Maintaining Esthetic Restorations in the Periodontal Practice

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Esthetic dentistry comprises one of the most rapidly growing segments of our profession, and patients receiving this type of treatment are often maintained on an alternating schedule. Improper maintenance care can quickly destroy many of these restorations. This article will serve as a resource for dental professionals who wish to offer these special patients customized maintenance care. (Int J Periodont Rest Dent 1996;16:231–239.)

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Patients with esthetic restorations have special maintenance needs that often are not addressed during routine periodontal supportive treatment. Absolute protection of cosmetic restorations must be assured during maintenance visits, yet the explosion of new varieties of dental materials renders the task of devising a customized maintenance routine a time-consuming and complex effort, even for the well-informed dental professional. Nevertheless, the responsibility for maintaining the esthetic restoration falls on each member that enters into the maintenance program—not only on the restorative dentist, but the patient and periodontist as well. Periodontal professionals whose primary focus is the preservation of the supporting structures of the teeth need well-organized information about the latest esthetic dental materials and their maintenance requirements. It is our intention that this article serve as that resource.

Fig 1 *Indirect resin veneers wrap around the tooth to reinforce and lengthen the tooth. The margin that is particularly vulnerable to maintenance care will be found on the incisal half of the lingual surface.*

Esthetic restorative materials and terms

A thorough understanding of the following materials and terms will assist the periodontal professional in devising a successful maintenance program:

1. Resin: an organic paste, filled or unfilled. Filled resins contain glass or silica filler particles; unfilled resins contain no filler particles and are used to bond porcelain and indirect veneers and for fissure sealants.
2. Composites: filled resins that can be chemically cured, light cured, or light activated and chemically cured (dual cure). The three types of composites are hybrids, microfills, and small particle composites. (Small particle composites are no longer being used clinically, but may be found in existing restorations.)
3. Hybrid composites: a mix of microfill and macrofill particles suspended in resin that can be used in both posterior and anterior teeth.
4. Microfill composites: composites that have very finely ground silica for filler material and may be polished to very high luster, but tend to be brittle. They are usually reserved for anterior teeth.
5. Bonding: physical or chemical adherence of a restorative material to enamel, dentin, or another restorative material.
6. Direct resin veneers: composite material applied to the tooth's facial or buccal surface. Direct veneers stain more easily than indirect veneers, lose their anatomy faster, and have less resilience to thermocycling.
7. Indirect resin veneers: composites fabricated from a model of prepared teeth, then baked at high temperatures. They are more dense than direct veneers and thus less likely to stain. Indirect resin veneers can wrap around the incisal edge to cover one third of the lingual surface. They are bonded with resin cement (Fig 1).
8. Ceramics: compounds containing a metal (one or more) plus a nonmetal (usually oxygen) which yield stable substances that are strong, hard, brittle, and inert conductors of thermal and electric energy.
9. Porcelain veneers: thin ceramic material bonded to facial or buccal surfaces of teeth.

Maintenance of esthetic restorations

A general discussion of the maintenance of ceramic and composite restorations will precede a detailed description of suggested sequential steps to be used in routine cleaning and polishing. The authors have summarized these steps in a flow chart (Fig 2).

Maintenance of Ceramic and Resin Restorations

1. Always use curettes to debride the restoration.
2. Polish 15 to 30 seconds with porcelain polishing paste when only porcelain is exposed. Polish with aluminum oxide paste on resin restorations or on porcelain restorations when resin cement or cementum is exposed.
3. Carry paste interproximally with floss and polish.
4. Rinse and inspect.

If there is no stain, go to step 5.

Light stain

Porcelain

A. Polish for 30 seconds with Ceramiste Ultracup (Shofu).
B. Polish for 30 seconds with Ultracup II.
C. Begin with Ultra Ceramiste Midi-points and graduate to Ultra II. Polish with each for 30 seconds.
D. Polish with porcelain polishing paste.

