Top 10 Crown & Bridge Mistakes
Producing Optimum Esthetic Restorations
Michael C. DiTolla, DDS, FAGD

Top 11 Preparation Problems

1. Too convergent
   - 5-8% taper
   - Preps typically underprepared on mesial & distal surfaces
   - Results in gingiva being strangled by PFM contours

2. Lack of Filler
   - Filler is stronger than cement
   - Better to have filler in prep holes than cement
   - Vitrebond, historically. Today, self-etching flowable composites.

3. Lack of Build-up
   - Need build-up for crown retention
   - No build-up leaves a lack of insulation for pulpal tissues

Advantages of Core Build-ups

- Decrease porcelain fracture in PFM cases due to homogenous thickness of metal under the ceramic, which allows for uniform cooling of porcelain (less trapped tensile forces).
- Decrease porcelain fracture in porcelain to zirconia cases due to homogenous thickness of metal under the ceramic, which allows for uniform cooling of porcelain (less trapped tensile forces).
- Decrease in amount of precious metal.
Advantages of Core Build-ups

- Increase ease of fabrications of provisional fabrication (no undercuts).
- Decrease effect of microleakage under both provisional and definitive restorations.
- Increase predictability of impression making.
- Decrease fracture potential of stone dies.
- Allow cementation without anesthesia 95% of the time (if provisional cement is easy to remove).

Top 11 Preparation Problems

4. Poorly Defined Margins
   - Ill-fitting restorations
   - Recurrent decay
   - Overcontoured crowns

Area Finish Lines

<table>
<thead>
<tr>
<th>Type</th>
<th>Level of difficulty</th>
<th>Esthetics</th>
<th>Restoration Margin</th>
<th>Marginal Stress</th>
<th>Indications/Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feather Edge 180º</td>
<td>Easy</td>
<td>Poor</td>
<td>Metal Collar</td>
<td>Very High</td>
<td>Only suitable for crowns with metal collars Good for peri disease</td>
</tr>
<tr>
<td>Knife edge &gt;180º</td>
<td>Easy</td>
<td>Poor</td>
<td>Metal Collar</td>
<td>Very High</td>
<td>Suitable for inlays and onlays as well</td>
</tr>
</tbody>
</table>

Small diameter burs should be avoided during preparation to prevent irregular surfaces or overheating the pulp

Area margins vs. Linear margins

Area - Feather-edge or Knife-edge
Linear - Shoulder margins  Chamfer margins with or without bevels

Mediocre Area Finish Lines are Preferable to Mediocre Linear Finish Lines

Linear Finish Lines

<table>
<thead>
<tr>
<th>Type</th>
<th>Level of difficulty</th>
<th>Esthetics</th>
<th>Restoration Margin</th>
<th>Marginal Stress</th>
<th>Indications/Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chamfer</td>
<td>Easy</td>
<td>Moderate</td>
<td>Metal Collar or Micromargin</td>
<td>Minimal</td>
<td>Multiple connected restorations</td>
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<tr>
<td>Rounded Shoulder</td>
<td>Difficult</td>
<td>Excellent</td>
<td>All Materials</td>
<td>Minimal</td>
<td>Not to be used for multiple connected restorations</td>
</tr>
<tr>
<td>90 degree Shoulder</td>
<td>Difficult</td>
<td>Excellent</td>
<td>All Materials</td>
<td>Minimal</td>
<td>Not to be used for multiple connected restorations</td>
</tr>
</tbody>
</table>

Small diameter burs should be avoided during preparation to prevent irregular surfaces or overheating the pulp

An overtapered axial wall has been made more retentive by creating a gingival shoulder.
This allows the vertical walls to be more parallel.

Overpreparation of margins: the “J” margin or the “ski jump” margin
Note the Different Positions of the Facial and Lingual Margins

Simple shoulder margin; maximum esthetics
Depth cut based preps protect pulpal tissues

Top 11 Preparation Problems

5. Lack of Retentive Grooves
   - Especially on short preps
   - M & D grooves resist facial-lingual movement, such as bruxism
   - F & L grooves resist M-D movement
   - Grooves should be half the depth of an 1170 bur

Top 11 Preparation Problems

The groove on the left has been cut parallel with the path of insertion.
The groove on the right has been incorrectly cut to parallel the over-tapered axial wall resulting in less resistance.

Top 11 Preparation Problems

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The groove on the right has been incorrectly cut to parallel the over-tapered axial wall resulting in less resistance.

