Guest Editorial

Biologic problems of the light-cured composite resin

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Although light-curing composite resin has various technical merits, it is fundamentally in conflict with the concept of the adhesive restoration, because it tends to separate from the cavity margin and floor. The tendency is clearly demonstrated by the differences in internal stress photoelastically developed in self-cured and light-cured composite resins (Figs 1a and 1b). Figure 2 illustrates the directions of polymerization shrinkage in the two types of composite resin.

The stress is very slight in the self-cured composite resin restoration, because it begins to polymerize adjacent to the fast-setting bonding agent–coated cavity wall, which is warmed by body temperature, and adheres to the wall. The overlaid composite resin bulk subsequently polymerizes, shrinking toward the cavity wall. In contrast, the light-cured composite resin begins to polymerize at the superficial layer that is irradiated from the top and tends to shrink transversally away from the cavity margins. The underlying composite resin bulk subsequently polymerizes and shrinks toward the hardened superficial layer and thus is separated from the cavity floor.

Manufacturers attempt to prevent such separations by improving their bonding agents, but such improvement is not necessarily a solution. If marginal separation were prevented, the marginal enamel rods would be separated. Even if the floor separation were prevented, a heavy strain or internal stress that would lower the bond strength with time would be produced.

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Figs 1a and 1b Photoelastic analysis of the internal stress produced by the prevented separation of material from the cavity wall. (Courtesy of Dr Y. Kinomoto, Osaka, Japan.)

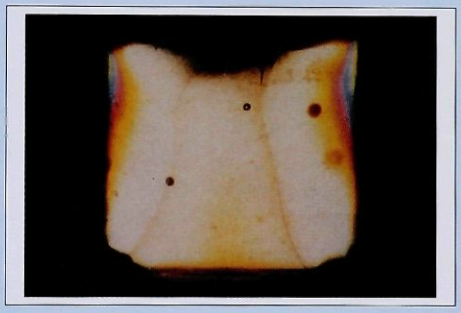

Fig 1a Self-cured adhesive composite resin restoration.

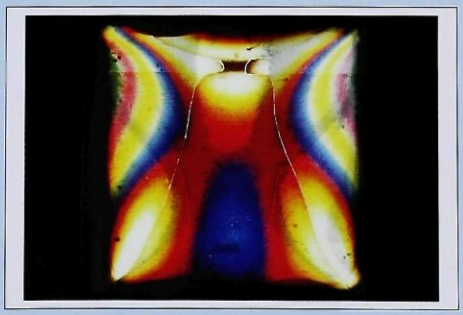

Fig 1b Light-cured adhesive composite resin restoration.

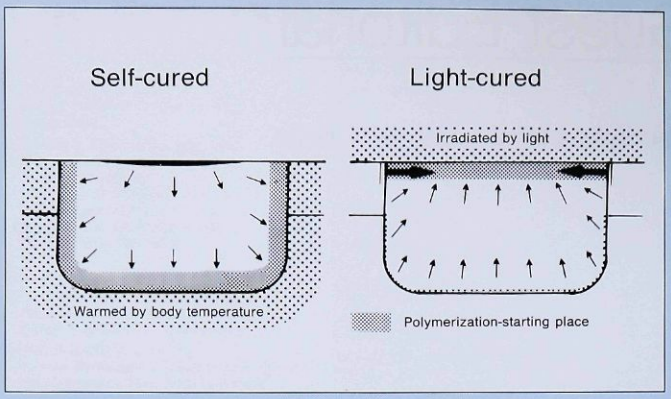

Fig 2 Directions of polymerization shrinkage in self-cured and light-cured adhesive composite resin restorations.

Underpolymerization at a deeply placed proximal margin causes another problem.

These problems are considered to be particularly significant in posterior restorations. Although inferiority in occlusal wear resistance of the self-cured composite resin has been often discussed, the average clinical wear, as indicated by the discrepancy between the enamel and resin surfaces, was only 50 to 70 μm after 10 years with Scotchbond, P-10 (3M Dental), and Clearfil Posterior (Kuraray) restorations placed in accordance with our technique. Because those materials were early versions, introduced more than 10 years ago, the current materials are believed to be far improved. Occlusal restoration with these self-curing composite resins is quite simple through the bite-forming technique.