

Views from World Leaders in Operative Dentistry

IOWA DENTAL REVIEWS
Continuing Education

Friday, June 10, 2022
College of Dentistry & Dental Clinics

1

EFFECTIVE AND EFFICIENT USE OF LIGHT CURING AND BULK FILL DENTAL COMPOSITE PLACEMENT

Natalia Restrepo-Kennedy DDS, MS
Aditi Jain BDS, MS

2



CONFLICT OF INTEREST

- No conflict of interest with any organizations

3



Objectives

- Discuss important considerations when choosing an efficient curing light and best practices for more predictable light curing

4

65,000 DENTISTS IN USA MAY **NOT** BE DELIVERING
MANUFACTURERS RECOMMENDED ENERGY

13,000 DENTISTS IN USA DELIVERING
< 5 J/CM²

From: Dr. Richard Price, Dalhousie University

5

Clinical Concerns





Inadequate polymerization




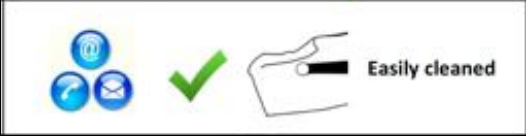
6



7

 Has the light been independently **tested and approved** for use in the country?
For example does it have the CE mark? 

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

 Easily cleaned

Roulet JF, Price R. Light curing - guidelines for practitioners - a consensus statement from the 2014 symposium on light curing in dentistry held at Dalhousie University, Halifax, Canada. J Adhes Dent. 2014 Aug;16(4):303-4
<http://www.cda-adc.ca/en/services/essentials/2016/issue6/#1>

8



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



Unless matched to a specific resin system, be wary of the lights delivering >2000 mW/cm² or offering exposure times < 10sec



Depth of cure




Heating pulp or periodontium


Roulet JF, Price R. Light curing - guidelines for practitioners - a consensus statement from the 2014 symposium on light curing in dentistry held at Dalhousie University, Halifax, Canada. J Adhes Dent. 2014 Aug;16(4):303-4
<http://www.cda-adc.ca/en/services/essentials/2016/issue6/#1>

9

Regularly monitor the light output over time

Measuring the light power (radiant flux) in [mW]

- 

Press the (+) button until the milliwatt program is selected and << ---mW >> is shown in the display.
- 

Position the light probe directly on the centring gauge and flush on the sensor surface.
- Switch on the polymerization light. The Bluephase Meter II is activated automatically. The measurement result of the power is displayed in milliwatts [mW].

Bluephase Meter II

The Bluephase Meter II is a precise dental radiometer for quick and easy verification of the curing light intensity in [mW/cm²] and the light output in [mW]. Unprecedented measuring accuracy for a radiometer with a tolerance of only ± 10 %, makes it two times more accurate than most portable radiometers currently available.

Suitable for all types of dental curing lights in the wavelength range of 380-500nm including halogen, plasma, and LED.



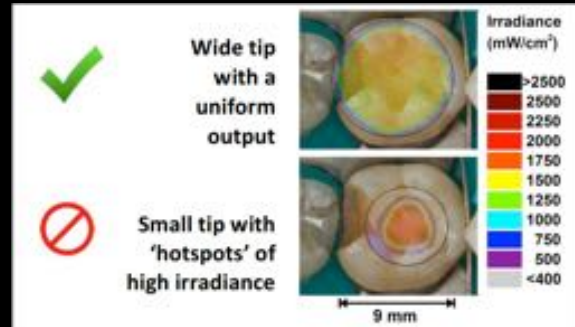
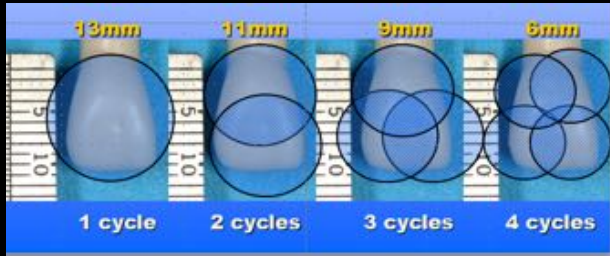
Bluephase Meter II