Top 11 Preparation Problems

5 REASONS FOR PLACING SUBGINGIVAL MARGINS:

1. Short preps when buildup not possible.
2. Caries extends subgingival.
3. Old restorations extend subgingival.
4. Physiologically incapable of cleaning teeth well.
5. Psychologically incapable of cleaning teeth well.

Top 11 Preparation Problems

6. Margins Too Far Subgingival
   - Gingiva bleeds spontaneously
   - Looks horrible—purple gums
   - 5 reasons for placing subgingival margins:

Top 11 Preparation Problems

7. Too Little M-D Reduction
   - Too little F-L reduction

Top 11 Preparation Problems

Proper angulation leads to proper reduction and resistance
Overangulation of bur leads to poor resistance and underprepared cervical thirds
8. Too Little Occlusal / Incisal Reduction
   - Bad esthetics
   - Poor strength
   - Metal shows

9. Sharp Occlusal Angles On Incisal Edge
   or Occlusal Surface in Posterior

10. Undercuts
    - Crowns are ill-fitting

11. Preparation Not Long Enough
    - Ceramic Fractures
    - Crowns Not Retentive

Average dentist gives 2,000 injections per year
- 850 of those injections are lower blocks
- We spend 10-12 minutes waiting for profound anesthesia and miss 25% of the time
- That’s 24 full 8 hour days of wasted time

Practice Building Topical

PFG Gel
- 10% Lidocaine
- 10% Prilocaine
- 04% Tetracaine

Steven’s Pharmacy
800-352-3784
www.stevensrx.com

DYC rinse

PFG Lite gel
- 05% Lidocaine
- 05% Prilocaine
- 02% Tetracaine

Modern Anesthesia Technique
Rapid Anesthesia Technique

Modern Shade Taking

- 75% of the prescriptions have one shade
- 25% have multiple shades

Numbers are from a study of over 2,000,000 crowns.

Most popular shades

Numbers are from a study of over 2,000,000 crowns.
<table>
<thead>
<tr>
<th>Shade</th>
<th>Percent of shades requested</th>
<th>Percent that came back for re-shade</th>
<th>Reshade vs normal percent differential</th>
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<tr>
<td>a2</td>
<td>17%</td>
<td>18%</td>
<td>4%</td>
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<tr>
<td>a3</td>
<td>11%</td>
<td>10%</td>
<td>-12%</td>
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<tr>
<td>a1</td>
<td>9%</td>
<td>14%</td>
<td>63%</td>
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<tr>
<td>b1</td>
<td>4%</td>
<td>11%</td>
<td>138%</td>
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<tr>
<td>d2</td>
<td>4%</td>
<td>6%</td>
<td>54%</td>
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<tr>
<td>d3</td>
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<tr>
<td>c2</td>
<td>3%</td>
<td>4%</td>
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<tr>
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<td>3%</td>
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<td>c3</td>
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<td>1%</td>
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<tr>
<td>c1</td>
<td>2%</td>
<td>5%</td>
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<tr>
<td>b2</td>
<td>2%</td>
<td>3%</td>
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<tr>
<td>a4</td>
<td>1%</td>
<td>2%</td>
<td>52%</td>
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</tbody>
</table>

Numbers are from a study of over 2,000,000 crowns.

**Color in Dental Terms**

- **Value (V)** - Represents the brightness of a color independent of its hue.
- **Chroma (C)** - The intensity or saturation of a color.
- **Hue (H)** - The color tone; e.g., red, yellow, green, blue.

**The Color Sphere**

- **Infinite Shades of Color**
  - The same color can appear different due to:
    - Light Sources
    - Size Differences
    - Background Differences
    - Directional Differences

- **VITA 3D Value Guide**

**VITA Easyshade Compact**

**Shade Selection Video**

**Modern Preparation**
Reverse Preparation Technique

- Predictable reduction through the use of depth cuts.
- Nearly perfect margin formation that is incredibly simple.

Depth Control Burs from Axis Dental

- MADC-006 0.6 mm 1 ring
- MADC-010 1.0 mm 2 rings
- MADC-015 1.5 mm 3 rings
- MADC-020 2.0 mm 4 rings
Impressions Received

<table>
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<tr>
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<th>Cadent</th>
<th>CEREC Connect</th>
<th>Lava CDS</th>
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<td>Dec 2011</td>
<td>248</td>
<td>1,513</td>
<td>75,215</td>
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</tr>
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</table>

“In reality, a crown and bridge impression is merely a reflection of the dentist’s integrity, nothing more and nothing less.”

