What should you look for in a curing light?

A panel discussion with Howard Strassler,[1] Joe Oxman,[2] and Frederick Rueggeberg[3]

Introduction

For long-lasting, durable restorations, one must select the right curing light for the practice. But sifting through manufacturer's claims and deciding what type of curing light to choose can be a daunting task. To help shed some light on this question, The Canadian Dental Association (CDA) convened a panel discussion with three light curing experts, Howard Strassler (HS), Joe Oxman (JO) and Frederick Ruggerberg (FR), who attended the 2014 Symposium on Light Curing in Dentistry in Halifax, Canada.

On the importance of access

HS: From a clinician's viewpoint, access is a very important criterion. I want to be able to access the tooth I'm restoring from the occlusal, buccal, and lingual aspects, knowing full well that not every patient can open their mouth adequately to get full access. A curing light should work well for both adult and pediatric patients with the light held at right angles to the surface and as close as possible without interfering with the composite.

On the importance of light intensity

JO: From my perspective as a photopolymer scientist, I believe there are several key factors one should investigate when you are considering buying a new curing light. The curing light should have enough intensity to ensure a good and comparable cure at both the top and bottom of the composite restoration, without generating too much heat. I would suggest lights with intensity values of 750 to no more than 2,000 milliwatts per square centimetre. Those with outputs higher than this amount potentially generate excessive heat, without curing the composite any faster. Most recent studies show that higher intensity does not result in shorter curing times due to the nature of today's curing chemistries. One should follow the suggested curing times of the composite manufacturer and not that of the light manufacturer.

On the importance of choosing a blue-only or a multiwave/multipeak curing light

FR: With LED-based curing lights, you're usually faced with 2 choices: a light that emits only blue light or a light that emits both blue and violet light, also known as a multiwave (or multipeak) light. A blue-only LED light activates a photoinitiator in the restorative

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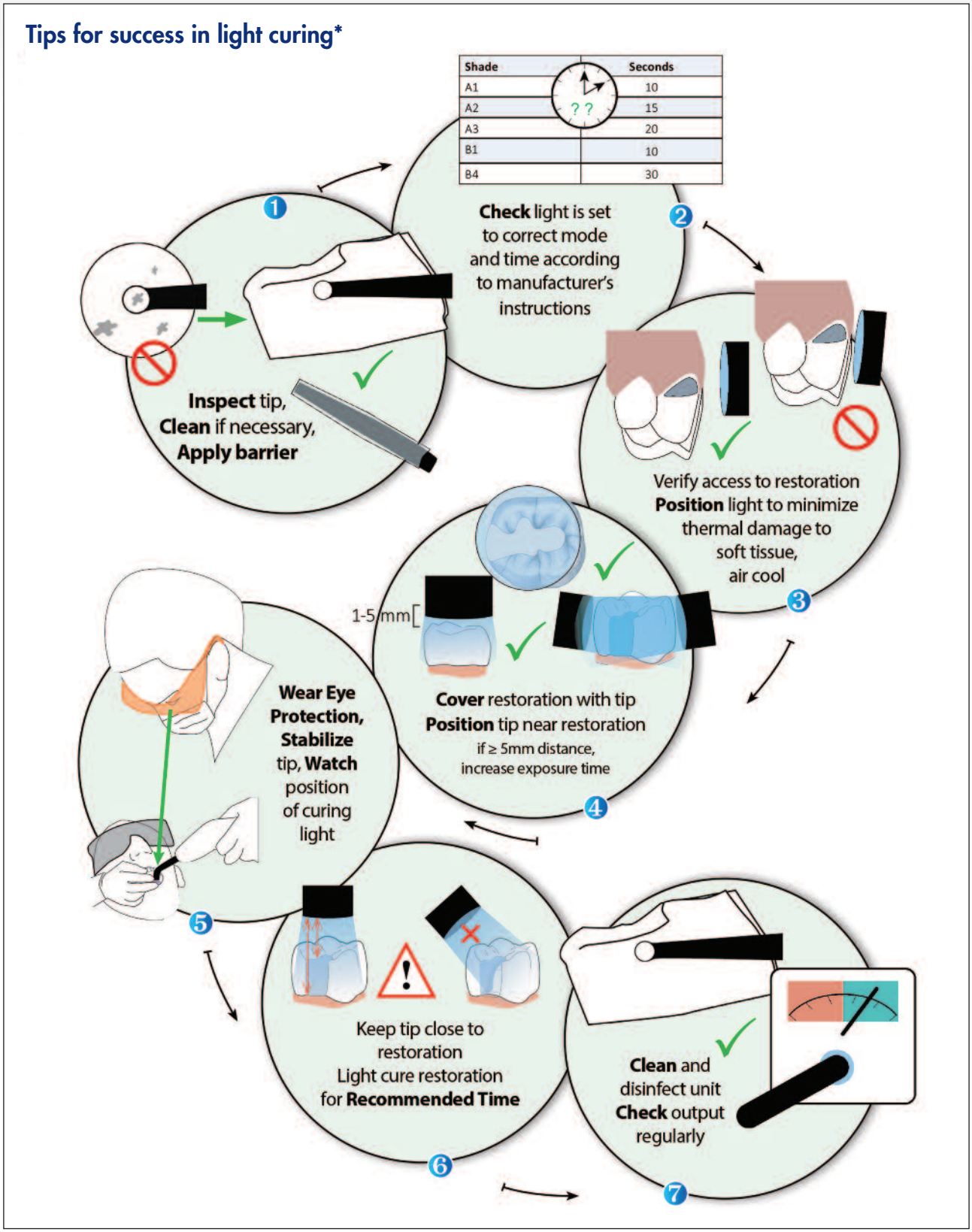
Tips for success in light curing*