Light stain

Resin cement

A. Polish for 30 seconds with aluminum oxide paste.
B. Smooth with medium carbide blade interproximal angle (Profin).
C. Protect gingiva. Apply composite whitening agent. Polish for 30 to 60 seconds.

Light stain

Composite restorations

A. Polish occlusal with pear-shaped finisher followed by a rubber polishing instrument.
B. Polish facial and lingual with a cup-shaped polishing instrument.
C. Polish with aluminum oxide polishing paste for 30 seconds.

Heavy stain on porcelain, composite restorations, and resin cement

A. Medium-grit aluminum oxide disk 10 to 15 seconds.
B. Fine-grit aluminum oxide disk 10 to 15 seconds.
C. Extra fine aluminum oxide disk 10 to 15 seconds.
D. Polish porcelain with porcelain polishing paste. Polish composite restorations and resin cement with aluminum oxide polishing paste and carry interproximally with floss.

Interproximal stain

A. Aluminum oxide finishing strips. Start with the finest grade and graduate to the next coarsest grade until stain is removed, then reverse the process and graduate to the finest grade until the restoration is smooth.

5. Apply sodium monofluorophosphate fluoride.

Fig 2

Ceramic restorations

Ceramic restorations are the most susceptible to stain in two main areas—the resin cement line and areas on the restoration where the dentist was required to "finish in the mouth." For porcelain veneers, only meticulous homecare and professional maintenance will prevent staining. The exposed resin cement at the margin will wear at a higher rate in ceramic inlays and onlays than in the porcelain, and will eventually lead to open margins that also require meticulous maintenance. Careful polishing is especially important for cast ceramics such as Dicor (Dentsply) that have color applied to the surface.

Composite restorations

Maintenance success of a composite depends on its ability to keep the marginal seal determined by the initial adaptation of the material to the cavity walls of the preparation. During the life of the composite, thermocycling and plucking of filler particles result in voids and tags in the material, which lead to plaque build-up and subsequent softening of the composite. The best maintenance regimen for composites includes polishing with aluminum oxide polishing paste every 3 or 4 months.

Microfill composites require careful treatment. The clinician must first locate the tooth-microfill margin to avoid scratching or ditching this area. In restorations of fractured anterior teeth or diastema closures in which only part of the tooth is microfill composite, the whole tooth should be treated as though it were composite. The entire tooth should be polished with aluminum oxide polishing paste, or, for teeth with excess stain, rubber polishing cups or aluminum oxide disks.

Posterior composites, challenged further by masticatory stress, are at risk for increased surface roughness. Annual polishing with rubber aluminum oxide-impregnated polishing cups, discs, or points is recommended.

Differentiation of ceramics from composite restorations

To differentiate a porcelain restoration from composite or enamel, gently run an explorer over the tooth's surface. The composite restoration will feel softer than enamel's hard surface. When an explorer glides over a porcelain veneer, a "scratchy sensation," which is unlike composite or enamel, can be felt and heard. A porcelain veneer's hardness mimics enamel and is much harder than the surface of composite restorations (Fig 3). Proper maintenance procedures depend on this differentiation, because porcelain is polished differently than composite material (Figs 4a and 4b).

Clinical tip. Label the chart with a "Porcelain Veneer" or "Composite Veneer" alert.

Routine cleaning and polishing of ceramic and composite restorations

Clinical tip. Use at least 2-power magnification for routine cleaning and polishing. Porcelain and resin cements can develop tiny cracks that are difficult to see without magnification. In addition, magnification helps the clinician detect the margins of these restorations.

