

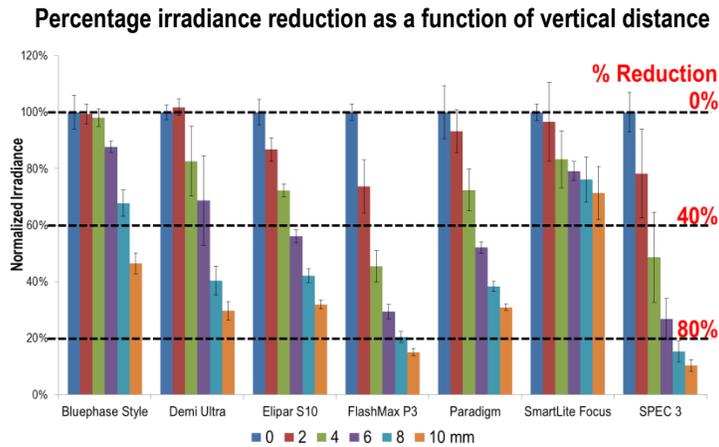
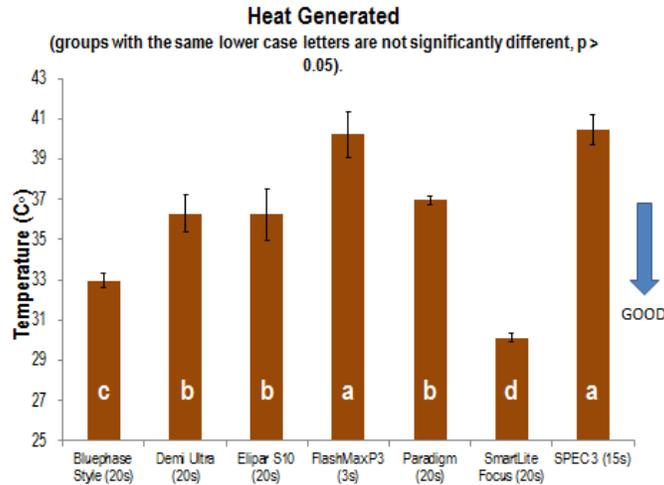


Laboratory Evaluation of Seven Latest Dental Light-Curing Units

Dental light curing units (LCUs) are constantly evolving. Their most common improvements include portability, ergonomics, battery efficiency, and the utilization of energy-efficient light-emitting diodes as their light-curing sources. Since “not all LCUs are created equal”, according to the “Light curing guidelines for practitioners: a consensus statement from the 2014 symposium on light curing in dentistry, Dalhousie University, Halifax, Canada” [1], choosing an appropriate LCU for your clinic requires some research, comparative analysis, and reviewing reports that can validate their claims, performance, and deficiencies. When buying a LCU, comparison of parameters such as irradiance [mW/cm^2], radiant exposure [J/cm^2], exposure times, radiant heat, effective curing spectral range, and beam profile (e.g., irradiance distribution and uniformity across the light tip) between different LCUs should be carefully weighed against each other or against a well-accepted LCU that has been validated for its efficacy and safety. Because the polymerizing kinetics and mechanisms for any photo-sensitive resin-based composite are complex and individual, carefully ensure that when curing, adequate total photon energy is delivered to the composite by always following its respective manufacturer’s recommended exposure energy, time, and increment thickness. Furthermore, most manufacturers tend to calibrate their LCU systems in accordance to their respective proprietary resin-based composite systems. For example, Ivoclar’s Tetric Ceram consists of two photoinitiators, CQ and PPD, and is recommended to cure with using a poly-wave LCU such as the Ivoclar’s Bluephase Style , while most of the other LCUs in the market are mono-wave systems. Recently, with the marketing slogan trending toward high irradiance output and short exposure time, especially with LCUs that claim 1-5 seconds curing times, the 2014 Symposium on Light Curing in Dentistry [1] recommended that **CAUTION** must be exercised since from past research, very high irradiance output and short exposure time may not provide adequate cure and can increase contraction stresses, leading to undesirable clinical properties. In addition, if operated under improper instructions, these high intensity LCUs can also transfer great amount of radiant heat that can potentially cause harm to the pulpal tissues. Thus, based on the 2014 Symposium [1] that new LCUs should be validate from a reputable independent 3rd party, DECS summarized our evaluation in a nutshell (**See following Tables: 1 & 2**) for the seven latest commercially available LCUs; other recent LCUs (e.g., Coltolux LED, FlashLite Magna 4.0, SmartLite Max, and Valo Cordless) that are not reported here can be found in the ADA Professional Product Review (Volume 9, Issue 4, 2014).