material called camphorquinone, whereas a multiwave light polymerizes materials by activating both camphorquinone and an alternative initiator. What difference does it make? Materials with both an alternate initator and camphorquinone—the ones you expose to a multiwave light—will cure better at the top surface than if you use a blue-only LED light. However, the blue light penetrates very deeply into the composite and that's where the bulk strength of the material comes from. With a blue-only light, the blue output is much more intense compared to the blue output of a multiwave light, so it's a tradeoff. You're likely going to optimize curing performance if you select a light and a specific composite from the same manufacturer—but you often don't have that luxury.

JO: I would argue that, based on today's light curing chemistries and much of the supporting literature and data, those curing lights with 2 distinct LED wavelengths may or may not provide any additional benefit to the curing chemistry itself. The bottom line is, I think we need to keep things simple.

HS: In general, a buyer of a multiwave light also needs to be aware that the blue and violet light-emitting diodes are placed in distinct locations in the curing light head. The section of the light head that has the violet LED will not effectively cure the surface of a composite that is only blue light sensitive. This means when the light illuminates the surface of a restoration, one area is exposed to violet light and another area is exposed to blue light. The locations of where the violet and blue lights fall within the cavity preparation become of clinical relevance.

On the importance of a uniform light beam

JO: I believe it's important to select a curing light that provides a light beam that is relatively homogenous or uniform over the entire tip at clinically relevant distances, somewhere between 3–10 mm. Preferably, the light should not have a distribution of what I call cold or hot spots; the goal is to ensure an even curing across the entire restoration.

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** Graphics based on Halifax 2014 Symposium on Light Curing, courtesy of Dr. Richard Price, Professor and Head of Fixed Prosthodontics, Department of Dental Clinical Sciences, Faculty of Dentistry, Dalhousie University, Canada. Email: rbprice@dal.ca*

Tips to help you choose your next curing light*

? Has the light been independently tested and approved for use in your country?

For example, does it have the CE mark? ✓

? Does the light come with support, contact information, and a warranty?
Can the light be easily disinfected?
Does the light feel robust?

Easily cleaned & robust. ✓

? When measured accurately, does the light deliver at least 500 mW/cm² in standard mode?

Unless they are matched to a specific resin system, be wary of lights delivering > 2,000 mW/cm², or offering exposure times less than 10 seconds.

<500 mW/cm² ⊘ >2,000 mW/cm² ⊘

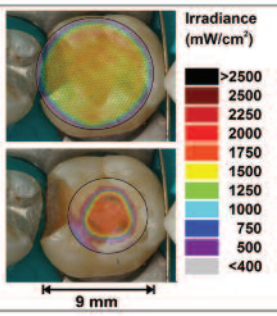
? Will the curing light tip completely cover most of your restorations, or will overlapping exposures be required?

Ideally light manufacturers should show that their light delivers a wide and uniform light output without irradiance 'hot' or 'cold' spots.

Can the light access all restorations in the mouth?

✓ Wide tip with a uniform output

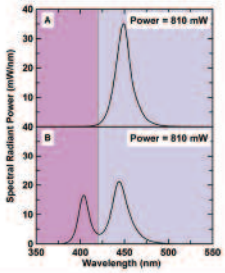
⊘ Small tip with 'hotspots' of high irradiance



? Ask the resin manufacturer if a single peak LED curing light is sufficient?

OR:

Would a broad-spectrum multi-peak LED curing light be beneficial to activate all the photoinitiators they use in their resins?



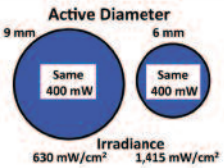
SINGLE PEAK (all blue LEDs) are most effective on camphorquinone.

MULTI-PEAK (blue **and** violet LEDs) to activate both camphorquinone **and** alternative photoinitiators.

! A low power (Watts) light can still deliver a high irradiance (mW/cm²) if a small tip diameter is used.

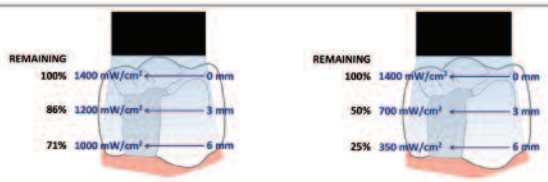
Because:

Irradiance = Power/Tip Area



Decreasing the tip diameter by 3-mm will double the average irradiance.

! Choose a light that is least affected as the distance from the light tip increases.



! Learn how to increase exposure time to compensate for the decrease in irradiance as distance between light tip and resin increases.

A 50% decrease in irradiance means you must double the exposure time.