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“It has been concluded that composite resin can be used successfully as a substitute for amalgam and gold.”

Composite Resin Restorations: A Simplified Approach

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Composite resin restorations were first recommended as a substitute for metallic restorations shortly after their introduction in the late 1960s. Unfortunately, a series of well-controlled clinical studies demonstrated they were completely unacceptable for such a purpose.[1-5] The clinical performance of the initial formulations was disappointing.[6] The initial formulations were chemically cured and their use was indicated for Class III, IV, and V restorations. The filler particles were large and the filler content was low.[7] Early attempts to use these formulations in the posterior dentition resulted in shortcomings, which included: inadequate resistance to wear,[7-12] fractures,[8,12] microleakage,[7,8,13] secondary caries,[14,15] marginal breakdown,[16] postoperative sensitivity,[16,17] improper interproximal contact and contour,[13] inadequate marginal adaptation,[17] color instability,[6,8] inadequate polishability,[6] pulpal irritation,[10] and endodontic therapy.[6]

Unfavorable past clinical performances, which gave composite resin such a poor reputation, were not only limited to insufficient physio-mechanical properties and wear resistance, but also employed inappropriate restorative techniques and preparation designs for composite resin for the particular clinical situations.[9,11,18-20] Undoubtedly, these and other problems associated with posterior composite resins could be attributed to inserting materials designed for anterior teeth into posterior preparations. Little or no thought was given to the type of cavity design for either Class I or II cavity preparations. Furthermore, no information was available to the clinician or the designer of such materials about what properties were necessary to withstand occlusal forces. Consequently, the entire history associated with the development of composite resins and associated techniques has been characterized by trial and error both in the laboratory and at the chair.

Today, after more than 40 years of concentrated efforts through science and clinical trials, it has been concluded that composite resins can be used successfully as a substitute for amalgam and gold.[21-24] Compared to metallic restorations, however, the associated procedures are largely different and complex. The number of specific procedural steps and the amount of time required to complete multiple-surfaced composite restorations is appreciably greater. Furthermore, based on the chemistry and mechanical characteristics of the composite resin, the cavity preparations recommended for their use is considerably different than those used for the corresponding metallic restoration (ie, amalgam, gold).[17]

Many of the restorative concepts and principles for metallic restorations are still being employed with current adhesive dentistry. However, dramatic changes in the understanding and control of the caries process (eg, a reduction in the incidence and severity of caries, the process of detecting decay with chemical agents) have subjected the current clinical judgment to rethinking the past preparation designs and principles that were applicable in a different era. The need for “extension for prevention” has been replaced with a more conservative approach to tooth preparation: the “adhesive preparation design.” The traditional methods of experience and skill for discerning decay from stained tooth structure have been supplemented with innovations such as caries-detecting agents and improved illumination and optical aids to enhance vision.[25] In addition, the differing physical and mechanical characteristics of the restorative materials require a protocol that diverges from that of earlier restorative materials. Unfortunately, many clinicians continue to use yesterday’s procedures with today’s restorative materials and wonder why they continue to have microleakage, recurrent decay, and sensitivity. Presently, the effect of this misdirection could be one of the reasons for the relatively short longevity of the composite restorations in the general dental practice.[26, 27] Advances in material science and adhesive technology require the clinician to modify nonadhesive restorative techniques for application to restorative adhesive concepts. The application of these concepts should be considered during diagnosis, material selection, preparation design, adhesive protocol, restorative placement techniques, restorative finishing and maintenance,[28-31] and even individual patient selection.

After years of in vitro and in vivo investigations, it is currently possible for the clinician to develop a durable, long-lasting restoration that is esthetically indistinguishable from natural tooth structure. Exacting shade matching and localized characterization are entirely possible. However, achieving the ultimate in esthetics can take a considerable amount of time and experience. An alternative approach that is simpler yet based on sound scientific principles can be used to achieve predictable long-term success with directly placed composite resin restorations for anterior and posterior teeth in a more time-efficient manner. These principles and the description of a simplified technique that uses restorative adhesive concepts with a nanohybrid composite (Grandio®, VOCO, Cuxhaven, Germany) to develop precise anatomical morphology, function, and esthetics are presented.

