LABORATORY RESEARCH REPORT

Evaluation of Demi LED Curing Light

Date: July 12, 2007

SPONSOR
David Tobia
Vice President, Research and Development
Kerr Corporation
Orange, CA, USA

INVESTIGATOR/CONSULTANT

Jeffrey Y. Thompson, PhD
Weston, FL

PROTOCOL

MATERIALS AND METHODS:

Materials:

All materials were supplied by Kerr Corporation to the investigator for this investigation.

TABLE 1: List of Curing Lights Used in Study (2)

(1) Demi Light (Prototype)	Kerr	LED Light
(2) LEDemetron II	Kerr	LED Light

TABLE 2: List of Composites Used in Study (5)*

**All composites used were A3 shade*

(1) Premise Body	Kerr	Nano-hybrid composite	Lot: 2762838
(2) Herculite XRV Enamel	Kerr	Hybrid composite	Lot: 2748205
(3) Filtek Supreme Plus	3M-ESPE	Nano-hybrid composite *(Mixed Lots)*	Lot: 20070130 20070117 20070208
(4) Spectrum TPH3	Dentsply	Hybrid composite	Lot: 703082
(5) Esthet-X	Dentsply	Micro-hybrid composite	Lot: 704262

Materials Manipulation:

All materials were manipulated following the stated instructions in individual manufacturers' enclosures in the package. All instructions were recorded in detail for reported results.

Specimen Preparation for Testing:

All specimens were prepared by dispersing material into appropriate molds for specific tests. The number of specimens is reported in the test descriptions below. Specimens for Vickers hardness measurement were cured and then aged for 24hr in deionized/distilled water (37°C) prior to testing. A Mylar strip was placed on the surface of the composite between the composite surface and the light tip to decrease the probability of oxygen inhibition.

Mechanical Testing:

All samples were tested in ambient conditions. Two irradiation times (5 sec, 10 sec) were used for each combination of light and composite (total of 20 groups for each test). For the Vickers hardness testing, there are 40 groups (top and bottom measurements on each disk specimen, 4 disks per each light+composite+time combination = 80 disks fabricated). The hardness testing system used was a Buehler Micromet 2100 with a Vickers diamond indenter. Specimen surfaces were not polished prior to hardness testing. The use of rigid molds, Mylar masks, and pressure to express excess material prior to curing resulted in flat, parallel upper and lower surfaces. The disks were 2.0 mm thick.

TABLE 3: Mechanical Tests (Individual test procedures are referenced):
[All tests were run at 25°C (in water when applicable)]

Depth of Cure (modified):*
Number of specimens per group: 10
Total number of specimens for test: 200
Reference for Procedure: ISO Standard 4049 (International Standards Organization)
**Measured DOC values are absolutes, not divided by 2 as in standard*

Hardness (Vickers):
Number of measurements per group: 12 (4 specimens/group; 3 measurements per specimen)
Total number of specimens for test: 80
Total number of measurements for test: 480 (240 top, 240 bottom)
Reference for Procedure: Thompson and Anusavice, *J Dent Res*, 1994; 73: 505-510.

Statistical Analysis:

All groups of specimens for each test were analyzed for means and standard deviations. Groups were compared within test sub-groups using ANOVA and post-hoc t-tests ($p \leq 0.05$).

RESULTS

Summary table of test results:

Depth of Cure

Material	LEDemetron II 5 seconds (mm ± sd)	DEMI Light 5 seconds (mm ± sd)	LEDemetron II 10 seconds (mm ± sd)	DEMI Light 10 seconds (mm ± sd)
Premise Body ***Kerr***	6.0 ± 0.2[a]	6.1 ± 0.2[a]	7.1 ± 0.2[b]	7.4 ± 0.3[b]
Herculite XRV ***Kerr***	6.3 ± 0.2[a]	6.4 ± 0.3[a]	7.5 ± 0.1[b]	7.8 ± 0.3[b]
Filtek Supreme Plus ***3M-ESPE***	5.9 ± 0.2[a]	6.1 ± 0.3[a]	7.0 ± 0.2[b]	7.3 ± 0.2[b]
Spectrum TPH3 ***Dentsply***	6.7 ± 0.3[a]	7.4 ± 0.3[b]	8.2 ± 0.4[c]	8.7 ± 0.4[c]
Esthet-X ***Dentsply***	5.3 ± 0.2[a]	5.5 ± 0.3[a]	6.3 ± 0.2[b]	6.5 ± 0.3[b]

*Superscript letters (a, b, c) represent statistically equivalent means for each property measured. Statistical comparisons done only for each composite (*i.e.*, comparisons are between the light/time combinations, not between composite A versus the other composites for a given light/time combination – read statistics for each row not column).

