

FINISHING AND POLISHING OF DIRECT POSTERIOR RESIN RESTORATIONS

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Direct composite resin materials have revolutionized the delivery of minimally invasive treatment in the posterior region. Contemporary resin formulations provide improved strength, wear resistance, and aesthetics. Microhybrid formulations have also been associated with enhanced polishability. Development of an optimal surface polish in turn reduces stain and plaque accumulation, minimizes wear, and enhances the appearance of the definitive restoration. This article presents a simplified technique and protocol for finishing and polishing composite resin materials following restoration of the posterior region.

Learning Objectives:

This article discusses techniques and a protocol for finishing and polishing posterior direct resin restorations. Upon reading this article, the reader should:

- Understand the clinical protocol necessary to create direct posterior resin restorations that require minimal finishing.
- Be able to select appropriate instrumentation for direct posterior resin finishing and polishing procedures.
- Understand the importance of correct finishing and polishing on plaque accumulation, stain resistance, and wear resistance.

Key Words: ??????

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Direct posterior resin restorations continue to increase in popularity as functional, aesthetic alternatives to amalgam. This patient-driven change in posterior restorations has led to the development of a new generation of microhybrid composites that exhibit increased strength, better handling characteristics, improved polishability, and enhanced aesthetics. The decreased range and average particle size and their distribution in the resin matrix have increased the polishability of composite restorations without sacrificing strength. Clinicians using these materials can create predictable and aesthetic restorations in posterior stress-bearing areas that exhibit long-term durability,¹ as well as a high degree of surface anatomy and luster. When properly manipulated and finished, microhybrid resins can achieve a level of polishability approaching the surface texture of natural enamel substrate.²

Proper treatment planning for direct resin restoration includes strict adherence to clinical technique as well as proper armamentarium. The continued maintenance of the restoration's color and stain-free appearance, as well as the health of the adjacent gingival tissue, should be regarded as necessary objectives. The prevention of both stain and plaque accumulation requires proper design, placement, and contouring of the composite restoration. Resulting external resin surfaces must be hygienically accessible, smooth, and stain resistant. Residual rough surfaces or inadequately finished margins will accelerate the accumulation of plaque,^{3,4} increase staining,^{5,6} and elevate the risk of recurrent caries.

The ideal completed posterior direct resin restoration requires minimal finishing and polishing. Margins and contours should be biocompatible with the adjacent dentition and soft tissues. The conservative and aesthetic nature of direct resin often permits supragingival margins not possible with other restorative materials, making the margins accessible for proper hygiene and less prone to inflammation.⁷ Development of an optimal surface polish will also reduce stain and plaque accumulation, minimize wear, and enhance aesthetics.

The effects of inadequate or iatrogenic finishing and polishing on the physical characteristics of posterior direct resin restorations is pronounced. Even minimal mechanical finishing causes trauma to the resin surface. Incorrect or inadequate surface texture influences light reflection and refraction, causing alterations in shade perception and matching.⁸ Vibration and heat caused by finishing instruments can create microcracks along the resin surface. Increased surface roughness decreases long-term wear resistance of posterior direct resin restorations.^{9,10}



Figure 1. Preoperative occlusal view of the pre-existing, defective amalgam restoration.



Figure 2. The compromised tooth structures were prepared with a continuous cavosurface bevel design.



Figure 3. Matrices were placed with the notch cut to the height of the adjacent marginal ridge.



Figure 4. The proximal wall was formed with an enamel shade during the centripetal buildup.



Figure 5. An initial dentinal increment was placed and the primary anatomy was sculpted.



Figure 6. The lingual enamel increment was placed following fossa characterization.



Figure 7. Buccal enamel margins were smoothed with an artist's brush.



Figure 8. Glycerin gel was placed over completed restoration prior to final light curing.

Minimizing finishing and subsequent trauma to the resin surface is critical. This can initially be addressed by diligence during the restorative process itself. Attention to detail and a meticulous technique minimize the need for subsequent finishing. The ideal direct resin restoration would require no finishing or polishing once completed. Since most operative conditions are less than ideal, minor finishing requirements must be addressed. Various instruments (eg, diamond burs, carbide burs, polishing disks, diamond-impregnated rubber points, polishing pastes) are available for sequential finishing and polishing.¹¹⁻¹⁹ There is some disagreement among clinicians and researchers as to the most effective sequence and media to use in achieving the ideal polished resin surface. This article discusses general guidelines for sequentially finishing and polishing both proximal and occlusal surfaces of posterior direct resin restorations.

Clinical Protocol

A complete and thorough radiographic, photographic, and clinical examination must precede discussion of the patient's treatment alternatives. The relative advantages and disadvantages of posterior direct resin restorations must be thoroughly discussed with the patient. Once patient goals and expectations have been assessed, treatment can be initiated.