RESTORATIVE MATERIAL SELECTION

In the past, the physical and mechanical properties of the individual composite systems (ie, hybrid, microfill) had inherent limitations that confined their use to specific procedures. To achieve an optimal

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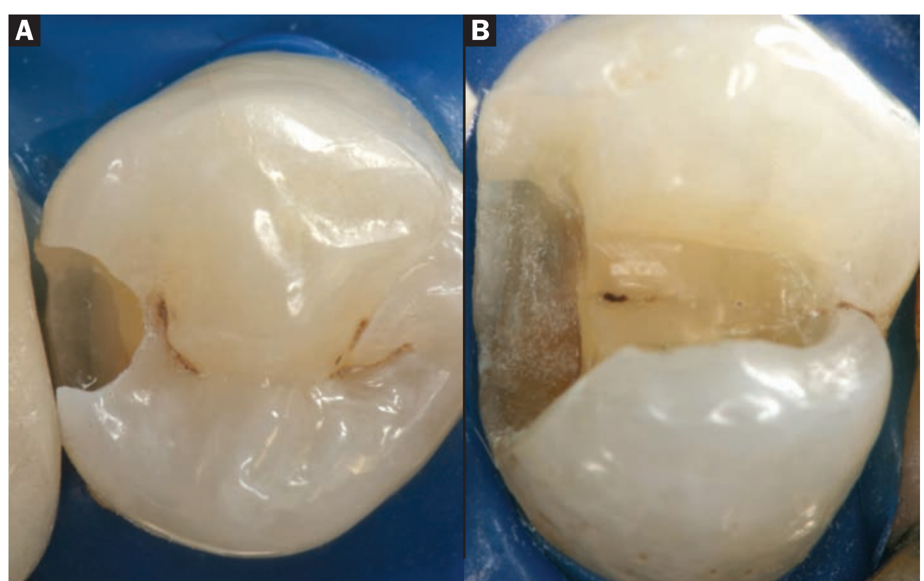

Figure 1A and Figure 1B The adhesive preparation for composite restorations allows a more conservative design than its amalgam counterpart.

Figure 2A Because amalgam does not bond to the walls of the cavity preparation, a space of several microns commonly exists between the restoration and the prepared surfaces. This leads to a potential for microbial invasion and secondary caries, as in this case of these defective amalgam restorations with recurrent decay

Figure 2B The occlusal outline was extended only to include carious enamel, provide access to the carious dentin, and remove any residual amalgam staining.

Figure 2C After the preparation was acid-etched, a single-component adhesive was applied.

Figure 2D An A3 shaded flowable composite was applied as a cavity liner and uniformly distributed on the pulpal floor with a ball-tipped instrument.

restorative result and compensate for these inequities, the clinician was required to select and layer both a hybrid and a microfill resin system. These intricate layering techniques further complicated the ability of some clinicians to achieve consistent and reliable results. Thus, newer formulations of microhybrid composite resins have been designed with the concept of combining dentin color and enamel value in relationship to the natural tissue anatomy. These composite restorative systems not only simplify the replication of the optical properties of the natural tooth, but also have physical and mechanical properties similar to those of tooth structure. With the selection of these improved biomaterials, the clinician is able to preserve, conserve, and reinforce tooth structure with more conservative preparation designs.

ADHESIVE PREPARATION DESIGN

Early operative concepts sanctioned the removal of healthy, sound tooth structure to perform the necessary restorative procedure.[32] Cavity designs were formulated with a specific geometric outline form for specific regions on the tooth and intended to prevent the possibility of caries. Metallic restorations would not adhere to the dental tissues. Hence, a mechanical approach was required to enhance the resistance and retention form. The modern adhesive preparation design employs a biologic approach that provides restoration retention through adhesion, in addition to reinforcement and strength to existing tooth structure. Metal-free direct restorative systems depend upon the use of adhesive preparation designs that are more conservative and require more thorough adhesive techniques.[33-36] There are no geometric outline preparation forms. Consideration should be given to tooth type, location in the arch, size and type of carious lesion, treatment of decayed or non-decayed unrestored teeth or restoration replacement, and the relationship between occlusal function and preparation boundaries. Other factors that should be considered are the type of restorative technique (ie, direct, semi-direct, or indirect), the quantity and quality of remaining tooth structure, mechanical forces on remaining structures, the presence of defects, and the parameters for extension of the preparation to the esthetic zone.[35,37]