Vickers Hardness (top surface of cured disk: thickness = 2.0 mm)

Material	LEDemetron II 5 seconds (VHN ± sd)	DEMI Light 5 seconds (VHN ± sd)	LEDemetron II 10 seconds (VHN ± sd)	DEMI Light 10 seconds (VHN ± sd)
Premise Body ***Kerr***	43.6 ± 2.4[a]	45.0 ± 2.7[a]	42.9 ± 1.1[a]	48.1 ± 1.7[b]
Herculite XRV ***Kerr***	54.4 ± 2.3[a]	54.0 ± 2.8[a]	57.3 ± 3.3[ab]	59.7 ± 3.4[b]
Filtek Supreme Plus ***3M-ESPE***	55.1 ± 1.5[a]	64.4 ± 3.4[b]	64.2 ± 2.2[b]	68.7 ± 2.0[b]
Spectrum TPH3 ***Dentsply***	50.4 ± 2.5[a]	51.5 ± 3.5[a]	51.6 ± 3.0[a]	55.2 ± 3.3[a]
Esthet-X ***Dentsply***	40.5 ± 3.5[a]	43.7 ± 2.1[a]	54.4 ± 1.1[b]	50.2 ± 4.8[b]

*Superscript letters (a, b) represent statistically equivalent means for each property measured. Statistical comparisons done only for each composite (*i.e.*, comparisons are between the light/time combinations, not between composite A versus the other composites for a given light/time combination – read statistics for each row not column).

Vickers Hardness (bottom surface of cured disk: thickness = 2.0 mm)

Material	LEDemetron II 5 seconds (VHN ± sd)	DEMI Light 5 seconds (VHN ± sd)	LEDemetron II 10 seconds (VHN ± sd)	DEMI Light 10 seconds (VHN ± sd)
Premise Body ***Kerr***	**27.2 ± 3.4[a]**	**30.6 ± 1.4[a]**	**35.0 ± 2.8[b]**	**41.8 ± 1.9[c]**
Herculite XRV ***Kerr***	**30.9 ± 2.6[a]**	**31.0 ± 5.2[a]**	**43.5 ± 4.6[b]**	**49.0 ± 1.9[b]**
Filtek Supreme Plus ***3M-ESPE***	**29.1 ± 2.2[a]**	**37.1 ± 2.0[b]**	**46.4 ± 2.3[c]**	**52.1 ± 1.9[d]**
Spectrum TPH3 ***Dentsply***	**31.7 ± 5.4[a]**	**38.1 ± 1.8[b]**	**41.8 ± 3.0[b]**	**46.5 ± 2.2[c]**
Esthet-X ***Dentsply***	**22.8 ± 4.0[a]**	**25.8 ± 3.1[a]**	**33.7 ± 1.9[b]**	**36.9 ± 3.0[b]**

*Superscript letters (a, b, c, and d) represent statistically equivalent means for each property measured. Statistical comparisons done only for each composite (*i.e.*, comparisons are between the light/time combinations, not between composite A versus the other composites for a given light/time combination – read statistics for each row not column).

Summary:

Both lights behaved in a similar manner. Where statistically notable differences were detected, the Demi Prototype unit yielded mean values for DOC or hardness significantly higher than those measured for specimens cured using the LEDemetron II unit. It should be noted that curing unit output was measured throughout the study using a hand-held radiometer. The Demi Prototype light intensity was approximately 1000 consistently, while the LEDemetron II was approximately 800. This likely accounts for the measured differences obtained in this study.