Direct Posterior Resin Composites (II)

Motaz A. Ghulman, BDS, MSD, CAGS, DScD

Assistant Professor of Operative/Esthetic Dentistry
Chairman, Conservative Dental Sciences Department
Faculty of Dentistry
King Abdulaziz University
Preventive Resin Restorations (PRR)

Once the lesion is eliminated, no further preparation is performed

A restoration

- Maximizes the benefits of conservative, adhesive dentistry
- Developed to overcome problems associated with traditional "extension for prevention" in restorations necessitated by minimal occlusal caries lesions
- Limits preparation to pit & fissures that are carious
Preventive Resin Restorations (PRR)

If restricted to **narrow & shallow opening of the fissure**
(a **resin sealant** or **flowable resin composite**) is placed

If **additional tooth structure is removed**
(a **posterior resin composite**) in that area & the remaining fissures & the surface of the resin composite restoration are sealed with (**resin sealant material** or **flowable composite**)
Preventive Resin Restorations (PRR)

- Conservation of tooth structure
- Enhanced esthetics
- Improved seal of restorative material to tooth structure
- Minimal wear
- No progression of sealed caries lesions
- Good longevity

Indications
- Minimally or moderately carious fissures

Contraindications
- Restorations that will occupy a large area of the occlusal surface
Preventive Resin Restorations (PRR)

- **Technique**
  - The *preoperative evaluation, marking the occlusion, shade selection, & rubber dam isolation*
    - should be accomplished
  - *The conservative adhesion preparation*
    - eliminates demeniralized dentin & associated unsupported & demeniralized enamel

- The preparation should be *initiated with the smallest instrument* (that will accomplish this limited preparation), such as a *No. 1/16 or 1/8 round bur*
  - *No bevel* should be placed on the occlusal margin
Preventive Resin Restorations (PRR)

- **No pulpal protection is needed**
  - (these restorations are limited in size & depth)

- **Areas that have extended into dentin**
  - (are filled with *post resin composites*)

- Prior to curing the **final increment, occlusal anatomy**
  - (is developed with a *hand instrument*)

- **Etching & application of dentin bonding agent**
  - (are the same as with other adhesive restorative procedures)
Preventive Resin Restorations (PRR)

- **If no adjustment is required**
  (sealant is placed over the resin composites, through remaining prepared or unprepared etched fissures, & cured)

- **If adjustment is required**
  (the entire fissure system, including the resin composite & its margins, should be re-etched & adhesive resin reapplied prior to sealant placement)

- **After completion of the restoration**
  (the RD is removed & correct occlusion verified or obtained)
Other class 1 resin composite restorations

When a Class 1 restoration is being placed due to *initial carious lesion*

The *PRR* is usually the technique of choice

If There was *a previous restoration*

The outline form & depth of the preparation will be determined by *previous restoration & any new pathosis*

Margins of occlusal preparations should not be beveled

Other class 2 resin composite restorations

As with preventive resin restorations

Class 2 restorations

Should be limited to

- obtaining access to the *carious dentin*, its removal,
- & the removal of any overlying *fragile & demeniralized enamel*
Class II resin composite restorations

- Prewedging
- Preparation
  - Use of cavity liners
  - Acid etching
- Application of bonding resin
  - Matrix application
- Resin composite placement
  - Finishing
- Rebonding & final cure
Class II resin composite restorations

- Prewedging
- Preparation
  - Acid etching
- Application of bonding resin
- Matrix appication
- Resin composite placement
- Finishing
- Rebonding & final cure
Class II resin composite restorations

- **Prewedging**
  
  *Placement of an interproximal wedge (at the start of the procedure)*

  is recommended to:
  
  - open the *contact with the adjacent tooth*
  - compensate for the *thickness of the matrix band*
  - protect the RD from damage & gingival tissue from laceration
  - reduce *leakage into the operative site*
  - promotes *more conservative preparation*
  - helps protect *adjacent teeth from damaging during preparation*
Class II resin composite restorations

- Preparation
- Use of cavity liners
  - Acid etching
- Application of bonding resin
- Matrix application
- Resin composite placement
- Finishing
- Rebonding & final cure
Class II resin composite restorations

- **Preparation**

  Preparation

  should be limited to

  - Eliminating *caries tooth structure*
  - & providing *access for restoration placement & finishing*

  *(areas of fissure caries lesions in the tooth, in addition to the proximal, should be treated separately)*
Class II resin composite restorations

- **Preparation**
  
  (following are recommendations regarding bevel placement in Class 2 preparations for posterior resin composite restorations)

  - **Facial & lingual proximal margins**
    
    Conservative bevels (0.5mm) at approx. a 45-degree angle
    
    (on the facial & lingual cavosurface margins) of the proximal box preparation
    
    this will
    
    - achieve the *benefits of beveling* (provides more area for acid etching & bonding)
    