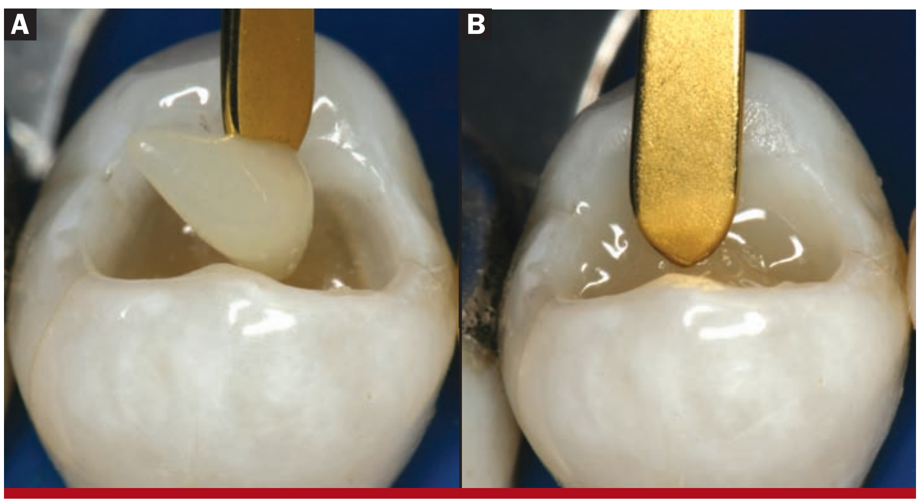

Figure 2E and Figure 2F An elongated A3 shaded nanohybrid composite (Grandio) increment was placed and adapted in an oblique layer with a curved metal instrument (TINL-R) against the cavity wall.

G. V. Black designed the original cavity preparations for direct restorative materials, both anterior and posterior, nearly 100 years ago. These principles of design are still applicable in the modern dental practice by simply modifying them to accommodate modern materials, techniques, and technology.[38]

The following adhesive design principles are modifications of the originals and should be considered for posterior and anterior composite resin restorations.

FOR POSTERIOR COMPOSITE RESIN PREPARATIONS

The original basic preparations were developed primarily for amalgam. The posterior preparations were based on a number of principles. The first of these was dimension.[39] Because the fracture resistance of amalgam is heavily based on minimal bulk, the preparations by composite resin standards were relatively large. Also, the proximal aspect of the Class II cavity preparation was designed to include the areas of greatest bacterial count and plaque concentrations. Because amalgam does not bond to the walls of the cavity preparation, a space of several microns commonly exists between the restoration and the prepared surfaces. This leads to a potential for microbial invasion and secondary caries.

The preparation design for posterior composite resins is considerably different than its amalgam counterpart (Figure 1A and Figure 1B). First, the preparation usually is smaller in dimension. Through the

Figure 2G The adapted increment was light-cured through the cusp using the ramp-curing mode to minimize polymerization stresses and enhance marginal adaptation.

Figure 2H A final increment of natural translucent shaded hybrid composite was placed, and the occlusal anatomy was developed with a burnisher (PKT-3A).

Figure 2I A variety of acceptable polishing protocols exist to impart a natural luster to composite restorations.

process of hybridization, the restoration becomes an integral part of the tooth itself. Under such a condition, there is no microscopic space between the restoration and the walls of the cavity preparation. Properly generated margins preclude the potential for microbial ingress. Due to this relationship, the proximal margins of the Class II preparation need not be extended beyond proximal contact. The same rule applies for the location of the gingival margin.

