materials

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Article

Fracture Toughness, Work of Fracture and Hardness of 3D-Printed Denture Base Resins

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Abstract

Objectives: To compare fracture toughness (FT), work of fracture (WOF) and Vickers hardness (HV) of four 3D-printed denture base resins—including two novel formulations—and one conventional cold-cured polymethylmethacrylate (PMMA) resin. **Methods:** 3D-printed specimens (Freeprint denture (FD)/denture impact (FDI), DETAX GmbH and V-Print dentbase/dentbase 2.0, VOCO GmbH) were fabricated at 90° layer orientation (n = 40/group) and notched according to ISO 20795-1. FT and WOF were measured via single-edge notched bend testing after seven-day water storage at 37 °C. HV was determined on fractured shards using 3 N load. Data were analyzed with Welch-ANOVA/Dunnett-T3 or ANOVA/Tukey (α = 0.05). **Results:** The conventional PMMA showed the highest FT and WOF, followed by the novel formulations of the 3D-printed groups VD2 and FDI. Lowest FT and WOF values were measured for VD and FD. HV was highest for the conventional PMMA, followed by the primary formulations FD and VD. Lowest hardness was measured for the novel formulations FDI and VD2. **Conclusions:** The formulations of the novel 3D-printed materials (FDI and VD2) exhibited markedly greater FT and WOF than their respective predecessors, although this improvement was accompanied by a decrease in hardness. Nevertheless, none of the 3D-printed materials fulfilled the ISO standard criteria for enhanced FT.