramic Conditioning**

- **“MDP”s perform differently**
  - Micro tensile bond strength to Dentin

- **Zr treated with**
  - Clean
  - Treat
  - SBS, MPa

- **Bond durability of phosphate monomers with different purity**
  - Okayama Univ. (Yoshihara K, et al.)
  - The 33rd Meeting of the Japanese Society for Adhesive Dentistry, 2014, P-7
How MDP Bonds to Zirconia

MDP-containing material bonds to Zirconia

- MDP
- γ-MPS
- Ethanol

Silane Treatments

<table>
<thead>
<tr>
<th>eMax™</th>
<th>Zirconia</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. HF Etch</td>
<td>1. Sandblast (20-80psi)</td>
</tr>
<tr>
<td>2. Ultrasonic Clean or Ivoclean</td>
<td>2. Ultrasonic Clean, Ivoclean</td>
</tr>
<tr>
<td>3. Apply Ceramic Primer &amp; Air Dry</td>
<td>3. Apply MDP-Based, Self-Adhering Cement or MDP-Based Silane</td>
</tr>
</tbody>
</table>

Review

- Ceramic Selection
- Aesthetics
- Strength
- Cementation Placement Technique based on isolation
- NEW Multi-Layered Translucent Zirconia
- Polish after adjusting
- Silanate with MDP material prior to try in of ceramics
- Cementation
  - High bonds to enamel with etching, adhesive and resin
  - High bond strength & durability for longevity with MDP monomer technologies on ceramic & dentin
  - Use a bonding agent with cement for highest bond strengths to both structure

Thank you!

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Questions?