

Simplified and Sophisticated Esthetic Composite Systems

These systems demonstrate significant advances in dental material science.

By Frank J. Milnar DDS, AAACD

In 1958, composite resin was first introduced and, since then, composite materials have evolved. In the 1970s, light-cured composites were manufactured, and this evolution created a paradigm shift within the profession. Direct restorations were more predictable, and there were longer working times and improved physical properties. These new composites were also more color-stable and they contained smaller particle sizes than previous self-cured resins.¹

Improvements in composite formulations continued into the 1980s, with ongoing reduction of particle size and the most significant advancement, increased filler loading, which broadened indications to universal use in anterior and posterior regions. Today, direct composites are considered all-purpose restorative materials, which are used daily for teeth affected by caries, to lengthen teeth, cover dark or discolored dentition, repair fractures, and close diastemas.²

Modern conservative dentistry follows the guidelines of optimized tooth form, minimal intervention, and enhanced esthetics.³ Newer composite science has merged with the old art of esthetic dentistry. Currently, there is a wide range of composite materials available to serve clinicians with

varied aptitudes for esthetic dental creativity. These include the following:

- Nanocomposites with 80% filler for anterior and posterior applications
- Low-shrinkage composites containing simpler shade formulations, allowing dentists to leverage the inherent esthetics of one workable shade (eg, Grandio[®] SO, VOCO America, www.vocoamerica.com; and Venus[®], Heraeus Kulzer, www.heraeus-dental-us.com)
- High-end and more sophisticated composite systems designed for dental composite artists (Estelite Omega, Tokuyama America Inc., www.tokuyama-us.com)
- Self-adhesive composites (Kerr Products, Kerr Corporation, www.kerrdental.com)
- Pink and white esthetic systems (eg, Amaris[®] Gingiva, VOCO America), which enable gingival tissue to be replicated so that complex and complementary esthetic structures (eg, white teeth and pink gingiva) can be re-created
- Flowable composites that complement the present trend of minimally invasive esthetics

Rather than review the multiple material and physical characteristics of the composites available today, which have been discussed frequently in this publication, this presentation reviews the characteristics and properties of two categories of esthetic composite systems: simplified and sophisticated.

Simplified Composite Systems

Simplified direct composite systems typically require placement of only one or two

composite shades and/or layers (Figure 1 through Figure 3). These systems are considered simple because they are based on a fundamental understanding of how tooth structure works, focusing on the interplay with light dynamics, shrinkage properties, and color schematics. Simplified composites represent an acknowledgement that dentin shines through enamel and, together, these two structures establish the color and appearance of a natural tooth. This interplay of light and color dynamics is re-created in a singular material layer.

These simplified composites are composed of a resin matrix, fillers, and coupling agents.⁴ Filler particles, integrated translucency levels, and a concise number of shades simplify the color-matching process, enabling these materials to assume the color characteristics of adjacent teeth and surrounding tooth structure. Nano-optimized composites, in particular, allow restorations to blend with the tooth's natural structure or with surrounding dentition.⁵ These composites often have low shrinkage and low wear rates to facilitate durability and longer-lasting restorations.

On the other hand, the esthetic properties of other simplified composite systems (eg, VOCO Amaris[®]) may require clinicians to select and place two composite layers, such as an opaque dentin composite layer and/or a translucent enamel layer that lightens, darkens, or complements the opaque shade. For example, if the chosen opaque shade matches the tooth, then a neutral translucent enamel shade can be placed on the restoration. If the dentin shade is too light, it can be darkened with a darker translucent enamel composite, etc.

Overall, simple esthetic composite systems are known for being user-friendly, requiring dentists to choose the desired restorative shade and place only one or two layers of material into the required area, resulting in minimal chairtime to produce an esthetically pleasing and acceptable result. Straightforward but accurate placement protocols are required, yet other more sophisticated esthetic considerations—such as nuances of



FRANK J. MILNAR
DDS, AAACD
Private Practice
St. Paul, Minnesota

internal tooth color stratifications, characterizations, etc.—are not necessary. Simplified composite systems do require dentists to appropriately complete finishing, contouring, and polishing to create an anatomically correct form and natural finish, as well as contribute to plaque resistance.

Whether for anterior or posterior indications, simple composite systems represent a cost-effective option for patients who need direct and esthetic restorations. Many of these materials, such as self-adhesive flowable composites (eg, Vertise™ Flow, Kerr) are multi-functional and can be used as pit-and-fissure sealants and cavity liners as well.⁶ Others, such as universal hybrid composites (Tetric EvoCeram™, Ivoclar Vivadent® Inc., www.ivoclarvivadent.com), demonstrate efficient handling characteristics that facilitate sculpting and placing the material, which ultimately affects the ease with which they can be contoured and finished.⁵

Sophisticated Esthetic Composite Systems

Sophisticated esthetic composite systems are used predominantly in the anterior to enable dentists to exercise conservative creativity (Figure 4 through Figure 6). These composite systems include an array of shade choices for dentin and enamel layers, as well as different areas of the teeth, such as the cervical, body, and incisal. Successfully placing composites from these systems requires a thorough understanding of the teeth's internal structures and their effect on polychromicity. This encompasses variations of thickness between dentin and enamel throughout different parts of the tooth, as well as form and color.

