1. Risk assessment, evaluation of disease activity, and treating disease (caries) in UIC clinics.
All patients must be evaluated to determine risk for disease, including caries, periodontal disease, and oral cancer. It is important to shift the focus from repairing teeth to enhancing health.

Expectant mothers should be counseled regarding the impact that their own oral health may have on the eventual oral health of their children. There must be preventive and therapeutic intervention and patient education to reduce the prospects for early transmission of disease to their children.

Results of patient risk assessments must be documented in the electronic patient record. The record must also include a plan for treating existing disease, as well as a plan for restoring defects that have resulted from disease.

Treatment plans must include proposals to alter modifiable risk factors, reduce or eliminate potential pathological factors and add or enhance preventive or protective factors. Caries management form (in Axium) must be used, explained and given to the patient to improve home compliance. The dental record must confirm that these measures have been implemented. There must be periodic re-assessments to document the effects of the proposed interventions.

All clinicians must include the full array of caries treatment options in the care that is provided. This includes topical use of fluoride and chlorhexidine pastes, varnishes and rinses. Newer products such as MI paste (GC America) that contains supplemental calcium and phosphate and various Xylitol chewing gums or mints may be prescribed for patients who might benefit from their use.

2. Detection of carious lesions: Detection relies on an assessment of clinical findings supported by faculty experience and judgment.

- Detection methods:
  - Visual/Tactile: teeth must be dried and plaque must be removed with the explorer or by prophylaxis to visualize possible lesions at their earliest stage of development. Magnification is helpful during the visual examination.
  - Each patient must have current radiographs.
  - Developing technology such as laser fluorescence may be used when available with an awareness of the demonstrated limitations in specificity – false positives are common.

- Attempting to use a sharp explorer to determine if it will “stick” in a pit or fissure must be discouraged. The use of a sharp explorer to detect primary occlusal caries adds little diagnostic information and may be detrimental.

- An explorer “catch” or staining of a pit or fissure cannot be interpreted alone as a reliable indication that active disease is present. A stained or discolored pit or fissure without visible cavitation should not be classified as carious unless there are other signs of disease present.
3. Charting carious lesions

*When charting lesions in Axium (electronic patient record):*

- In low risk patients, lesions without enamel breakdown should be charted as “non cavitated” and may receive treatment to promote remineralization.
- An assessment of the disease activity, (active, inactive/arrested) must be made for early lesions.

**Diagnostic criteria and guidelines for treatment decision**

<table>
<thead>
<tr>
<th>Diagnostic criteria</th>
<th>Suggested intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cavitation / active caries</td>
<td>Operative intervention</td>
</tr>
<tr>
<td>No cavitation / inactive</td>
<td>No intervention</td>
</tr>
<tr>
<td>No cavitation / active</td>
<td>No operative intervention Antimicrobials, remineralization – based on determination of caries risk. For “high risk patients”, early surgical intervention might be indicated.</td>
</tr>
</tbody>
</table>

4. Caries management / treatment of disease

- The cause of the disease (etiology) must be evaluated and treated. Repairing defects caused by disease without implementing measures to treat the disease is **NOT** an acceptable practice.
- Proper patient care and material selection is based on the individual risk assessment.
- Emphasis must be placed on altering the caries balance between protective and pathological factors to favor health and to prevent future disease.

Examples of the materials currently recommended for treating caries:

