

Spotlight

Composites, Matrix Systems, and Curing Lights

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Together, composites, matrix systems, and curing lights allow clinicians to give patients the durable, high-quality restorations they need, but there are multiple variables that can affect the longevity of the restoration. By fully understanding and considering the options for each, clinicians can choose the ones that work best together and also benefit the patient the most.

Composites

Composite resins are a popular restorative option in dentistry today. Although the effort to create the “perfect” material is ongoing, significant improvements have been made in composite resin systems.

Today’s composites have dozens of shade options, including opaque and translucent shades. The end result is the ability to create highly esthetic composite restorations that disappear within the tooth structure.

Another essential improvement is their filler particles. While composites with smaller particles have more wear, the combination of different size particles in the new nanofilled composites have low-wear properties. In addition, modern composites have significantly lower polymerization shrinkage, the ability to maintain a high polish, and improved handling properties.

Microfilled composites are translucent and very polishable, making them highly esthetic. They are most commonly used as a veneering material, acting as the last thin layer placed over a microhybrid composite.

Microhybrid composites demonstrate excellent physical characteristics with improved handling and less wear than microfilled composites.



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They are used for anterior and posterior restorations, and have long been considered a “universal” composite material.

Nanofilled composites offer properties similar to microhybrid composites, and have similar polish and gloss retention to microfilled composites. Nanofilled composites have demonstrated excellent strength and wear properties, have favorable handling characteristics, and are highly esthetic. Some manufacturers are now incorporating nanosized particles into their formulations, resulting in the creation of another composite category, the “nanohybrid.”

While polymerization shrinkage can be a concern with composite resins, most current microhybrid and nanohybrid composites only have a polymerization shrinkage from 2% to 3.5%. With the goal to minimize shrinkage to the greatest possible extent, some manufacturers are introducing low-shrinkage materials. With further research to find new chemistry and improve composite resin restorations, their clinical use will likely increase as well.

Matrix Systems

An excellent matrix system is critical for the clinical success of a Class II composite restoration. Composite matrix bands have varying thickness, width, size, and contour, and can allow you to work more quickly and effectively.

Advanced matrix systems, which enable a more predictable Class II composite restoration, consist of a sturdy ring clamp that helps to obtain close adaptation of the matrix to the prepared tooth and provides separation between the teeth. This allows for a consistently tight proximal contact. In addition, these systems provide an anatomically correct matrix band that allows for proper emergence angles and placement of the proximal contact in the proper area of the tooth.

New-generation systems may include wedges, adjacent tooth guards, instruments, and retainer rings or clips, which hold the bands in place during the procedure and can also be used as a rubber dam clamp.

System selection depends on location within the mouth and the amount of remaining tooth structure. Circumferential matrix systems are suited for larger restorations that extend buccally or lingually beyond the line angles of a cusp. Sectional matrix systems may be preferred for smaller restorations because they offer visibility and access, reduced flash, and don’t require forced wedging. Additional features include bands that are translucent to allow use of a curing light, or those that are non-reflective and high-contrast, which is advantageous under bright light sources.

Balancing flexibility with rigidity, the technological improvements offered by today’s matrix bands enhance adaptation and predictability—the foundation for optimal results.

Curing Lights

Today’s clinician needs an effective and reliable curing light to match the rise in resin composites and light-curable materials. Since the release of quartz-tungsten-halogen (QTH) curing lights in the 1970s,¹ the light-emitting diode (LED) has taken center stage.

When selecting a curing light, clinicians have multiple variables to consider, such as power density, wavelength, timing of the device, the power source used, etc. To ensure the highest quality and durability of composite resin restorations, clinicians need to understand how light-curing affects different materials from resin adhesives and resin-based composites to resin cements and other light-activated materials.

It is important to evaluate curing lights on their energy output. In contrast to QTH curing lights, LEDs were developed to be highly efficient transmitters of wavelength. They have high light output, and the bulbs offer a stable source of light for a longer duration of time. LEDs contain two semiconductor crystals, each of which produce different energies, yielding wavelengths²⁻⁴ that emit in the blue region of the visible spectrum (no filter necessary).^{2,4}

Considering the landscape of composite materials, there is an increasing need for clinicians to understand proper radiation exposure in the form of exposure time, light output, and energy absorption by the composite. The composite resins on the market are also infused with a variety of photoinitiators to propagate polymerization. As various initiators are used in composites, the operator must make sure that the curing light effectively activates the initiators contained in the composite. Polywave LED curing lights should be preferred over single-peak lights. Knowing that you are using a broad-spectrum light gives the user peace of mind.

While the first generation of LEDs had low output and poor curing performance compared to QTH units, today's LED lights have a broader spectrum and a higher-powered light source so they can effectively activate more photoinitiators, and polymerize a wider array of composites.⁵

Heat is also an important consideration when light-curing. As reported by Wahbi et al, clinicians should evaluate energy output, power density, light power, cooling devices, application time, irradiation time, and irradiation time's affect on temperature. These factors are

essential to understanding the interaction between the curing unit and light-activated bonding agents to avoid pulpal damage and to ensure an optimal clinical outcome.⁵

While some believe that darker and more opaque composite resins require longer curing times for a given thickness of composite, some of the whiter composites also require longer curing times because there is less of the photoinitiator camphorquinone (CQ). This is often the case because CQ possesses a yellow compound that produces a less desirable esthetic outcome; for this reason, many of the whiter composites contain less CQ.⁶ The recommended curing thickness is usually 2 mm. Clinicians can adjust for thickness and shading when curing.²

References

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