    - aid in placing the *margin in a more accessible location* for finishing & polishing
Class II resin composite restorations

- **Preparation**
  - **Gingival margins**
    
    The gingival margin should be *beveled*

    only if

    - the margin is *well above the CEJ*
    - & an adequate *band of enamel remains*
Class II resin composite restorations

When the enamel is well above the CEJ

- Appropriate proximal cavosurface margin can be beveled

(gingival as well as facial & lingual vertical cavosurface margins are beveled)
Class II resin composite restorations

As the preparation nears the CEJ

- the enamel layer is thinner than in the other regions of the crown
- & beveling the preparation increases the potential for removing the little enamel that remains

Because of the presence of prismless enamel in this region, acid etching is often less effective

When cavity preparation approaches within approx. 1mm of CEJ, adhesion is essentially no better than bonding to dentin
Class II resin composite restorations

- **Preparation**
  - **Gingival margins**

  *Use of an inverse bevel, or so-called internal bevel (leaving enamel that is not supported by dentin at the gingival cavosurface margin)* has been shown to significantly reduce *microleakage* compared to a butt region.

  - & would be preferable to *placing the gingival margin on, or near, the CEJ*
Class II resin composite restorations

- **Preparation**
  - **Occlusal margins**

  *The use of occlusal cavosurface margin bevels* is not indicated

  *A normal preparation in the occlusal surface will result in end-cut enamel rods because of the orientation of the enamel rods in cuspial inclines*
Class II resin composite restorations

Avoidance of bevel on the occlusal surface

- Prevents the loss of sound tooth structure
- Decreases the surface area of the final restoration
- Lessens the chance of occlusal contact on the restoration
- Eliminates a thin area of composite that would be more susceptible to fracture
- Presents a well demarcated marginal periphery to which resin composite can more precisely finished
Class II resin composite restorations

- Prewedging
- Preparation
  - Use of cavity liners
- Application of bonding resin
- Matrix application
- Resin composite placement
- Finishing
- Rebonding & final cure
Class II resin composite restorations

- **Use of cavity liners**
  - *calcium hydroxide liner*
    - If used, should be limited to:
      - those areas of the preparation that are believed to be very close to the pulp, where there is the possibility of a minute pulp exposure

  **If the preservation is conservative in size, no liner is required in addition to adhesive agent**

- **Placement of a calcium hydroxide liner over an extensive area of dentin**
  - Provides no benefit to the pulp
  - Decreases the surface area for adhesion
  - Dissolution of the liner during acid etching can interfere with a sound bond to enamel & dentin
Class II resin composite restorations

- **Use of cavity liners**
  - *glass-ionomer*
    - may be beneficial
      - in deeper preparations & those in which the gingival margin approaches or extends beyond the CEJ

- **When used under posterior resin composites**
  - Bond to both tooth structure & overlying resin composites
  - Introduce *less polymerization stress* into tooth structure than does resin composite
  - Release fluoride into adjacent tooth structure
  - Improve *marginal integrity*
  - Decrease *marginal leakage*
Class II resin composite restorations

- Prewedging
- Preparation
- Acid etching
- Application of bonding resin
- Matrix application
- Resin composite placement
- Finishing
- Rebonding & final cure
Class II resin composite restorations

- **Acid etching**
  - 37% phosphoric acid
  - for 15 seconds
  - The enamel is examined for a frosted matte appearance to confirm proper enamel conditioning
Class II resin composite restorations

- Prewedging
- Preparation
- Application of cavity liners
  - Acid etching
- Application of bonding resin
- Resin composite placement
- Finishing
- Rebonding & final cure
Class II resin composite restorations

- Application of bonding resin

- **Primer**
  - Hydrophilic resin
    - contained in a volatile liquid carrier
  - After application
    - the carrier evaporates, leaving behind a very thin layer of resin

- **Adhesive**
  - Applied in a very thin layer & thinned further with a blotted brush
Class II resin composite restorations

- **Application of bonding resin**

  fifth-generation, or “single bottle,” adhesive systems,

  in which the primer & adhesive components have been combined,

  A different placement technique is required

  - *Air thinning* (needed to ensure adequate evaporation of the solvent)
  
  - *Additional applications* (recommended to maximize the bond to dentin)
Class II resin composite restorations

- Prewedging
- Preparation
- Cavity liners
- Application of bonding resin
- Matrix application
- Resin composite placement
- Finishing
- Rebonding & final cure
Class II resin composite restorations

- **Matrix application**

  Several useful matrices are available, including:
  - **clear plastic matrix**
  - *ultrathin* (0.001-inch) Toflemire metal matrix
    - *thin* (0.0015-inch) sectional matrix
  - & Toflemire metal matrix with photoetched-thinned (0.0005-inch) contact area
Can be used in conjunction with a light-reflecting wedge

