Assessment of the Performance of Flowable and Sculptable Bulk-fill Composites

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Objectives: Recently, a new material category of composite resins (CRs) is stated to be the option to place 4mm thick layers instead of the current incremental technique, without negatively affecting cavity adaptation or degree of conversion (DC), while decreasing the shrinkage stress. The purpose of the present study is to compare the DC, adaptation and porosity of flowable and sculptable bulk-fill CRs.

Experimental methods: Four different bulk fill composite resins were evaluated: two flowables (SureFil®SDR®flow-DENTSPLY Caulk, USA and TetricEvoFlow®BulkFill-Ivoclar Vivadent, Liechtenstein), and two sculptables (TetricEvoCeram®BulkFill-Ivoclar Vivadent, Liechtenstein and Filtek™BulkFill-3M™ ESPE, U.S.A.). Cylindrical samples (4mmx10mm, n=6 for each material) were prepared and light-cured (20s). Atomic-force-microscopy (AFM) and Fourier-transform-infrared-spectroscopy (FTIR) were performed on each sample. Additionally, 12 teeth were cut at the cemento-enamel junction, occlusal cavities were prepared, the teeth were divided in 4 groups and restored. The flowables were covered with an enamel layer of regular CR. Micro-computer-tomography (μCT) videos and 3D-morphometric analyses were carried out to evaluate the porosity and the adaptability of the bulk-fill CRs. Then, the samples were cut longitudinally in the vestibulo-oral direction and scanning-electron-microscopy (SEM) was performed.

Results: FTIR showed DCs higher than 80% in all tested samples. AFM demonstrated that the roughness of SureFil®SDR®flow is higher than that of TetricEvoFlow®Bulk Fill; and that the roughness of Filtek™BulkFill is greater than that of TetricEvoCeram®BulkFill. μCT and SEM showed that the flowable bulk-fills have excellent adaptability to the cavity walls, particularly compared to the sculptable materials. Additionally, the 3D-morphometric analysis showed that TetricEvoCeram®BulkFill had 14.9% lower porosity than Filtek™BulkFill, while TetricEvoFlow®BulkFill had 81% lower porosity than SureFil®SDR®flow.

Conclusions: The flowable bulk-fill composites have better adaptability to the cavity walls. The surface roughness and the porosity are lower in flowable bulk-fill CRs and the DC in 4mm increments is sufficient in all tested materials.