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Time domain analysis of fracture of composite tooth interface using acoustic emission technique

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The aim of this study was to evaluate the interfacial debonding behaviors of the tooth-composite interface using an acoustic emission (AE) technique and relate it to the polymerization shrinkage kinetics of composites. An AE system was manufactured to detect the acoustic signals which were generated by the debonding at the tooth-composite interface during composite restoration. A class I cavity was prepared on the 14 extracted human premolars and divided into two groups. The prepared teeth in each group were restored with either a methacrylate-based Z250 (3M ESPE) composite or a siloxane-based P90 (3M ESPE) composite. AE signals were measured as a function of time for 4000 s after the initiation of light curing. The polymerization shrinkage and peak shrinkage rate of two composites were measured. The mean of the total number of AE events for P90 was lower than that of Z250. AE in Z250 group was detected right after the beginning of light curing, while AE was first initiated 40 s after light exposure in P90. The polymerization shrinkage of P90 (1.34 %) was lower than that of Z250 (2.16 %). Peak polymerization shrinkage rate in P90 (0.247 %s-1) was also lower than that in Z250 (0.404 %s-1), and the time to reach peak shrinkage rate of P90 was longer (3.21 s) than that of Z250 (1.41 s). The lower the shrinkage (rate) and slower polymerization reaction of composites resulted in the lower AE events number. The AE is an effective technique to monitor the debonding kinetics at the tooth-composite interface during the composite restoration in real time.

Biography

Nak Yeon Cho has completed her PhD in conservative dentistry from Seoul National University in Korea. She is a clinical associate professor of conservative dentistry at Seoul National University Gwanak Dental Hospital in Korea.

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