Proper occlusal and proximal morphology of the final resin restoration is paramount in minimizing finishing and polishing. Creating a restoration that is in harmony with the existing dentition and occlusion eliminates excessive postoperative finishing.

Overcontouring is one of the most common errors in fabrication of direct resin restorations. As a result, intricate anatomy and detailed color are compromised during occlusal adjustment and reduction. Marginal and surface integrity are jeopardized,²⁰ and finishing is significantly increased as compared to resins built to contour. To prevent overcontouring, three parameters of occlusion must be observed. The occlusal surface and anatomy of the existing restoration must be carefully inspected, and the adjacent teeth must also be evaluated. The patient's opposing dentition and overall occlusion should also be observed. These parameters provide the clinician with guidelines for the final contours and anatomy of the direct resin restorations.

Proper shade selection is necessary prior to isolation in order to ensure aesthetic harmony (Figure 1). A prefabricated or custom-fabricated shade guide may be used. Examining the cervical third of adjacent or contralateral teeth will indicate the appropriate dentin shade.



Figure 9. A finishing disk was used to open the interproximal embrasures with the matrix remaining to protect the adjacent marginal ridge.



Figure 10. The gingival margins were finished and excess resin was removed with a 12B scalpel.

Careful inspection of the occlusal third will indicate enamel shade, translucency, fossa color, and any maverick colors or characterization. The selected shades may be verified by placing a small unetched button of composite on the buccal surface, light curing for 5 seconds, then comparing it to the natural cervical and occlusal hues. The composite buttons can then be removed with an explorer tip.

Rubber dam isolation is critical to prevent moisture interference or contamination with the intricate adhesive process.²¹ Floss ligatures are placed circumferentially on teeth to be restored proximally in order to invert the rubber dam further apically. The existing amalgam restoration can then be removed with a carbide bur or diamond bur with copious water spray. Any existing decay should be removed with sequentially smaller slow-speed round burs, beginning with #8. Cavosurface margins are subsequently beveled with a fine diamond to optimize etching of the enamel rods (Figure 2).^{22,23}

The Class II posterior direct resin restoration is the most challenging due to the operative intricacy of the proximal precinct.²⁴ The primary challenge is to create a functional, predictable proximal contact that emulates the physiological ideal. The complex and multifactorial structures to be restored must be performed within an operative site that is difficult to access. Proper finishing and polishing of the final resin restoration is more challenging due to the same limited access and visibility. The restoration of proper physiological form is critical to long-term restorative success.

There are a variety of matrix systems available to assist in the restoration of physiological form in the proximal area. Metal matrices are generally preferred to reduce the amount of excess resin material buildup at the restorative margins.²⁵ In situations where the contact



Figure 11. A narrow (2-mm) fine-grit interproximal finish strip was used to finish the apical convex areas.

area is not ideally suited to restoration with standard matrices, various proximal contact formers may be used.

When using a matrix band, the marginal ridge heights of the adjacent teeth must be observed. Overcontouring of the marginal ridges will result in subsequent overcontouring of the entire restoration. To ensure proper visibility, a notch may be cut in the matrix band using a high-speed bur to approximate the height of the adjacent marginal ridge (Figure 3).

Once the matrix band is properly placed, the adhesive process can be initiated and completed according to manufacturer's specifications. Initiation of the incremental buildup begins with the application of a flowable resin (Tetric Flow, Ivoclar Vivadent, Amherst, NY) to the base of the preparation.²⁶ An explorer tip should be used to manipulate a thin layer evenly across the pulpal floor and proximal walls. Additionally, flowable resin can be drawn along the margins of the proximal box and light cured.

The enamel shade of composite (Vit-escence Pearl Frost, Ultradent Products, South Jordan, UT; Esthet-x, Dentsply Caulk, Milford, DE) is placed along the proximal wall



Figure 12. A super-fine finishing diamond was used to remove excess resin on the occlusal surface.



Figure 14. A surface-penetrating sealant was placed once acid etching was completed.



Figure 13. A diamond-impregnated brush was used to polish the occlusal surfaces.

in a centripetal buildup technique (Figure 4).²⁷ The resin is manipulated to the height of the cutout in the matrix band and soft-cured.²⁸⁻³⁰ The matrix ring is removed, and the band reflected back to protect the adjacent tooth during proximal finishing. The clinician now has essentially a Class I restoration to complete.

The dentin shade of composite (Vit-escence Pearl Frost, Ultradent Products, South Jordan, UT; Esthet-x, Dentsply Caulk, Milford, DE) is manipulated and soft-cured incrementally to within 1 mm of the cavosurface margin.^{31,32} The resin layers are soft-cured to reduce stresses from polymerization shrinkage. Excess stresses along the cavosurface margins can induce the formation of microgaps, which manifest as “white lines” at the enamel-composite interface. Microgaps at the marginal interface cannot be properly finished and can lead to microleakage. Care is taken during the restorative process not to directly connect the buccal and lingual cusps with one increment of composite prior to polymerization. Polymerization shrinkage of such increments can induce additional stress within the tooth.

