Restorative Dentistry
Clinical Reference®

Department of Restorative Dentistry
University of Washington
Seattle, Washington USA

Dr. Glen H. Johnson
Professor Emeritus

September 2021
25th Annual Edition
To Our Students, Staff and Dental Colleagues,

In April 1996, I proposed the creation of the *Restorative Dentistry Clinical Reference* to our department chair at that time, Dr. David Bales. He gave me the green light to proceed with this project given a need for a concise, current summary of common Restorative procedures in our clinics. Annual editions have been produced and printed now for 25 years, thus 2021 is a silver anniversary of sorts.

The aim of the *Restorative Dentistry Clinical Reference* is to provide a convenient, concise, standardized source of information for common clinical materials and procedures employed in our Restorative Dentistry Clinics. I hope you find this resource useful. The primary intended users of this reference are our regular faculty, affiliate faculty, students, dental assistants, and dispensary staff. Annually, a pocket edition of the *Restorative Dentistry Clinical Reference* is printed and distributed to those directly involved in our educational process. The list of recipients also includes affiliate faculty at 16 regional clinical training sites to aid in mentor calibration.

The contents of the current *Restorative Dentistry Clinical Reference* are placed on our Department website as well to aid State of Washington practitioners and their staff, and to post updates.

From all the hard-working folks in the Department of Restorative Dentistry at University of Washington, we extend our very best wishes.

Sincerely,

Glen H. Johnson, D.D.S., M.S.
Professor Emeritus
<table>
<thead>
<tr>
<th>Sec</th>
<th>Procedure</th>
<th>Clinic Material(s)</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cavity bases - what and when</td>
<td>Filtek Ultra Supreme, Fuji II LC, Fleck’s ZP</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Cavity liners - what and when</td>
<td>Dycal, Fuji Lining LC</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Cavity sealers - what and when</td>
<td>Scotchbond Universal</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Use of Scotchbond Universal (SBU) – general</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Filling Material Selection Matrix</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>Class 5 restoration options</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Field Isolation</td>
<td>Rubber dam, retraction cord</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>▪ Amalgam</td>
<td>Valiant PhD</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>▪ Composite resin</td>
<td>Filtek Ultra Supreme + SBU</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>▪ Resin Modified Glass Ionomer</td>
<td>Fuji II LC</td>
<td>8</td>
</tr>
<tr>
<td>7</td>
<td>Class 1, 3-6 composite resin restoration</td>
<td>Filtek Ultra Supreme + SBU</td>
<td>8</td>
</tr>
<tr>
<td>8</td>
<td>Ultraconservative Class 1 Restoration</td>
<td>Filtek Flow + SBU</td>
<td>9</td>
</tr>
<tr>
<td>9</td>
<td>Class 2 posterior composite restoration</td>
<td>Filtek Ultra Supreme + SBU</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>Repair of a defective proximal contact</td>
<td>Filtek Ultra Supreme + SBU</td>
<td>14</td>
</tr>
<tr>
<td>11</td>
<td>Surface sealer for a composite restoration</td>
<td>Fortify</td>
<td>15</td>
</tr>
<tr>
<td>12</td>
<td>Treating root sensitivity</td>
<td>SBU</td>
<td>15</td>
</tr>
<tr>
<td>13</td>
<td>Dentin sealers under amalgam</td>
<td>SBU</td>
<td>16</td>
</tr>
<tr>
<td>14</td>
<td>Tx: Exposure or near exposure of pulp</td>
<td>MTA; Dycal-Fuji Lining LC-SBU sealer</td>
<td>16</td>
</tr>
<tr>
<td>15</td>
<td>Foundation/Buildup Restorations Choices</td>
<td>LC or DC Composite Resin; Amalgam</td>
<td>17</td>
</tr>
<tr>
<td>16</td>
<td>Dual-cured composite foundation/buildup</td>
<td>ParaCore + SBU + DCA</td>
<td>18</td>
</tr>
<tr>
<td>17</td>
<td>Bondable reinforcement ribbon applications</td>
<td>2,3,4 mm Ribbond, scissors, wetting resin</td>
<td>19</td>
</tr>
<tr>
<td>18</td>
<td>Silver Diamine Fluoride (SDF) Caries Treatment</td>
<td>Advantage Arrest (38% SDF)</td>
<td>22</td>
</tr>
<tr>
<td>19</td>
<td>Check list for pulp capping &amp; restorations</td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>20</td>
<td>Bonding to and/or repairing a composite filling</td>
<td>Microabraison, Filtek Ultra Supreme, SBU</td>
<td>24</td>
</tr>
<tr>
<td>21</td>
<td>Porcelain Repair</td>
<td>Microabraison, Filtek Ultra Supreme, SBU</td>
<td>25</td>
</tr>
<tr>
<td>22</td>
<td>Luting cements – indications/contraindications</td>
<td></td>
<td>26</td>
</tr>
<tr>
<td>23</td>
<td>Cerements and Cementation</td>
<td></td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>▪ Preliminary procedures</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Gold Inlays/Onlays</td>
<td>Fleck’s Zinc Phosphate</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>▪ Gold and P+M Crowns</td>
<td>RelyX Luting, RelyX Unicem 2 Automix</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>▪ Implant-Supported Crowns</td>
<td>Ceramix C&amp;B</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>▪ Zirconia-based Crowns</td>
<td>RelyX Luting, RelyX Unicem 2 Automix</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>▪ Glass Ceramic Crowns/Inlays/Onlays</td>
<td>Variolink Esthetic or RelyX Ultimate</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>▪ Porcelain/Glass Ceramic Veneers</td>
<td>Variolink Esthetic Kit</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>▪ Resin-Bonded Bridge (Maryland Bridge)</td>
<td>Panavia 21</td>
<td>42</td>
</tr>
<tr>
<td>24</td>
<td>Provisional Cements</td>
<td>TempBond NE, Durelon</td>
<td>45</td>
</tr>
<tr>
<td>25</td>
<td>Provisional Filling Materials</td>
<td>IRM, Ketac-Fil Plus Applicap, Fermit-N</td>
<td>47</td>
</tr>
<tr>
<td>26</td>
<td>Posts and Post Cementation</td>
<td>RelyX Unicem 2 Automix</td>
<td>48</td>
</tr>
<tr>
<td>27</td>
<td>Treating Superficial Enamel Discoloration</td>
<td>18% HCl + flour of pumice</td>
<td>52</td>
</tr>
<tr>
<td>28</td>
<td>Bleaching at-home with trays</td>
<td>Carbamide Peroxide 10%</td>
<td>53</td>
</tr>
<tr>
<td>29</td>
<td>Power Bleaching In–office</td>
<td>38% Hydrogen Peroxide</td>
<td>54</td>
</tr>
<tr>
<td>30</td>
<td>Curing Light - power output check</td>
<td>Optilux Curing Radiometer</td>
<td>57</td>
</tr>
<tr>
<td>Restorative Clinic Cassette Contents</td>
<td></td>
<td>58</td>
<td></td>
</tr>
<tr>
<td>Dispensary Materials - Listing</td>
<td></td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>References</td>
<td></td>
<td>64</td>
<td></td>
</tr>
</tbody>
</table>
1. Cavity Bases

A base is used as a replacement material for missing dentinal tooth structure. The primary indication for use of a base is to eliminate undercuts, to facilitate draw of a preparation. Additionally, a base can be used to reduce the bulk of a direct or indirect restoration. The rationale for use of a base to gain thermal insulation is not as accepted today. It is believed that sealing dentin (with a sealer) is far more effective in controlling post-operative sensitivity. The base should have adequate strength and modulus of elasticity to support the overlying restoration.

Examples of acceptable bases used in the D-2 and D-3 clinics are

<table>
<thead>
<tr>
<th>Type</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>zinc phosphate cement</td>
<td>Fleck’s Cement</td>
</tr>
<tr>
<td>light-cured composite resin</td>
<td>Filtek Supreme Plus</td>
</tr>
<tr>
<td>dual-cured composite resin</td>
<td>ParaCore</td>
</tr>
<tr>
<td>resin-modified glass ionomer</td>
<td>Fuji II LC</td>
</tr>
</tbody>
</table>

2. Cavity Liners

A cavity liner is a thin layer (usually less than 1/2 mm) of a flowable material placed on dentin placed to achieve a therapeutic effect (e.g. calcium hydroxide paste) or to create a physical barrier (e.g. glass ionomer, resin-modified glass ionomer). Examples of calcium hydroxide liners include Dycal, VLC Dycal, and Life. Examples of resin-modified glass ionomer liners are Vitrebond, Ketac Bond and Fuji Lining LC. See section 5 for treatment of deep caries and pulp exposures. Indications for use of calcium hydroxide are for pulp capping of pulpal exposures and near exposures. Indications for use of other liners (e.g. Fuji Lining LC) are to seal around calcium hydroxide and to seal dentin.

Examples of acceptable liners used in D-2 and D-3 Clinics are

<table>
<thead>
<tr>
<th>Type</th>
<th>Function</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>chemical-cured Ca(OH)₂</td>
<td>Therapeutic</td>
<td>Dycal</td>
</tr>
<tr>
<td>resin-modified glass ionomer</td>
<td>physical barrier and sealer for Ca(OH)₂</td>
<td>Fuji Lining LC</td>
</tr>
</tbody>
</table>
3. Cavity Sealers

A cavity sealer is a thin film which provides a protective coating for freshly cut tooth structure of the prepared cavity.

1. Varnish - A natural gum, such as copal rosin, or a synthetic resin dissolved in an organic solvent, such as acetone, chloroform, or ether. Examples include Copalite, Plastodent Varnish, and Barrier. **Do not use copal resins** (e.g. Copalite) in clinic. In lieu of Copalite, we use the adhesive primer *Scotchbond Universal*.

2. Resin Primers - includes the primers from purpose dentin bonding systems. Examples include All-bond 2 Primer A and B, Scotchbond MP⁺, OptiBond, SE Bond, Scotchbond Universal. Scotchbond Universal is the sealer of choice in the UW Restorative clinics.

3. Other cavity sealers - include GLUMA® Desensitizer, Microprime G, Barrier and Protect. The mechanism for sealing with glutaraldehyde desensitizers is that the glutaraldehyde in the solution causes a precipitation of plasma protein in the dentinal fluid to occlude the tubules. Barrier and Protect consist of a fluoride releasing resins that reside on the tooth surface after air-drying to remove the carrier solvent. **We have used GLUMA Desensitizer and Microprime G in the past, but given the potential for serious soft tissue damage with glutaraldehyde-based products, their use has been discontinued.**

For an evidenced-based review of bases, liners and sealers, see pp. 104-8 of the Operative Dentistry text.¹⁰

4. Scotchbond Universal (SBU) - General Instructions for use

**https://multimedia.3m.com/mws/media/12796380/3m-scotchbond-universal-adhesive-technical-product-profile.pdf**

**Indications for Use – per manufacturer**
- All classes of fillings (according to Black) with composite
- Cementation of veneers when combined with RelyX™ Veneer Cement
- Root surface desensitization
- Sealing of cavities prior to cementation of amalgam restorations
- Sealing of preparations prior to temporary cementation of indirect restorations
- Protective varnish for glass ionomer fillings
- Bonding of pit and fissure sealants
- Introraal repair of existing composite, porcelain fused to metal and all ceramic restorations w/o extra primer
- Bonding of dual-cure and chemical-cure cements, core build-up materials and composites, with DCA activator.
Bonding of core build-ups made of composite or other core build-up materials
Repair of composite fillings
Cementation of indirect restorations (crowns, inlays) of composite, ceramic and metal when combined with RelyX Ultimate cement.

Premature cure/Storage
- Scotchbond Universal (SBU) can prematurely polymerize when exposed to natural or artificial lighting. Avoid intensive light exposure during application.
- Store Scotchbond Universal and Scotchbond Universal DCA at 02-25° C (36-77° F).
- Do not use after the expiration date.

Cleaning of the Cavity
1. Remove loose preparation debris by spraying with water, and lightly air dry the cavity in only 2-3 bursts of water-free and oil-free air, or use cotton pellets to dry it off. Do not over dry.
2. The cavity should be just dry enough that the surface has a slightly glossy appearance. Over drying can lead to post-operative sensitivity.
3. Use 2% Chlorhexidine for cleaning, moistening and disinfecting, especially in the presence of plaque. Why use 2% Chlorhexidine? 2% chlorhexidine is an aqueous solution intended for cleansing, moistening and disinfecting cavity preparations. It is recommended for use upon completion of tooth preparation, before cementation or etching, prior to sealing dentinal tubules. For evidence, chlorhexidine has been shown to be an effective antimicrobial agent1,2 and has been shown to decrease post-operative sensitivity3.
4. With SBU bonding, the manufacturer advises against the use of other substances such as desensitizers, disinfectants, astringents, dentin sealants, rinsing solutions containing EDTA, hydrogen peroxide after the final cleaning. The residues of these substances can be detrimental to the bonding strength and setting reaction of the adhesive, especially of dual- and self-cure materials.

Selective Enamel Etching
1. Accidental etching of the dentin does not have any detrimental effect on the adhesion.
2. Apply a commonly used phosphoric acid etching gel (about 35%) to the prepared and unprepared (if present) tooth enamel and allow to react for 15 sec.
3. Rinse thoroughly with water and dry with water-free and oil-free air or with cotton pellets; do not over dry.

Total Etching Procedure (Optional - advised for enamel and sclerotic dentin)
From the manufacturer: “clinically adequate adhesive bonds are achieved by the application of the adhesive. Even higher adhesive values can be achieved by selectively etching the enamel or using the total etching procedure”.
1. Apply a 32-37% phosphoric acid etching gel to the prepared and unprepared (if present) tooth structure (enamel and dentin) and allow to demineralize for 15 sec.
2. Rinse thoroughly with water and dry with water-free and oil-free air or with cotton pellets; do not over dry.
Dosing Scotchbond™ Universal Adhesive from the Bottle
1. The dosing bottle cap has a thumb depression so that it can be opened to one side and closed again with one hand. The cap will remain open if the opening angle is >90°.
2. To open, take the bottle in your hand, place your thumb in the thumb depression, and push the cap to the side until it remains in the open position.
3. Hold the bottle upside down in a vertical position and pour the required quantity of Scotchbond Universal in a mixing well. Protect the adhesive in the mixing well from light.
4. After use, carefully close the bottle again by applying pressure to the lever from above.
5. The cap tangibly snaps into place when pressed closed and a small, even gap between the cap and bottle can be seen all the way around.

Dosing of Scotchbond Universal from the L-Pop Blister
1. **Attention:** Do not squeeze the L-Pop blister without the disposable applicator.
2. Hold the shaft of the disposable applicator with one hand, covering the blister opening with your thumb. This will prevent the etching liquid from spraying out.
3. With the thumb and index finger of the other hand, squeeze the reservoir of the L-Pop blister, starting with the outer end, in the direction of the disposable applicator.
4. Turn the disposable applicator back and forth in the liquid to cover it completely.
5. For easy application in the cavity, the disposable applicator can be bent while it is still in the L-Pop blister. In order to do this, only pull the disposable applicator out of the blister far enough so that the narrow section of the applicator shaft can be seen. Fold the applicator shaft at this location over your thumbnail.
6. During the treatment, press all of the liquid into the open depression end with your thumb and index finger to rewet the applicator.