<table>
<thead>
<tr>
<th>Company</th>
<th>Product Name (current choice)</th>
<th>Material Category</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>3M</td>
<td>Vanish</td>
<td>Fluoride varnish, 5% NaF</td>
<td>White varnish, flavored, easy to apply, delivers 22,600 ppm fluoride</td>
</tr>
<tr>
<td>GC America</td>
<td>MI Paste</td>
<td>Bio-available Calcium and phosphate paste derived from milk casein</td>
<td>Topical paste to supplement topical fluoride to promote re-mineralization of incipient lesions</td>
</tr>
<tr>
<td>Colgate</td>
<td>PreviDent brush on Gel or Prevident 5000 Plus</td>
<td>1.1 % neutral Sodium Fluoride gel or dentifrice</td>
<td>Available by prescription (Axium) for at home topical application</td>
</tr>
<tr>
<td>Johnson &amp; Johnson</td>
<td>ACT</td>
<td>0.05% Sodium Fluoride daily rinse</td>
<td>Over the counter daily rinse for caries prevention</td>
</tr>
</tbody>
</table>
5. OPERATIVE DENTISTRY - General Guidelines:

- **Occlusion must always be evaluated prior to beginning restorative treatment.** Marking the occlusion with articulating film prior to beginning a preparation allows evaluation of existing centric stops and anticipation of potential occlusal problems. Occlusion may also be evaluated using the patient’s articulated diagnostic casts, when casts are indicated.

- **Use rubber dam isolation for operative dentistry procedures.** Rubber dam isolation must be used unless the supervising instructor determines that it is not indicated. It is well documented that current bonding systems cannot produce clinically acceptable results when isolation is lacking. Rubber dam isolation techniques are still a critical part of most licensure examinations and students need to master proper techniques. Rubber dam isolation helps prevent contamination of the operating area and is an essential aid for protection of the practitioner as well as the patient. In restoration of posterior teeth, isolate **at least** one tooth posterior to the tooth to be restored and extend the rubber dam to the midline or to the opposite canine. For anterior restorations, isolate the entire anterior portion from first bicuspid to first bicuspid. When conditions permit, other than for gingival retraction for cervical lesions, **do not place a retainer on the tooth to be restored.** Single tooth isolation is not often used for restorative dental procedures.

- **Conserve tooth structure.** Keep preparations as narrow as the caries progression or defect will allow. Do not extend preparations into occlusal grooves unless the grooves are carious. If extension through non-carious grooves is indicated, use a conservative approach, making the extension as narrow as possible using burs such as #1/2 or #1/4 round, #329 MWV burs and #1169.

- **Seal the dentin beneath restorations.**

**Clinical steps requiring approval by instructors**

- Review of medical history and planned restorative procedure (tooth, surfaces included, radiographs, anesthesia and rubber dam isolation) and obtain “start check” in Axium
- Preparation to ideal outline form as requested by instructor
- Request for specific modifications to remove remaining decay or weakened tooth structure
- Completed cavity preparation
- Liner/base, matrix and wedge (mandatory for beginning D2, and then at discretion of the supervising instructor)
- Restoration placement, evaluation and adjustment of occlusion and finishing

6. Clinical Guidelines for Pulpal Protection

- A cavity **sealer**, such as Gluma, will always be placed under an amalgam restoration.
- A cavity **liner** is indicated for tooth preparations when the remaining dentin thickness is insufficient to prevent pulpal irritation from the presence of bacteria or bacterial byproducts.
- An indirect pulp cap may be completed using calcium hydroxide only in the area of pulpal proximity. Although success rates exceeding 90% are reported for direct pulp caps for vital pulps following small mechanical exposures, success drops dramatically when pulp capping of carious exposures is attempted.
- Indirect or direct pulp capping is discouraged when an indirect restoration is planned.
- **Bases** are only indicated for indirect restorations to block undercuts or to achieve ideal thickness for the planned restoration.
Steps for pulp protection beneath amalgam restorations:

**Shallow preparation**
- Complete cavity preparation under rubber dam isolation
- Apply one coat of Gluma using a gentle rubbing motion
- Wait for 30 sec. Gently air dry
- Place the amalgam restoration

**Moderate preparation (< 2 mm of remaining dentin thickness)**
- Complete cavity preparation under rubber dam isolation
- Apply a thin layer of Fuji lining LC on deep area (axial wall or pulpal floor). Light cure for 20 sec.
- Apply one coat of Gluma using a gentle rubbing motion on the entire cavity preparation
- Wait for 30 sec. Gently air dry
- Place the amalgam restoration

