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Mechanical properties and three-body wear of dental restoratives and their comparative flowable materials.

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Objective: To compare wear performance and resistance to crack propagation (K1C) of commercial restorative materials and their flowable variations. A potential correlation between three-body wear and fracture toughness, modulus of elasticity, fracture work, Vickers hardness, and filler content was investigated. Method and Materials: Seven restoratives (five composites, one ormocer, and one compomer) and their corresponding flowable materials were used to determine and compare the three-body wear with a bolus of millet-seed shells and rice food (Willytec). The wear characteristics were measured by profilometry after 50,000, 100,000, 150,000, and 200,000 loading cycles. The fracture toughness value, K1C (MPam1/2), for each single-edged notched specimen was measured in a three-point bending test (universal testing machine 1446, Zwick). Fracture work and modulus of elasticity were calculated from the load curves. Vickers hardness was measured (HV hardness tester, Zwick) according to DIN 50133. The veneering composite Sinfony (3M ESPE) was used as a reference material. Results: Heavily filled composites experienced less wear than their flowable variations. The nanofiller composites revealed better wear results than hybrid composites, compomers, and ormocers. After 200,000 load cycles, the lowest wear rates were detected for Grandio (14 Mu;m; Voco), and the highest mean values were found for Dyract AP (104 Mu;m; Dentsply DeTrey). The values for fracture toughness (K1C) ranged from 0.82 to 3.64 MPam1/2. Highest K1C data was exhibited by the nanocomposite Nanopaq (Schutz Dental). All tested restorative materials exhibited higher fracture toughness than their low-viscosity variations. Conclusions: The wear resistance of the newer generation composites with incorporated nanofiller or microfiller particles increased to a high extent. Flowables show less resistance against wear and crack propagation because of their lower filler content. The reduced mechanical properties limit their use as a restorative to small noncontact, low-stress clinical situations. (Quintessence Int 2010;41:e1-e10).