Application of Scotchbond Universal on tooth surface
1. Use the disposable applicator to apply the adhesive to the entire tooth structure and **rub it in for 20 sec.** Avoid contact between the adhesive and the oral mucosa.
2. If necessary, rewet the disposable applicator during treatment.
3. Subsequently direct a gentle stream of air over the liquid for about 5 sec until it no longer moves and the solvent has evaporated completely.
4. Harden the adhesive with a LED curing light for 10 sec.
Dosing Scotchbond™ Universal DCA Activator (dual and self-cure composite)
1. Unscrew the lid of the bottle.
2. Mix the required quantity of Scotchbond Universal DCA in a ratio of 1-to-1 (drops) with Scotchbond Universal in a mixing well.
3. Mix for 5 sec immediately before application. Protect the liquid in the mixing well from light.
4. Carefully close the bottle tightly after dosing. If necessary, disinfect the bottle in accordance with local hygiene regulations.
5. **Application:** Avoid any contamination with blood, saliva, or sulcus fluid during application.
6. We recommend the use of a rubber dam to ensure that the treated area is kept sufficiently dry and to prevent exposure of any soft tissue.

### 5. Filling Material Selection

<table>
<thead>
<tr>
<th>Material Type →</th>
<th>Admixed amalgam</th>
<th>L/C composite resin</th>
<th>Dual-cured composite resin</th>
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<th>Chemically-cured glass ionomer</th>
<th>Low viscosity, lightly filled composite resin</th>
<th>Reinforced ZnO-Eugenol</th>
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<tbody>
<tr>
<td>Product →</td>
<td>Valiant PhD</td>
<td>Filtek Supreme Plus</td>
<td>ParaCore</td>
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<td>Ketac-Fil</td>
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</tbody>
</table>

1 use only when a temporary crown can be placed at the same appointment
2 provisional for cusp fracture
3 use for caries control
6. **Class 5 Restoration -- three options**

**Isolation for Class 5 Preparation and Filling**

The preferred choice for isolation is rubber dam. One option with a rubber dam is to place a supplemental retainer (aka clamp) such as the 212. The Schulz retainer shown here is also ideal for this purpose. It has the appearance of a sectioned 212.

At times it may not be possible or feasible to place a rubber dam to isolate the complete Class 5 lesion. The alternative at such times is gingival retraction coupled with effective field control. In addition to braided cotton retraction cord, one useful option for Class 5’s is to use DEKNATEL braided surgical silk suture material. Request the sizes desired at the dispensary. It comes in the same sizes as braided cotton cord (00, 0, 1, 2). The advantage of DEKNATEL is that the Scotchbond Universal adhesive and composite will not stick to it. In addition, the insertion of silk cord into the sulcular tissue is remarkably easy. See images below.

**Option 1:** Dental amalgam (Valiant PhD)

**Option 2:** Composite Resin (Filtek Supreme Plus + Scotchbond Universal)

Indication: Use preferentially over resin-modified glass ionomer. See indications for RMGI below.

**Technique**

1. Clean and prepare cavity.
2. Optional: Etch enamel and dentin using 32-37% H₃PO₄ for 15 seconds.
3. Rinse thoroughly. Remove excess water with a brief burst of air. DO NOT DESICCATE!
4. Apply SBU primer as described in Section 4.
5. Place Filtek Supreme composite in layers not to exceed 2 mm; light cure 20 sec. Using your IPC instrument, take extra care to prevent submarginal or excess composite at the gingival margin.
6. Contour, finish and polish restoration.
7. If excess at the gingival is detected, consider carefully using an **8888 fine diamond bur** rather than the 7901 multifluted carbide bur. Carbides tend to grab and cut, whereas the fine diamond functions a bit more like an abrasive. Sof-Lex disks can damage the gingival tissues in this hard-to-reach area.

**Option 3: Resin-modified glass ionomer (Fuji II LC Capsules)**

**Indications:** Use preferentially over composite only when long-term fluoride release is desired and esthetics is not paramount. Also use for root caries and other clinical situations where isolation is difficult.

**Technique**
1. Select shade
2. Clean and prepare cavity.
3. Apply GC Cavity Conditioner for 10 sec
4. Rinse thoroughly, dry gently, but avoid desiccation and contamination.
5. Tap capsules to loosen powder. Depress plunger. Click once in capsule applier to activate.
6. Mix capsule for 8 sec at high (4300 cycles/min).
7. Apply material in increments not to exceed 2 mm.
8. Light cure 20 sec.
9. Repeat steps 5 and 6 until filled.
10. Finish and polish immediately

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7. **Composite Resin Restorations (Classes 1, 3-6)**

**Use Filtek Supreme Plus with Scotchbond Universal**

**Clinical Procedures**
1. Clean and prepare cavity.
2. Optional: Etch enamel and dentin using 32-37% H₃PO₄ for 15 seconds.
3. Rinse thoroughly. Remove excess water with a brief burst of air. DO NOT DESICCATE!
4. Apply Scotchbond Universal primer as described in Section 4.
5. Place Filtek Supreme composite in layers not to exceed 2 mm; light cure 20 sec.
6. Contour, finish and polish restoration.
8. Ultraconservative Class I Filling

Use: Filtek Flow or Filtek Supreme Plus and Scotchbond Universal

**Indications:** Minimally invasive carious lesion or defect in the anatomical grooves of a posterior tooth. A flowable composite (Filtek Flow) can be used if the defect resides within enamel and a composite (Filtek Supreme Plus) must be used if the defect extends into dentin.

**Contraindications for Flowable Composite:**
1. Any anatomical feature other than the occlusal, lingual and buccal grooves.
2. If the preparation width is larger than the ½ round bur
3. If the caries or defect extends into dentin.
4. Need for local anesthetic (for defect removal)

**Materials:**
1. Filtek Flow and SBU can be used if no contraindications exist.
2. Given any of the contraindications above, use Filtek Supreme Plus composite resin and SBU (see section 7 above) for the filling material. Composite resin is better formulated to match the material properties of dentin and exhibits less wear in areas of occlusal function.

**Technique for Flowable Composite (Filtek Flow):**

1. Use the D801 round diamond bur or ¼ or ½ round carbide bur (in slow or high-speed handpiece) to eliminate areas that are stained, defective, or carious.
2. The bonding procedure is the same as for all composite restorations. Since there is mostly enamel, you should etch before SBU primer application. See section 4.
3. Inject flowable composite (Filtek Flow) into the prepared fissures by moving the syringe tip from distal to mesial areas, maintaining constant pressure on the syringe to prevent voids.
4. Run the explorer tip through the prepared fissure(s) to eliminate entrapped bubbles and facilitate flow of the composite.
5. You may use a fine-tipped brush or small sponge tip to adapt composite to cavosurface and to eliminate excess.
6. Light-cure for 40 seconds, moving the light guide slowly to cover all areas of the restoration.
7. Check the occlusion and remove excess with a slow speed round bur.
8. Polish with rubber points found in the composite finishing kit.

**Fee Code:**
1. If the restoration is within enamel, use the code for sealant.
2. If the groove restoration enters dentin, Filtek Supreme Plus must be used. Thus use the code for a one surface composite restoration.
Advantages of Class 2 Posterior Composites
1. esthetics
2. seal (resistance to microleakage)
3. conservation of tooth structure
4. slight tooth reinforcement
5. low thermal conductivity

Disadvantages of Class 2 Posterior Composites
1. difficult technique (placement, anatomy, contacts, embrasures)
2. shorter clinical half-life than amalgam
3. minimal radiopacity of some products
4. polymerization shrinkage
5. increased incidence of recurrent caries compared to amalgam

Indications for Class 2 Posterior Composites
1. patient requirement for an esthetic restoration
2. proper isolation of entire cavosurface margin attainable
3. low caries risk/rate; good oral hygiene
4. conservatively-sized restorations

Contraindication for Class 2 Posterior Composites
1. poor oral hygiene; high caries risk.
2. history/evidence of recurrent caries
3. deep subgingival areas requiring restoration
4. proper isolation cannot be achieved
5. patient desire for removal of clinically acceptable amalgams (UW policy)

Materials
1. In addition to your tray with standard instruments, request a composite finishing kit, a set of separating rings, and pre-contoured Dixieland Bands or sectional matrix.
2. Filtek Supreme Plus nano composite is our choice for Class 2 composites since it can be inserted, adapted, contoured and formed somewhat easier than low viscosity composites which can slump some prior to curing.
4. *Scotchbond Universal*

5. Bard Parker handle & #12 scalpel blade

6. Sof-Lex Kit - disks and strips (3M ESPE)

7. Cups, points and disks (med, fine - Komet USA).

Technique

1. **ISOLATION.** For placement of Class 2 composite restorations, it is a requirement to isolate prepared tooth and area with rubber dam.

2. **PROTECT APPROXIMAL TEETH** (optional). One can insert the “Wedge Guard” from the Palodent System as needed, to protect the approximal surfaces when preparing the proximal boxes.

3. **PRE-SEPARATION** (optional). When placed between teeth, the spring action of the Palodent ring supplies a constant, gentle wedging force to create orthodontic-type separation of teeth. When possible, place the ring prior to, and during cavity preparation to help gain additional proximal separation. Secure the ring with the special forceps (below) and place the ring into the interproximal space to be restored. Note that the ring can be placed in either direction and inserts nicely over the wedge. There are two rings, dark blue – narrow and turquoise - universal. Either can be used for separation and in either direction.

4. **PREPARATION.** Employ a conservative preparation as for amalgam. Do not bevel the proximogingival or occlusal margins. It is much easier to locate a non-beveled finish line on the occlusal during contouring and finishing.

5. **BONDING.** Application of Scotchbond Universal is as described in Section 4.
6. **MATRIX SELECTION.** Choose from one of the **dead-soft, pre-contoured sectional matrixes** in the Palodent Plus box and as shown to the right (3.5, 4.5, 5.5, 6.5 mm). Whether restoring one or two proximal surfaces, it is best to use the sectional matrix. The smaller matrices are generally used with primary teeth. The matrix on the far right, is designed for larger proximal boxes where there an extension to accommodate an extended gingival floor. The small occlusal flap with the hole can be used with the special “pin tweezers” for placement, and the flap can be bent onto the neighboring occlusal to stabilize the wedge.

7. **MATRIX APPLICATION.** **ONLY ONE PROXIMAL SURFACE IS TO BE RESTORED AT A TIME.** Remove the ring if used to pre-separate the teeth. Place a sectional matrix into one of the proximal areas to be restored. Select a proper fitting wedge (wooden or Palodent Plus plastic) and insert it into the gingivoproximal using the cotton pliers or “pin tweezers”. Then use the large end of your amalgam condenser to advance the wedge as much as possible. The sectional matrix can be carefully adapted if the contact is not closed, but it should not be burnished as for amalgam since this may create a rough proximal contour that is difficult to polish.

8. **SEPARATION.** Apply the ring to the proximal using the special forceps. The v-shaped rubberized tines of the ring are to be positioned over the ends of the wedge. An extra wedge can be added to adapt the matrix against the tooth to aid in forming contours. **IMPORTANT.** Take care to protect your and your patient’s eyes when placing the steel ring. And only place them with a rubber dam in place to prevent patient aspiration of a “flying separator”.
Are you permitted to restore two proximals simultaneously? You should separate and restore only one contact at a time since it is more difficult to establish proximal contacts when filling two proximal areas at the same time (i.e. thickness of two matrices). Only with explicit permission from your clinical instructor, may you restore both contacts simultaneously. When restoring MOD preparations, the Palodent Plus System allows one to place two round rings in opposite directions or one round ring first, then the elongated one in the same direction as shown above. If the sectional matrices do not function well, then try the dead soft, pre-contoured Dixieland Band (right) with the Tofflemire holder.

9. COMPOSITE PLACEMENT. Place composite in 2 mm increments (max) and cure each increment for 20 sec. Begin with the proximal boxes. As increments near the marginal ridge area, take care to form the proximal and occlusal embrasures with the IPC instrument to avoid excess and to reduce the time for finishing. Similarly, the occlusal anatomy should be formed to the extent possible before light curing.

10. PROXIMAL CURE. Remove the ring separator and wedge, and bend the flanges of the matrix back to check the proximal surfaces for adequacy of filling. If needed, add composite to deficient areas and cure. Under any circumstances, cure the facial and lingual proximal areas, each for 40 sec. Remove the matrix.

11. PROXIMAL CONTACT. Next, check the adequacy of the proximal contact with floss and by viewing it with a mouth mirror. If restoring a second proximal contact on the same tooth, proceed with restoring this surface even if the first contact is light. If curing is complete and a contact is open or too light, note instructions below for re-establishing a Class 2 proximal contact (Sec 15). Make this repair before finishing and polishing.

12. FINISHING AND POLISHING. If needed, use the #12 scalpel blade to remove excess on the gingival and proximal. Use a careful technique to prevent tissue injury and to promote shearing of excess rather than bulk fracture. The yellow-brown, plastic-backed Sof-Lex series of disks are ideal for finishing and polishing proximal and other smooth surfaces. The twelve- and thirty-fluted finishing burs can be used on the occlusal to remove excess and further define the anatomy. One can also use Komet Finishing and Polishing cups, points and/or disks. The small, blue, rubber-backed Sof-Lex discs can also be used to finish the occlusal surface, and always for smooth surfaces. Proximal surfaces are best polished with the brown plastic-back Sof-Lex disks and/or Epitex Finishing and Polishing Strips.

13. RESIN SURFACE SEAL. An instructor should check the restoration while the rubber dam is still on. If acceptable, clean the occlusal surface with etchant and apply Fortify resin. See Section 11 for instructions on the use of the Fortify surface sealer.

14. CHECK THE OCCLUSION. Remove the rubber dam, check and adjust the occlusion. Thereafter, re-polish these areas. Using your hand mirror, show the patient your fine work.
10. **Repair of a Defective Proximal Contact**

1. **INDICATIONS.** If at the time of restoring a tooth, or during an exam (i.e. existing composite restoration), you note an open or light proximal contact, one should follow this procedure to re-establish a proper contact. Remember open contacts can lead to tooth migration and/or food impaction. So let’s make it right.

2. **PLACE OR RE-PLACE RUBBER DAM.**

3. **PREPARATION.** A small proximal box must be prepared into the existing composite, generally extending to the proximal walls and below the contact, but not necessarily to the gingival floor. You can also air-abrade the prepared surface of an older composite to facilitate bonding.

4. **BONDING.** Once prepared, repeat bonding steps using Scotchbond Universal as before. Note that this is the same procedure as given in section 18 – Bonding or Repair of an Existing Composite.

5. **MATRIX BAND.** Place a sectional matrix into the proximal area as mentioned above. Check to see that the matrix is against the approximal surface.

6. **SEPARATION.** Do not use the circular ring for separation if its use just resulted in an open/light contact. We need a fail-safe separator at this point. Apply the Elliot posterior separator to the gingivoproximal and tighten the screw snugly for gingival adaptation of the band and to separate the teeth. Advise your patient that they will feel pressure from the separation. It is necessary to have adequate facial and lingual tissue anesthesia since the Elliot separator applies pressure also to the gingiva.