Another dramatic difference between the posterior composite resin and an amalgam restoration relates to the concept of "extension for prevention." Black's posterior cavity preparation extended to include all adjacent regions that were highly susceptible to primary caries. This was a viable precept because the rate of caries a century ago was considerably greater than at present, and caries was not diagnosed as a bacterial disease.[40] Addition of fluoride to the water and other sources (eg, toothpaste), as well as the emphasis on oral hygiene, have significantly reduced the incidence of caries. Consequently, the practice of extending the preparation into potentially vulnerable areas of the tooth is no longer necessary for bonded composite resin restorations. The outline form should only follow the extent of the carious lesion.

All of these factors mandate a modification in the dimension and design of the posterior cavity preparation. In the case of pit-and-fissure decayed regions on the occlusal surface, it is suggested that the cavity preparation be limited only to the region of the tooth that is affected by caries and then restored.

In the case of Class II cavity preparations, the amount of sound tooth structure that can be left intact is even more impressive. Assuming the presence of a small carious lesion on one of the proximal surfaces of a posterior tooth, it is advised to generate a preparation that is considerably smaller in all dimensions than those of Black's original cavity designs. No attempt should be made to open the proximal contacts with the adjacent tooth, as is required with amalgam. The width of the preparation should be as narrow as possible, as the wear resistance of the restoration is a direct function of dimension.[28] Also, increased buccolingual width of the preparation can trespass into the centric holding areas.

The distance between the proximal-occlusal surface and the extension onto the occlusal table should not exceed 2 mm. Finally, assuming minimal caries in the proximal region, the distance from the gingival margin and the cervical line should be at least 2 mm. Such a condition ensures maximum enamel on the gingival floor for optimal bonding of the composite restoration. It also minimizes the deflection of the proximal aspect of the restoration when subjected to occlusal loading.

Numerous clinicians and a number of in vitro studies have suggested that beveling of the occlusal cavosurface angle should be accomplished for all Class I and II cavity preparations. The presumption is that placing bevels actually extends the surface area of enamel for bonding, thereby decreasing the potential for leakage along the margins. This supposedly contributes to the fracture resistance of the restored tooth. While this theory sounds credible with many clinicians employing this technique, at least one study has demonstrated that beveled restorations commonly undergo a higher rate of wear compared to those that are not beveled.[41] The actual increase in wear over a 2-year period possibly can be attributed to a higher potential for involving the antagonist cusp. This can be credited to the fact that beveling automatically increases the width of the cavity preparation.[41]

Beveling of the gingival margin, however, should be encouraged because it effectively increases the thickness of the enamel surface in this region. Beveling of the buccal and lingual extensions of the proximal aspect of the preparation should also be recommended. Finally, it is probable that beveling of the occlusal surface should be considered when the preparation is rather extensive buccolingually. Under such a condition, the beveling may actually increase the strength of the restored tooth.

FOR ANTERIOR COMPOSITE RESIN PREPARATIONS

The preparation design for anterior teeth generally involves the incisal edge, cervical region, and/or the interproximal zone. The preparation typically requires minimal tooth preparation and the margins of the preparation are usually confined to the enamel and, if completely mineralized and well supported by dentin, significantly contribute to the retention and strength of the composite restoration. To increase the enamel-adhesive surface, a chamfer is placed around the entire margin that is in enamel. The chamfer preparation defines the finish line and it allows a greater bulk of material to be placed at the restorative margin to increase fracture resistance[8] and reduce the stress at the restorative interface.[42] In addition, a lingual chamfer should be placed coronally or apically to the contact area.[43] When enamel is present, a bevel should be placed, but only on the enamel margin. Beveling increases the bonding surface area, decreases microleakage by exposing the ends of the enamel rods for etching, and improves blending of the resin with tooth structure.[44] Bevels should not be placed on lingual surface margins that are in areas of centric contact or subjected to heavy occlusal forces; composite has a lower wear resistance for withstanding such forces than enamel does.[45]

In addition to these specific preparation design principles, a number of general guidelines for posterior and anterior preparations should be considered. These new principles of design and general

Figure 3A The direct bonding duo-shade technique is used in cases where noncarious cervical lesions are present (eg, saucer-shaped noncarious cervical lesions on the mandibular right premolars).