1. Debride with curettes, which offer the tactile sensitivity necessary for the clinician to clean porcelain and composite restorations without scratching the material (Fig 5). Hand scalers and sonic or ultrasonic scalers can scratch the glaze of porcelain and composites.[1]
   Clinical tip. When porcelain has become roughened through occlusal wear, polish with an Ultracup II (Shofu) for 15 to 30 seconds prior to moving on to Step 2.
2. Polish porcelain veneers with porcelain polishing paste, unless resin cement

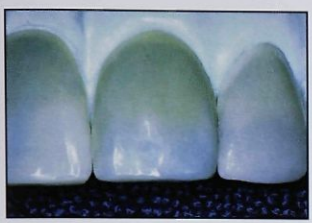

Fig 3 *The central incisor is a microfill indirect veneer; the lateral is a porcelain veneer. Tactile sensitivity is necessary to distinguish one from the other. This differentiation is essential in proper maintenance care.*

Fig 4a *Fractured maxillary central and lateral incisors.*

Fig 4b *Same teeth as in Fig 4a following restoration with microfill composites. Note how difficult it is to identify the restoration and how quickly it could be destroyed by improper maintenance.*

Fig 5 *Curettes are the best instruments to remove plaque from porcelain restorations without scratching them.*

Fig 6 *Polish each restoration for 15 to 30 seconds.*

Fig 7 *Carry the polishing paste interproximally with floss.*

or cementum is exposed. If either of the latter conditions exist, or if veneers are composite, use aluminum oxide polishing paste, a product safe for use on composites and porcelain. Apply the paste with a cotton tip applicator directly to the restoration.

3. Place a drop of water in the rubber cup and polish each restoration thoroughly for 15 to 30 seconds (Fig 6).
4. Carry paste interproximally with floss (Fig 7).
5. Wash and dry the teeth and inspect for stain.
6. Apply sodium monofluorophosphate fluoride following manufacturer's instructions.[2] (Acidulated phosphate fluoride can etch porcelain and composites.)

Removing stain

Removing light stain on porcelain

This technique is to be used when the porcelain, not the resin cement, is stained. Porcelain rubber polishing instruments, slightly harder than composite rubber polishing instruments, come in three grades. The two finest are used in this procedure.

1. For facial or lingual surfaces, start with the rubber polishing instruments (Ceramiste Ultracup) which are especially helpful for margins with light stain. Use the cup on a dry tooth for 30 seconds. Carefully inspect the tooth visually and with an explorer for stain and roughness.
2. Polish with the Ultracup II for 30 seconds.
3. For lingual, incisal, or occlusal surfaces, start with the Ceramiste Ultra Midi-points (Shofu). Begin with the Ultra and graduate up to the Ultra II. Polish with each for 30 seconds.
   Clinical tip. Always use light, uniform strokes with rubber polishing instruments. Too much pressure can overheat the restoration and the tooth.
4. Apply the porcelain polishing paste and polish thoroughly for 30 seconds with a rubber cup. If strips or disks went interproximally, carry the paste in those areas with floss.
5. Dry the tooth and carefully inspect the restoration. You are finished if there is no stain.

Removing light stain on resin cement

Stain on the resin cement surrounding the porcelain veneer can be removed by composite whitening agents and interproximal polishing angles (Profin, Weismann Technology) (Fig 8).

1. Thoroughly clean the entire area with a rubber cup and aluminum oxide polishing paste.
2. Remove composite tags and smooth with a medium carbide blade on the Profin instrument. Check for smoothness with an explorer (some of the stain may be left). Rinse thoroughly.
3. Protect the gingiva with a gingival protectant (Brite-Smile). Apply composite whitening agent (Accel Advantage, Brite-Smile) with a cotton tip applicator. Polish with rubber cup for 30 to 60 seconds. Rinse thoroughly.
4. Polish resin cement with aluminum oxide polishing paste.

Removing light stain on composite restorations

The following maintenance procedures are used if there is stain on the margins or line angles after polishing with aluminum oxide polishing paste. Composite rubber polishing instruments incorporate aluminum oxide into a soft rubber and are available in a variety of shapes easily adaptable to every surface. These save an extra step (compared to the disks) because they come in only two grits: finishers and polishers. The finishers remove surface irregularities, tags, and light stain. The polishers leave the restoration as smooth as possible.