- Allows penetration of the curing light from multiple directions
- Allows the clinician to cure the increments of composites from the proximal & gingival directions, rather than from the occlusal aspect only
- To ensure adequate polymerization of each increment
- Allows more favorable direction of the polymerization shrinkage

- The clear matrix is thicker than the thinnest metal matrices
- Its lack of rigidity makes placement through tight interproximal contacts difficult
- The rigidity & smoothness of the light-reflecting wedge makes it less effective in gaining the slight tooth separation
Ultrathin metal matrices

- Tight interproximal contacts are more easily developed with it
- Easier to place
- Maintain their shape better
- Can be burnished against the adjacent tooth (to avoid flat proximal surfacet contours)
- Increments must be initially cured from the occlusal aspect
Sectional matrix

*used with metal rings with springlike properties*

- After the sectional matrix & wedge are placed, the ring is placed using RD clamp forceps,
  - so that the vertical points are positioned in the facial & lingual embrasures adjacent to the box preparation
- The ring holds the end of the sectional matrix tightly against the tooth & exerts a continuous separation force between the teeth

- **Provide wedging** to ensure good interproximal contact
- **Provide better proximal contour** than traditional matrices
- **Simplify matrix placement** for single proximal surface restorations, compared to circumferential band
Sectional matrix

Another type
involves a short piece of thin, stainless steel matrix material

- That is contoured only occlusogingivally & does not surround the tooth at all
- The contoured matrix is secured with a wooden wedge & lies passively against the adjacent tooth surface or it held there with an instrument during curing of the first increment

- Allows some light curing from facial & lingual aspects
Class II resin composite restorations

- Preweding
- Preparation
- Cavity liners
- Acid etching
- Application of bonding resin
- Matrix application
- Resin composite placement
- Finishing
- Rebonding & final cure
Class II resin composite restorations

- **Resin composite placement:**
  
  *incremental technique*

  - Successive, laminated increments, to
    - Ensure curing
    - Decreases the effect of polymerization shrinkage
    - Enhances marginal adaptation
    - Decreases gap formation
    - Reduces marginal leakage
    - Decreases cuspal deformation
    - Makes the cusps more resistant to fracture
    - & decreases postoperative sensitivity
Class II resin composite restorations

- **First increment**
  - An increment *no more than 1.0 mm* is placed against the gingival floor
    - to ensure proper light irradiation throughout the increment
  - *A light, translucent shade* should be used in the box
    - to maximize polymerization
Class II resin composite restorations

- If a clear matrix & light-reflecting wedge are being used,
  - the initial curing should be directed through the flat end of the wedge

- If a metal matrix that surrounds the tooth has been chosen
  - All increment must be cured from the occlusal direction
  - After the metal matrix is removed
    - All proximal area of the restoration should receive additional light curing
Class II resin composite restorations

- **Subsequent increments**
  - should be placed in *thickness no greater than 2.0 mm*

- If *a surrounding metal matrix* is employed
  - An oblique layering technique should be used, & the restoration should be cured from the facial & lingual aspects after removal of the matrix
Class II resin composite restorations

- If *a clear matrix* is used
  - The oblique technique or a vertical technique should be used
Class II resin composite restorations

Resin composite placement:
An alternative to layering technique

- Conical light curing tip
- Prepolymerized resin composite “balls”
Class II resin composite restorations

- Resin composite placement: An alternative to layering technique
  - (The use of a conical light curing tip):
    - Conical tip is wedged into the resin composite
    - Used to apply pressure to the matrix band & push it against the adjacent tooth during curing
    - Subsequent increments restore the cone-shaped gap formed by the tip
  - Ensure adequate interproximal contact
  - Minimize the thickness of resin composite that the light must penetrate
Class II resin composite restorations

- **Resin composite placement: An alternative to layering technique**
  - *(the use of prepolymerized resin composite “balls”):*
    - A small, slightly flattened ball of composite is precured on the tip of an instrument.
    - An additional increment of uncured resin composite is placed into the proximal box.
    - The precured ball is pushed into this increment to wedge the matrix tightly against the adjacent tooth, then the resin composite is cured.
- Aid in *establishing interproximal contact*
Class II resin composite restorations

- Resin composite placement: incremental technique
  - Final increment
    - Careful control of the final increment
      - minimize the amount of finishing
    - After removal of the wedge & matrix:
      - The resin composite is cured from the facial & lingual aspects
        - To help ensure adequate polymerization throughout the entire restoration
Class II resin composite restorations

- Prewedging
- Preparation
- Use of cavity liners
- Acid etching
- Application of bonding resin
- Matrix application
- Resin composite placement
- Finishing
- Rebonding & final cure
Class II resin composite restorations

