Turbo Tips

Guest Experts
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One of the main requirements to obtain long-lasting composite restorations is the degree of conversion of the material. A properly polymerized composite is more resistant to wear, hydrolytic degradation, and discoloration. To obtain adequate polymerization, a resin composite requires a sufficient amount of light (photons). With this aim, there was a sort of race among companies to market curing light lamps with increasing power.

It is important to highlight that a proper polymerization of the resin composite does not depend on the amount of light emitted by the lamp but on the quantity of photons reaching the material to be polymerized. In some clinical situations, such as fiber post cementations or Class II restorations, the distance between the light guide and the area to be irradiated could be substantial. As light diminishes following the inverse-square law, which states that a physical quantity or strength (light) is inversely proportional to the square of the distance from the source of that physical quantity (the tip of the light guide), this might end in an inefficient polymerization process. "Inefficient polymerization" does not mean that the composite and/or the adhesive look uncured, but rather that the degree of conversion could be low; so apparently everything looks fine, but actually it is not.

A classic example is placement of a Class II restoration. In the cervical area, both the adhesive system and resin composite must be polymerized, and the distance between the light guide and the area to be irradiated is usually several millimeters. This might not be a problem for the adhesive, which is a very thin layer, but it could be a problem for the first layer of the composite. Moreover, the first layer could be an opaque one used to mask some discoloration of the substrate coming from sclerotic or stained dentin due to a previous amalgam restoration, and opaque composite layers require a high irradiation time due to the scarce penetration of light within their structure.

Another factor affecting the polymerization reaction is the geometry of the tip used for light transmission. In order to improve the amount of light reaching the resin, various manufacturers introduced the so-called turbo tips. These tips are designed so that the exit diameter is smaller than the entry diameter; in this way, the light beam emitted by the lamp is concentrated through a smaller area, thus increasing the amount of photons per unit area. However, for a geometric law (Figure 1), the photons exit with an angle that is the function of the ratio between the larger entry diameter and the exit smaller diameter of the tip. When a certain amount of light is generated (the real power of the light source), the tip with a smaller exit diameter is prone to emit more light energy at the proximal portion of the light cone generated. For this reason, a turbo tip will concentrate a higher amount of the photons/area on the first millimeters from the tip, but then the light will be dispersed in a larger area. Therefore, the turbo tips will be more efficient in the first few millimeters and

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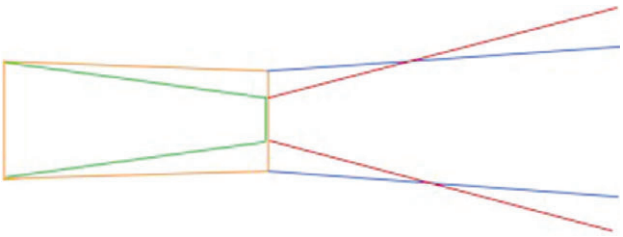

FIGURE 1. Geometric behavior of light tips. When the tip's exit diameter is smaller than the entry diameter, a narrower light beam is created. In the near portion of the light beam, the intensity is greater than that emitted by a standard tip. However, at a distance of 4–5 mm, the light intensity decreases and is actually less than that emitted by a standard tip.

less efficient than standard tips at a certain distance. The authors in a previous study quantified this distance as about 5 mm from the tip.

It is important to highlight that if a clinician uses a turbo tip in a Class II procedure, at a certain distance from the emission tip (e.g., the cervical area), instead of obtaining a boost, the "turbo" tip, actually will reduce the amount of light reaching the composite to initiate the polymerization process.

From a practical viewpoint, it is usually recommended to change the tip depending on the clinical situation, but the same result could be obtained just taking into account some tricks. For example, increasing the polymerization time and reducing the thickness of the first composite layer are advisable to ensure proper polymerization of the restorative material in the deepest areas of the preparation. The light tips should be not only perfectly cleaned, but also periodically checked for possible damage that might occur during restorative procedures. Also, checking the light output periodically with a radiometer is recommended. Halogen bulbs degrade with use, so they should be changed regularly and not merely when they burn out; conversely, light-emitting diode arrays are not subject to decreasing efficiency over time.

SUGGESTED READING

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EDITOR'S NOTE

If you have a question on any aspect of esthetic dentistry, please direct it to the Associate Editor, Dr. Edward J. Swift, Jr. We will forward questions to appropriate experts and print the answers in this regular feature.

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