The general anatomy and morphology of the final restoration is reflected in the primary anatomy of the dentinal resin (Figure 5). Any characterization, tints, or fossa colors the patient desires can be added after the dentin buildup. Microcannula tips can be used to place color in precise amounts. Artist’s brushes are used to remove color and accentuate cusp ridge characterization.

The occlusal portion of the restoration is restored with the same enamel resin shade as the proximal wall. Resin is placed in increments equal to the number of primary cusps. For the maxillary second premolar, the lingual increment is placed first (Figure 6). A composite instrument (Compo Sculpt, Suter Dental Manufacturing, Chico, California) is used to shape the resin and define anatomy. If necessary, a filled resin can be used as a wetting agent to aid in the placement and manipulation of resin. Use of unfilled resin will result in a loss of surface gloss in the final restoration.³³ A fine artist’s brush is used to feather each increment across the cavosurface margin and remove excess resin. The lingual increment is soft curved. The buccal increment is carefully placed and sculpted to form (Figure 7). A composite instrument (Mallifer #10 Micro-opener, Dentsply Caulk, Milford, DE) is used to separate the buccal and lingual resin masses. A small amount of enamel resin or flowable composite can then be used to fill any voids in the central fossa.

Conversion of the air-inhibited layer to a smooth, cured surface is achieved by placing a clear water-soluble gel over the resin surface (Figure 8). The gel must not interfere with the transmission of light and have no adverse chemical effect on the surface of the composite.³⁴ The restoration is then fully cured through the buccal, occlusal, and lingual surfaces.



Figure 15. Postoperative appearance of the posterior direct resin restoration exhibits replacement of natural morphology and lustrous surface finish.

While an ideal restoration would require no postoperative finishing or polishing proximal refinements, small occlusal adjustments are often necessary. A series of proximal finishing disks (Flexidises Cosmedent, Chicago, Illinois), can be used to contour the marginal ridge and polish the proximal areas (Figure 9). The remaining metal matrix protects the adjacent marginal ridge from iatrogenic finishing and adjustments. The slowly rotating curved disks impart a natural rounded finish to the finished marginal ridge. Disks can be used without water at slow speeds with a light, intermittent touch to enhance visibility.³³ The polishing side of the finishing disk can be oriented to allow the clinician access from different angles. Medium and fine grits are used to contour and polish the interproximal embrasures and the marginal ridge.

A 12B scalpel should then be employed to remove any excess or unbonded resin from the proximal area (Figure 10). Overcontoured resin is carefully removed from the facial and lingual interproximal embrasures. The curved tip of the blade is used to feather the gingival cavosurface margin of the proximal box. The scalpel's fine tip is the ideal instrument in cases where the margin of the proximal box extends into an area where the natural anatomy becomes concave. The natural morphology of the marginal ridge and proximal contact area are sculpted to ideal form.

Any additional polishing can be performed with a narrow fine diamond abrasive strip in the embrasure area (Figure 11). The 2-mm-wide strip can be passed through the contact area apical to the gingival margin. Care must be taken not to tear the rubber dam or roughen the adjacent root surface. Polishing strips will only function properly in areas where the surface to be finished is convex or flat.

Final occlusal adjustments of excess resin can be made with an egg-shaped fine diamond finishing bur (eg, PoGo, Dentsply Caulk, Milford, DE; Neo Diamond #3900VF, Microcopy, Kennesaw, GA) with high water spray (Figure 12). Heating the resin surface above 200° F may cause degradation of the resin surface and jeopardize marginal integrity. Ideally, the bur should be used at the low range of an electric high-speed handpiece to maximize tactile sense. Diamond finishing burs are suggested to enable the clinician to selectively sculpt away excess resin without significantly affecting marginal integrity. Superfine egg-shaped carbide fluted burs with water spray should only be used to adjust minute areas. Carbides have less tactile sense than diamonds, are more difficult to control, and tend to chatter the resin surface.

Composite polishing cups and points are used to polish the previously adjusted areas only, using light, intermittent touches to prevent loss of anatomy and surface morphology. A diamond-impregnated polishing brush (Jiffy Brush, Ultradent Products, South Jordan, UT) is used to give a high luster to the occlusal surface.³⁴ The fine bristles can reach into concave surfaces and areas where cups and points are too cumbersome to reach (Figure 13).

Once the rubber dam is removed, occlusion can be verified in centric and exclusive movements. Minor occlusal adjustments can be made to any specific areas with an egg-shaped carbide bur with high water spray, followed by a diamond-impregnated polishing brush (Jiffy Brush, Ultradent Products, South Jordan, UT).