7. **FILLING & FINISHING** is accomplished as before. If the proximal contact is too strong and/or slightly rough to flossing, re-separate the proximal surface after band removal to reduce and polish the proximal surface using *Epitex Finishing and Polishing Strips*. Check the contact with floss.
11. Surface Sealer for a Composite Restoration

Composite Surface Sealing

**Indication:** Application of **FORTIFY** Composite Surface Sealant is required for restorations subject to functional wear (e.g. occlusal surfaces) and suggested for other restorations including resin-modified glass ionomer (Fuji II LC). This is to be done after final polishing and finishing. Evidence has shown significantly decreased occlusal wear of sealed restorations in the first year of service.5

1. Rinse tooth and restoration with copious amounts of water to remove all debris.
2. Clean the surface of the composite restoration and etch approximately 1 mm of enamel beyond the tooth/composite margin with 32% H₃PO₄ for 15 seconds. Rinse and dry thoroughly.
3. Using a sponge tip, carefully apply a thin layer of FORTIFY to etched enamel and composite surface with a disposable brush tip. Do not air thin. Take care when placing Fortify, as excess can pool, and when cured, becomes difficult to remove.
4. Light cure for 20 seconds.
5. Check occlusion.

12. Treating Sensitive Root Surfaces

Desensitizing Root Surfaces
Also needed: 2% Chlorhexidine (e.g. Bisco CAVITY CLEANSER)

**Procedure**
1. Clean dentin surface by scrubbing with 2% Chlorhexidine.
2. Rinse thoroughly with warm water or blot with a sponge tip and warm water.
3. Blot gently with moistened cotton pellet. To minimize discomfort, do not air dry.
4. Apply **Scotchbond Universal Adhesive** to area to be sealed and rub it in for 20 sec. Avoid contact between the adhesive and the oral mucosa.
5. Direct a gentle stream of air over the liquid for about 5 sec until it no longer moves and the solvent has evaporated completely.
6. Harden the adhesive with a commonly used curing light for 10 sec.
7. Optionally, one can apply a thin layer of Fortify resin with a sponge tip and light cure. Avoid any excess since that can be difficult to remove.

8. **Charge for this service**: Use the code for Application of desensitizing medication for cervical and/or root surface, per tooth. Do not use this for sealers, bases and liners under restorations. And if using a resin root sealer to desensitize, do not use code 9910 (application of desensitizing medicaments) as this is more for fluoride varnishes.

### 13. Application of a dentin sealer under amalgam - *Scotchbond Universal*

This “sealing” procedure is employed when the student or attending dentist determines that it might be beneficial to seal the dentin before the amalgam is placed. This procedure is employed to prevent and control sensitivity by sealing dentin.

**Indications:**
1. Always seal following pulp capping (section 14)
2. Deeply excavated areas without pulp capping
3. History of thermal sensitivity of tooth

**Contraindications:**
1. Shallow to moderate depth amalgam preparations
2. Non-vital tooth

**Procedure:**
1. Following preparation of the cavity, rinse and remove excess water with a brief burst of air. Do not desiccate dentin since Scotchbond Universal penetrates better in the presence of physiologically moist dentin. Note that it is unnecessary to etch dentin when placing Scotchbond Universal as sealer under amalgam.
2. Apply Scotchbond Universal Adhesive to area to be sealed and rub it in for 20 sec. Avoid contact between the adhesive and the oral mucosa.
3. Direct a gentle stream of air over the liquid for about 5 sec until it no longer moves and the solvent has evaporated completely.
4. Harden the adhesive with a commonly used curing light for 10 sec.

### 14. Treatment of deep caries with exposure or near exposure of a vital pulp

**Treatment choices**
- **MTA (Mineral Trioxide Aggregate)** See lecture and course material for Endodontics Clerkship (DENTCL 633A), directed by Dr. Flake. The associated Canv2222as site contains the lecture material for this procedure. References: 6, 7, 8
- **Calcium hydroxide pulp capping.** See the following with References.
When not to pulp cap: If you experience a carious exposure (not mechanical) >0.5 mm in size and/or cannot control the hemorrhage, extirpate the pulp and plan root canal treatment. References: Refer to an article by Pameijer and Stanley and Summitt, et. al pages 108-9 and TJ Hilton review for evidence-based support for this approach to pulp capping.

Procedure:
1. **Control the hemorrhage** using a cotton pellet. If hemorrhage cannot be controlled, extirpate the pulp.
2. Apply a thin layer of a calcium hydroxide liner (i.e. Dycal) to and slightly beyond the exposure site, or the site of the near exposure. Allow the calcium to harden (note: water will accelerate the reaction of the chemically-cured Dycal).
3. **Mixing Fuji Lining LC.** This is a paste-paste formulation in a dispenser. Depress the lever to place a small quantity of the two pastes on a pad. Replace the cartridge cover. Mix for 15 seconds. Note that the Fuji liner is preferred over Vitrebond based on cytotoxicity tests.
4. Place one or two layers of the Fuji Lining LC over the Dycal and slightly beyond the margins, to seal and protect the Dycal. Light cure for 20 seconds.
5. **For bonding** associated with composite restorations and sealing dentin under large amalgam restorations, see sections 7 & 11. Proceed with instructions for placing these restorations. Note that we only use 32-37% H₃PO₄ for all of our demineralization (i.e. etching) procedures in our clinics since 10% H₃PO₄ has been shown to be not as effective for etching enamel as 32%.

15. **Foundation Restoration Materials (i.e. core, crown buildups).**

Foundation restorations are extensive restorations, which will later serve as the “foundation” for complete veneer, or partial veneer (e.g. ¾ crown) cast restorations.

**Acceptable foundation materials** for the Restorative Clinics

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<thead>
<tr>
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<tbody>
<tr>
<td>1.</td>
<td>High copper, admixed dental amalgam</td>
<td>Valiant PhD, Valiant PhD XT</td>
</tr>
<tr>
<td>2.</td>
<td>Light-cured composite resin</td>
<td>Filtek Supreme Plus</td>
</tr>
<tr>
<td>3.</td>
<td>Dual-cured composite resin</td>
<td>ParaCore*</td>
</tr>
</tbody>
</table>

* Important – Dual-cured composite resin (e.g. ParaCore) may be used only when the tooth can be prepared and temporary crown placed at the same appointment. Otherwise, amalgam or light-cured composite must be used. Since Paracore polymerizes rather quickly, a flat occlusal and open proximal contacts are common. That is not a problem if a provisional crown is placed and the buildup appointment. Valiant PhD or Filtek Supreme Plus must be used when a temporary crown cannot be made at the buildup appointment. This is so that proper proximal and occlusal contacts, occlusal anatomy and axial contours can be generated.
16. Dual-cured Composite Foundation Restoration/Buildup

Important – Dual-cured ParaCore may be used for buildups only when the tooth can be prepared adequately to accommodate a temporary crown. See detailed rationale above.

Materials: ParaCore Composite with Scotchbond Universal and Dual-Cure Activator (i.e. two SBU bottles must be used with DC and Self-cure)

Clinical Procedure
1. Etch with 32% phosphoric acid gel for 15 sec.
2. Using bottles and not the single-dose blister, place one drop each of Scotchbond Universal and Scotchbond Universal DCA in a mixing well and mix for 5 sec.
3. Use a disposable applicator to apply the mixture to the entire tooth structure and rub it in all areas to be bonded for 20 sec. Avoid contact of the oral mucosa with the adhesive.
4. If necessary, rewet the disposable applicator and apply as needed to cover surface.
5. Subsequently direct a gentle stream of air over the liquid for about 5 sec until it no longer moves and the solvent has evaporated completely.
7. ParaCore comes in three shades: Translucent, Dentin & White. Note also that translucent of one of the dentin shades offers a slower chemical set (i.e. longer working time). Choose the desired color and setting time. If a metal or zirconia-based crown is planned, the white (opaque) is often ideal in order to distinguish composite from dentin when preparing teeth.
8. If filling a Toffelmire matrix or Automatrix, apply a clear plastic strip to the occlusal of the matrix and apply pressure with your finger tip until initial set of the composite buildup material has taken place. After removal of the matrix band, light cure each surface for 20 s. See example below.

Automatrix

Buildup – crown prep required
17. **Use of Ribbond** (bondable reinforcement ribbon)  

Section by Dr. Alireza Sadr, Clinical Associate Professor

**Materials in Dispensary:** 2, 3, 4 mm Ultra Ribbond, scissors and the wetting resin

**References**¹³,¹⁴


**Application 1: Single-Visit Bridge**

Ribbond single-visit bridges are cost effective and reliable options for emergencies, implant temporization, congenitally missing laterals and patients who cannot afford conventional lab fabricated bridgework. Use natural tooth, denture tooth, or composite build-up.

**Technique**

**Step 1** - Check occlusion. It is recommended to wax up the bridge work and create a putty matrix from the wax up to serve as a palatal or labial guide when cross-sectioned along the incisal edge. If clearance permits, a bridge can be made without preparation of the abutments. If there is not adequate space, shallow preparations might be necessary. The preparations should have smooth, rounded internal contour, flaring toward the facial to facilitate optimum fiber orientation and adaptation. Measure for fiber (a piece of floss can work well for this). Prepare teeth for bonding and place a thin layer of composite on the teeth.

**Step 2** - Wet the Ribbond with bonding resin and place it spanning from one abutment to the other. Place the Ribbond so that it will be under the incisal edge of the pontic. Remove excess composite and cure. The putty index can help in positioning the

**Step 3** - Place a thin layer of composite lingual to the first piece of Ribbond in the pontic section of the Ribbond framework.

**Step 4** - Wet a second piece of Ribbond and place it against the composite in the pontic section of the framework. Cure.

**Step 5** – place a 0.5 to 0.75mm composite layer in the middle. The second Ribbond layer attaches over the first composite layer only to the proximal lingual angles of the teeth adjacent to the pontic.

**Step 6** - Cover Ribbond on abutments with composite. Cure.

**Step 7** - Creating the Pontic (3 options)

A. **Natural Tooth**
   1. Cut off the root of the extracted tooth and fill pulp chamber with composite.
   2. Ribbond framework.
3. Prepare an undercut lingual groove on the extracted tooth.
4. Bond natural tooth pontic to Ribbond framework with composite.

B. Denture Tooth

1. Choose and shape denture tooth to fit in the edentulous area.
2. Build Ribbond framework.
3. Prepare an undercut lingual groove in denture tooth to fit the Ribbond framework.
4. Use a small round burr to drill small holes in the pontic for extra mechanical retention. Sandblast groove for better mechanical retention.
5. Bond denture tooth to pontic with composite.

C. Composite Buildup

1. Build Ribbond framework.
2. Build composite pontic onto Ribbond framework using standard composite technique.

Application 2: Fiber Reinforced Composite Restoration

Ribbond mitigates the effect of C-factor and shrinkage of the composite against the tooth, preventing gap formation. Ribbond also bridges cracks and reinforces structurally compromised teeth.

Technique

Step 1 - The tooth is prepared for bonding and a bonding adhesive is applied.

Step 2 - The proximal wall is built-up with composite. A flowable composite is placed in the bed of the preparation and is also placed against the interior walls of the prepared tooth. Ribbond piece(s) are wetted with bonding resin and the Ribbond pieces are pressed through the flowable composite against the tooth surfaces covering as much of the interior tooth surfaces as possible, without being exposed at the margins of the occlusal surfaces.

Alternatively, the cut and wetted fiber can be sandwiched in a thin layer of regular composite extraorally and then placed into the preparation as a single layer.

Step 3 - The composite with Ribbond pieces are cured, and composite is incrementally placed into the preparation.

Step 4 - The occlusal surfaces are built-up with composite, finished and polished as usual.
Application 3: Fiber Core Buildup for Teeth with Insufficient Ferrule

**Technique**

**Step 1** - Round any unsupported or sharp remaining tooth structure with a high-speed handpiece to enable close approximation of fiber with the dentin floor.

**Step 2** - Remove 1-2 mm of gutta percha was removed from the orifices and widen the orifices carefully (similar to post space preparation but only about 2 mm) to increase space available for the interlacing fibers to be placed.

**Step 3** - Place a cotton pellet into the pulp chamber over the orifices.

**Step 4** - Use a composite or Duralay rein to create the desired core shape. Use an appropriate bur to cut back the resin if necessary.

**Step 5** - Use VPS impression material to create a putty matrix of the mock core buildup to create an external surface form of the tooth. Remove the putty from the tooth and cut the occlusal portion of the created matrix with a scalpel blade.

**Step 6** - Remove the resin core pattern and cotton pellet from the tooth.

**Step 7** - Prepare the pulp chamber and orifices dentin surface for bonding, apply adhesive according to the manufacturer’s instructions.

**Step 8** - Fit the putty index matrix on the tooth and adapt a layer of composite buildup material (less than 0.5 mm) to the walls of the matrix to create a core shell circumferentially. Remove the index after polymerizing the core shell.

**Step 9** - Cut two or more strips of Ribbond fiber to appropriate length and width, so that the core can be internally supported with the fiber. Wet the fiber in uncured wetting resin and place them against the pulp chamber floor with a thin amount of core buildup composite material, in a similar manner. This can be achieved intraorally or extraorally. Place the fiber in mesiodistal and buccolingual directions. The fiber should be closely adapted to the dentin surfaces, into the canal orifices and internal axial walls of the core. An additional fiber layer maybe laminated circumferentially over the axial walls and polymerized.

**Step 10** - Place the core buildup composite into the remainder of the space existing within the buildup shell to the appropriate occlusal level of the core. Adjust the core shape to the desired shape further if necessary, fabricate a provisional crown and take the final impression.
18. Silver Diamine Fluoride (SDF) Caries Treatment

Advantage Arrest (38% SDF)

References 15, 16, 17

Indications for SDF treatment:
1. Extreme caries risk (Xerostomia or severe Early Childhood caries).
2. Treatment challenged by behavioral or medical management.
3. Patients with carious lesions that may not all be treated in one visit.
4. Difficult to treat dental carious lesions
5. Patients without access to dental care

Contraindications for SDF treatment
This product is contraindicated in patients with ulcerative gingivitis or stomatitis, or known sensitivity to silver or other heavy-metal ions. Patients with more than six affected sites, patients having a full mouth of gingivectomies and patients showing abnormal skin sensitization in daily circumstances are recommended for exclusion.

Protocol for clinical use of Silver Diamine Fluoride (SDF):
1. Clinical faculty approval required
2. Obtain 1 drop of SDF into the deep end of a dappen dish
3. Apply petroleum jelly to gingiva near affected areas with a cotton applicator
4. Dry affected tooth surfaces as well as possible with triple syringe, or if not feasible dry with cotton.
5. Bend the microbrush, immerse into the SDF, and remove excess on the side of the dappen dish
6. Apply one drop directly onto the tooth surface with a microbrush.
7. Allow to absorb for 1 minute, then remove excess with cotton (2x2 or gauze).
8. Remind patient of no eating or drinking for 1 hour.