**Deep preparation (close to pulp)**
- Complete cavity preparation under rubber dam isolation
- In an area of dentin transparency, apply a thin layer of calcium hydroxide only in the area of intimate contact with the pulp.
- Cover the Ca(OH)$_2$ with a thin layer of Fuji lining LC. Light cure for 20 seconds.
- Apply one coat of Gluma using a gentle rubbing motion on the entire cavity preparation
- Wait for 30 sec. Gently air dry
- Place the amalgam restoration

Steps for pulp protection beneath resin composite restorations:

**Shallow preparation**
- Complete cavity preparation under rubber dam isolation
- Follow the sequence for bonding with OptiBond Solo
- Place resin composite restoration

**Moderate preparation (< 2 mm of remaining dentin thickness)**
- Complete cavity preparation under rubber dam isolation
- Apply a thin layer of Fuji lining LC at the deepest area (axial wall or pulpal floor).
- Light cure for 20 sec.
- Follow the sequence for bonding with OptiBond Solo
- Place resin composite restoration.

**Deep preparation (close to pulp)**
- Complete cavity preparation under rubber dam isolation
- In an area of dentin translucency, apply a thin layer of Ca(OH)$_2$ only in the area of intimate contact with the pulp.
- Cover the Ca(OH)$_2$ with a thin layer of Fuji lining LC. Light cure for 20 sec.
- Follow the sequence for bonding with OptiBond Solo
- Place the resin composite restoration.

If Gluma is used as a desensitizer under adhesive restorations, apply the Gluma after removal of the smear layer and prior to application of bonding agent.
Steps for pulp protection beneath indirect restorations:

- A base of RMGI (Fuji lining LC) is indicated to block preparation undercuts and ‘base back to ideal”
- In the case of a deep preparation or pulpal proximity, the protocol for deep preparation under amalgam should be followed.

Examples of materials currently recommended for pulp protection:

<table>
<thead>
<tr>
<th>Company</th>
<th>Product Name (current choice)</th>
<th>Material Category</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultradent</td>
<td>Ultrabland Plus</td>
<td>Calcium Hydroxide</td>
<td>Hard setting</td>
</tr>
<tr>
<td>Dentsply/Caulk</td>
<td>DyCal</td>
<td>Calcium Hydroxide</td>
<td>Traditional calcium hydroxide liner – does not contain resin</td>
</tr>
<tr>
<td>Heraeus Kulzer</td>
<td>Gluma</td>
<td>Dentin desensitizing compound</td>
<td>Resin</td>
</tr>
<tr>
<td>GC America</td>
<td>Fuji Lining LC</td>
<td>Liner (pulp protection)</td>
<td>RMGI</td>
</tr>
</tbody>
</table>
7. Contemporary enamel/dentin bonding system and clinical recommendations for Pre-doctoral clinics

- In order to obtain clinically acceptable bonded restorations, the clinician must consider the limitations of the material, provide a contamination-free environment for its use and manipulate the material appropriately (follow manufactures’ instructions).
- The dentin must remain moist, though not excessively moist, while the primers are applied. Formation of a hybrid layer, resin-impregnated collagen layer, is vital for effective dentin bonding.
- The technique for removal of the smear layer, conditioning and priming of dentin varies, depending on the bonding concept designed for each specific material. The current systems approved for use in the UIC clinics are:

  *AllBond 2- Bisco (4th generation):* The bonding steps are performed separately: Etching, Primer and Bonding resin.

  *Optibond Solo Plus – Kerr (5th generation):* The acid etching step is done prior to the use of a bottle that contains both, the primer and the bonding resin.