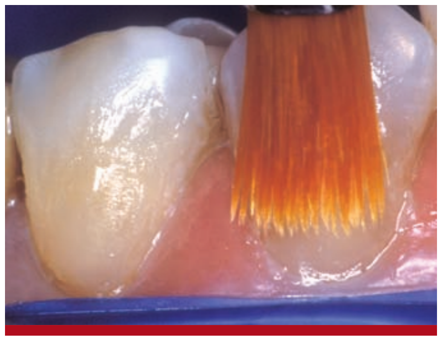

Figure 3B To correct this condition, the initial dentin layer was applied, then a second translucent enamel layer was smoothed cervico-incisally with a sable brush.

Figure 3C The completed composite restorations exhibited bioesthetic integration at the dentogingival interface.

Figure 4A The direct bonding duo-shade technique can be employed effectively in cases of fractures (eg, fractured maxillary central incisors).

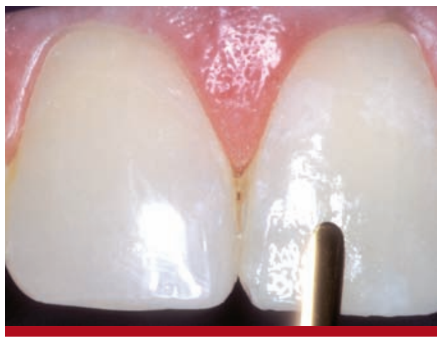

Figure 4B An opacious increment was placed as the internal dentin core, and a second small increment of translucent-shaded hybrid composite was added to encapsulate this core.

Figure 4C The composite restorations using the simplified duo-shade placement technique were completed with satisfactory results in a simpler, shorter period of time than would have been the case if another method had been used.

guidelines for adhesive restorations replace the traditional mechanistic approach to the restoration of teeth while initiating applications of biomechanical concepts.

- The cavity outline is extended only to include carious enamel, provide access to the carious dentin, remove any residual staining, and provide access for the application of restorative materials.
- Healthy tooth structure should be removed only when the preparation outline requires extension to a point beyond or within the previously indicated functional stops.[46]
- To allow for a better resin adaptation, all internal line angles should be rounded.[47]

SELECTING AN ADHESIVE STRATEGY

The chemical treatment of enamel and dentin by acids to provide adhesion between resins and dentin substrates (eg, enamel, dentin) has become a standard clinical procedure in adhesive dentistry.[48] The removal of the smear layer raises the surface energy and alters the mineral content of the substrate so that it can be infiltrated by subsequently placed adhesive primers and resins.[49-52] The mechanism of adhesion is similar for enamel and dentin: a micromechanical entanglement of monomers into the enamel microporosities or collagen interfibrillar spaces created by acid dissolution of mineralized tissues.[53,54] When evaluating restorative success, the marginal integrity achieved by this procedure becomes a priority because an intact restorative-tooth interface is essential to the exclusion of bacteria and the interfacial hydrodynamic equilibrium of the dentino-pulpal complex.

Contemporary bonding philosophies adopt either the total-etch or self-etch technique for successful bonding to dentin.[48,53,55] Both of these adhesive strategies permit the formation of a resin-reinforced zone (ie, the resin-infiltrated layer or hybrid layer), the primary bonding mechanism of many current adhesive systems.[56,57] Hybridization is a process by which the inorganic support (ie, hydroxyapatite crystals) is first removed and then replaced with a low-viscosity monomer or dentin bonding agent. Using phosphoric acid (eg, total-etch) or a low-pH monomer (eg, self-etch), the dentin is demineralized. In comparison to acid-etch, the self-etch adhesives do not allow a discrepancy between the depth of demineralization and depth of resin infiltration because both processes occur simultaneously.[53] Therefore, the potential for postoperative sensitivity is less with self-etch systems because the smear plugs are not removed before the application of the adhesives. This hybridization of the exposed dentin with an adhesive system is currently considered the most effective way of protecting this pulp-dentin interface, as well as of bonding the composite resin to the tooth structure to provide resistance to microleakage and retention of the restoration, regardless of the depth of the preparation.[29,58-60]