Perfect Impression Requirements

1. Must capture 360 degrees of easily identifiable tooth structure apical to the margin with no guesswork in die trimming.
2. The impression must capture all of the necessary esthetic and functional aspects of the unprepared teeth.
3. Making the impression must not irreversibly damage the patient’s biology including connective tissue.
4. The impression must be free of organic and inorganic contaminants such as: blood, serum, saliva, grinding debris.
5. The set of the impression material must not have been inhabited—no slime.
6. The impression material must not have been dislodged from the tray during removal or lab handling.

Predictable Impressions: 2-Cord technique

Ultrapak Cord

Ultrapak Cord
**GingiTrac**
- Cordless gingival retraction
- Polyvinylsiloxane material
- Controls bleeding with aluminum sulfate
- Removes cleanly in one piece with no rinsing
- Used in combination with GingiCap

**ViscoStat Clear**
- 25% aluminum chloride gel
- Causes collagen in capillaries to swell and close off
- Will not stain hard and/or soft tissues
- Especially useful in esthetic zone

**ViscoStat Plus**
- 22% ferric chloride
- Rapid hemostasis when scrubbed with Dento-Infusor tip
- Can cause temporary discoloration of soft tissue
- Will typically work when ViscoStat Clear is not strong enough

**GingiTrac**
- Select proper size GingiCap.
- Express GingiCap around tooth like impression material.
- Fill GingiCap with GingiTrac and place onto prepared tooth.
- Have patient bite down with medium pressure for 3-5 minutes.

**Double Arch Trays**
- Only one prep or two adjacent preps, no bridges.
- Occlusal prematurities should be eliminated, if present, prior to prepping.
- Upper and lower teeth must be firmly together in maximum intercuspation with the tray in place, try it in!
- Posterior DA impressions should extend from most posterior tooth to include upper and lower canines on that side.
Double Arch Trays

- Anterior DA impressions should include all four canines.
- Interocclusal wafer must be extremely thin and non-absorbing. The QUAD-TRAY Xtreme from Clinicians Choice is 0.002 inches thick.
- Posterior connector of facial and lingual aspects must be thin and not interfere.

Interocclusal wafer must be extremely thin and non-absorbing. The QUAD-TRAY Xtreme from Clinicians Choice is 0.002 inches thick.

- Tray contact with teeth, preps or tori can produce distortions in DA impression. Occasionally soft tissue can touch without complications.
- Combination of tray and impression should make a rigid unit—metal tray with flexible material, plastic tray needs rigid material.
- If no distal molar is present, over closure might occur.

“Research has shown that properly made DA impressions for simple clinical conditions can be as good as or better that when using much more time consuming and difficult full arch impressions and interocclusal record.”

Dr. Gordon Christensen

Lab Technique for Double Arch Trays

1. Wash out impression and dry it.
2. Pour the arch which includes the tooth preparation(s) in dies stone, place the appropriate dowel pin(s), and let stone set.
3. Pour the opposing arch in regular stone and let the stone set.

4. With arches still unseparated from impressions, mount the upper and lower casts on a small hinge articulator using low-expansion mounting stone (Mounting Stone by Whip Mix) and let it set.
5. Trim all excess anterior and posterior overlapping stone to eliminate the possibility of stone debris restricting closure to proper occlusion when arches are separated.

Open the articulator, separate the arches, saw the dies(s) from the working cast, trim the dies, and make the restoration(s).

Clinicians Choice

QUAD-TRAY Xtreme

- Wide Arch width
- Low sidewalls
- Inflexible, but cannot be bent
- Thin distal bar

Triotray Pro

Enhanced Design Considerations

- Anatomical Design
- “The Accurate Fit”
  - Two trays for different arch sizes (S&L)
  - Fits into patient’s mouth comfortably
  - Controls the tongue
  - Allows for flatter palates
Enhanced Design Considerations

- Well-supported canine to help with excursions
- Even support along the arch
- Back seal
  - Ensures molar is captured in the distal aspect
  - Prevents the impression material going backwards

Modern Restorative Materials

- Monolithic Restorations vs Bilayered Restorations
- Lab industry appears to have been permanently changed by these materials
- Pacific Dental

Ceramic Choices:
- Feldspathic: Highly translucent and esthetic ceramic used most commonly for veneers. Lowest strength ceramic, ranging from 70-110 MPa.

