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Dynamic ATR-FTIR and TEM Study of the Resin-Dentin Interface in Reactmer Bond  
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This study examined: (1) the interaction of 4-acryloxyethyltrimellitic acid (4-AET) with dentin, using dynamic ATR-FTIR spectroscopy, and (2) ultrastructural change of the resin-dentin interface bonded by a glass ionomer-based, all-in-one adhesive containing 4-AET, using TEM. 4-AET-solution (4-AET/HEMA: 40/60, wt%) was placed on bovine dentin treated with 1% NaOCl (Apatite group) or 6N HCl (Collagen group). Dynamic ATR-FTIR measurement of the 4-AET-solution and dentin treated with or without the 4-AET-solution were performed in 0.66 s cycles under a germanium (Ge) crystal during 15 min. Human dentin disks were ground with 180-grit SiC paper. Reactmer Bond (RB, Shofu Inc., Japan) was placed onto the dentin disks for 20 s, 5, 10 and 15 min in the dark, and then light-cured. Specimens were demineralized in EDTA and processed for TEM examination. Dynamic ATR-FTIR and difference spectra showed that Ca-carboxylate (4-AET Ca; 1600 cm<sup>-1</sup>, 1420 cm<sup>-1</sup>) developed in the Apatite group. A new hydrogen bond (1695 cm<sup>-1</sup>) between 4-AET and collagen fibrils also developed in the Collagen group. The rate of creation (%) of 4-AET Ca (1600 cm<sup>-1</sup>) was 2.3 (2 s), 7.3 (28 s), 26.4 (61 s), 46.8 (258 s), 57.7 (389 s), 69.5 (520 s), 80 (718 s) and 100 (783 s). The rate of formation (%) of hydrogen bond (1695 cm<sup>-1</sup>) was 8.5 (3 s), 25.2 (62 s), 48.0 (128 s), 75.0 (325 s), 97.8 (720 s) and 100 (852 s). TEM revealed a hybrid layer between 0.8-1.5 μm. A interaction layer that was thought to be caused by ion exchange of the 4-AET with either remnant dentin apatites or ion-leachable glass fillers could be seen on top of the hybrid layer. There was a tendency for the interaction layer to merge with the hybrid layer in the 10 and 15 min groups. It is concluded that increased treating time results in increased production of 4-AET Ca salt and hydrogen bonding with collagen. This provides a dual bonding mechanism (chemical and micromechanical) to smear layer-covered dentin.

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