Controversy exists regarding the use of surface sealants as the last step in polishing. Although long-term studies are not currently available to discuss the efficacy of these materials and their effects on the resin surface, short-term studies have shown that microcracks caused by the trauma of finishing procedures are resealed.³⁵ Given that microcracks, particularly at the cavosurface margins, can propagate over time, it is logical that the use of surface sealants postoperatively may decrease the surface wear and increase the longevity of direct resin restorations. Traditional surface sealants (Fortify, Bisco Dental Products, Schaumburg, IL; Permascal, Ultradent Products, South Jordan, UT) have an oxygen-inhibited layer remaining after light curing, which then must be cured or removed. A new acrylate-based, light-cured surface sealant and glaze (BisCover, Bisco Dental Products, Schaumburg, IL) has been developed that does not produce an oxygen-inhibited layer.³⁵ It can be placed on the enamel layer of partially cured composite resin to interact with the existing oxygen-inhibition layer and

prevent its formation. If the restoration has been fully cured and polished, it can be placed as a surface sealant after acid etching to fill any microcracks and will cure without an oxygen-inhibited layer (Figure 14).

Conclusion

After proper finishing and polishing, the final posterior direct resin restoration replicates natural occlusal and proximal morphology (Figure 15). The highly polished resin surface resists staining and plaque accumulation. Proper interproximal embrasures and cavosurface margins increase cleansibility and promote restorative success. By developing a smooth surface following restoration with direct composite resins, the clinician can ensure development of an aesthetic, durable, and functional result, that will further increase patient satisfaction and the longevity of the restoration.

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CONTINUING EDUCATION (CE) EXERCISE No. X



To submit your CE Exercise answers, please use the answer sheet found within the CE Editorial Section of this issue and complete as follows: 1) Identify the article; 2) Place an X in the appropriate box for each question of each exercise; 3) Clip answer sheet from the page and mail it to the CE Department at Montage Media Corporation. For further instructions, please refer to the CE Editorial Section.

The 10 multiple-choice questions for this Continuing Education (CE) exercise are based on the article "Finishing and polishing of direct posterior resin restorations," by Michael Morgan, DDS. This article is on Pages 211-216.

1. Rubber dam isolation is:

- a. Never required during direct restoration.
- b. Mandatory to achieve proper isolation.
- c. Ineffective in moisture prevention.
- d. Required to facilitate placement of floss ligatures.

2. Proper shade selection:

- a. Is required prior to tooth isolation.
- b. Can be performed using a prefabricated or custom resin shade guide.
- c. Can be ensured by examining the cervical third of adjacent or contralateral teeth.
- d. All of the above.

3. Incorrect surface polishing can result in:

- a. Reduced microcracks.
- b. Reduced surface roughness.
- c. Decreased long-term wear resistance for posterior direct resin restorations.
- d. All of the above.

4. When restoring Class II defects in the posterior region:

- a. The primary challenge is the creation of a functional, predictable proximal contact.
- b. Restoration of the multifactorial structures to be restored is performed within an easily accessible operative site.
- c. Proper finishing and polishing is facilitated due to the increased access and visibility within the operative field.
- d. None of the above.

5. The dentin shade of composite should be:

- a. Soft-cured incrementally to within 1 mm of the cavosurface margin.
- b. Cured to eliminate excess stresses along the cavosurface margins, thus limiting development of microgaps.
- c. Incrementally layered to eliminate white lines at the enamel-composite interface.
- d. All of the above.

6. The use of a surface sealant as the last step of polishing:

- a. Has demonstrated long-term efficacy on the resin surface.
- b. Reseals microcracks caused during finishing procedures.
- c. May decrease surface wear and increase the longevity of direct resin restorations.
- d. Both b and c are correct.

7. Occlusal and proximal morphology of the definitive resin restoration:

- a. Should be properly developed to minimize finishing and polishing.
- b. Eliminates excessive finishing after placement.
- c. Should not be overcontoured.
- d. All of the above.

8. Intricate anatomy and detailed color:

- a. Can be compromised by overcontouring of the restoration.
- b. Can be developed during occlusal adjustment and reduction.
- c. Can be enhanced by additional finishing to ensure marginal and surface integrity.
- d. None of the above.

9. Based on the procedures outlined in this article, placement of a matrix band should be:

- a. Placed to ensure proper overcontouring of the marginal ridge.
- b. Performed prior to the adhesive process.
- c. Without placement of a guide to approximate the height of the adjacent marginal ridge.
- d. Following the placement of flowable resin along the margins of the proximal box.

10. Ideal posterior direct resin restorations should:

- a. Require minimal finishing and polishing.
- b. Never contain supragingival margins.
- c. Only be used as a provisional option.
- d. None of the above.