Note: Please check with clinical faculty for reapplication protocol for each patient

#7 Caries stabilized with SDF

Insurance Billing Code: D1354 Interim Caries arresting medicament application
Manufacturer’s DFU

Advantage Arrest
Silver Diamine Fluoride 38%
Professional Tooth Desensitizer
Rx Only
Desensitizing Ingredient: Aqueous Silver Diamine Fluoride, 38.3% to 43.2% w/v
Inactive Ingredients: Purified water
Clinical Pharmacology: Product forms insoluble precipitates with calcium or phosphate in the dentinal tubules to block nerve impulses.
Indication and Usage: Treatment of dentinal hypersensitivity. For use in adults over the age of 21.
Contraindications: This product is contraindicated in patients with ulcerative gingivitis or stomatitis, or known sensitivity to silver or other heavy-metal ions. Patients with more than six affected sites, patients having had full mouth gingivectomies and patients showing abnormal skin sensitization in daily circumstances are recommended for exclusion.
Warnings: This product is intended for local application only. Not for ingestion. Protect the patient's eyes. Use caution to avoid contact with skin or clothing. In the event of exposure to eyes or skin, flush the area copiously with water and immediately seek medical consultation. This product yielded positive cytotoxicity in standard testing.
Precautions for Use:
1). Advantage Arrest does not normally stain enamel or burned dentin. Advise patients that soft dentin or margins of composite restorations may be stained. Staining may be reversed by gentle polishing with tincture of iodine (weak iodine solution).
2) Advise patients that air-drying and product application can cause momentary transient pain to hypersensitive areas. Advantage Arrest has not been shown to cause pulpal necrosis even when soft dentin is used.
3) Minimize product contact with gingiva and mucus membrane by using recommended amounts and careful application. Advantage Arrest may cause reversible short-term irritation. When applying Advantage Arrest to areas near the gingiva, apply petroleum jelly or cocoa butter and use cotton rolls to protect the gingival tissues. Alternatively, a rubber dam can be used to isolate the area.
4) If accidental contact occurs, thoroughly wash the area with water, saline solution or ~3% hydrogen peroxide. This includes contact with skin, clothes, floors and cabinets.

Because Advantage Arrest is clear and thus may be difficult to see, use caution to avoid transferring the material from gloved hands to other surfaces.

Precautions for Handling:
1. Storage Precautions
   1) Store in original packaging in a cool, dark place.
   2) Replace cap immediately after use.
   3) Use as soon as dispensed.
2. Advantage Arrest will stain skin, clothes, counter tops, floors and instruments brown or black. Refer to the following for stain removal:
   1) Skin: wash immediately with water, soap, ammonia or iodine tincture and then rinse thoroughly with water. Do not use excessive methods in an attempt to remove difficult stains from skin as the stains will eventually fade.
   2) Clothing/Countertops/Floors/Instruments: use the same procedures as with stained skin. Difficult stains may be treated with sodium hypochlorite.
3. If Advantage Arrest is dispensed into a separate container, be sure to wash or thoroughly wipe the container clean immediately after use.

Adverse Reactions: Transient irritation of the gingiva has rarely been reported.

Dosage and Administration:
1. Isolate the affected area of the tooth with cotton rolls or protect the gingival tissue of the affected tooth with petroleum jelly. Alternatively, a rubber dam can be used to isolate the area.
2. Clean and dry the affected tooth surface.
3. For up to 5 treated sites per patient, dispense 1-2 drops of solution into a disposable dappen dish. Transfer material directly to the tooth surface with an applicator.
If needed, one or two reapplications may be administered at intervals of one week.

How Supplied: Single 10 mL dropper-bottle containing 8 mL of product. Not sterile.

Storage: Do not freeze or expose to extreme heat. Keep in an air-tight container in a dark place.

Caution: Federal law restricts this device to sale by or on the order of a dentist or physician.

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Seattle, WA 98195-7456 USA ● http://dental.washington.edu/restorative-dentistry/
19. Procedure Check List for Pulp Capping and/or Placing Restorations

<table>
<thead>
<tr>
<th>Step</th>
<th>Composite resin</th>
<th>Amalgam Build-up</th>
<th>Amalgam Build-up</th>
<th>ParaCore Build-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>caries removal</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>control hemorrhage</td>
<td>✓</td>
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<tr>
<td>apply thin layer Ca(OH)₂</td>
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<tr>
<td>apply Fuji liner LC</td>
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<tr>
<td>place base</td>
<td>as needed</td>
<td>as needed</td>
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<tr>
<td>etch with 32% H₃PO₄</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>apply Scotchbond Universal</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>air dry 5 sec</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>light cure for 10 sec</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>apply metal matrix</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scotchbond Universal + DCA</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>light cure for 10 sec</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>apply plastic matrix</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>place filling</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

For evidence, see Gordan et al¹⁸, D’Alpina et al¹⁹, Rathke et al²⁰, Gordan et al²¹

1. Clean tooth and affected areas.
2. Prepare the fractured or defective composite surface with a medium to coarse diamond bur, carbide bur, or disk to create a fresh composite surface. Make sure enough material has been removed to provide for some bulk of composite and ease of filling and finishing. One can also use the alumina air-blaster shown in Section 19, to enhance the bond by creating more surface area.
3. Clean thoroughly by spraying with water, and dry with water-free and oil-free air.
4. Do not apply phosphoric acid etchant to zirconia, alumina and metal as a cleaner because this can weaken the adhesion to these materials.
5. Continue immediately with the application of Scotchbond Universal Adhesive, using additional primer as unnecessary.
6. Proceed with composite layering, polymerization, finishing and polishing.
7. Fee: Typically this is a single surface restoration unless one is repairing a restoration recently placed at the SOD. Charge for the # surfaces created.
21. Porcelain Repair

Procedure:
1. You must place a rubber dam! Clean surface of porcelain and metal with flour of pumice.
2. Bevel fractured porcelain margin with a diamond bur.
3. For optimum results, alumina air-abrade metal and porcelain with air microabrasion unit shown here. If microabrasion unit is not available, abrade with medium diamond bur.
4. Place BARRIER GEL on the gingival tissues that may be exposed and/or on porcelain areas which are not to be etched. For optimum bonding, etch prepared area with Porcelain Etchant* (4% hydrofluoric acid) for 3-4 minutes. Rinse and dry. If hydrofluoric acid is not available, apply 32% H₃PO₄ for 5-10 seconds to cleanse and acidify the porcelain surface.
5. Apply Scotchbond Universal Primer to porcelain surface for 10 s. Air dry.
6. If metal is exposed, use Bisco DUAL CURE OPAQUER. Shake both bottles well before using. Dispense and mix base and catalyst and apply a thin layer to metal. Light cure for 30 seconds to prevent slumping. If exposed metal is not present, omit this metal opaquer step.
7. Proceed with composite layering and finishing.

* PORCELAIN ETCHANT - IMPORTANT PRECAUTIONS
(Obtained from Dispensary only by floor Instructor request)

Hydrofluoric acid is a very powerful and aggressive chemical. It is a severe eye and tissue irritant. If accidentally splashed into the eye, flush with copious amounts of water for 15 minutes and seek immediate medical attention. Hydrofluoric acid also releases a vapor that irritates respiratory passageways. Chronic inhalation of fumes is dangerous and can cause damage. Extreme care must be taken to protect the patient, operator and assistant. These individuals must wear protective eyewear. The operator and assistant must wear protective gloves. Rubber dam isolation must be used for intraoral porcelain repair.

If PORCELAIN ETCHANT comes in contact with other tissues: rinse affected area immediately with copious amounts of water for several minutes. Injury may result if etchant is allowed to remain on the skin or mucosa for any length of time.

BISCO's 4% PORCELAIN ETCHANT has been buffered, gelled and packaged to minimize problems, provided that it is used in accordance with these instructions. Do not use this product until you have thoroughly read and understood these instructions.
## 22. Indications and Contraindications for Use of Permanent Cements

<table>
<thead>
<tr>
<th>Luting Cements</th>
<th>Type</th>
<th>UW Restorative Clinic Indications</th>
<th>UW Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fleck’s* (Mizzy)</td>
<td>zinc phosphate</td>
<td>Partial coverage castings (inlays, onlays, partial veneer crowns)</td>
<td>CVC gold, porcelain &amp; ceramic restorations; posts</td>
</tr>
<tr>
<td>RelyX Luting (3M)</td>
<td>dual-cured, resin-modified glass ionomer</td>
<td>complete veneer metal or metal-ceramic crowns; zirconia-based crowns; preferred when minimal resistance and retention form exists</td>
<td>Glass ceramic restorations; partial coverage castings; posts; cast post/cores; if a temporary cement with eugenol was used.</td>
</tr>
<tr>
<td>RelyX Unicem 2 Automix (3M)</td>
<td>Self-adhesive, modified resin</td>
<td>Fiber-reinforced posts, cast posts, manufactured posts; complete veneer metal or metal-ceramic crowns; zirconia-based crowns</td>
<td>all other cementsations</td>
</tr>
<tr>
<td>Ceramir C&amp;B (Doxa)</td>
<td>Calcium Aluminate</td>
<td>Implant abutment supported crowns of all types (i.e. not screw retained)</td>
<td>all other cementsations</td>
</tr>
<tr>
<td>Panavia 21 (Kuraray) Use ED primer A &amp; B</td>
<td>S/C composite resin</td>
<td>Resin-bonded bridges (aka Maryland Bridge)</td>
<td>all other cementsations</td>
</tr>
<tr>
<td>Variolink Esthetic** Use with Adhese Universal (Ivoclar)</td>
<td>Light- and dual-cured composite resin</td>
<td>Use exclusively for all-porcelain/ceramic veneers; additionally for ceramic inlays, onlays, &amp; crowns (i.e. e.max) when cement color selection is needed.</td>
<td>all other cementsations</td>
</tr>
<tr>
<td>RelyX Ultimate use with SBU (3M)</td>
<td>Dual-cure composite resin</td>
<td>Use for ceramic inlays and crowns (e.max) when cement color determination is unnecessary.</td>
<td>all other cementsations</td>
</tr>
</tbody>
</table>

* Zinc Phosphate is used when cementing partial coverage cast-metal restorations (inlays, onlays, partial veneer crowns) given a long working time to finish margins.

** Three shades with try-in pastes; for veneers, select light-cure syringes; otherwise dual-cure.
### 22. Indications and Contraindications for Use of Permanent Cements continued

<table>
<thead>
<tr>
<th>Restoration</th>
<th>Fleck’s</th>
<th>Ceramir C &amp; B</th>
<th>RelyX Luting</th>
<th>RelyX Unicem 2 Automix</th>
<th>Variolink Esthetic</th>
<th>RelyX Ultimate</th>
<th>Panavia 21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consistencies</td>
<td>ZnPO₄</td>
<td>Calcium Aluminate</td>
<td>RMGI</td>
<td>Self-adhesive, modified-resin</td>
<td>Composite resin (D/C)</td>
<td>Composite resin (D/C)</td>
<td>Composite resin (S/C)</td>
</tr>
<tr>
<td>Brand</td>
<td>P-L</td>
<td>Capsule</td>
<td>P-L</td>
<td>Paste-Paste</td>
<td>Paste-Paste</td>
<td>Paste-Paste</td>
<td>Paste-Paste</td>
</tr>
<tr>
<td>cast metal inlay or onlay</td>
<td>✓¹</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>partial coverage cast crown</td>
<td>✓¹</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>complete cast metal or metal ceramic crown</td>
<td>✓ ✓ ✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>complete cast metal or metal ceramic FPD</td>
<td>✓ ✓ ✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>zirconia-based crowns</td>
<td>✓²</td>
<td></td>
<td>✓²</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>implant supported crowns</td>
<td>✓³</td>
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</tr>
<tr>
<td>cast post &amp; core</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>manufactured metal post</td>
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<td></td>
<td>✓</td>
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<td></td>
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<td>fiber-reinforced resin post</td>
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<td></td>
<td>✓</td>
<td></td>
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<tr>
<td>ceramic veneer</td>
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<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ceramic inlay or onlay</td>
<td>✓ ✓ ✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ceramic crown (lithium disilicate - e.max Press)</td>
<td>✓ ✓ ✓</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>resin-bonded bridge (aka Maryland Bridge)</td>
<td>✓ ✓ ✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 For a mixing video, go to https://dental.washington.edu/restorative-dentistry/clinic-resource-information/
2 See Section 23 for clinical procedure since they differ from glass-ceramic (e.g. e.max Press)
3 For a Ceramir C&B mixing and cementation video, go to http://www.ceramirus.com/how-to-indication/

### 23. Cements and Cementation Procedures

#### Seating/Cleaning of Casting and Preparation

1. Remove the temporary crown and clean prepared tooth of all temporary cement.
2. Seat the casting restoration by adjusting the proximal contacts, checking the adaptation of the restoration to the preparation finish line and by adjusting the occlusion.
3. Polish the crown as needed.
4. Clean the internal of the casting with a small tooth brush and liquid soap.
5. Thereafter, place the casting in a plastic bag with 2% chlorhexidine and clean in an ultrasonic bath. Rinse thoroughly and dry.
6. Clean the preparation using 2% chlorhexidine.
7. Rinse, dry some but leave dentin slightly moist.
8. Apply dentin sealer if needed.
9. Isolate the quadrant for cementation with cotton and saliva ejector.
**Gold Inlays/Onlays**  
**Fleck’s Zinc Phosphate** (Mizzy)  
(per Tucker Study Clubs’ Technique)

**Zinc Phosphate Cementation Tips**
1. Chill the mixing slab  
2. Employ careful mixing technique (P:L ratio!)  
3. Always check the consistency - cement strings 1-2 cm  
4. Line internal of the casting with a layer of cement.  
5. Seat with firm pressure; check occlusion and adaptation for proper seating.  
6. Have patient bite firmly on cotton until cement has achieved initial set.  
7. Clean cement after completely hard.

Video: zinc phosphate mixing technique  

<table>
<thead>
<tr>
<th>Zinc Phosphate</th>
<th>min:sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixing time</td>
<td>02:00</td>
</tr>
<tr>
<td>Working time</td>
<td>04:00</td>
</tr>
<tr>
<td>Setting time</td>
<td>07:00</td>
</tr>
</tbody>
</table>

**Gold Crowns and Porcelain-metal Crowns**

**Option 1:**  
**RelyX Luting** (RMGI) 3M ESPE

**Cementation Technique**
1. Roll the powder bottle; dispense 3 level scoops. 1 scoop per drop liquid. Close caps immediately. Did you know that moisture contamination of the powder can cause the cement not to set?  
2. Hold liquid bottle vertically, squeeze gently to dispense 3 drops of liquid for one crown (6:2 for two crowns).  
3. Mix all of the powder into the liquid rapidly.  
4. Continue mixing for 30 seconds.  
5. Line internal of casting with a layer of cement.  
6. Seat with firm pressure; check occlusion and adaptation for proper seating.  
7. Have patient bite firmly on a folded 2x2 gauze until cement has achieved initial set.  
8. Clean excess cement when set (no earlier than 3 min after seating).