Protocols for use of bonding systems with direct restorative materials

<table>
<thead>
<tr>
<th><strong>“Bonded amalgam” restorations:</strong></th>
<th><strong>Resin composite restorations:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material:</strong> AllBond 2 (Bisco).</td>
<td><strong>Material:</strong> Optibond Solo Plus (Kerr).</td>
</tr>
<tr>
<td>1. Rubber dam isolation.</td>
<td>1. Rubber dam isolation.</td>
</tr>
<tr>
<td>4. Mix Primer A and B. Apply 5 consecutive coats. Do not dry between coats. After primer application, lightly dry the surface for 5-6 sec (until excess solvent and water is removed). Surface must be glossy. Light cure for 20 sec.</td>
<td>4. Apply the system (primer/bonding resin) using light brushing motions for 15 sec.</td>
</tr>
<tr>
<td>5. Mix 1 drop of D/E bonding resin and 1 drop of Pre-bond resin. Brush a thin layer onto the entire cavity surface. Lightly air thin the surface to avoid pooling.</td>
<td>5. <strong>Lightly</strong> air thin the surface until excess solvent and water is removed (no more than 5 seconds) Surface must be glossy.</td>
</tr>
<tr>
<td></td>
<td>7. Proceed with composite insertion.</td>
</tr>
</tbody>
</table>

*Use Gluma as a dentin sealer/desensitizer if needed*
8. Clinical Guidelines for placement of Silver Amalgam Restorations

• Use rubber dam isolation. When interproximal lesions are to be restored, place wooden wedges immediately after application of the rubber dam. This helps to retract the rubber dam and the underlying gingiva. Pre-contoured wedges are recommended.

• Use minimally invasive restorative procedures when possible. Extension to non-carious fissures for anticipated prevention of caries is not indicated. “Slot preparations” may be used when there is no occlusal involvement – but generally when this is appropriate, the restorative material of choice would be resin composite rather than amalgam. Internal line angles must generally be slightly rounded. Discolored dentin near the pulp that cannot be removed with a sharp spoon excavator should be retained. Any discolored dentin found at the dentin-enamel junction must be removed. An enamel hatchet or a gingival margin trimmer may be used to remove unsupported enamel rods at the gingival cavosurface margin of a Class II preparation. The recommended bur for conservative amalgam preparations is #329 MWV.

• The recommended dentin sealer beneath amalgam restorations is GLUMA

• Burnishing amalgam is merely lightly rubbing and smoothing the surface, forceful burnishing, such as is done for gold, must be avoided, since this merely draws mercury to the surface and weakens the restoration. Newly placed amalgam restorations should not be burnished to produce a shiny appearance.

Materials currently recommended for placing silver amalgam restorations:

<table>
<thead>
<tr>
<th>Company</th>
<th>Product Name (current choice)</th>
<th>Material Category</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vivadent</td>
<td>Valiant PhD (2-spill)</td>
<td>Alloy, Silver Amalgam</td>
<td>Dispersed phase / admix</td>
</tr>
<tr>
<td>Kerr</td>
<td>Tytin Spherical double spill</td>
<td>Alloy, Silver Amalgam</td>
<td>Spherical</td>
</tr>
<tr>
<td>SDI</td>
<td>Permite</td>
<td>Alloy, Silver Amalgam</td>
<td>Admix</td>
</tr>
</tbody>
</table>

9. Clinical Guidelines for placement of tooth-colored direct restorations

Pit & Fissure Sealants (Procedure code is 01351.)

• There are good indications for sealant use in adult patients
• Sealant use depends on detection of dental defects (pits or fissures) and determination of patient risk
• Rubber dam isolation is strongly recommended
• Following proper etching, use of a system containing an adhesive and a primer is thought to be advantageous prior to sealant application.

Preventive Resin Restorations (Procedure code is 02385.)

Minimally invasive restorative procedures should be employed when tooth preparation is indicated, as opposed to attempting remineralization.

