

2000 Novel Fluorescence Method for Cure Monitoring of Photo-Cured Composites

[K. KOMATSU](#)¹, F.W. WANG², and K. NEMOTO¹, ¹ Nihon University School of Dentistry at Matsudo, Japan, ² National Institute of Standards and Technology, USA

Objective: The mechanical properties of a composite resin depend greatly on the degree of its conversion. This study used a fluorescence monitoring system to investigate the dependence of the conversion of a photo-cured composite resin on its filler content. In this system, a curing light was used not only to cure the composite resin but also to excite a fluorescent probe dissolved in the resin. **Method:** The photo-cured composite resin was prepared from spherical silica particles [mass fraction: (20, 40, 60 or 80) %] and a mixed monomer (Bis-GMA and TEGDMA, mass ratio of one) containing a photo-initiator (CQ and EDMAB) and a fluorescent probe (AHPBS). The composite resin was placed in a cylindrical cavity (6 mm in diameter and 4 mm in depth), and its fluorescence was detected at the distal ends of the optical fibers (0.5 mm in diameter) located at the center and at the edge of the composite resin. After the exposure of the composite resin to the curing light for 100 s, the fluorescence spectrum of the fluorescent probe, excited at 460 nm by the curing light, was measured with a spectrometer. **Result:** The ratio of the fluorescence intensities at 622 nm and 718 nm decreased with increasing filler content of the composite resin for both detection positions. This result indicated that the conversion of the monomer in the composite resin decreased with increasing filler content because the attenuation of the curing-light intensity by silica particles depended on the filler content of the composite resin. **Conclusion:** It was concluded that the degree of conversion of a photo-cured composite resin depended on its filler content.

Table Influence of filler content of photo-cured composite resin on fluorescence intensity ratio

Detector Position	center				edge			
Filler Content (%)	20	40	60	80	20	40	60	80
Intensity Ratio	2.188 ^a	2.124 ^{ab}	2.100 ^b	2.006	2.059 ^c	1.995 ^{cd}	1.958 ^d	1.879
Expanded Uncertainty	0.049	0.045	0.045	0.045	0.056	0.051	0.051	0.051
Sample Size	5	6	6	6	5	6	6	6

Expanded uncertainties are Bonferroni 95% simultaneous confidence bounds computed separately for the fluorescence intensities measured in the two different detector positions. Values followed by the same superscript letter are not significantly different as determined by Tukey's Procedure for simultaneous comparison of all pairwise comparisons ($p < 0.05$).