



# Irradiance of Curing Lights using a New Chairside Spectrometer-Trained System

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Douglas Holmes, DMD

Lt Col, USAF, DC

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# Co-Investigators



- Wen Lien, DMD, MS, MS  
Col, USAF, DC
- Christopher Raimondi, DDS, MS  
Lt Col, USAF, DC
- Wyeth Hoopes, DDS, MS  
Lt Col, USAF, DC
- Kraig Vandewalle, DDS, MS  
Col (Ret), USAF, DC

# Outline



- **Background**
- **Materials and Methods**
- **Results**
- **Conclusions**

# Background



- Light-Curing Units – More than a Bright Idea
  - Initiates polymerization process
  - Transforms composite resin
  - ADA recommends practitioners monitor irradiance

# Background



- Monitoring LCU Output
  - Spectrophotometers-Gold Standard
    - ✦ Accurate
    - ✦ Expensive
  - Conscientious Practitioners
    - ✦ Hand-held radiometers
    - ✦ Affordable
    - ✦ Unreliable accuracy
    - ✦ Applicable in clinic?

# Background



- BlueLight Analytics – checkUP Claims
  - Affordable
  - Accurate
  - Customized Results
    - ✦ Bluetooth app
      - determines irradiance
    - ✦ Specific composite resin
    - ✦ Specific shades
      - individualized curing time

# Objective



- The focus of this study was to compare the irradiance of 9 LCUs measured on CheckUP and two popular chairside radiometers (Bluephase Meter I, Bluephase Meter II, Ivoclar Vivadent) to a laboratory-grade thermopile (10A-SH-V1.1ROHS, Ophir).

# Null Hypotheses



- There will be no difference in the LCU's irradiance output measured among a spectrometer, a thermopile, a chairside radiometer, and CheckUP.

# Materials and Methods



- Evaluated nine contemporary LED-LCUs
- 10 measurements per system for each LCU
- Thermopile
  - Two Handheld radiometers
  - CheckUP

# Light-Curing Units



Light Curing Unit (LCU)	Manufacturer	Multi-Spectrum	Measured Active Optic Area (cm <sup>2</sup> )	Reported Irradiance (mW/cm <sup>2</sup> )
Bluephase G4	Ivoclar Vivadent	Y	0.636	1200
Bluephase Style	Ivoclar Vivadent	Y	0.622	1200
Bluephase 20i	Ivoclar Vivadent	Y	0.430	1200 (High) 2000 (Turbo)
Demi Ultra	Kerr	N	0.490	1042-1545
Paradigm	3M ESPE	N	0.622	1470
Smartlite Focus	Dentsply		0.422	
SmartLite Pro Cure	Dentsply	Y	0.785	1250
SPEC 3	Coltene	N	0.407	1600 (High) 3000 (3K)
Valo Grand	Ultradent	Y	1.075	1000 (Std) 1600 (High) 3200 (Xtra)

# Materials and Methods



- Thermopile
  - (Pulsar 4, Ophir; PM10, Coherent)
    - ✦ Light source to entrance = 0 mm
    - ✦ Evaluate power per LCU
    - ✦ Converted to irradiance ( $\text{mW}/\text{cm}^2$ )

# Materials and Methods



- Radiometer
  - Bluephase Meter I, Ivoclar Vivadent
    - ✦ Light source to entrance = 0 mm
    - ✦ Irradiance ( $\text{mW}/\text{cm}^2$ ) provided

# Materials and Methods



- Radiometer

- Bluephase Meter II, Ivoclar Vivadent
  - ✦ Light source to entrance = 0 mm
  - ✦ Power provided
  - ✦ Converted to irradiance ( $\text{mW}/\text{cm}^2$ )

# Materials and Methods



- 9 Light Curing Units Measured
  - Each LCU irradiance measured 10 times on each system

# Data Analysis



- Data were analyzed with bivariate regression to evaluate the correlation of the LCU irradiance between the various spectrometer and radiometer systems.

# Results



- Significant differences in mean irradiance between the four meters depending on LCU brand
- Bivariate regression analysis: Irradiances correlated better between thermopile and CheckUP than thermopile and the two radiometers

# Results



- Absolute mean percent difference from thermopile:
  - CheckUP: 7.4 +/- 2.9%
  - Bluephase Meter I: 21.4 +/- 15.4%
  - Bluephase Meter II: 17.1 +/- 11.0%

# Results



Light Curing Unit	Irradiance (mW/cm <sup>2</sup> )					Absolute Difference % Change from Thermopile		
	Thermopile	CheckUP	BM I	BM II		CheckUP	BM I	BM II
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)				
Bluephase G4	1054 (9) D	1111 (11) C	1135 (14) B	1357 (11) A		5.4 %	7.7 %	28.7 %
Bluephase Style	974 (3) C	1047 (8) B	914 (37) D	1234 (7) A		7.5 %	6.2 %	26.7 %
Bluephase 20i	1213 (17) C	1339 (7) A	1130 (19) D	1255 (15) B		10.4 %	6.8 %	3.5 %
Demi Ultra	1433 (36) B	1359 (8) C	711 (19) D	1495 (15) A		5.2 %	50.4 %	4.3 %
Paradigm	1055 (10) C	1173 (5) B	935 (25) D	1303 (13) A		11.2 %	11.4 %	23.5 %
SmartLite Focus	904 (5) B	921 (4) B	600 (27) C	953 (15) A		1.9 %	33.6 %	5.4 %
SmartLite Pro Cure	1142 (12) C	1234 (7) B	750 (16) D	1485 (20) A		8.1 %	34.3 %	30.0 %
SPEC 3	1778 (8) A	1640 (12) B	1424 (68) D	1577 (13) C		7.8 %	19.9 %	11.3 %
Valo Grand	765 (14) C	833 (9) B	936 (26) A	925 (7) A		8.9 %	22.4%	20.9 %
					Mean (SD)	7.4 (2.9) A	21.4 (15.4) B	17.1 (11.0) AB

Groups with the same letter per row are not significantly different (P>0.05)

# Conclusions



- The new chairside spectrometer-trained system (CheckUP) provided the best correlation and the lowest overall percent deviation in irradiance from the thermopile compared to other radiometers tested

# Questions?