1. A pointed or pear-shaped finisher should be used for occlusal surfaces and embrasures. Next the polishing point is used to leave the restoration as smooth as possible. Use a light, uniform stroke. Too much pressure can overheat the restoration and the tooth. Rinse thoroughly. Carefully examine the tooth to ensure a smooth surface that is free of stain.
2. For facial surfaces, use the cup-shaped instrument. Cups can also be used on the lingual surfaces of posterior teeth.
3. Polish again for 30 seconds with aluminum oxide polishing paste and floss interproximally. Rinse well with water.

Removal of medium stain

Medium stain or roughness can be removed from the interproximal aspects of porcelain restorations, on composite restorations, and on resin cement with aluminum oxide polishing strips. Carefully insert the plastic middle portion of the strip (which is not abrasive) into the embrasure so the contact is not opened. Start with the finest grade. If this does not remove the stain, graduate to the next coarsest grade. Continue this process until the stain is removed. Then graduate back to the finest grade to leave the restoration as smooth as possible. The coarsest grade of the strip should not be used for stain removal as it can open the contact or embrasure.

Removal of heavy stain

This technique is often used when porcelain and composite restorations and resin cement are stained and damaged from previous use of an air-abrasive polisher, a sonic or ultrasonic scaler, or a coarse polishing paste.

Heavy stain found outside the proximal areas, including embrasures, can be removed with aluminum oxide disks (Fig 9). Most disks come in two sizes and four grits: coarse, medium, fine, and extra-fine (coarse disks are not recommended for this procedure). These disks should be used only after the operator has been carefully trained. Improper use could destroy the restoration and ditch the resin cement.

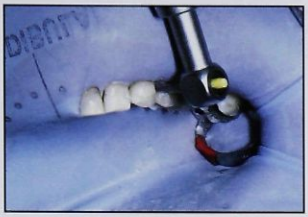

Fig 8 *Profin handpiece oscillates from lingual to facial sides to remove overhanging margins and stain from restorations. The handpiece is available in carbide and diamond blades with one smooth side that permits access interproximally and subgingivally to a limited degree.*

Fig 9 *Aluminum oxide disk removes stain and smoothes and polishes restorations at gingival margins, proximal areas, and incisal areas. Protect the tissue with a plastic instrument (shown).*

1. Begin with the medium aluminum oxide polishing disk. Protect the gingival tissue with a plastic instrument. Apply light, even pressure to the stained and roughened surface for 10 to 15 seconds. Rinse and carefully examine the tooth. You are ready for Step 2 if there is no stain or roughness.
2. Use the fine aluminum oxide polishing disk for the same length of time that the medium disk was used. Cover the same surface area of the tooth to ensure a smooth surface.
3. The extra-fine disk is used for the same length of time that the fine and medium disks were used. Thoroughly rinse the tooth for 30 seconds.
4. The surface areas treated with aluminum oxide paste should be polished for 30 seconds, carrying the polish interproximally with floss.

Fig 10 (left) *Note the pitted surface of the microfill veneer following the use of an air-powder abrasive instrument.*

Fig 11 (right) *The scratched and abraded surface of the microfill composite was caused by a hard toothbrush with baking soda and hydrogen peroxide.*

Figs 12a *Note the inflamed periodontium associated with the resin veneers. Plaque causes the margins of the restoration to break down further, and this in turn irritates the periodontium.*

Fig 12b *Periodontium returns to health after the removal of the veneers and institution of proper homecare procedures.*

Fig 12c *Same area as in Figs 12a and 12b after placement of properly contoured porcelain veneers.*

Improper maintenance of porcelain and composite restorations

The following common maintenance procedures can jeopardize the initial smooth surface of a restoration:

