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Comparison study between light-emitting diode and quartz tungsten halogen light curing systems

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Objective: The purpose of this study was to measure the temperature rise caused by 10 light-emitting diodes (LED) and three quartz-tungsten-halogen (QTH) dental curing lights and to relate the measured temperature rise to the power density of the curing light. The hypothesis was that the temperature rise induced by the LED curing lights would be smaller than that generated by the QTH curing lights operating at the same power density.

Materials & Methods: The curing lights evaluated in this study included a conventional QTH light (XL3000, 3M ESPE, St. Paul, MN, USA), two high-intensity QTH lights (Optilux 501, SDS/Kerr, Orange, CA, USA; Elipar Highlight, 3M ESPE) and 10 LED curing lights (Aqua Blue, Toesco, Kanagawa, Japan; CoolBlu, DentalSystems, Tokyo, Japan; DioPower, CMS, Copenhagen, Denmark; Elipar Freelight, 3M ESPE; Elipar Freelight 2, 3M ESPE; L.E. Demetron 1, SDS/Kerr; Lux-OMax, Akeda, Lystrup, Denmark; Lux-O-Max P1, Akeda; SmartLite, Dentsply, Konstanz, Germany; Ultra-Lume 2, Ultradent Products, South Jordan, UT, USA). The estimated relative heat generated by the curing lights was determined by measuring the temperature rise on the surface of a 4×4 mm cylinder of resin composite (Tetric Ceram; Ivoclar Vivadent, Schaan, Liechtenstein) using a thermocouple connected to a galvanometer (Radiometer, Copenhagen, Denmark). All measurements were made at the end of a 20-second exposure to the curing light. Power density was measured using a dental radiometer (Demetron Research, Danbury, CT, USA). The data were evaluated statistically by regression analysis and by the Newman-Keuls multiple comparison test.

Results: Taking all curing lights into consideration, the coefficient of correlation between temperature rise and power density was very good and statistically significant at $r=0.93$ ($p<0.001$). The correlation coefficient for only the LED curing lights was even stronger, $r=0.96$ ($p<0.001$). This means, of course, that temperature rise increases with increased power density. On the plotted LED regression line, the temperature rise of two of the three QTH curing lights exceeded (by 2 and 2.3 °C) the projected temperature rise of an LED curing light measured at the same power density (650 mW/cm2). The measured temperature rise of the conventional QTH curing light operating at 360 mW/cm2 was not significantly different from the predicted LED temperature rise regression line.

Conclusion: In general, the hypothesis that temperature rise caused by LED curing lights would be less than that generated by QTH curing lights operating at the same power density could not be confirmed. The data did not support earlier findings that LED curing units generated smaller temperature rises than QTH curing lights. The authors concluded that the main reason for earlier findings was that first-generation LED curing lights had lower power densities than present-day lights.

Biography

Dr. Ahmed Elmarakby has completed his PhD at the age of 38 years then postdoctoral studies both were from Al-Azhar University Faculty of Dentistry, Cairo, Egypt. He is Assistant Professor of restorative dentistry science, Alfarabi Colleges, KSA. He is A Lecturer in Operative Dentistry Department , Faculty of Dentistry,Al-Azhar University, Egypt. He has published 4 papers in international journal.He shared one poster in the KSA at jan 2017 and has acceptance to 6 posters in 6 international conferences at this year 2017.

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