Once the evacuated intercollagenous spaces are filled with the dentin bonding agent, sealing the dentin tubular openings, the potential for odontoblastic fluid movement is eliminated. This, in turn, appreciably reduces the possibility of postoperative sensitivity. Furthermore, hybridization allows internal adaptation for stress relief at the restorative interface while eliminating sensitivity. The adhesive layer may absorb polymerization shrinkage stress of the resin composite by elastic elongation,[58,61] reducing internal stress at the tooth-restorative interface; this results in improved marginal and interfacial adaptation with reduced gap formation.

Regardless of the generation of adhesives, it is important that sufficient time be given to the etching process, as well as the process of resin diffusion into the decalcified intercollagenous zones. Once achieved, the surface is sufficiently air-dispersed for the purpose of thinning the bonding agent; it is light-cured for 10 to 15 seconds. Failure to adequately reduce the thickness of the residual bonding agent can readily result in a radiographic misinterpretation. Specifically, postoperative radiographs of the restored tooth may suggest secondary caries because of the presence of a thick and radiolucent region between the restorative material and the wall of the preparation.

The use of flowable composites as a stress-absorbing lining material between the adhesive system and the restorative composite resin has been suggested for large restorations.[62] The combination of flowables and viscous composite ensures a more intimate contact with the dentin bonding agent because of the lower viscosity and has resulted in enhanced internal adaptation.[63] Nearly all of the currently available composite resin formulations exhibit a viscosity that is considerably greater than that of their predecessors. Consequently, special attention must be given to the method by which the unpolymerized composite resin adapts to the prepared surfaces. The best method for achieving this goal is to employ a flowable composite resin. Because of an inherently lower contact angle between it and the surface, the flowable wets the hybridized surface extremely well,[63] flowing into all the intimate details of the prepared cavity. This results in a more complete interfacial internal adaptation and may reduce the formation of voids, which can contribute to a weakened surface and microleakage. Because the chemistry of the hybridized layer and the flowable composite resin is similar, an excellent chemical bond is generated between the two systems.

Another interesting characteristic of the flowable composite is that it acts as an elastomer and buffers the polymerization shrinkage stress by flow, which theoretically eliminates cuspal deformation or gap formation and reduces microleakage.[64] Because of a lower elastic modulus than the restorative material, it will strain appreciably more when subjected to stress. Specifically, as the overlying composite resin undergoes curing shrinkage during the process of polymerization, it begins to pull on the surface of the flowable composite resin. If the elastic modulus is low, the composite will stretch to accommodate the inherent modulus of the tooth and the internal layer may absorb polymerization shrinkage stress of the resin composite by elastic elongation.[58,61] This stretching or straining of the flowable prevents the material from being pulled from the surface of the preparation, thereby ensuring excellent marginal integrity. By understanding this complex mechanism between polymerization shrinkage and adhesion, the clinician can select adhesive strategies and restorative materials that can reduce the potential for interfacial stress and gap formation at the time of placement for each individual clinical situation.

For the flowable resin to exhibit elastic elongation, it must be of minimal dimension. It is recommended that the thickness of this intermediate agent be at least 0.5 mm to 1 mm. The flowable liner also should cover all the dentin of the prepared cavity. While it is permissible to contact the enamel portion of the cavity preparation, it is important that it not contact the occlusal margins. Generally, these agents are rendered wettable by increasing the diluent of the composite and reducing the filler content. As a result, they exhibit a number of properties (ie, reduced resistance to wear, greater polymerization shrinkage, and greater water sorption) that are appreciably inferior to the overlying composite resin restoration. Finally, it is important to state that the flowable composite resin should be cured before the restorative composite resin is placed over it. Failure to do so may cause a thinning of the flowable resin in some regions, thereby reducing the potential for straining or stretching during curing of the overlying composite resin.