As a general rule: As flexural strength increases, esthetics decrease

Ceramic Choices:
- Leucite-Reinforced (IPS Empress Esthetic, Cerpress SL): Excellent esthetics and translucency. The addition of leucite crystals to the glass matrix slightly improves mechanical properties. Ideal for veneers, inlays/onlays, and anterior crowns.

Ceramic Choices:
- Lithium Disilicate (IPS e.max): Composed of a glass matrix filled with 70% lithium disilicate crystals, resulting in a material that is relatively translucent and 2-3 times stronger than leucite-reinforced ceramics. It is a universal material that combines strength and esthetics and can be used for veneers, inlays/onlays, and anterior and posterior crowns.

Ceramic Choices:
- Zirconia (BruxZir, other generics): Highest strength ceramic with highest fracture toughness due to the composition of polycrystals. The lack of a glass component within the matrix results in an opaque restoration, compromising esthetics in some cases. Its use is indicated for anterior and posterior crowns, 3-5 unit bridges, Maryland bridges, and implant abutments. Newer zirconias have improved translucency.

As a general rule: As flexural strength increases, esthetics decrease

Ceramic Choices:
- Resin Nano-Ceramic (Lava Ultimate): Newest class of CAD/CAM materials. The ceramic block is infused with resin resulting in a material that is easy to mill, requires no firing, can be easily repaired and adjusted, and does not wear the opposing dentition.

As a general rule: As flexural strength increases, esthetics decrease

Ceramic Choices:
- BruxZir and Milled ™️.macCAD: Very promising 1-year Results

Should You Change from PFM to Full-Ceramic Restorations?

- Improved aesthetic properties
- Improved marginal integrity
- Reduced risk of recurrent caries
- Improved patient acceptance

Bondo and Prepara. Must be finished with a finishing tool for a smooth, semi-gloss finish. Bondo is a gel-like material that is applied to the cavity preparation. Prepara is a hardening agent that is mixed with Bondo to harden the material. The mixture is applied to the cavity preparation and allowed to harden. The cavity is then finished with a finishing tool to achieve the desired smooth, semi-gloss finish.

TRAC is a computer-aided design/computer-aided manufacturing system that allows for the creation of highly precise, customized dental restorations. It enables dentists to design and fabricate restorations with unprecedented accuracy and precision.

Gold Standard: Gold is the standard for dental restorations due to its excellent properties, including high strength, durability, and aesthetic appeal. It is often used for crowns, bridges, and inlays.

Cont'd on next page
One Year After Fabrication
Fracture Rates

<table>
<thead>
<tr>
<th>Material</th>
<th>Fracture Rate</th>
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<tbody>
<tr>
<td>Empress</td>
<td>4.9%</td>
</tr>
<tr>
<td>Procera Zirconia</td>
<td>4.9%</td>
</tr>
<tr>
<td>Lava</td>
<td>2.5%</td>
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<tr>
<td>Clinical Zirconia</td>
<td>1.6%</td>
</tr>
<tr>
<td>IPS e.max</td>
<td>1.0%</td>
</tr>
<tr>
<td>BruZir</td>
<td>0.4%</td>
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<tr>
<td>Full Cast</td>
<td>0.0%</td>
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One Year In-vivo
Posterior Non-Splinted
Fracture Rate

<table>
<thead>
<tr>
<th>Material</th>
<th>Fracture Rate</th>
</tr>
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<tbody>
<tr>
<td>Empress</td>
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<td>Lava</td>
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<td>Clinical Zirconia</td>
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<tr>
<td>PFM</td>
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<td>BruxZir</td>
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<tr>
<td>Full Cast</td>
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One year In-vivo
Posterior Bridge
Fracture Rate

<table>
<thead>
<tr>
<th>Material</th>
<th>Fracture Rate</th>
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<tr>
<td>Lava</td>
<td>4.4%</td>
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<tr>
<td>Premise</td>
<td>2.6%</td>
</tr>
<tr>
<td>Clinical Zirconia</td>
<td>2.0%</td>
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<tr>
<td>BruxZir</td>
<td>1.5%</td>
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<td>PFM</td>
<td>1.0%</td>
</tr>
<tr>
<td>Full Cast</td>
<td>0.0%</td>
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</tbody>
</table>

IPS e.max CAD and Press
“Cementable Empress”

IPS e.max CAD
(Ivoclar Vivadent)

- Introduced in 2006.
- Structural Ceramic
- Lithium Disilicate
- 360 MPa of flexural strength.
- 70% crystallized post-crystallization.