10



Will the curing light tip 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

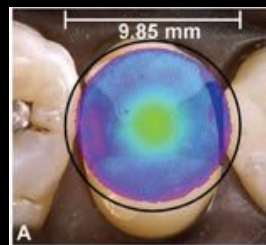


Roulet JF, Price R. Light curing - guidelines for practitioners - a consensus statement from the 2014 symposium on light curing in dentistry held at Dalhousie University, Halifax, Canada. J Adhes Dent. 2014 Aug;16(4):303-4
<http://www.cda-adc.ca/en/services/essentials/2016/issue6/#1>

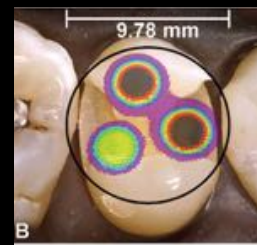
11



Ask the resin manufacturer if a **single peak LED curing light** is sufficient OR Would a broad-spectrum **multi-peak curing light** be beneficial to activate the photoinitiators used in their resins ?



SINGLE PEAK
 (all blue LEDs)
 Most effective on
 Camphoroquinone (CQ)



MULTI-PEAK
 (blue and violet LEDs)
 Activate both CQ and
 alternate photoinitiators

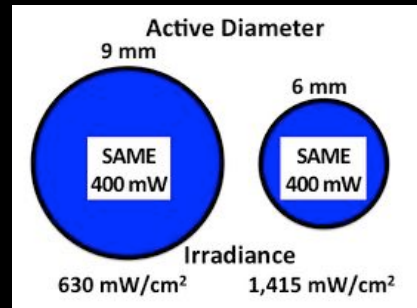
R.B. Price, J.L. Ferracane, A.C. Shortall. Light-Curing Units: A Review of What We Need to Know. Journal of Dental Research 2015, Vol. 94(9) 1179-1186
<http://www.cda-adc.ca/en/services/essentials/2016/issue6/#1>

12



Low power (Watts) light can still deliver a **high irradiance** (mW/cm²) if a **small tip** is used

Irradiance = Power/ Tip Area



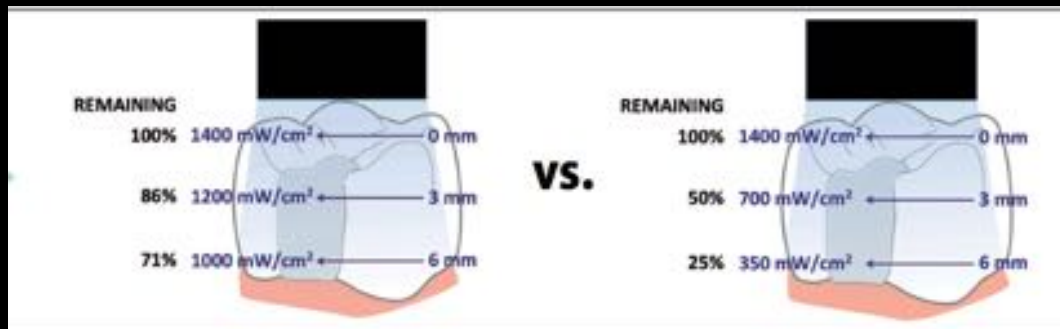
Decreasing tip diameter by 3mm can double the average irradiance

Roulet JF, Price R. Light curing - guidelines for practitioners - a consensus statement from the 2014 symposium on light curing in dentistry held at Dalhousie University, Halifax, Canada. J Adhes Dent. 2014 Aug;16(4):303-4
<http://www.cda-adc.ca/en/services/essentials/2016/issue6/#1>

13



Least reduction in irradiance as the **distance from tip** increases



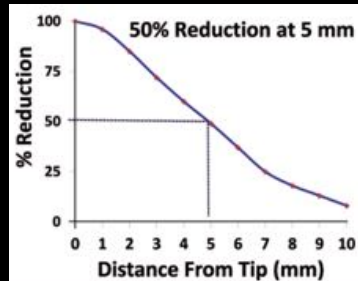
Roulet JF, Price R. Light curing - guidelines for practitioners - a consensus statement from the 2014 symposium on light curing in dentistry held at Dalhousie University, Halifax, Canada. J Adhes Dent. 2014 Aug;16(4):303-4
<http://www.cda-adc.ca/en/services/essentials/2016/issue6/#1>