- **Finishing**
  - *Placement procedures that minimize the need for finishing*, should be used
  - *The smoothest surface that can be obtained* is that of
    - unfinished resin composite that has been cured against a smooth matrix
  - Finishing & polishing procedures are inherently
    - *Destructive* to the restoration surface
    - & may result in the formation of *microcracks* below the surface
      - Because cracks may also produced or exacerbated during mastication, the fracture toughness may be significantly reduced by destructive finishing techniques
Class II resin composite restorations

- **Finishing & polishing**
  - Similar to that used with other composites
    - A No. 12 or 12b *scalpel blade*
    - Sharp No. 14L *carvers*
    - Weldelstaedt *chisel* or other thin, sharp-edged hand instrument
      - *Removing flash* from the proximal & gingival margins
      - & for *shaping proximal surfaces*
Class II resin composite restorations

- **Finishing & polishing**
  - Successively finer grits & *polishing points, cups or discs*
    - Finish & blend the composite material to the tooth
  - *Aluminum oxide disks*
    - Restoration *contours that are relatively flat or convex* (e.g. facial & lingual proximal embrasure areas)
  - *Multifluted carbide finishing burs or fine diamonds*
    - Shaping & finishing of *occlusal surfaces*
Class II resin composite restorations

- **Finishing & polishing**
  - Rubber or silicone disks, points & cups, impregnated with aluminum oxide
    - Smooth the composite surface after initial finishing
  - Finishing strips coated with aluminum oxide
    - Finish proximal surfaces
  - Rubber prophylaxis cup with aluminum oxide
    - The final high polish
## Class II resin composite restorations

- Prewedging
- Preparation
- Use of cavity liners
- Acid etching
- Application of bonding resin
- Matrix application
- Resin composite placement
- Finishing
- Rebonding & final cure
Class II resin composite restorations

- **Rebonding & final cure**
  - *Rebonding* (the application of a low-viscosity resin to the finished surface & margins of a restoration)
    - May be performed yearly for maximal effectiveness
    - Improve the *marginal integrity* of resin composite restorations
    - Reduce *microleakage*
    - Reduce *marginal staining*
    - Reduce *wear* & prolong *marginal integrity*
Class II resin composite restorations

- **Rebonding & final cure**
  - **Method**
    - Phosphoric acid is usually applied to the marginal areas for 10 seconds, rinsed off, & the area thoroughly dried.
    - The rebonding resin is applied, thinned with a blotted brush or applicator, & light cured for 20 to 40 seconds.
    - To prevent the rebonding resin from joining the restored teeth to the adjacent teeth:
      - A piece of matrix may be placed interproximally prior to the performing of the rebonding procedure
      - Alternatively, floss is passed through the interproximal contacts before curing of the rebonding resin
The Tunnel Restoration

- An alternative to the traditional approach for gaining access to proximal carious dentin
- First suggested by Jinks in 1963, then modified later by Hunt (1994) & Knight (1984)

- Advantages
- Disadvantages
- Indications & contraindications
- Restoration
The Tunnel Restoration

- Access is made in the occlusal fossa adjacent to the marginal ridge.

- A “tunnel” is made under the marginal ridge to the carious dentin (usually just below the interproximal contact).
The Tunnel Restoration

- Tunnel preparation (access opening)
- Tunnel restoration. Occlusal fissures have been sealed
The Tunnel Restoration

**Advantages**
- Less potential for a restorative *overhang*
- *Destruction of tooth structure* is minimized
  - Less potential for *microleakage*
  - Reduced potential for *disturbance for the adjacent tooth*

**Disadvantages**
- *Difficult* procedure
- Demanding careful *control of the preparation by the operator*
  - Decreased *visibility*
  - More *uncertain removal of carious* dentin
- The concern that the *marginal ridge is undermined & its strength* reduced (the most common causes of restoration failure are fracture & secondary caries)
The Tunnel Restoration

**Indications**

- Should be *limited to* those patients with *high esthetic demands* & a low *caries index*, who exhibit small, non-cavitated proximal caries lesions that can be removed without penetrating the proximal surface.

**Contraindications**

- Should be *avoided when* large carious lesions are diagnosed, where *access is particularly difficult*, or when the overlying marginal ridge is subject to *heavy occlusal loads or demonstrates a crack*.
The Tunnel Restoration

**Glass ionomer**
- was the material of choice
  - Because of their radiopacity & fluoride release

**Resin-modified glass ionomer**
- are the current material of choice for this restoration
  - They are radiopaque
  - & have been shown to prevent microleakage
  - But, have more probability to fail under occlusal stress

**Resin composites**
- More wear resistant than glass ionomer
- May help to increase the fracture resistance of the restored teeth

The occlusal 1.5 to 2.0 mm of the preparation should be filled with a VLC resin composite.
THANK YOU