IPS e.max CAD blocks
- Available in different opacities as LT, MT, and HT.
- Partially crystallized to 130 MPa for milling; the same flexural strength the other blocks.
- Milled, tried in mouth and adjusted. Restoration then fully crystallized during a 20 minute firing cycle using a two-step ceramic furnace. Restoration carried to 1,650 degrees F helping it reach its final flexural strength of 360 MPa. This is approximately four times the strength of leucite–reinforced glass ceramic (IPS Empress).
- This makes IPS e.max cementable
- Can be cut back and layered, but then it is no longer monolithic.

IPS e.max: Lithium Disilicate

- Available as a homogenous ingot for hot pressing or a pre-crystallized block for milling.
- Either one can be used full contour or can be cut back and layered.

IPS e.max Press

Lithium Disilicate vs. Zirconia

Veneered Zirconia Failure Pattern

20g Vennement
105/165
Wear and tear
Bleeding
IPS e.max CAD
40% lithium meta-silicate
Crystal size of 0.5 microns

IPS e.max CAD
19 minute crystallization cycle

IPS e.max CAD
70% volume lithium disilicate crystals
Crystal size of 1.5 microns

IPS e.max Veneers

IPS e.max CAD

BruxZir
Solid Zirconia Restorations
34% reduction in remakes

Their total business increased 54% from 2008 to 2011

BruxZir fabrication since Apr. 2009

- 1,823,404 BruxZir restorations since launch between Glidewell and 185 partner labs

BruxZir Solid Zirconia

- Ideal for bruxers & grinders who have destroyed other restorations thanks to its virtually chip-proof durability.
- An esthetic alternative to metals with CAD/CAM consistency of contacts and occlusions.
- Conservatively prepare as thin as 0.5 mm with feather edge margins, much like you would cast gold.

BruxZir Adjustment & Polishing Kit

History of Cements

Zinc Phosphate Cement

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Areas of Application</th>
<th>Weaknesses</th>
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<tbody>
<tr>
<td>Over 100 years of clinical experience</td>
<td>Routing application in metal supported crowns and bridges</td>
<td>Occasional postoperative sensitivity</td>
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<tr>
<td>Low fluoride ion release</td>
<td>Molecular bonding to the tooth surface</td>
<td>Low hardness</td>
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<tr>
<td>High solubility</td>
<td>Acceptable for retention of metal supported crowns and bridges</td>
<td>Low solubility</td>
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Polycarboxylate Cement

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<th>Weaknesses</th>
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<td>25 years of clinical experience</td>
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<td>High solubility</td>
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<td>Low fluoride ion release</td>
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<td>Low hardness</td>
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<tr>
<td>Molecular bonding to the tooth surface</td>
<td>Long-term provision</td>
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**Conventional Glass Ionomer Cement**

<table>
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<th>Areas of Application</th>
<th>Weaknesses</th>
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<tbody>
<tr>
<td>20 years of clinical experience</td>
<td>Routine application for metal-supported crowns and bridges</td>
<td>Occasional post-operative sensitivity</td>
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<tr>
<td>Fluoride ion release</td>
<td>Limited application with high-strength ceramics</td>
<td>Sensitive to water and mechanical loading</td>
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<td>Molecular bonding to the tooth surface</td>
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<td>Solubility</td>
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<td>Minimal dimensional change</td>
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<td>Simplicity of use</td>
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<td>Medium material strength</td>
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<td>Good routine cement</td>
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**Resin-Modified Glass Ionomer**

<table>
<thead>
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<th>Areas of Application</th>
<th>Weaknesses</th>
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<tr>
<td>10 years of clinical experience</td>
<td>Medium material strength</td>
<td>Moisture sensitive powder</td>
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<tr>
<td>Fluoride ion release</td>
<td>Good routine cement</td>
<td>Swelling/linear expansion</td>
</tr>
<tr>
<td>Molecular bonding to the tooth surface</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low solubility or erosion of cement margins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simplicity of use</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Self-Adhesive Resin Cements**