1. Coarse polishing paste may roughen, scratch, and dull the surface glaze of porcelain and composites.[3]
2. Sonic or ultrasonic scalers can scratch the surface and "pluck" out filler particles of a composite.[1] They can also remove significant amounts of resin cement and break the bond of the veneer to the tooth.
3. Air-powder abrasive instruments can scratch and pit the surface of composite restorations (Fig 10) and even remove part of the composite material.[4] They can break the resin bond of porcelain veneers and result in pitting, staining, and loss of luster.[5]
4. A hard toothbrush and abrasive toothpaste may abrade composites (Fig 11).[6,7]
5. Never use acidulated phosphate fluoride; it can etch the veneer and resin,[2] increase the surface roughness, and reduce surface luster. The result will accelerate pitting and staining.[8,9]

Home care following porcelain and composite restorations

Composite resins and the resin cement around porcelain restorations can be damaged by plaque or by an abrasive toothbrush and toothpaste, leading to softening, pitting, and

scratching of the restoration. Accelerated staining, increased plaque retention, and marginal leakage will result (Figs 12a to 12c).

A conscientious regimen of daily flossing and plaque control with a soft toothbrush is a necessary part of home care.

Antimicrobial rinses

Though antimicrobial rinses have become a popular adjunct for treating periodontal diseases, two side effects warrant careful consideration. First, most rinses contain high concentrations of alcohol, which can soften bonding and lead to further plaque retention, staining, and microleakage. Second, some rinses are inherently staining. Both risks need to be carefully weighed against plaque-reducing benefits.[10]

Conclusion

Three basic principles should underlie all planned maintenance. First, professional supportive care should harm neither the periodontium nor the restoration. Second, responsibility for the maintenance of the restoration falls not only on the restorative dentist, but on the periodontal professional and the patient. Third, interoffice communication must ensure that all necessary maintenance procedures are being provided. Patients on alternating recall historically have been casualties of compartmentalized maintenance—the periodontal office has often failed to address the requirements of the esthetic restoration, and the esthetic dental professional has relegated the care of the periodontium to the periodontist. Responsibility for the maintenance of the teeth, restorations, and supporting structures lies with each dental professional that enters into the alternating recall maintenance contract.

This paper is not meant to dictate standards of care but to raise issues of responsibility for those professionals sharing patients on alternating recall and to provide succinct information for periodontal professionals who seek to provide the best care to patients with esthetic restorations.

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References

1. Zitterbart P. Effectiveness of ultrasonic scalers: A literature review. General Dent 1987;35:295–297.
2. Ripa L. Effect of type of fluoride compound and fluoride concentration on the caries inhibition of dentifrices. Compend Contin Ed Dent 1988;11(suppl):365–370.
3. deWet FA, Ferrerra MR. Polishing procedures for microfilled resins. J Dent Assoc S Am 1982;37:797–803.
4. Reel CR, Abrams H, Gardner S, Mitchell RJ. Effect of a hydraulic jet prophylaxis system on composites. J Prosthet Dent 1989;61:441–445.
5. Barnes CM, Hayes EF, Leinfelder KF. Effects of an air-abrasive polishing system on restored surfaces. General Dent 1987;35:186–189.
6. Strassler HE, Moffitt W. The surface texture of composite resin after polishing with commercially available toothpastes. Compend Contin Ed Dent 1987;8:826–830.
7. Van Dijken JMV, Ruyter IE. Surface characteristics of posterior composites after polishing and toothbrushing. Acta Odontol Scand 1987; 45:337–346.
8. Gonzalez E, Naleway CA, Fran PL, Jaselskis T. Decrease in reflectance of porcelains treated with APF gels. Dent Mater 1988;4:289–291.
9. Council on Dental Materials, Instruments and Equipment; Status Report: Effect of acidulated phosphate fluoride on porcelain and composite restorations. J Am Dent Assoc 1988;116:115.
10. Asmussen E. Softening of Bis-GMA based polymers by ethanol and by organic acids of plaque. Scand J Dent Res 1984;92:257–261.