14



Increase **exposure time** to compensate for decrease in irradiance as **distance** between light tip and resin increases

50% reduction in irradiance requires **2X** the exposure time



Roulet JF, Price R. Light curing - guidelines for practitioners - a consensus statement from the 2014 symposium on light curing in dentistry held at Dalhousie University, Halifax, Canada. J Adhes Dent. 2014 Aug;16(4):303-4
<http://www.cda-adc.ca/en/services/essentials/2016/issue6/#1>

15

Types of Curing lights

Quartz tungsten halogen (QTH) [100 - 1600 mW/cm²]

- Wide spectral irradiance (370-550nm)
- 5% energy for curing, remaining filtered as heat
- Examples: **Optilux 501 (Kerr)**, **Demetron LC (Kerr)**



Krämer et al (2008). Light curing of resin-based composites in the LED era. Am J Dent 2008 Jun;21(3):135-42

16

Light emitting diodes (LED) [1500 - 2000 mW/cm²]

- less heat than QTH, light weight, portable
- 1st generations: low power output and did not perform as well as QTH

Example: **VersaLux, LumaCure**

- 2nd generation: much higher intensities but also much more concern with heat

Example: **UltraLume 2 (Ultradent),**



- 3rd generation: multiple chips for different spectral outputs for use with multiple photoinitiators, also known as “polywave” LEDs

Example: **Valo (Ultradent), Bluephase G2 (Ivoclar Vivadent)**



Krämer et al (2008). Light curing of resin-based composites in the LED era. Am J Dent 2008 Jun;21(3):135-42

17

Plasma arc curing (PAC) [up to 2400 mW/cm²]

- High intensities created in a narrow wavelength
- Claimed 3s curing time, research shows at least 3 X 3s
- Example: **SapphirePlus (DenMat)**

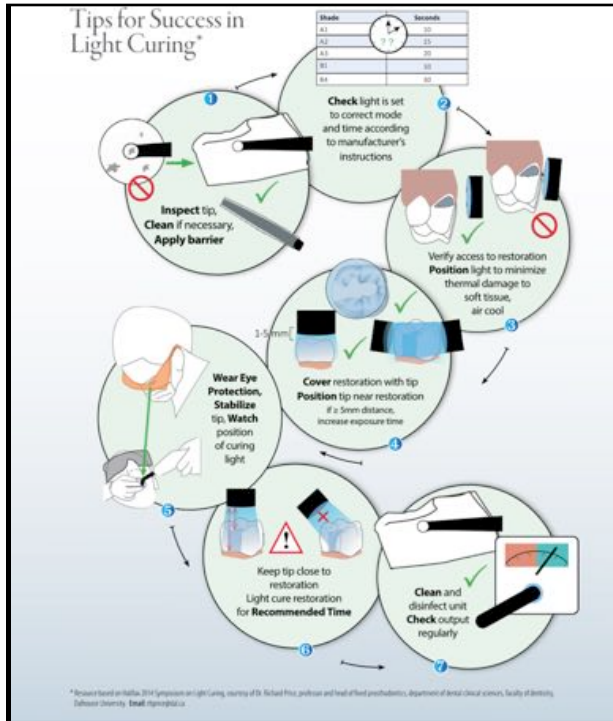


Argon-ion lasers [~ 250 ± 50mW/cm²]

- Blue-green light of argon ions of wavelengths that fall within CQ absorption spectra
- heat generation during polymerization, high initial shrinkage stresses
- Example: **AccuCure 1000 (LaserMed Inc.)**

Krämer et al (2008). Light curing of resin-based composites in the LED era. Am J Dent 2008 Jun;21(3):135-42

18



<http://www.cda-adc.ca/en/services/essentials/2016/issue6/#1>

Resource courtesy of Dr. Richard Price, professor and head of fixed prosthodontics, department of dental clinical sciences, faculty of dentistry, Dalhousie University. Email: rprice@dal.ca

19

Light curing

- Clinician must know:
 - Light curing unit performance
Energy/radiant exposure you are delivering
 - Clinical technique
How to deliver light energy effectively
 - Material requirement
Energy/radiant exposure you need to deliver

20