Blue Phase Style	Demi Ultra	Elipar S10	FlashMax P3	Paradigm	Smart Lite Focus	Spec 3
						

1. RB Price. Light curing guidelines for practitioners: a consensus statement from the 2014 symposium on light curing in dentistry, Dalhousie University, Halifax, Canada. *J Can Dent Assoc.* 2014; 80: e61.



Mean Knoop microhardness of various LCU brands measured at the top and bottom of 2 mm thick discs, placed at two different source-to-object distances (2 versus 8 mm). Groups with the same case letters are not significantly different ($p > 0.05$).

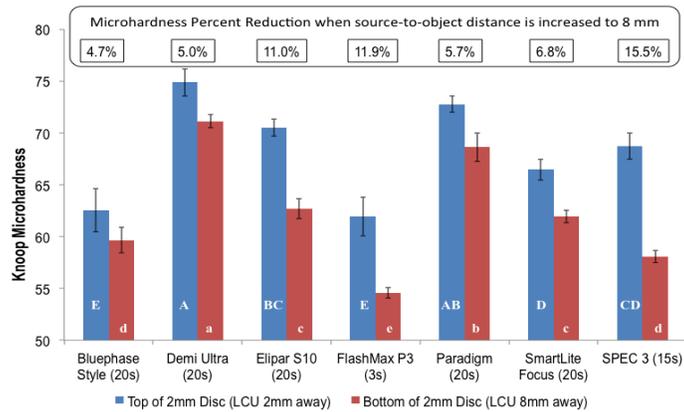


Table 1: In a Nutshell.

Product (Manufacturer) & Light Source	Power Options	Cure Time Options (Seconds)	Battery Type	Radiometer Included (Yes/No)	Battery Replacement Cost	Time to Fully Charge	Manufacturer Stated Wavelength Range (nm)	Manufacturer Stated Weight (g)	DECS Measured Weight (g)	Price	Light Warranty (Year)	Battery Warranty (Year)	
Bluephase Style (Ivoclar Vivadent)	LED	10, 15, 20, 30s	Li-Ion	No	\$105	2 h	385-515	120	120.76	\$800 (Gov), \$1395 (Comm)	3	1	
Demi Ultra (Kerr)		5, 10, 20s	Ultracapacitor	Yes	N/A (Requires service from company)	70 s	450-470	207	208.90	\$1,025	3	1	
Elipar S10 (3M ESPE)		Cordless	(5, 10, 15, 20s), (Continuous Mode = 120s), and (Tack-Cure Mode)	Li-Ion	Yes	\$246.75 (Gov), \$356.80 (Comm)	1.5 h	400-515	250	248.57	\$1,099 (Gov), \$1625 (Comm)	3	1
FlashMax P3 (CMS Dental)			1, 3s		No	\$70.00	2 h	390-480	120	120.36	\$1,350	2	2
Paradigm (3M ESPE)		Cordless and Corded	(5, 10, 15, 20s), (Continuous Mode = 120s), and (Tack-Cure Mode)	Li-Ion	No	Requires service from company	2 h	400-515	180	171.94	\$652 (Gov), \$911 (Comm)	2	1
SmartLite Focus (Dentsply)		Cordless	20s		No	\$76.74 (Gov), \$117.75 (Comm)	3 h	420-540	90	86.97	\$651 (Gov), \$1,000 (Comm)	2	1
SPEC 3 (Coltene)			(Standard Mode: 5, 10, 15s) and (Ortho Mode: 1, 2, 3s)		No	\$125	2.4 h	430-490	125	128.13	\$1,378	2	2

Table 2: DECS Ratings.

LCUs	Bluephase Style	Demi Ultra	Elipar S10	FlashMax P3	Paradigm	SmartLite Focus	SPEC 3
Wavelength(s)	Blue & Violet	Blue	Blue	Blue	Blue	Blue	Blue
Camphorquinone Excitation	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TPO or PPD Excitations	Yes	No	No	No	No	No	No
Ease of Use	+++	++++	+++	+	+++	+++	+++
Ergonomics	+++	+++++	+++	+	+++	+++	+++
Autoclavable	No	No	No	No	No	No	No
DECS Rating	Acceptable	Excellent	Excellent	Marginal	Excellent	Excellent	Marginal