Impacts of Conservative Endodontic Cavity on root canal instrumentation efficacy and resistance to fracture assessed in incisors, premolars and molars

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ABSTRACT

Conservative endodontic cavity (CEC) may improve fracture resistance of teeth but compromise instrumentation of canals. This study assessed the impacts of CEC on both variables in three tooth types. Extracted human intact maxillary incisors, mandibular premolars and molars (n=20/type) were imaged with micro-CT (20µm resolution) and assigned to CEC or traditional endodontic cavity (TEC) groups (n=10/group/type). Minimal CEC’s were plotted on scanned images. Canals were prepared with WaveOne instruments using 1.25% NaOCl and post-treatment micro-CT images obtained. Proportion of untouched canal-wall and dentin volume removed (DVR) for each tooth type was analyzed with independent-samples t-test. The 60 instrumented and 30 intact teeth (negative control; n=10/type) were loaded to fracture in the Instron Universal Testing machine (1 mm/min) and data analyzed with one-way ANOVA and Tukey test. Mean proportion of untouched canal-wall was significantly higher (p<0.04) only in distal canals of molars with CEC (57.2±21.7%) compared to TEC (36.7±17.2%). Mean DVR was significantly smaller (p<0.003) for CEC than for TEC in incisors (16.09±4.66 vs. 23.24±3.38 mm³), premolars (8.24±1.64 vs. 14.59±4.85 mm³) and molars (33.37±67.71 mm³). Mean load-at-fracture for CEC was significantly higher (p<0.05) than for TEC in premolars (586.8±116.9 vs. 328.4±56.7 N) and molars (1586.9±196.8 vs. 641.7±62.0 N) without differing significantly from the negative controls. While CEC was associated with the risk of compromised canal instrumentation only in the distal canals of molars, it conserved coronal dentin in the three tooth types and conveyed a benefit of increased resistance to fracture in the mandibular molars and premolars.