<table>
<thead>
<tr>
<th>RelyX Luting Cement</th>
<th>min:sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixing time</td>
<td>00:30</td>
</tr>
<tr>
<td>Working time</td>
<td>02:30*</td>
</tr>
<tr>
<td>Setting time</td>
<td>05:30*</td>
</tr>
</tbody>
</table>

* Temperature dependent
**RelyX Unicem 2 Automix** using the crown cementation mixing tip shown. (3M) - Reference²⁷

**Cementation Technique**

1. Sandblast the restoration with aluminum oxide after try-in (Max 2 bar or 30 PSI, particle size ≤ 50µm).
2. Clean with alcohol and air dry with oil-free air.
3. Remove provisional restoration. Mechanically clean prepared tooth (e.g. with pumice paste).
4. Tip: Make sure any residue (temporary cement, desensitizers, astringents, disinfectants, etc.) is completely removed. Do not use H₂O₂, EDTA or Na₂CO₃.
5. Rinse and lightly dry. Leave tooth surface moist. Do not over dry the tooth. Over drying can lead to post-operative sensitivity.
6. Discard a small amount of cement onto a mixing pad to ensure a perfect ratio of base and catalyst. Using the correct mixing tip (shown), automix cement and dispense cement directly into the crown.
7. Firmly seat the crown with finger pressure and confirm proper seating. For posterior crowns, patients can provide seating force using a folded gauze or cotton roll.
8. Excess cement can be removed 2 minutes after seating the restoration or after tack light curing 5 seconds per surface. Remove excess cement with a scaler while holding the crown in place.
9. Setting time is 6 minutes after mixing. Finish restoration and adjust occlusion.
10. Important: Store with original sealing cap in place. DO NOT store with used mix tip.
11. Tip: To prevent premature curing and drying of the paste, be sure to follow recommended cleaning and storage steps. Ideal storage is normal ambient room temperature of 18–24°C.
Cement Description (from manufacturer) For an instructional video, see http://www.ceramirus.com/video/ Ceramir Crown & Bridge cement is a new class of dental materials called Nanostructurally Integrating Bioceramics (NIB)\(^2\). The technology behind it is the result of 25 years of clinical research and development. The result is a luting cement that provides long-term retentive strength and stability\(^3\) with no shrinkage and postoperative sensitivity. The cement integrates with the tooth at the molecular level to foster the build-up of nanocrystals that attach to the tooth surface during the hardening phase. This biomimetic process known as nanostructural integration, gives the cement the unique capacity to seal the tooth-restorative interface without the shrinkage, stress and chemical degradation. Ceramir Crown & Bridge is hydrophilic, wets and flows well and possesses a viscoelastic consistency that allow for excess cement escapement upon seating of the crown. It requires no etching, priming, bonding or surface conditioning. It is self-curing and naturally adhesive, easy to handle and offer ample working and setting times, and excess is easily removed.

Preparation of the crown
- If a lithium disilicate crown (e.g. e.max), the intaglio is most often etched with HF by our contracted dental laboratories. If not etched, etch the intaglio with 9.5% HF acid for 15 seconds and clean with Ivoclean.
- Do not use any pre-treatment agents such as silanes, primers or bonding agents when cementing with Ceramir Crown & Bridge. Use of any such pre-treatments will have adverse effects on the bond between cement and restoration.

Activation & Mixing
- Open the aluminum pouch and remove the capsule.
- Hold the capsule firmly against a hard, flat surface with the plunger facing down (fig. 1).
- Push down firmly, forcing the plunger into the body of the capsule until it stops (fig. 1).
- WORK QUICKLY since the reaction between the liquid and powder starts directly after activation.
- Place the capsule in a Rotomix (fig. 2) and mix for 8 seconds. Use the “mulling” feature with the Rotomix since this organizes the mix at the injection tip and removes air in the mix. See image.

Application
- Immediately insert the capsule into the applicator using the grooves to hold it in place (fig. 3). The GC applicator works well with these capsules.
- Gently close the dosing lever two times to push the cement towards the tip.
- Then apply the cement by gently squeezing the lever to line the crown with cement.
- After application, remove the empty capsule using the applicator release button.
Working and setting times
- Working time (from end of mixing) at 23 °C/73 °F: 2 minutes.
- Setting time (from end of mixing): 3 to 8 minutes. Note: Room temperatures above 23 °C/73 °F will accelerate setting and reduce the working time available.

Insertion and finishing
- Seat the restoration and stabilize it under pressure, to avoid any movements, until the cement reaches a rubber-like consistency (approx. 2 min) (fig. 4-5).
- Remove excess material when the cement has reached the rubber-like consistency (fig. 6).
- Keep the restoration stabilized for an additional 4 minutes (fig. 7).
- Check the area around the margins of the restoration (especially the gingival sulcus) and remove any remaining cement.
- Advise the patient not to bite heavily on the crown for the first hour after cementation.

Storage and shelf life
- Keep Ceramir Crown & Bridge capsules at temperatures between 4 °C/39 °F and 20 °C/68 °F. Do not open the aluminum pouch until immediately before use.
- Do not use Ceramir Crown & Bridge capsules after their expiry date.
This type of crown consists of several forms of CAD/CAM milled and sintered zirconia. This type of crown is “tough” and the intaglio cannot be HF etched to facilitate bonding. For this reason, the procedures for cementation can be quite different and simpler that those given above for lithium disilicate (ceramic) restorations.

Zirconia-based Products:  Lava Plus (3M ESPE), Procera Zirconia (Nobel Biocare), ZenoStar (Ivoclar), BruxZir (Glidewell Laboratories)

Zirconia Internal Surface Preparation
- The dental laboratory most often will air abrade the internal of crown with 50 micron grit alumina for a 15 seconds using 4-5 bars of pressure.
- Research has shown that no internal treatment is need for cement retention of the zirconia.24

Try-In of ZrO₂ Crown
- If needed, adjust the zirconia intaglio (internal) of the crown with a small round diamond to achieve proper fit. Typically, the CAD design creates more “cement space” virtually than that created for metal-ceramic restorations so this step is often not necessary.
- Adjust the proximal and occlusal contacts of the veneered feldspathic porcelain or pressed lithium disilicate much like you do for ceramometal crowns.
- Polish adjusted surfaces.

Cleaning of ZrO₂ Crown after try-in (chair-side)
- After try-in of crown, rinse the interior of the crown thoroughly with water.
- Dry gently with air
- IMPORTANT! In order to create a strong bond, do not clean the zirconium oxide surfaces with phosphoric acid.

Cementation - RelyX Luting and RelyX Unicem 2 Automix
See previous instructions for mixing and placement. For evidence of the efficacy of these two cements for long-term retention of zirconia crowns, see this reference.25
Glass Ceramic Cementation for Crowns and Inlays/Onlays

<table>
<thead>
<tr>
<th>Two Cement Options for glass ceramic (e.max) crowns/inlays/onlays</th>
<th>Type/Materials</th>
<th>When to use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>RelyX Ultimate</strong> cement + <strong>Scotchbond Universal</strong> (3M)</td>
<td>Dual-cure composite Resin + adhesive</td>
<td>Use when determined that it is not necessary to select cement color to enhance esthetics</td>
</tr>
<tr>
<td>2. <strong>Dual-Cure Variolink Esthetic cement</strong> + <strong>Adhese Universal Viva Pen</strong> + <strong>Monobond Plus</strong> ceramic primer (Ivoclar)</td>
<td>Dual-cure composite Resin + dentin adhesive + ceramic primer</td>
<td>Use when it is deemed advantageous to choose cement color to enhance esthetics. Try-in pastes are available.</td>
</tr>
</tbody>
</table>

**Option 1:**  
**RelyX Ultimate Cementation Technique** (3M) See following reference for evidence of use.  

---

**Cement Description** (from manufacturer)  
*RelyX™ Ultimate* is a dual-curing composite resin cement supplied in an automix syringe. *RelyX™ Ultimate* cement is formulated for glass ceramic and other cementation as to allow easy handling. *RelyX Ultimate* cement offers all properties specially needed for cementing veneers: high mechanical strength, radiopacity, high wear resistance, high adhesive strength and low film thickness. *RelyX Ultimate* is used in combination with *Scotchbond™ Universal Adhesive*. The adhesive can be used either as a “Total Etch” or “Self-Etch” procedure.

**Cleaning of Preparation**  
- This is the same as for other cementations. Use 2% Chlorhexidine, rinse, dry gently, keeping dentin physiologically moist.

**Total Etching - only if deemed necessary (e.g. hard, sclerotic dentin)**  
- Apply a commonly used phosphoric acid etching gel (about 35%) to the prepared and unprepared (if present) tooth structure (enamel and dentin) and allow to demineralize for 15 sec.
- Rinse thoroughly with water and dry with water-free and oil-free air or with cotton pellets; do not over dry.
Scotchbond Universal Application

- **IMPORTANT:** Even though this cement is dual-cured, this is the one case when DCA is not needed for the reaction to take place. Thus only the SBU blister is used much like with composite restorations.
- Use the disposable applicator to apply the adhesive to the entire tooth structure and *rub it in* for 20 sec. Avoid contact between the adhesive and the oral mucosa.
- If necessary, rewet the disposable applicator during treatment.
- Subsequently direct a gentle stream of air over the liquid for about 5 sec until it no longer moves and the solvent has evaporated completely.
- **DO NOT LIGHT CURE** Scotchbond Universal. When cementing indirect restorations or posts, Scotchbond Universal Adhesive is not light-cured.

Crown intaglio

- Use a disposable applicator to apply Scotchbond Universal primer to the intaglio surface to be luted and allow it to react for 20 sec. Rewet the disposable applicator as required.
- Subsequently direct a gentle stream of air over the liquid for about 5 s until it no longer moves and the solvent has evaporated completely.

Cement Mixing, Application and Clean-up

- Remove and discard the mixing tip remaining on the automix syringe from the previous application.
- Attach a “standard” mixing tip and secure it by turning it to the right.
- Squeeze out and discard a peppercorn-size quantity of RelyX Ultimate until an evenly mixed paste in a homogeneous color flows out of the tip.
- The paste requires a certain amount of time to flow through the mixing tip. The flow-through speed cannot be accelerated by increasing the pressure on the plunger.
- As soon as the pressure on the plunger decreases, the material flow stops and the paste begins to set up.
- Protect the area from contamination with water, blood, saliva, and sulcular fluid during the application and setting phase.
- Apply mixed cement to the bottom of the crown. Keep the opening of the mixing tip immersed in the material during the application to prevent the inclusion of air bubbles.
- Seat with strong finger pressure.
- Leave the used mixing tip on the automix syringe as a cap until the next application.
- Remove excess before polymerization using a sponge or cotton pellet, while using a suitable instrument to hold the restoration in position.
- Optional: Apply glycerin gel (Liquid Strip) to margins and light-cure each surface 20 s.

<table>
<thead>
<tr>
<th>Cement</th>
<th>Working Time (min:sec)</th>
<th>Setting Time (min:sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RelyX Ultimate*</td>
<td>2:30</td>
<td>6:00 (self-cure)</td>
</tr>
</tbody>
</table>

*RelyX Ultimate is a dual-curing cement and therefore also sensitive to natural or artificial light. The working time is significantly reduced during application under operating lights.*
Option 2: **Variolink Esthetic DC cementation** (for ceramic crowns, inlays and onlays)

**Cement Description** (from manufacturer)

Variolink Esthetic is a color-stable, adhesive luting system for the permanent cementation of ceramic and composite resin restorations. Variolink Esthetic is offered in a purely light-curing (Variolink Esthetic LC) and a dual-curing version (Variolink Esthetic DC). The special filler composition gives Variolink Esthetic a very high radiopacity.
Cement Kit Elements
(top to bottom in image)

<table>
<thead>
<tr>
<th></th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Try-in paste (1 of 3)</td>
<td>Select color</td>
</tr>
<tr>
<td>Ivoclean</td>
<td>Clean intaglio before applying primer</td>
</tr>
<tr>
<td>Monobond S</td>
<td>Ceramic primer (silane coupler)</td>
</tr>
<tr>
<td>H₃PO₄ Etchant</td>
<td>Elective dentin etching</td>
</tr>
<tr>
<td>Adhese Universal</td>
<td>Bonding agent</td>
</tr>
<tr>
<td>DC Variolink Esthetic Cement (1 of 3)</td>
<td>Resin cement (neutral, light &amp; warm)</td>
</tr>
<tr>
<td>Liquid strip</td>
<td>Glycerin gel to eliminate oxygen inhibited layer</td>
</tr>
</tbody>
</table>

Cement |
<table>
<thead>
<tr>
<th>Working Time (min:sec)</th>
<th>Setting Time (min:sec)</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variolink Esthetic DC cement</td>
<td>5:00 at 23 °C</td>
<td>8:00 at 23 °C</td>
</tr>
<tr>
<td></td>
<td>2:00 at 37 °C</td>
<td>4:00 at 37 °C</td>
</tr>
</tbody>
</table>

Cleaning Tooth Preparation
This is the same as for other cementations. Remove possible residue of the temporary luting cement from the preparation. Use 2% Chlorhexidine, rinse, dry gently, keeping dentin physiologically moist.

Try-in Pastes
- Shade simulation with the help of try-in pastes must always be carried out before the working field is isolated or the teeth are dried, since drying temporarily lightens the tooth structure.
- Color choices. The gradation of Variolink Esthetic shades is based on the effect that a luting composite exerts on the brightness value of the final restoration. **Variolink Esthetic Neutral** does not affect the brightness value. At the same time, it demonstrates the highest translucency and is thus neutral in shade. **Variolink Esthetic Light** makes the restorations lighter, while **Variolink Esthetic Warm** creates a darker overall shade impression. In order to evaluate the overall effect of the restoration in conjunction with the various Variolink Esthetic shades prior to permanent cementation, we recommend using the **Variolink Esthetic try-in pastes**.
- Apply a small amount of the selected try-in paste to the restoration and carefully seat it without pressure. If the restoration cannot be seated easily, check the inner surface of the restoration as well as the proximal regions for any premature contacts. Do not forcefully seat the restoration (risk of fracture!).
- Completely rinse any try-in paste residue from the restoration and the tooth with water prior to applying the permanent cement. Otherwise, the bond between the restoration and Variolink Esthetic cement may be compromised.

**Seating of Restoration and Isolation**
- When an adhesive luting protocol with composites is used, effective isolation of the operating field is required. If the dental hard tissue is contaminated with saliva or blood during try-in, it needs to be cleaned again.
- Confirm the fit and occlusion of the restoration.
- Care should be taken when checking the occlusion of fragile and brittle ceramic objects before they are permanently cemented, as there is a risk of fracture. If necessary, make adjustments with fine diamonds at medium speed and with slight pressure and adequate water cooling. Polish ground surfaces.

**Treatment of the intaglio of the ceramic restoration – Ivoclean; Monobond Plus**
- If a restoration has been pre-treated with hydrofluoric acid (HF) etching in the dental laboratory and is contaminated with saliva or blood during try-in, the contaminated bonding surface of the restoration needs to be cleaned with water followed by Ivoclean:
  - **Ivoclean** – What is it? Ivoclar states that Ivoclean consists of an alkaline (sodium hydroxide) suspension of zirconium oxide particles. Due to the size and concentration of the particles in the medium, phosphate contaminants are more likely to bond to them than to the surface of the ceramic restoration. **Ivoclean** absorbs the phosphate contaminants like a sponge and thus leaves behind a clean zirconium oxide surface.
  - From [NaOH and column cleaning.pdf (proteinguru.com)](http://proteinguru.com). Solution of Sodium hydroxide has been shown to be effective in removing proteins and nucleic acids. It is also effective for inactivating most viruses, bacteria, yeasts, and endotoxins.
  - Following try-in, thoroughly rinse the restoration with water spray and dry with oil-free air.
  - Shake **Ivoclean** before use and completely coat the bonding surface of the restoration with the product using a microbrush or bush.
  - Leave **Ivoclean** to react for 20 s, then thoroughly rinse with water spray and dry with oil-free air.
  - Additional notes: Contamination of the restoration with saliva or blood must be absolutely avoided after cleaning with Ivoclean. In case of contamination, the entire treatment of the restoration must be repeated. After cleaning, the bonding agent must be reapplied to surfaces that were previously silanized and primed.
Warning

- Sodium hydroxide can cause burns.
- In case of accident or if you feel unwell, seek medical advice immediately.
- Do not breathe fumes/aerosols.

