

Influence of power density on microhardness of resin composite

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INTRODUCTION: It is generally accepted that sufficient light energy has to be transmitted to dental composites if their mechanical properties are to be good. In a recent study, Peutzfeld and Asmussen¹ showed that these properties were determined by not only energy density but also power density. The aim of this study was to assess the effect of power density on the microhardness of composites when the energy density was fixed.

METHODS: Two light sources, one LED (Bluephase[®]/Ivoclar-Vivadent) and one QTH (Astralis[®]10/Ivoclar-Vivadent), were used to irradiate two composite resins (CeramX[™]/Dentsply, and Tetric EvoCeram[®]/Ivoclar-Vivadent). For each light source, power densities were fixed at 400 and 1000 mW/cm² by varying the distance between the lamp tip and the composites, and energy was fixed at 8 J/cm² by varying the exposure duration (energy = power density x duration). Five samples (3mm in depth) were cured for each resin / curing-unit / power-density combination. The specimens were stored at 37°C for 24 h. For each specimen, the Vickers hardness number (VHN) was measured at the top and the bottom surfaces using a microhardness meter (Buehler model 5104).

RESULTS: Measurements of VHN showed (fig.1):

- for the **LED unit:** no significant differences between 400 and 1000 mW/cm² either at the top surface or at the bottom one for both composite resins,

- for the **QTH unit:** no significant differences between 400 and 1000 mW/cm² at the top surface for both composite resins, but at the bottom surface, resins (both materials) cured at 400 mW/cm² had the greatest microhardness values.

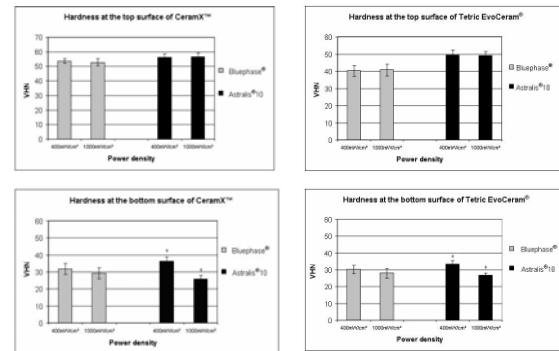


Fig.1: Microhardness of composites cured with the LED unit and the QTH unit at 8 J. Asterisks represent significant differences ($p < 0.001$) (ANOVA, Tukey, $\alpha = 0.05$) between the two power densities.

DISCUSSION & CONCLUSIONS:

The present study underlines that, for the QTH unit, at the bottom surface, for both resins, the lower power density induced the highest VHN. The same results have been found by Peutzfeld and Asmussen¹ concerning the degree of curing of resin composites. This may be explained by the kinetics of photopolymerisation: lower power densities delay the formation of a rigid network², which allows polymerisation of the composite at depth. Thus, an increased exposure duration may be more advisable for curing composite resins at 3 mm depth than a high power density.

REFERENCES: ¹ A. Peutzfeldt, E. Asmussen. (2005) *Resin composite properties and energy density of light cure* J Dent Res **84**:659-662. ² A.D. Neves, J.A.C. Discacciati, R.L. Oréfice, M.I. Yoshida (2005) *Influence of the power density on the kinetics of photopolymerization and properties of dental composites* J Biomed Mater Res B Appl Biomater **72**:393-400.

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