• Rubber dam isolation is critical.
• Preparations are made by conservatively extending through the enamel, with a 1/4 or 1/2 round bur, to access the carious lesion. Carious dentin is removed without consideration for the retention and resistance form that would be necessary for placement of amalgam restorations.
• The enamel margins are not beveled.
• After removal of carious tooth structure, the remaining pits and fissures are etched, rinsed and dried, and the tooth is then restored with a combination of resin composite and flowable composite or sealant.

**Resin composite restoration procedures**

• Clean the teeth to be restored and those adjacent using a slurry of pumice. Flour of pumice (Preppies, Whip-Mix) mixed with water should be used rather than commercial prophy pastes.

• Select an appropriate shade prior to rubber dam isolation

• Use rubber dam isolation. Any saliva contamination will result in a significantly compromised prognosis for an adhesive restoration. Do not desiccate the prepared tooth. Dentin bonding is enhanced when current generation bonding agents are applied to “moist dentin”. Dentin can be re-moistened with water or a cavity cleaning agent such as 2% chlorhexidine gluconate

• Conservative preparations are advocated. For restorations with all margins in enamel, internal retentive features are less critical. Non-carious dentin must be conserved when possible. For restorations which extend onto root surfaces, the bond to enamel and dentin should be augmented by mechanical retentive features. Preparations for resin composite involve conservation of tooth structure and removal of decay, they do not need to resemble amalgam preparations.

• **Do not mix components** from various restorative materials made by different manufacturers unless you are sure of their compatibility.

• Most restorations require incremental build-up of material to minimize the adverse affects from polymerization shrinkage. Shallow cervical lesions may be restored by placing resin-composite material in a single increment.

**Direct Posterior resin composite restorations**

• **Treatment Guidelines**

  1. The primary indications for use of resin composite for direct posterior restorations are to achieve a more esthetic result and to conserve healthy tooth structure
  2. The tooth to be restored MUST be isolated by placement of a rubber dam
  3. The faciolingual width of the cavity preparation should be restricted to no greater than two thirds of the intercuspal dimension.
  4. Gingival cavosurface margins MUST be located on intact enamel
  5. Cuspal replacement with resin composite is NOT appropriate
  6. Centric occlusal stops should be on enamel
  7. The patient should not exhibit excessive wear from clenching or bruxing.
  8. Must never be used for patients who report allergy to the material
  9. Resin composite should not be used to restore portions of teeth that will incorporate occlusal rests for removable partial dentures

• Limit the extent of the preparation to eliminate caries, barely break interproximal contact when indicated. Generally cavosurface bevels are not placed on the occlusal enamel margins. Other cavosurface margins are beveled slightly past 90 degrees if they are on enamel. Do not bevel gingival margins if they end on dentin or cementum.

• A Bi-tine ring and sectional matrix can be used to achieve a proper proximal contact more easily. An alternative to the sectional matrix system is the use of universal “dead soft” matrix bands in the Tofflemire retainer. Mylar strips are not acceptable as the matrix for posterior resin composite restorations.
RESTORATION OF CERVICAL LESIONS:

A determination of lesion etiology is necessary in order to properly design a cavity preparation for a cervical defect. The etiology might be carious involvement, abrasion, or abfraction (stress induced cervical lesions).

For carious defects the decay is excavated and enamel margins are beveled to improve marginal seal and esthetic finishing of the restoration. Abrasion is generally restored without cavity preparation and relies on proper cleaning and conditioning of the tooth surface to enhance potential bonding. Areas of sclerotic dentin should be lightly abraded with a fine diamond bur. Abfractions require addition of mechanical retention within the preparation (a gingival groove at the axiogingival line angle and occlusoaxial or incisoaxial grooves or retentive coves) for more predictable retention of resin composite restorations.

Microfilled resins (such as Renamel Microfill or Durafill VS) are the best choice for restoration of lesions where tooth flexure is considered to be a part of the etiology (abfraction). Opaquers (Cosmedent) can be used to reduce the translucency of restorations that are placed on exposed root surfaces.