Next, apply a thin coat of Monobond Plus ceramic primer to the intaglio of the ceramic restoration, not allowing the liquid to pool. Allow the Monobond Plus primer to react with the surface for 60 seconds.

- Disperse the remaining liquid with a strong stream of air.

Bonding - Conditioning with phosphoric acid gel (optional)

- The bond to enamel can be improved by selectively etching the enamel or by applying the "etch & rinse" technique. Unprepared enamel surfaces must be conditioned with phosphoric acid.
- Selective enamel etching - Apply phosphoric acid gel onto the enamel and allow it to react for 15-30 s. Then rinse thoroughly with a vigorous stream of water for at least 5 s and dry with compressed air until the etched enamel surfaces appear chalky white.
- Total etch technique - Apply phosphoric acid gel onto the prepared enamel and dentin. The etchant should be left to react for 15 s. Rinse thoroughly with a vigorous stream of water for at least 5 s and gently dry with compressed air so that the prepared surfaces are not wet but physiologically moist.

Bonding - Application of Adhese Universal Viva Pen

Description - Adhese Universal is a light-curing single-component dental adhesive for enamel and dentin, which is supplied in the VivaPen® in the Variolink Esthetic kit. The VivaPen can be used for repeated dispensing of adhesive and the adhesive can be used with the self-etch technique or selective enamel etch technique.

Adhese Universal Viva Pen Application

- Remove protective tip of the pen. Apply a sponge applicator.
- Express the adhesive liquid by pressing on the green button.
- Starting with the enamel, thoroughly coat the tooth surfaces to be treated with Adhese Universal.
- The adhesive must be scrubbed into the tooth surface for at least 20 s. This time must not be shortened. Applying the adhesive on the tooth surface without scrubbing is inadequate.
- Disperse Adhese Universal with compressed air until a glossy, immobile film layer results.
- Important note: Avoid pooling as this may compromise the accuracy of fit of the definitive restoration.
- Light-cure Adhese Universal for 10 s using a light intensity blue-phase lamp.
- Replace protective cover on VivaPen.
Cement Mixing and Application

- Apply a new mixing tip and automix catalyst and base, discarding the initial pea-sized amount of material out of the mixing tip.
- **Note:** Variolink Esthetic DC should be used quickly after it has been dispensed and the restoration should be placed rapidly. See working and setting times provided.
- Apply mixed cement to the intaglio bottom and sides of the crown. Keep the opening of the mixing tip immersed in the material during the application to prevent the inclusion of air bubbles.
- Apply strong pressure to seat crowns. Check adequacy of seating.
- “Tack” light-cure excess cement 1-2 s per surface using a polymerization light.
- Excess cement is easily removed with a suitable instrument. Subsequently, light-cure all margins again for 20 s.
- Variolink Esthetic is subject to oxygen inhibition thus the surface layer (approx. 100 μm) does not polymerize during the curing process. To avoid this, you may cover the restoration margins with glycerin gel (e.g. Liquid Strip) immediately after the removal of excess.
- After complete polymerization, the glycerine gel/air block is rinsed off with water.

Porcelain or Glass Ceramic Veneer Cementation

**Cement:** Variolink Esthetic LC + Adhese Universal Viva Pen + Monobond Plus (Ivoclar)

**Type of veneers:** Feldespathic, Glass Ceramic, Lithium disilicate (e.g. IPS e.max)

**Indication:** Use for try-in and cementation of porcelain or glass ceramic veneers to allow working time for seating and cement removal. The same try-in pastes are used as for DC

**Technique – General Info**
Procedures are nearly identical to those given for Variolink Esthetic DC Cement above. The same try-in pastes, Ivoclean cleaner, Monobond S silane coupler, Adhese Universal bonding agent and Liquid Strip are used as described above. What differs is that etching of enamel is not elective and a strictly light-cured resin cement is used (single barrel) rather than dual-cured.

**Variolink Esthetic LC Cement - Veneer Try-in**

- Try-in each veneer independently dry to confirm the fit and marginal integrity.
- Then, try-in each veneer with its adjacent veneers with water. This will allow you to check for sequential fit problems.
- If the shade match is crucial, try-in veneers with a supplied try-in paste.
Apply a thin layer of the try-in paste to the internal aspect of the veneer and proceed to seat the restoration.

- Check the color match. Work without the operatory light to avoid setting of the paste and to have a better appreciation of the shade.
- Try-in pastes are usually water-soluble and need to be cleaned off with water spray and dried with oil-free air. If the try-in paste is not water-soluble, you will need to clean the veneer with acetone.
- You may need to repeat the process with a different shade of try-in paste if the color match is not satisfactory.

Cleaning and Priming of the ceramic veneer

- If a restoration has been pre-treated with hydrofluoric acid (HF) etching in the dental laboratory and is contaminated with saliva or blood during try-in, the contaminated bonding surface of the restoration needs to be cleaned as follows:
  - Following try-in, thoroughly rinse the restoration with water spray and dry with oil-free air.
  - Shake Ivoclean before use and completely coat the bonding surface of the restoration with the product using a microbrush or bush.
  - Leave Ivoclean to react for 20 s, then thoroughly rinse with water spray and dry with oil-free air.
- Next, apply a thin coat of Monobond Plus ceramic primer to the intaglio of the ceramic restoration, not allowing the liquid to pool. Allow the Monobond S primer to react with the surface for 60 seconds.
- Disperse the remaining liquid with a strong stream of air.

Variolink Esthetic LC Cement - Tooth Preparation

- Remove temporary restoration and pumice tooth. If there was no temporary restoration placed, you still need to pumice the tooth to clean it. Use floss or sandpaper strips to clean interproximally. Avoid tissue damage.
- Place either mylar strips, plumber’s tape or shim stock strips interproximally on both sides of the tooth to be veneered. This will avoid accidental etching of the adjacent teeth.
- Etch enamel and dentin with 32% H₃PO₄ gel for 15 seconds, rinse thoroughly and dry (if only enamel present). If there is an area of exposed dentin within the preparation, be careful not to over-dry it.
- Adhese Universal Viva Pen Application.
  - Remove protective tip of the pen. Apply a sponge applicator.
  - Express the adhesive liquid by pressing on the green button.
  - Starting with the enamel, thoroughly coat the tooth surfaces to be treated with Adhese Universal.
  - The adhesive must be scrubbed into the tooth surface for at least 20 s. This time must not be shortened. Applying the adhesive on the tooth surface without scrubbing is inadequate.
  - Disperse Adhese Universal with compressed air until a glossy, immobile film layer results.
Important note: Avoid pooling since this may compromise the accuracy of fit of the definitive restoration.

- Light-cure Adhese Universal for 10 s using a light intensity blue-phase lamp.
- Replace protective cover on VivaPen.

Variolink Esthetic LC – Veneer Cementation

- **Variolink Esthetic LC** is supplied in single tubes since it is light-cured only. There are three colors from which to choose: Light, Neutral and Warm; the very same shades as the try-in pastes.
- **Variolink Esthetic LC** is sensitive to any blue light (operatory light, ambient light). Therefore, Variolink Esthetic LC should not be dispensed until right before use. Exposure to intensive light should be avoided during application.
- Apply the selected color of **Variolink Esthetic LC** with the application tip or a brush/spatula directly to the internal surface of the restoration as described before for DC.
- Line the veneer with an even layer of the cement, making sure the margins are covered.
- Using finger pressure, push gently, but firmly, on the veneer until it’s seated in place. Clean the gross excess material from the margins with an explorer.
- Increase finger pressure and hold for a few seconds, bringing the veneer to a complete seat. Remove excess cement with a brush from difficult to access areas such as the interproximal and cervical embrasures. Be careful not to brush the cement out of the margins.
- At this point, you can “tack-cure” the veneer by light curing an area of the incisal edge with a small diameter light-guide tip (2mm) for 1-2 seconds. Do not light-cure the proximal or cervical areas.
- Remove the interproximal strips by pulling to the lingual and floss the proximal areas to remove residual cement.
- Cover the restoration margins with the **Liquid Strip** glycerin gel and light-cure for 60 seconds from the buccal, incisal, lingual and proximal aspects. If the tip of the curing light is not large enough to include all the margins of the veneer, each margin will have to be light-cured separately for 60 seconds. The glycerin gel will avoid an oxygen inhibition layer at the margins.
- Use a #12 scalpel blade to remove any overhangs from the cervical or interproximal areas very carefully. The blade is very sharp and you can initiate gingival bleeding. You can also use a sharp scaler or gold knife.
- If necessary, a diamond finishing strip can be used to finish the proximal surfaces, followed by Epitex strips. Margins can be finished with very fine diamonds (under 25µm) and finishing flexible disks.
- Adjust occlusion with fine diamonds under water spray and polish with silicon points and disks.

For additional information on insertion of porcelain veneers, refer to p 485 of your Operative Text¹⁰
Resin-Bonded FPD (Maryland Bridge)

Cement:  *Panavia 21 Cement* Kit (Kuraray) chemically-cured, opaque color (OP) recommended for base-metal systems. CEMENT KIT TO BE OBTAINED FROM GRADUATE PROSTHODONTICS AS PART OF A SHARING AGREEMENT WITH RESTORATIVE CLINICS. REMEMBER to obtain the kit early to allow materials to adjust to room temperature.

Types of bridges: base metal-porcelain (lithium disilicate and zirconia only upon recommendation by and guidance from a specific RESD prosthodontic instructor)

Introduction: Since the preparation for PFM resin-bonded fixed partial dentures (FPD) is not designed to facilitate mechanical retention, clinical success relies on the adhesive bond of the metal framework to the supporting tooth structure. If the tooth preparation is primarily confined to the enamel structures and adhesive bonding techniques are performed appropriately (acid etching, bonding agent application), a predictable resin bond to the metal can be established with the use of composite resin luting agents containing adhesive monomers that can bond directly to the metal. Base metal alloys should be typically used for PFM resin-bonded FPD’s due to their stiffness and susceptibility to form a surface oxide layer. Adhesive resin luting agents provide strong resin bonds to this oxide layer without pretreatment of the base-metal framework other than sand-blasting with Al₂O₃. Noble and high-noble alloys must be pretreated with special alloy primers, tin plated, or silica-/silane-coated. Since the metal retainer wing may reflect through thin abutment teeth and result in a grayish appearance, dual- or self-cure resin cements of high opacity can be used to minimize this phenomenon and optimize the esthetic outcome.

**PANAVIA 21 Cement Kit (#470KA OP - Opaque Color)**

<table>
<thead>
<tr>
<th>Catalyst paste 4ml (7.9g)</th>
<th>ED Primer Liquid A 4ml</th>
<th>ED Primer Liquid B 4ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universal paste 4ml (7.6g)</td>
<td>OXYGUARD II 6ml</td>
<td>Mixing spatula</td>
</tr>
<tr>
<td>Etching agent V 5ml</td>
<td>Paste dispenser</td>
<td>Mixing dish</td>
</tr>
<tr>
<td></td>
<td>Mixing pad</td>
<td>Sponge pledgets</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 Brush holders (white &amp; black)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 Disposable brush tips</td>
</tr>
</tbody>
</table>
Resin-Bonded FPD Cementation Instructions
(Refer also to pp. 823-824 of Rosenstiel’s Contempory Fixed Prosthodontics, 4th Edition)

Treatment of Tooth Structure
1. Clean the teeth with pumice and water. Isolate them with a rubber dam, and acid etch with 32-37% phosphoric acid for 30 seconds. Rinse and dry enamel.
2. Dispense one drop of each ED PRIMER Liquid A and Liquid B into a well of the mixing dish and mix for three-five seconds. Using a small sponge pledget apply the mixture to the prepared tooth surface. After 60 seconds evaporate the volatiles with a gentle stream of air; the surface will appear glossy.
3. NOTE: Do not apply ED PRIMER to the metal or silanated porcelain. Do not rinse.

Treatment of Metal
1. Non-precious metals should be sandblasted with 30-50 micron alumina particles at an air pressure of 4.2-7 kg/cm² (60-100 PSI); two to three seconds per cm² will remove the luster producing a matte finish.
2. Precious and semi-precious metals should be sandblasted as above and then tin-plated. A layer of tin approximately 0.5 microns thick should be deposited. To avoid contamination do not touch the tin-plated surfaces.
3. After sandblasting and after tin-plating, wash the casting in a stream of water for one minute then ultrasonically clean for two-three minutes in a neutral detergent solution. 
NOTE: The prepared tooth surface and casting must be kept dry and contamination free.
Usage of PANAVIA 21 paste
1. Remove the syringe cap and slowly rotate the dispensing knob ONE FULL TURN clockwise until it clicks. This dispenses the proper ratio and amount of PANAVIA 21 Catalyst and Universal for the cementation of an adhesion bridge with two abutments. If more PANAVIA 21 paste is required, dispense an additional FULL TURN.
NOTE: PANAVIA 21 paste must always be dispensed in increments of full turns.
2. Mix the dispensed Catalyst and Universal pastes for 20-30 seconds, creating a smooth, uniform paste. Because of PANAVIA 21’s anaerobic properties the mix should be spread in a thin layer on the pad until ready to use.

Seating of the Adhesive Bridge
1. Apply a thin, even layer of PANAVIA 21 paste to the prepared, cleaned and dried metal surface, being careful to avoid air entrapment.
NOTE: DO NOT additionally apply PANAVIA 21 paste to the tooth surface primed with ED PRIMER as this will accelerate the set of PANAVIA 21 paste.
2. Seat the restoration and apply finger pressure. After about 60 seconds release pressure and remove the excess PANAVIA 21 at the margins with a small disposable brush tip starting first with the proximal surfaces.
3. With a disposable brush tip apply OXYGUARD II to the margin. After three minutes remove the OXYGUARD II with a cotton roll and water spray.
4. Any slight excess of PANAVIA 21 remaining at the margin can be removed with an explorer or small scaler. The restoration can then be finished and polished with pumice and water.

Storage and other recommendations
- PANAVIA 21 paste and ED PRIMER should be stored at refrigerated temperatures when not in use; bring to room temperature before using.
- Avoid exposure to direct sunlight or high temperatures.
- PANAVIA 21 paste or ED PRIMER should be immediately removed from skin or clothing with an alcohol moistened cotton pledget.
- PANAVIA 21 paste or ED PRIMER should be immediately flushed from the eye with copious amounts of water; consult a physician immediately.
- PANAVIA ETCHING AGENT should be immediately washed from the face or oral tissue with water.
- PANAVIA 21 should not be used with any patients known to be hypersensitive to Methacrylate monomers.
- OXYGUARD II can be removed from the hands, face or clothing with a water moistened cotton pledget.
- Use of protective gloves is recommended during the handling and use of PANAVIA 21.
- The syringe cap of the dispenser should be replaced as noted in the insertion guide.

