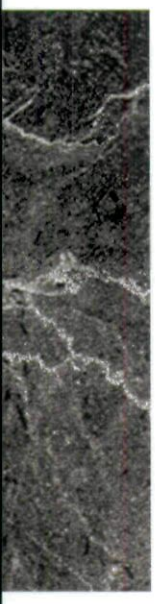

Ask the Experts

VISIBLE LIGHT CURING

Guest Expert
Fred Rueggeberg, DDS, MS*

QUESTION: Can I really cure composite in just 3 seconds?

ANSWER: There is probably no other field of dental products that continues to make such bold and unchallenged statements as those concerning light-curing units. The clinician is faced with the dilemma of wanting to provide the best, longest-lasting restorations, while also making the most efficient use of chair time. The most popular dental periodicals (nonresearch) are full of advertisements making a wide variety of claims about the ability of specific light-curing devices to perform in only a few seconds what used to take either 60, 40, or 20 seconds using a conventional quartz-tungsten-halogen (QTH) source. However, clinically relevant aspects usually not mentioned in these advertisements include the depth to which the device cures, how the intensity changes with tip distance, and for which composites the stated exposure times are valid. Current options range from the high-intensity QTH lights to plasma arc units to the relatively new blue light-emitting diode (LED) lights.

Many times, the advertised claims of curing times are the only information a clinician has regarding the supposed "performance" of one light-curing unit relative to another. However, these claims have potentially serious clinical repercussions because the clinician's income depends partly on his or her reputation as reflected in the longevity of the restorative work delivered. Clearly, poor curing results in inferior resin-based restorations. But how is one to judge the validity of these claims for short exposure times?

It is *very* easy to adequately expose the top surface of a photoactivated material—it could be done using even a common blue LED keychain light. However, what is happening in the depths of the material is the most important aspect of curing. The goal of a light-curing procedure is to provide equivalent degrees of cure on the bottom and top surfaces so that the restoration will undergo minimal flexure during function, minimizing fatigue stress at the bonded cavosurface margin. Unfortunately, the clinician can evaluate only the well-cured exposed surface.

Advertising claims usually do not mention the fact that not all composites respond similarly to the same light-curing unit, even if they contain the same photoinitiator, such as camphorquinone. This ease of photo-curing varies greatly among different products, even those of similar shade.

Many research articles have been written about the myriad factors affecting the cure of composite, and some have compared different types of light-curing units. This information provides good, fundamental, scientific evaluation of products under controlled conditions using only a small variety of restorative materials or lights that are on the market. However, what the clinician needs to know is how a light performs with his restorative materials in his office compared with the unit he is currently using.

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So how can you evaluate the performance and claims of a "new light" that you may be considering buying? Ask for a light you are considering for purchase to be loaned to you for evaluation. To evaluate curing efficiency, do *not* rely strictly on intensity measurements by handheld radiometers. Instead, perform a simple test using the light-curing unit currently owned, the new light in question, and the specific restorative material used in the office.

Remove the stopper and cut the curved end off a compule of composite, or merely remove the top from a composite syringe. For the compule, place a piece of polyester film (Mylar, DuPont, Wilmington, DE, USA) on the tabletop, put the previously stoppered compule end on top of the polyester film, and pack all the composite in the compule against the polyester film. This process creates a cylinder of uncured composite. Then use the current office light for the normal exposure duration and at a variety of tip distances from the compule. Eject the composite from the compule using a dispensing gun or from the syringe by twisting the delivery end. Once retrieved, remove the uncured composite with a paper towel and measure the thickness of the remaining cured piece using a device usually used to check thickness of veneers or crowns: a Boley gauge or micrometer.

This same procedure is then repeated using the same composite, again using a variety of exposure times and tip distances, but now using the new light being considered. Comparing the thickness of composite cylinders cured by the test light with those cured by the standard light will clearly indicate what exposure duration is required at similar tip distances to provide an equivalent polymerization reaction to that obtained using present office conditions.

In this manner, a clinician can easily and accurately evaluate the claims of lights for very short exposure times against what is currently considered adequate. It must be noted that the thickness obtained using this method is *not* an indication of clinical composite performance (depth of cure), where the bottom surface attains an extent of cure similar to that of the top. Instead, it is meant only as a relative guide for establishing equivalent performance among lights, exposure durations, and tip distances. Thus, by using this simple test, much of the uncertainty and confusion can be eliminated, providing the clinician with valid performance information that is relevant to his or her practice environment.

SUGGESTED READING

Asmussen E, Peutzfeldt A. Polymer structure of a light-cured resin composite in relation to distance from the surface. Eur J Oral Sci 2003; 111:277–279.

Caldas DB, de Almeida JB, Correr-Sobrinho L, Sinhoreti MA, Consani S. Influence of curing tip distance on resin composite Knoop hardness number, using three different light curing units. Oper Dent 2003; 28:315–320.

Ernst CP, Meyer GR, Muller J, Stender E, Ahlers MO, Willershausern B. Depth of cure of LED vs QTH light-curing devices at a distance of 7 mm. J Adhes Dent 2004; 6:141–150.

Katahira N, Foxton RM, Inai N, Otsuki M, Tagami J. Comparison of PAC and QTH light sources on polymerization of resin composites. Am J Dent 2004; 17:113–117.

Editor's Note: If you have a question on any aspect of esthetic dentistry, please direct it to the associate editor, Edward J. Swift Jr, DMD, MS. We will forward questions to appropriate experts and print the answers in this regular feature.

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