For patients with high caries risk an open sandwich technique can be used. A glass ionmer or resin-modified glass ionomer material is used as the first increment with the fluoride releasing material extending to the cavosurface margins. A resin composite is veneered on the surface for enhanced finishing and translucency.

Technique suggestions to minimize post-operative sensitivity with placement of all direct posterior resin composite restorations:

- Use GLUMA to seal dentinal tubules
- Use a resin modified glass ionomer liner such as Vitrebond Plus or Fuji II Lining LC on pulpal or axial walls of deeper preparations
- Use an incremental build-up to reduce stress from polymerization shrinkage
Materials currently recommended for placing tooth-colored direct restorations:

<table>
<thead>
<tr>
<th>Company</th>
<th>Product Name (current choice)</th>
<th>Material Category</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bisco</td>
<td>All-Bond 2</td>
<td>Bonding System</td>
<td>(4th Generation) Multi-bottle</td>
</tr>
<tr>
<td>Kerr</td>
<td>Optibond Solo Plus (unit dose)</td>
<td>Bonding System</td>
<td>(5th Generation- “one bottle system”)</td>
</tr>
<tr>
<td>3M/ESPE</td>
<td>Sof-lex system</td>
<td>Finishing and Polishing discs</td>
<td>For resin composite materials</td>
</tr>
<tr>
<td>Brasseler</td>
<td>Polishing discs – unit packaged, disposable mandrel</td>
<td>Finishing and Polishing discs</td>
<td>For resin composite materials</td>
</tr>
<tr>
<td>Dentsply/Caulk</td>
<td>Enhance System</td>
<td>Finishing and Polishing tips</td>
<td>For resin composite materials</td>
</tr>
<tr>
<td>Shofu</td>
<td>One Gloss polishing tips</td>
<td>Finishing and Polishing tips</td>
<td>For resin composite materials</td>
</tr>
<tr>
<td>Dentsply/Caulk</td>
<td>Replacement matrix retainers (Bi-tine rings) – Palodent system</td>
<td>Matrix</td>
<td>Matrix retainer</td>
</tr>
<tr>
<td>Bisco</td>
<td>Fortify Plus</td>
<td>Surface sealant</td>
<td>Resin glaze</td>
</tr>
<tr>
<td>SDI</td>
<td>Wave Pre loaded tips</td>
<td>Tooth-colored restorative material - Resin Composite</td>
<td>Flowable material – unit dose</td>
</tr>
<tr>
<td>Kerr</td>
<td>Herculite XRV</td>
<td>Tooth-colored restorative material</td>
<td>Resin Composite – Micro-hybrid</td>
</tr>
<tr>
<td>Cosmedent</td>
<td>Renamel Microhybrid</td>
<td>Tooth-colored restorative material</td>
<td>Resin-composite - microhybrid</td>
</tr>
<tr>
<td>Cosmedent</td>
<td>Microfill or Nanofilled resin composite</td>
<td>Tooth-colored restorative material</td>
<td></td>
</tr>
<tr>
<td>Cosmedent</td>
<td>Opaquers – Creative Color</td>
<td>Opaque resin to be used with Cosmedent incremental technique</td>
<td></td>
</tr>
<tr>
<td>Cosmedent</td>
<td>Enamelize</td>
<td>Polishing paste</td>
<td></td>
</tr>
<tr>
<td>LD Caulk</td>
<td>Prisma Tints and opaques</td>
<td>Colored resin</td>
<td>For characterization of direct restoration</td>
</tr>
</tbody>
</table>
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Sturdevant CM, Roberson TM, Heymann HO, & Sturdevant JR.
The Art and Science of Operative Dentistry.

Rosensteil SF, Land MF, and Fujimoto J.
Contemporary Fixed Prosthodontics.

Craig RG and Powers JM
Restorative Dental Materials