

Dentin shear bond strength and degree of conversion of the dentin bonding agents irradiated with light emitting diode

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I. Objectives

This study investigated the dentin shear bond strength and the degree of conversion (DC) of currently used dentin bonding agents (DBAs) that were irradiated with a light emitting diode (LED) light curing unit (LCU) and a halogen LCU.

II. Materials and methods

The halogen LCU and the LED LCU used in this study were a VIP (Bisco, Schaumburg, IL, USA) and an Elipar Freelight (3M-ESPE, St Paul, MN, USA) respectively. For the VIP, 400mW · cm⁻² intensity mode was used to adjust to the intensity of the LED LCU. The DBAs used in this study were Scotchbond Multipurpose(3M ESPE), Single Bond (3M ESPE), One-Step (Bisco), Clearfil SE Bond(Kuraray), and Adper Prompt (3M ESPE).

Using the EPM 1000 power meter (Molelectron Detector Inc., Oregon, USA) and the MS 257 monochromator (Oriel Ins., Stratford, USA), the actual intensity and the spectrum through the wavelength of two LCU used in this study were compared to obtain the basis of optic characteristics for the investigation. 120 extracted human third molars were prepared and bonding procedures were performed according to manufacturers protocols. The shear test was performed by employing the design of a chisel-on-iris supported with a Teflon wall. The fractured dentin surface was observed with scanning electron microscopy (SEM) to determine the failure mode.

The DC was measured using a Fourier-transform infrared (FT-IR) spectrometer (Spectrum One, Perkin Elmer, Norwalk, CT, USA). A drop of each DBA was placed on a KBr disc and made as uniform as possible. The infrared spectra of the uncured sample were then obtained. After an irradiation was performed under the same condition to the bond strength test, the infrared spectra of the cured sample were obtained. Three replicate specimens were made for each of the uncured and cured conditions.

III. Results

1. the halogen LCU had a maximum peak in the 487 nm and showed broad spectrum, while the LED LCU had a maximum peak in the 465 nm and showed a narrow spectrum around the peak.
2. With the exception of the Clearfil SE bond, each 4 DBAs showed no significant difference between the halogen light-cured group and the LED light-cured group in the mean shear bond strength ($p > 0.05$).
3. For the Clearfil SE bond, the shear bond strength of halogen light-cured group was significantly greater than that of LED light-cured group ($P < 0.05$).
4. Two-way ANOVA showed that the factors, LCU ($P=0.018$) and DBA ($P=0.000$), have a statistically significant effect in the mean shear bond strength. Their interactions were also significant ($P=0.009$).
5. There was no evidence of dentin pull-out of the specimens by SEM.
6. The DC of the halogen light-cured group and the LED light-cured group was similar in each DBA ($P > 0.05$).

IV. Conclusions

The results can be explained by the strong correlation between the absorption spectrum of camphoroquinone(CQ) and the narrow