SIMPLIFIED PLACEMENT TECHNIQUE

The method of restoring the prepared tooth has been the subject of considerable discussion. Myriad restorative techniques have been developed to avoid the limitation of depth of cure, reduce the effects of polymerization shrinkage, improve the marginal adaptation and seal,[11,19,65-67] enhance esthetic results,[68,69] and provide the clinician with maximum benefit for their application.[70] Several of the incremental stratification techniques include: horizontal, vertical oblique, centripetal, three-sited light-cure, and centripetal build-up. These various methods are recommended according to the type and dimension of the cavity preparation.[38] While it is commonly accepted that segmentally filling the preparation generates the least pull on the buccal and lingual cusps, not all literature agrees. In a study conducted at the University of Minnesota, Douglas and colleagues demonstrated that bulk fill produced the least strain on the opposing cusps.[71] Although these stratification techniques allow the clinician to provide esthetically pleasing results, the use of intricate multi-layering with numerous shades of composite may not be efficient, realistic, or practical for the modern dental practice.

In an effort to improve efficiency and expedite the insertion and carving stages, the authors offer the following duo-shade modified placement technique:

1. A low-shrinkage hybrid resin system should be selected that has dentin and enamel shades. This modified placement technique uses one continuous increment (ie, hot dog shaped) that is placed and adapted in an oblique layer with a curved metal instrument (TINL-R, Brasseler® USA, Savannah, GA) against the cavity wall.
2. The increment is cured through the cusp, and the original cavity floor becomes part of the cavity walls. This process reduces the ratio of cavity volume to the area of the cavity walls, which results in a substantial reduction in the marginal contraction gap.[72]
3. A second elongated increment is adapted in the same oblique manner against the opposing cavity wall and light-cured through the cusp. For small- to medium-size occlusal and proximal cavity preparations, the internal dentin core requires two incremental placements.
4. A final enamel layer is filled all the way to the occlusal margins. Any residual composite material is removed with a burnisher (PKT-3A, Brasseler® USA).
5. The composite condenser is pressed against the occlusal surface. Employing finger pressure, the instrument is used to trace the entire margin of the preparation. Such a technique not only eliminates all residual composite extended beyond the preparation, but it also fills in any region that may have been underfilled.
6. Upon completion, the same burnishing instrument can be used to develop the central fissure, buccal, and lingual developmental grooves, and the incline planes.
7. After light-curing, the rubber dam is removed and the occlusion is evaluated in centric, protrusive, and lateral excursions.

This same duo-shade placement technique can also be used in direct anterior composite restorations. However, the magnitude of the shrinkage stresses generated from polymerization shrinkage is less for most anterior composite restorations because the ratio of bonded to unbonded surfaces is generally less for these restorations. Therefore, using stratification techniques to minimize the effects of shrinkage stress is a minor clinical consideration. The authors prefer to use a long-bladed interproximal carver for placement and adaptation, and a sable brush to smooth the surface. A curved metal instrument (such as the TINL-R) can be used to shape the lingual surfaces of anterior restorations. For Class III and IV composite resin restorations, an opacious dentin increment is placed as the internal core and a second enamel layer encapsulates this core. For the Class V, this same placement procedure can be used with a translucent or opacious dentin core, depending on the color of the substrate. *Note:* for deeper cervical restorations, placement of the dentin core in two sequential increments allows for an overall stress reduction by allowing more yielding of the free surface of the restoration to the underlying contracting bulk. Placing the occlusal dentin segment with higher bond strength to enamel first and then the gingival segment may reduce the potential for microgapping at the gingival margin.

FINISHING AND POLISHING

Defined by surface morphology of the tooth and restoration, the successful finishing and polishing of any composite restoration are determined by the type of restorative material used and the shape of the finishing device. Because the geometry and shape of the natural teeth and these devices essentially remain unaltered, the only variable is the continual changes in the formulation of the restorative material.