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Areas of Application</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>New self-adhesive technology</td>
<td>High mechanical properties</td>
<td>Limited long-term clinical history</td>
</tr>
<tr>
<td>High adhesion without use of etchant, primer or adhesive</td>
<td>Good aesthetics</td>
<td>Available only in capsule delivery</td>
</tr>
<tr>
<td>Ease of use</td>
<td>Easy clean up</td>
<td>Low fluoride release</td>
</tr>
<tr>
<td>Capsule delivery system</td>
<td>All metal-based, ceramic, and indirect composite restorations with the exception of veneers</td>
<td></td>
</tr>
<tr>
<td>Low potential for postoperative sensitivity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High hardness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low solubility</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Resin Cements (Composite)**

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Areas of Application</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-20 years of clinical experience</td>
<td>High adhesion with use of pretreatments (etching, priming, bonding)</td>
<td>Difficult to use</td>
</tr>
<tr>
<td>High adhesion</td>
<td>High hardness</td>
<td>Requires use of separate primers or adhesives</td>
</tr>
<tr>
<td>Low solubility</td>
<td>High mechanical properties</td>
<td>Difficult clean up</td>
</tr>
<tr>
<td>Low fluoride release</td>
<td>Good aesthetics</td>
<td>Technique sensitive</td>
</tr>
<tr>
<td></td>
<td>All metal-based ceramic and indirect composite restorations</td>
<td>Low or no fluoride release</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Potential for postoperative sensitivity</td>
</tr>
</tbody>
</table>
Ceramir Crown & Bridge

Basic properties

<table>
<thead>
<tr>
<th></th>
<th>Ceramir Crown &amp; Bridge</th>
<th>Ketac Cem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working time:</td>
<td>2 min</td>
<td></td>
</tr>
<tr>
<td>Net Setting time:</td>
<td>5 min</td>
<td></td>
</tr>
<tr>
<td>Film thickness:</td>
<td>15µm</td>
<td></td>
</tr>
<tr>
<td>Compressive strength (24 h):</td>
<td>160 Mpa</td>
<td></td>
</tr>
<tr>
<td>Radio Opacity:</td>
<td>1.5 mm Al</td>
<td></td>
</tr>
</tbody>
</table>

Working time: 2 min
Net Setting time: 5 min
Film thickness: 15µm
Compressive strength (24 h): 160 Mpa
Radio Opacity: 1.5 mm Al

Shear Bond Strength

Shear Bond strength (MPa) to different substrates

<table>
<thead>
<tr>
<th>Substrate</th>
<th>Ceramir Crown &amp; Bridge</th>
<th>Ketac Cem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dentin</td>
<td>11</td>
<td>4.7</td>
</tr>
<tr>
<td>Enamel</td>
<td>8.4</td>
<td>8.4</td>
</tr>
<tr>
<td>Gold</td>
<td>10.2</td>
<td>2.8</td>
</tr>
<tr>
<td>Alumina</td>
<td>7.5</td>
<td>6.6</td>
</tr>
<tr>
<td>Zirconia</td>
<td>8.2</td>
<td>3.7</td>
</tr>
</tbody>
</table>

In all tests the standard deviation was about 2 MPa.

Unique Handling Properties

- Likes some moisture
- No extra steps (etching, priming, bonding)
- Easy to:
  - seat the unit on the abutments (unique viscoelasticity)
  - remove excess material

Chemically Stable

- All studies on Ceramir Crown & Bridge have shown minimized leakage
- Alkaline (pH > 7) resist attacks from both acid and acid-producing bacteria


Ivoclean

Scientific Documentation

The Mechanism Behind the Contamination of Zirconium Oxide Surfaces
The Mechanism Behind the Contamination of Zirconium Oxide surfaces

Ivoclean

Extraoral cleaning paste for indirect restorations

Standard composition

- Zirconium oxide: 10 - 15 wt%
- Water: 65 - 80 wt%
- Polyethylene glycol: 8 - 10 wt%
- Sodium hydroxide: ≤ 1 wt%
- Pigments, additives: 4 - 5 wt%

Physical properties

- pH: 13 - 13.5
- Dry mass at 120°C: 17 - 19 wt%

Cleaning Effect of Ivoclean on Zirconium Oxide

Cleaning Effect of Ivoclean on Lithium Disilicate

BruxZir Anterior Crowns

Cleaning Effect of Ivoclean on Zirconium Oxide
Removal of BruxZir Crowns