PANAVIA 21 HAS A SHELF LIFE OF 18 MONTHS FROM THE DATE OF MANUFACTURE WHEN KEPT REFRIGERATED.
24. Provisional Cements in Clinic

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Mfg.</th>
<th>Use/Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>TempBond NE</td>
<td>Zinc Oxide – Non-Eugenol</td>
<td>Kerr Mfg.</td>
<td>short-term provisional cement</td>
</tr>
<tr>
<td>Durelon Cement</td>
<td>Polycarboxylate</td>
<td>3M</td>
<td>long-term provisional cement</td>
</tr>
</tbody>
</table>

Instructions of use of Durelon Carboxylate Cement

DURELON – DOSING

**Powder:**
Press the dosing rod into the powder, and then remove excess powder with some instrument. Dose the powder onto a mixing block or glass plate by lightly tapping the dosing rod.

**Liquid Dropper Bottle:**
Holding the bottle vertically, dispense single droplets next to the powder by lightly squeezing the bottle. Recap the bottle immediately after use.

**Liquid Dosing Syringe:**
Insert the enclosed plunger and dose the desired number of scale units. Keep the plunger for subsequent use with other syringes. Reseal the dosing syringe immediately after use.

**Mixing ratio**
1 dose powder Durelon = 1 dosing rod filling.
2 dose liquid = 2 drop from the bottle or 1 small scale unit from the dosing syringe.

**Mixing**
Mix Durelon at an ambient temperature of 20-25°C/68-77°F with a metal spatula. Place all powder into the liquid in one move and mix rapidly until a homogeneous consistency is attained.
DURELON – APPLICATION
- Protect the working area from water and saliva during the application and setting phase.
- Coat neighboring teeth or crowns with Vaseline to make removal of excess material easier.
- Apply a thin layer of cement to the internal surface of the crown and the prepared tooth.
- Do not overfill the crown as hydrostatic pressure in tightly fitting crowns may lead to discomfort of the pulp.
- Then seat the restoration.
- Wash metal instruments with cold water before Durelon has set.

Times
The times in the table below are valid at an ambient temperature of 23°C/73°F and 50% relative humidity:

<table>
<thead>
<tr>
<th>Mixing min:sec</th>
<th>Working Time min:sec</th>
<th>Setting Time min:sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>00:30</td>
<td>02:30</td>
<td>10:00</td>
</tr>
</tbody>
</table>

Setting times are shortened at higher temperatures and prolonged at lower temperatures than those stated (e.g., mixing on a chilled glass plate). Using a larger quantity of powder also shortens the processing time.

Removing Excess Material
To simplify cleaning, remove any excess material shortly before definitive setting of the material using an instrument. Be careful to avoid pulling any material from the seam. After the setting time has elapsed remove any remaining excess material, e.g., with a probe.
# Provisional Filling Materials in Clinic

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Mfg.</th>
<th>Use/Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRM</td>
<td>Polymer-reinforced ZnO-Eugenol</td>
<td>Caulk Dentsply</td>
<td>Caries control/short-term provisional filling</td>
</tr>
<tr>
<td>Ketac-Fil Plus Aplicap</td>
<td>Chemically-cured glass ionomer</td>
<td>3M ESPE</td>
<td>long-term provisional filling</td>
</tr>
<tr>
<td>Fermit-N</td>
<td>Light-cured, resilient resin</td>
<td>Ivoclar-Vivadent</td>
<td>Inlays and onlays</td>
</tr>
</tbody>
</table>

- **IRM mixing Instruction:** A video of the IRM mixing technique is located at [https://dental.washington.edu/restorative-dentistry/clinic-resource-information/](https://dental.washington.edu/restorative-dentistry/clinic-resource-information/)

- **Ketac-Fil Plus Aplicap:**
  Need Activator, Rotomix, Applier

<table>
<thead>
<tr>
<th>Activity</th>
<th>min:sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activation of capsule</td>
<td>0:02</td>
</tr>
<tr>
<td>Mixing with RotoMix</td>
<td>0:08</td>
</tr>
<tr>
<td>Working time (from start of mixing)</td>
<td>1:30</td>
</tr>
<tr>
<td>Setting time (from start of mixing)</td>
<td>7:00</td>
</tr>
</tbody>
</table>

- **Fermit-N**
  A light curing, single component composite resin for temporary restorations and temporary inlays and onlays and does not require additional temporary cementation material.
### 26. Posts and Post Cementation

Section by Dr. Doug Verhoef, Clinical Associate Professor Emeritus & Dr. Glen Johnson, Professor Emeritus

#### Materials:  
*ColteneWhaledent® ParaPost® System; RelyX Unicem 2 Automix Cement*

#### Guidelines for Posts

<table>
<thead>
<tr>
<th>Prefabricated Stainless Steel post (ParaPost®X System)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Round to slightly oval canal shape.</td>
<td></td>
</tr>
<tr>
<td>▪ Most anterior teeth and premolars with ≥2mm ferrule.</td>
<td></td>
</tr>
<tr>
<td>▪ Many molars do not require posts due to adequacy of remaining tooth structure and depth of pulp chamber. If necessary, one SS post is placed in palatal or distal canal. A second smaller post can be placed into another canal at a different angulation and requires less length.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prefabricated fiber post (ParaPost® Fiber Lux)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ All-ceramic crowns</td>
<td></td>
</tr>
<tr>
<td>▪ Must have optimal ferrule to prevent fracture</td>
<td></td>
</tr>
<tr>
<td>▪ Generally not indicated for maxillary canines</td>
<td></td>
</tr>
<tr>
<td>▪ Core material is light-cure composite</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Core/Foundation Materials</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Amalgam or composite is permitted, but decision to be made based upon strength, need for longevity, esthetics, need for bonding. Consult with instructor before appointment.</td>
<td></td>
</tr>
<tr>
<td>▪ ParaCore may be used, but only of the crown is prepared the same day. See Section 10.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cast Post</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Any shape canal OK, but necessary for irregular shape.</td>
<td></td>
</tr>
<tr>
<td>▪ Tooth will demonstrate minimal ferrule when restored.</td>
<td></td>
</tr>
<tr>
<td>▪ May be fabricated at <em>slight</em> angle from long axis of root if tooth is tipped.</td>
<td></td>
</tr>
<tr>
<td>▪ Direct technique utilizes <em>serrated</em> plastic pattern and Duralay resin to create desired core shape.</td>
<td></td>
</tr>
<tr>
<td>▪ Indirect technique utilizes smooth plastic post and subsequent impression.</td>
<td></td>
</tr>
<tr>
<td>▪ Much higher cost due to lab fee and 2nd appointment.</td>
<td></td>
</tr>
</tbody>
</table>
Design of Post Length:
Several suggested optimal lengths have been proposed in the literature. No single “rule” is applicable for all clinical applications. In ALL situations there must be 4-5mm of remaining gutta percha seal at the apex of the root. In ALL situations it is advantageous to maximize the length, but without compromising the integrity of the root thickness. The diameter of the post should be instrumented to engage vertical walls of the canal space except in highly tapered canals (Fig. a below).

Among the suggested lengths are (see figures below):

- The length of the post should be greater than or equal to the length of the crown (Fig #1).
- The length of the post below the level of the bone should be greater than or equal to the length of the post/core above the level of the bone. (Fig #2)
- The length of the post should be greater than the length of the core. (Fig #3)

Canal Preparation for Post (see Fixed Prosthodontics Clinical Manual)

<table>
<thead>
<tr>
<th>#</th>
<th>Color</th>
<th>Drill Diameter (in)</th>
<th>Drill Diameter (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>brown</td>
<td>.036</td>
<td>0.90</td>
</tr>
<tr>
<td>4</td>
<td>yellow</td>
<td>.040</td>
<td>1.0</td>
</tr>
<tr>
<td>4.5</td>
<td>blue</td>
<td>.045</td>
<td>1.14</td>
</tr>
<tr>
<td>5</td>
<td>red</td>
<td>.050</td>
<td>1.25</td>
</tr>
<tr>
<td>5.5</td>
<td>purple</td>
<td>.055</td>
<td>1.40</td>
</tr>
<tr>
<td>6</td>
<td>black</td>
<td>.060</td>
<td>1.50</td>
</tr>
</tbody>
</table>
Cement Choice for Post Cementation: *RelyX Unicem 2 Automix* - a self-adhesive, modified resin cement. A recent long term aging study supports the use of this cement. The advantage of this cement over others for post cementation is the automixing and a small dispensing tip (Endo Tip) by which the cement can be placed to the depth of the prepared post space with ease.

**Post Cementation Technique** (glass fiber-reinforced, prefab metal, cast post)
- Clean the post with alcohol and dry thoroughly to facilitate adhesion.
- For first use of a new *Unicem 2 Automix* syringe, remove the sealing cap, express a small amount of cement on a pad so that there are equal parts of base and catalyst being expressed.
- Place an “Endo tip” onto the end of the “wide” mixing tip. It should snap into place.
- Place assembled unit onto the *Unicem 2 Automix* syringe.
- Insert the Endo Tip as deeply as possible into the prepared canal and press plunger firmly to mix and express the cement.
- Keep the Endo Tip immersed in the cement and slowly move the Endo Tip upwards as the level of the paste raises.
- Do not remove the Endo Tip from the cement until the root canal has been completely filled. Note: this so-called “immersion filling” should not be carried out in less than 5 sec to minimize the entrapment of air bubbles.
• Place the post in the cement-filled canal, apply moderate pressure to hold it in position. A slight rotation of glass fiber and prefab metal posts is recommended during seating of the post to avoid inclusion of air bubbles.

• After about 3 minutes of self-curing time, while cement is in a doughy stage, remove excess cement with an appropriate instrument. Take extreme care not to disturb/move the post when doing so.

• Once excess is removed, light-cure
  o Glass fiber post 40 sec by holding tip of curing light on top of the post
  o Cast and prefab metal posts for 20 sec around cement line between post and dentin

• Roughen shiny area where excess cement resided to provide fresh dentin for bonding composite.

• Proceed with placement of foundation restoration (fiber-reinforced, prefab metal posts).

RelyX Unicem 2 Automix Cement

<table>
<thead>
<tr>
<th></th>
<th>min:sec</th>
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<tbody>
<tr>
<td>Mixing time</td>
<td>00:10</td>
</tr>
<tr>
<td>Working time</td>
<td>02:00*</td>
</tr>
<tr>
<td>Remove Excess</td>
<td>03:00</td>
</tr>
<tr>
<td>Setting time</td>
<td>06:00*</td>
</tr>
</tbody>
</table>

*Important – times above are for chemically-cured cement; without light-curing
27. Treating Superficial Enamel Discoloration

**Technique Summary** (references 28, 29, 30, 31, 32)

- Examine enamel defect(s) while the tooth is hydrated to assess the degree of defect removal needed.
- Isolate of the tooth or teeth with a double application of heavy weight rubber dam.
- Apply the usual patient protective items including clothing drapes and protective eye wear.

- Disks or abrasive points can be first used to remove some of the defect.
- Place flour of pumice into a small plastic dish and add a few drops of 18% hydrochloric acid with a medicine dropper to create a thick paste.
- Fashion the wooden end of a cotton-tipped applicator to resemble the end of a straight chisel.
- Pick up a small amount of the acid-pumice paste and apply to the defect by rubbing the abrasive mix with the end of the wooden applicator. Rub for 5 seconds and gently rinse for 10 seconds using only water in the air-water syringe. Use high volume evacuation to remove water and abrasive; dry gently.

- It is best to visualize the effect of acid-abrasion treatment by moistening the tooth. If the defect is still prominent, repeat the step described above. Note that under a rubber dam, the defect will appear more noticeable than for a totally hydrated tooth. Therefore, limit the degree of removal to the point where there is noticeable change, but a hint of the defect can still remain.

- Polish the enamel with the disks and strips (e.g. Sof-Lex, Komet, Sof-Lex, Epitex). Apply APF fluoride gel to the enamel.
- Additional appointments can be scheduled as needed for additional treatment.
Additional Information:

<table>
<thead>
<tr>
<th>Time needed</th>
<th>30-60 minutes/appointment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Billing</td>
<td>bleaching of vital teeth</td>
</tr>
</tbody>
</table>

28. **Bleaching (At-home with trays)**

Section by Dr. Doug Verhoef, Clinical Associate Professor Emeritus and Dr. Glen Johnson, Prof Emeritus

**Material:** Ultradent® Opalescence® PF10% (Carbamide Peroxide with Potassium Nitrate and Fluoride - Also sold as 15%PF, 20%PF, 35%PF, and 10% plain)

- Recommended for whitening discolored teeth PRIOR to placement of restorations
- Manufacturer states it is effective for fluorosis and tetracycline staining
- Various recommendations for wear time depending upon concentration used
- 20% carbamide peroxide concentration equals approximately 7.5% hydrogen peroxide
- Bleaching material is viscous and sticky allowing it to stay in the tray
- Shelf-life: 24 months when refrigerated.

Prior to beginning at-home bleaching procedures, you must first advise your patient of the **risks and benefits.**

1. Different teeth will bleach at different rates in different patients. Do not guarantee “snow white”.
2. Tooth sensitivity may occur which will shorten application times, and lengthen the time necessary to obtain the desired effect.
3. Several studies have shown the effectiveness of Carbamide Peroxide as a bleaching agent, and that it does not adversely affect enamel, dentin, existing fillings or bonding materials.
4. It is recommended that treatment begins with only one arch for the first week. This should clearly demonstrate to the patient that the bleaching procedure is being effective.

5. Dark foods or beverages can reverse the bleaching process during the course of treatment.

**Instructions for use** (as described by manufacturer)

1. A highly accurate cast is fabricated from an impression made at a previous appointment, or, on the same day with fast-set dental stone. Immediately pour the impression to prevent distortion.

2. Record the shade in the patient’s records to monitor progress.

3. Create reservoir spaces, by applying block-out resin approximately 0.5mm thick onto the labial surfaces of the cast. Stay 1.5mm away from the gingival line. Do not extend past the incisal edges or occlusal surfaces.

4. Tray material is found at the dispensary. Do not substitute with stiffer material. With a vacuum former, heat the tray until it sags about 1.5 inches. Quickly adapt the plastic over the cast and cool.

5. With sharp scissors, trim the tray to allow 0.5mm past the gingival margin. This should create a good seal that will prevent leakage of the material into the patient’s mouth.

6. Return the tray to the cast and verify the fit. Flame the edges if necessary so that they are not felt by the patient.

7. Demonstrate loading the tray to the patient. Load by expressing one continuous bead of gel approximately half way up from the incisal edge on the facial side of the tray from molar to molar. This should use a total of about 1/3 to 1/2 of a syringe for both arches.

8. Place tray in the mouth with light pressure and remove excess with a fingertip or soft toothbrush.

9. After the bleaching procedure has been completed, the tray should be carefully cleaned with cool water.

10. Overnight bleaching is most effective unless sensitivity occurs. If necessary, reduce the contact time. (i.e. every other day or 4 hours after eating)

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**29. Power Bleaching (In-Office)**

Section by Dr. Doug Verhoef, Clinical Associate Professor Emeritus and Dr. Glen Johnson, Professor Emeritus

**Material:** Ultradent® Opalescence® Xtra® Boost

- 38% Hydrogen Peroxide (with potassium nitrate and fluoride to control sensitivity)
- Chemically activated – no light necessary
- Syringe-to-syringe mixing
- Good for 10 days after mixing when refrigerated
- Use with OpalDam® for gingival protection
Caution: Direct with material will injure gingival tissue. Students are instructed to consult with faculty prior to the day of appointment for thorough review of the procedure.