When working with sophisticated composite systems, dentists are placing composites in such a manner as to build up the restoration to create the illusion of diverse translucencies and opacities.⁷ They must select,

layer, sculpt, and cure appropriate composite shades to manipulate the way in which hue, chroma, and value affect the restoration's appearance.⁸ The esthetic properties of finished restorations exhibit color and optical characteristics identical to surrounding dentition only when the underlying dentin color is considered before enamels are placed.

Sophisticated esthetic composites incorporate an artistic and technical approach to color and shade selection. Color matching often involves classic and three-dimensional shade guides and digital shade-taking technologies to verify the best shade choices for different tooth aspects.^{8,9} To seamlessly blend restorations, clinicians must determine maverick colors, hypoplastic spots, varying degrees of opacity and translucency, and the thickness or thinness of enamel and how this affects light showing from the dentin.⁸⁻¹⁰

There are many benefits to using sophisticated esthetic composite systems, including



FIG. 1



FIG. 2



FIG. 3



FIG. 4



FIG. 5



FIG. 6

CASE EXAMPLES (1.) Preoperative view of a patient with discoloration on teeth Nos. 7 and 8 who would receive conservative composite restorations using a simplified composite system. **(2.)** A single shade/layer of composite was precisely placed and sculpted onto the minimal tooth preparations. **(3.)** View of the highly esthetic, chameleon single-shade, direct composite restorations. **(4.)** Preoperative view of a patient who presented for enamelplasty and anterior direct composite veneers to correct the smile appearance. **(5.)** Composite shades were previewed on the teeth to determine the appropriate cervical, body, and incisal composite shades. **(6.)** View of the completed anterior multiple-composite-shade restorations that demonstrate enhanced color and harmony.

navigating the creative terrain as dental artists while fabricating restorations. However, before dentists undertake such restorations, knowledge and understanding of the esthetic and material properties of the system they will use—as well as the patient's natural tooth structure—are of paramount importance.¹¹

Among the sophisticated esthetic composite systems are those containing nano-fill, nano-hybrid, hybrid, microhybrid, and microfill formulations. Nano-fills are an ideal material for high-end esthetics due to their small particle size, fracture and wear resistance, sculptability, and color stability. Nano-hybrid composites (eg, KALORE™, GC America, www.gcamerica.com) are known for their chameleon effects, which imitate natural optical properties, polishability, flexural strength, wear resistance, and decreased polymerization shrinkage.^{9,12} Hybrid composites have ideal characteristics, but their wear resistance and polishability are poor due to their larger particle sizes.¹³ Microhybrids generate enhanced luster, color stability, and polish, while microfills are considered ideal for polishing ease and longevity.¹³

Conclusion

The availability of both simplified and sophisticated esthetic direct composite systems demonstrates the significant advancements that have been made in dental material science. Although science and research are consistently improving material characteristics and simplifying techniques, this may not necessarily always produce a satisfactory outcome. For example, while there are several good composite finishing and polishing products available (eg, Dimanto®, VOCO; Venus Supra, Heraeus; and Shape & Shine™, Clinicians Choice, www.clinicianschoice.com), these assume and require clinicians to have the requisite skills to build a defect-free, homogenous restoration as the basis for lifelike luster. Perhaps it is an unfortunate result of the economic downturn, but fewer hands-on educational workshops and classroom exercises are being conducted for dental professionals to properly learn about product use and placement. Despite the worthwhile and notable improvements made

in direct composite materials, there is always room for improvement within our industry.

References

1. Talib R. Dental composites: a review. *J Nihon Univ Sch Dent.* 1993;35(3):161-170.
2. Margeas R. Composite resin: a versatile, multi-purpose restorative material. *Compend Contin Educ Dent.* 2012;33(1):42-45.
3. Raghu R, Srinivasan R. Optimizing tooth form with direct posterior composite restorations. *J Conserv Dent.* 2011;14(4):330-336.
4. Zimmweli B, Strub M, Jeger F, et al. Composite materials: composition, properties and clinical applications. A literature review. *Schweiz Monatsschr Zahnmed.* 2010;120(11):972-986.
5. Kwong W. Predictable results: the restoration of teeth with Tetric EvoCeram. *Reflect.* 2010;6-8. (Ivoclar Vivadent publication)
6. Poss SD. Utilization of a new self-adhering flowable composite resin. *Dent Today.* 2010;29(4):104-105.
7. Blank JT. Simplified techniques for the placement of stratified polychromatic anterior and posterior direct composite restorations. *Compend Contin Educ Dent.* 2003;24(2 Suppl):19-25.
8. Vanini L. Conservative composite restorations that mimic nature. *J Cosmetic Dent.* 2010;26(3):80-98.
9. Terry DA, Leinfelder KF. An integration of composite resin with natural tooth structure: the Class IV restoration. *Pract Proced Aesthet Dent.* 2004;16(3):235-244.
10. Fahl N Jr. Mastering composite artistry to create anterior masterpieces—part 2. *J Cosmetic Dent.* 2011;26(4):42-55.
11. Heymann HO. The artistry of conservative esthetic dentistry. *J Am Dent Assoc.* 1987;(Spec No.):14E-23E.
12. Keulemans F, Palav P, Aboushelib MM, et al. Fracture strength and fatigue resistance of dental resin-based composites. *Dent Mater.* 2009;25(11):1433-1441.
13. Fahl N Jr. A solution for everyday direct restorative challenges. *J Cosmetic Dent.* 2010;26(3):56-68.