Thus, the surface quality of the composite is not only influenced by the polishing instruments and polishing pastes, but also by the composition and the filler characteristics of the composite.[73,74] Newer formulations of small particle hybrids and microhybrids have altered filler components with finer filler size, shape, and orientation and concentration. These improved physical and mechanical characteristics allow the resin composite to be polished to a higher degree.[75] The variation in hardness between the inorganic filler and the matrix can result in surface roughness as these two components do not abrade uniformly.[75,76] Accordingly, because the gloss can influence color perception and shade matching of the restoration and tooth surface, it is imperative that the surface gloss between the restorative material and tooth interface be similar.[75, 77]

Restorative materials of the past (ie, amalgam, gold) required finishing and polishing procedures to refine anatomical morphology, contours, marginal integrity, and occlusion while enhancing the surface smoothness of the restoration. The objectives of finishing and polishing techniques of tooth-colored adhesive restorations are the same today. However, the development of adhesive materials has introduced a new element to the restorative equation: esthetics. An optimally finished esthetic adhesive restoration should provide a smooth surface that will prevent plaque accumulation and resist stain.[78] It should also possess ideal contours and emergence profile for improved tissue compatibility.[78] Additional benefits of a proper finish are anatomical form for occlusal harmony, shade coordination to surrounding dentition, symmetrical surface texture to adjacent or opposing natural teeth, improved marginal adaptation and integrity, and longevity.[78] Aside from the actual finishing and polishing, the final challenge for the operator is long-term restorative maintenance of the surface polish. An understanding by the patient and clinician of the importance of periodic and routine maintenance of composite restorations and the use of proper finishing devices, polishing techniques, and protective surface glazes at the maintenance visit may provide the benefit of increased restoration longevity.[73,79,80]

Finishing focuses on contouring, adjusting, shaping, and smoothing the restoration; polishing concentrates on producing a smooth surface luster and highly light-reflective surface.[81] As Pratten and Johnson have indicated, there is no statistical difference between finishing and polishing anterior and posterior restorative materials.[82] The consideration factors for finishing and polishing any restoration depend on the instrument shape, the surface shape and texture of the tooth and restoration, the surfaces of the finishing and polishing instruments, and the sequence and amount of time allotted for the restorative treatment.[82]

While several acceptable finishing and polishing protocols exist, the authors provide the following clinical suggestions:

- Minimize finishing procedures through careful preoperative occlusal registration and composite shaping before curing. At least one study revealed that a reduction in finishing results in less damage to the composite and improved wear and clinical performance.[83]
- Select finishing and polishing devices that have shapes corresponding to the anatomical contours of the restored tooth.[84]
- Finishing diamonds may demonstrate resin matrix crazing and significant filler particle loss for hybrids, affecting the wear resistance of posterior hybrid composite resin restorations.[73]
- High-speed finishing with multifluted carbide burs for a hybrid composite resin produces a smooth, flat, and undisrupted surface free from striations and grooves left by diamond burs.
- Wet finishing with diamonds is more appropriate for microfilled composites; carbide finishing burs are contraindicated for microfills.[73]
- The use of a surface sealant has been shown to reduce the wear rate of posterior composite resins,[85] improve resistance to interfacial staining,[86] and decrease microleakage around composite resin restorations.[86-88]
- Place composite surface sealant and cure before polishing with silicone points because silicone surface contamination may prevent adhesion of the sealant.

CONCLUSION

Modern clinicians have many of the same clinical challenges for selecting the appropriate restorative material and treatment modality as their colleagues of the 19th century. However, advances in material science and technology have provided the 21st century clinician with the knowledge to transform the mechanical approach of operative dentistry into a biological philosophy, strategy, and design. The clinical procedures photographed here—posterior (Figure 2A through Figure 2I) and anterior (Figure 3A through Figure 3C; Figure 4A through Figure 4C)—illustrate the application of the aforementioned biologic principles and concepts in a simplified direct bonding duo-shade technique. Using a nanohybrid composite to develop precise anatomical morphology and function, predictable long-term success with directly placed composite resin restorations was achieved in a simplified manner.

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