OpalDam® is a light-cured, methacrylate-based resin barrier used for isolation tissue adjacent to teeth being bleached. It is light-reflecting, and according to the manufacturer is designed to minimize heat and tissue sensitivity during curing. The original shade was white; the newer shade is green.

Instructions for use:
1. Teeth must be clean. Plaque may prevent a complete seal.
2. Dry the teeth
3. Using the small metal syringe, begin to extrude the material a few teeth at a time. Because it can be runny, it is advised to first place it 2-3 mm from the gingival margin. Then, with a “plastic instrument” quickly pull it to the enamel and light cure for approximately 10 seconds per tooth. Be sure to completely seal into the embrasures. If you miss a spot, you can go back and place more. Do not cover more of the enamel than is necessary as it will inhibit the bleaching effect in those areas.
4. Generally masking the gingival surfaces from the mesial of 1st molar to 1st molar.

Retraction. Although other types of retraction may be utilized, an orthodontic-type retraction device is most efficient for controlling tongue movement, and saliva control. It generally allows for adequate isolation of both arches simultaneously.

Instructions for use:
1. Before scheduling patients for in-office bleaching, you must first advise them of the risks and benefits of the procedure.
   o If existing composite restorations are present, the bleaching procedure will not change the shade, therefore if new restorations need to be placed, the bleaching should be accomplished first. There is more control of the shade of a new composite than the shade of the enamel after bleaching.
   o Advise your patient that the amount of bleaching cannot be guaranteed since enamel will be affected by hydrogen peroxide differently with different patients.
   o Also, advise your patient that it is not unusual for sensitivity to occur which may shorten the procedure, and reduce the effect.
2. Match the shade of the existing enamel and record as a permanent record. Match more than one tooth if some teeth are significantly different than others.
3. Review information presented at the prior appointment.
4. Place retraction barrier (shown above).
5. Place the OpalDam®

**Activate the bleach**

*Allow the contents to come to room temperature before mixing the two chemicals together. Ensure the red and clear syringes are securely attached together before proceeding.*

1. Mix activator with bleaching agent by pressing the plunger of red syringe (A) in, pushing all contents into the clear syringe (B).
2. Forcefully press the small clear stem into clear plunger, making sure the small clear stem is pressed completely into the larger clear syringe.
3. To activate, press the chemical from the red syringe into the clear syringe with thumbs. Mix back and forth rapidly a minimum of 25 times (12–13 times each direction/side). Press entire mixed chemical into red syringe.
4. Remove clear syringe and dispose

**Bleaching procedure**

1. Use protective eyewear
2. Place the brush tip into the red syringe
3. Carefully inject the red gel bleach onto the teeth, and rub gently. Be observant, and be careful that bleach does not drip.
4. Allow the bleach to be in contact with the teeth for 20 minutes. Gently rinse the bleach using high-speed evacuation. Do not use air. The manufacturer states that the use of an additional high intensity light source is not necessary as is used by other manufacturers.
5. Repeat the procedure for 20 minutes.
6. If your patient experiences a burning sensation during the procedure, the OpalDam® is probably leaking and should be removed immediately as gingival tissues are being damaged. If your patient experiences sensitivity, it may be a “normal” response, but the bleach should be rinse prior to 20 minutes.
7. After the bleaching procedure has been completed, the OpalDam® can be easily be removed by placing the plastic instrument below on edge and pulling.
8. Instruct your patient not to drink dark beverages for 24 hours. Expect teeth to darken slightly once they are re-hydrated. Re-appoint your patient in 2-3 days to evaluate the effectiveness of the procedure as compared to the original shade.
9. Suggest that patient have at-home trays made so that the whiteness can be restored every 4-6 months. Over-the-counter bleach strips can also be suggested.
30. Curing Light Power Output Check

Optilux Curing Radiometer – See Jeff in D1

Most curing lights in clinic and preclinical are LED types. Not long ago, I (Dr. J) tested various LED lights in the clinic and was surprised to find that the output varied among various lights and one was too low. So I suggest you check the LED curing light output from time to time so the base of your composite filling is not the consistency of brie cheese. So here is the procedure.

- Obtain the Optilux radiometer from the Dispensary. **Use only this brand** of radiometer since others often give high or low readings.

- Hold the tip of the light wand flat on the sensor, turn on the light. The value for the LED lights we use should exceed 800 mW/cm². Do this two to three times in succession. Often power output will decay a bit as the light is turned on a few times.

- Given a value significantly lower than this (i.e. <500 mW/cm²), please tell the Clinic Manager to have maintenance check the light unit. Leng or Dave in Dental Maintenance (543-5958) should be able to offer a second check. But you might check the light guide in case it is faulty (i.e. the tip) or feature this, composite bonded to the tip!

- This test is accomplished so simply and the rewards are potentially enormous. Do this quarterly to make certain you are curing composite resin, adhesives and liners polymers with adequate power. To not do so, is really bad news since the restorations or liners may be inadequately polymerized at deeper levels.
Contents of Cassettes for Operative Dentistry and Prosthodontics

The link to the Genius tray/equipment request system is http://uwsod.secure-innovations.com/

Operative/Prosthodontics Cassette
8. Wall Carver 18. Interproximal Carver 27. Rubber Dam Forcep
10. Aspirating Syringe

Operative Exam Cassette (4th year)

Operative Exam Cassette (3rd year)
1. 17/23 Explorer 4. 11/12 Explorer 6. Cotton Plier
3. Mirror

Rubber Dam Cassette (Only for 3rd year Operative)
1. Palodent Forceps 3. Clamps * 5. Rubber Dam Forceps
2. Drubber Dam Frame 4. Palodent separator*

Jaw Relations Cassette
1. Wax Spatula 3. Occlusal Bite Plate 5. Spatula
2. Bard Parker Handle 4. Buffalo Knife

Lynal Placement Cassette
2. Spatula 4. Buffalo Knife

* Checked out from dispensary
ADHESIVE/BONDING AGENTS
- Scotchbond Universal Adhesive (Unidose) 3M
- Scotchbond Universal Adhesive and Dual-Cure Activator (DCA) Bottles - 3M
- Adhese Universal Bond - in Variolink Esthetic Kit (Ivoclar)

ADHESIVE PLACEMENT TIPS
- True-Grip (tacky sticks to hold inlays, veneers, etc. - They come in 2 sizes - Standard or Mini (Clinicians Choice)

AMALGAM
- Valiant PhD Regular set (Ivoclar/Vivadent)
- Valiant PhD-XT (extended working time) Ivoclar/Vivadent

ANESTHETICS, Local
- Lidocaine 2% (1:200,000 and 1:50,000)
- Polocaine 3% (Mepivacaine HCl w/o epi)
- Septocaine 4% (Articaine 1:200,000) D-3 only. Faculty must sign out from dispensary.

ANESTHETICS, Topical
- Lollicaine 20% Benzocaine (unit dosed topical)
- Hurricane 20% Benzocaine (spray)

ASTRINGENTS AND HEMMORAGE CONTROL
- Viscostat gel (20% ferric sulfate)
- Hemodent (buffered hemostatic solution)

ARTICULATING PAPER/and DETECTORS
- Articulation Ribbon, red silk
- Articulation Ribbon, blue

- Accu-Film/Exacta-Film (ArDent)
- Fit Checker (GC)
- Occlude (Pascal)

ARTICULATING FORCEPS (Miller)
- Metal - in instrument trays
- Paper - disposable

BITE REGISTRATION MATERIALS
- Regisil 2X (Dentsply Caulk)

BLEACHING - take home
- Opalescence Patient Kit (10%)
- Block out resin (Ultradent)
- Sof-Tray sheets 5x5 0.035"

BLEACHING - In-Office Opalescence Boost Bleaching
- 40% Hydrogen peroxide bleach
- Activator
- Liquid dam
- Nola retractor

BRUSHES & APPLICATORS
- Benda Brush (Centrix)
- Benda microbrushes – fine/x-fine

BURS (for crown removal)
- Komet burs

CARIES INDICATOR
- Caries Indicator (Henry Schein)

CAVITY CLEANSERS
- Bisco’s Cavity Cleanser (2% chlorhexidine)

CAVITY LINERS
- Caulk’s Dycal (chemical cured)
- Fuji Lining LC (light cured)
CEMENTS – Crowns, Inlays, Veneers
- Fleck's Zinc Phosphate powder and liquid
- RelyX Luting (resin-mod glass ionomer)
- Variolink Esthetic DC & LC (multiple shades and try-in pastes, liquid stripes for eliminating air inhibited layer at cement margins before curing and for a try-in cements)
- RelyX Ultimate (e.max) Shade A1
- RelyX Unicem 2 Automix – mixing tips for crowns
- Panavia 21 Kit – composite resin cement components for bonding resin-retained bridges.
- Ceramir C&B QuikCap – implant supported crown cementation.

CEMENT – For Posts
- RelyX Unicem 2 Automix (self-adhesive, modified resin) – mixing tip + cannula for posts

CEMENTS: PROVISIONAL
- TempBond NE (Kerr)
- IRM (powder/liquid) Caulk
- Cavit (3M)
- Durelon (polycarboxylate)
- Fermit N

CHEEK RETRACTORS
- Metal (for retraction of cheeks, impressions, etc.)

COMPOSITES & GLASS IONOMERS
- 3M ESPE Filtek Supreme Plus
- GC Fuji II LC (resin-modified glass ionomer)
- 3M ESPE Ketac-Fil Aplicaps

COMPOSITE SEALER
- Bisco's Fortify (apply after finish of restorations & to eliminate air inhibited layer)
- Ivoclar's Liquid Strips (for covering composites)

COMPOSITE POLISHING SUPPLIES
- Soflex discs and strips – 3M
- Composite finishing/polishing kits (cups, points, disks) - Komet

COMPOUND
- Red stick compound (Kerr)
- Green stick compound (Kerr)

CORE/BUILDUPS
- ParaCore - dual curing composite resin
- FilTek Supreme Ultra – LC comp resin

CROWN FORMS
- Clear plastic (Anteriors and premolars)
- Polycarbonate
- Ion-aluminum shells

CROWN SECTIONING AND REMOVAL
- T-bar for bending crown framework
- GC plier
- Crown cutting bur (Komet)

DESENSITIZING AGENTS
- Scotchbond Universal Primer
- Fluoride varnish

ELECTROSURGERY
- 1 kit each in D2 and D3
- Tips: straight/loop

FLUORIDES
- Duraflor 5% sodium fluoride varnish
- Silver diamine fluoride 38% (Advantage Arrest)
FRACTURE FINDER
- Tooth Slooth

GINGIVAL DISPLACEMENT
- UltraPak Plain knitted cords (Ultradent) - Sizes
  ✓ 000, 00, 0
  ✓ 1, 2, 3
- DEKNATEL braided surgical silk cords
  ✓ 00, 0
  ✓ 1, 2

IMPRESSION MATERIALS
- Polyether Tray adhesive (3M ESPE)
- Impregum F (Removable Pros)
- Permadyne Garant 2:1
- Aquasil Ultra Monophase – Med body (Dentsply Caulk)
- Aquasil Ultra XL – light body
- VPS tray adhesive (for Aquasil)
- Jeltrate Alginate (Dentsply Caulk)
- Cinch for provisional matrix
- Regisil – bite registration

MATRIX BANDS
- Dixieland precontoured bands 0.0015 (soft) –Getz Waterpik
- Matrix Bands "T"
- Matrix Bands, .002, #1
- Matrix Bands, ultra thin, #1
- Matrix Bands, ultra thin, #2
- Copper band set with pliers set
- Caulk’s Automatrix System
- Palodent Plus Sectional Matrix System (protectors, wedges, matrices, separation rings)

MEDICATIONS
- Amoxicillin 500 mg (must have printed and signed prescription)
- Clindamycin 150 mg (must have printed and signed prescription)
- Hydrogen peroxide 3%
- Sodium hypochlorite (6%)
- Peridex mouthrinse (chlorhexidine gluconate)
- Peroxy (1.5% hydrogen peroxide) – patient rinse before appointment
- Acetaminophen 500mg ea.
- Ibuprofen 200mg ea.
- Extra strength pain reliever (Acetaminophen 250mg, Aspirin 250mg, Caffeine 65mg ea.)
- Oral glucose gel
- Arestin (minocycline HCI 1mg) microspheres

OCCLUSAL CLEARANCE TABS
- 1, 1.5 & 2 mm tabs (Kerr)

PORCELAIN POLISHING KITS
- Intraoral kit with blue, pink, and gray points, and finishing and polishing burs.

PORCELAIN REPAIR KIT
- Porcelain Etchant – 9.5% HFI (by instructor request and signout)
- Scotchbond Universal Primer
- Barrier Gel
- Opaquer Base and Catalyst - Bisco

POST SYSTEMS
- Para-post twist Drills (.036, .040, .045, .050, .055, .060, .070)
- Para-post plastic posts for casting & impression
- Para-post (threaded stainless steel)
- Para-post Fiber Lux – translucent fiber-resin posts
- System B Heatsource with Fine, med-fine and medium pluggers
PROSTHODONTICS – MISC. MATERIALS
- Pink base plate All season’s wax
- Sticky wax
- Aluwax denture forms
- Aluwax denture sheets
- Utility red wax
- Rope wax
- Color transfer applicators (Dr. Thomson’s stick)
- Universal polishing paste
- Kois index trays
- Bite tabs (bite form compound disks)
- Jeltrate dustless alginate
- Hold tray adhesive (for alginate)

PROVISIONAL FILLING MATERIALS
- IRM (powder/liquid) Caulk
- Cavit (3M)
- Fermit N
- Ketac-Cem Plus Aplicap

PULP CAPPING MATERIALS
- Dycal (Caulk)
- Fuji Lining LC

RESINS - PROSTHODONTICS
- Caulk's Temporary Resin, Shades 62, 65 & Incisal
- Duralay Resin (red) for cast posts and indexing
- Filtek Flowable (A2, A3 for provisional repair)
- ProTemp (A1, A2, A3, A3.5)

RIBBOND – bondable reinforcement ribbon for composite; 2mm, 3mm, 4mm

ROOT CANAL REPAIR CEMENT – MTA (mineral trioxide aggregate) Dentsply

RUBBER DAM LUBRICANT
- Surgilube

SALIVA EJECTORS & MOISTURE CONTROL
- Metal or disposable (Hygoformie)
- Svedoptor
- Cotton roll holders
- Dry-angles
- ISOLITE System (ATC only)
- ISOVAC w/small, med, large mouthpieces (D2/D3 clinics)

SEALANTS
- ClinPro Sealant, Liquid etchant

SHADE GUIDES
- Vita
- Portrait IPN by Dentsply Trubyte (Pros)

RESINS – DENTURE REPAIR
- Lang Jet denture repair resin
- Ortho Jet Crystal

RESINS - OTHER
- Duralay: (red) for custom post fabrication and for connecting segments of bridges to facilitate solder of bridge in lab

VITALITY TESTING
- Electric Pulp Tester w/metal tips
- Endo Ice

WEDGES (contoured)
- Premier Interdental Wedges
- Palodent Plus plastic wedges
- Wedjets rubber dam stabilization cord – small, large
References


