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Doctoral Dissertation
Doctoral Program in Bioengineering and Medical-Surgical Sciences (36th Cycle)

Micro-CT and 3D imaging analysis and planning of minimally invasive endodontic procedures

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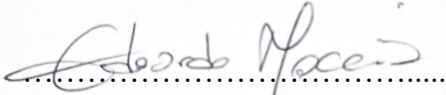
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Summary

Preservation of pericervical dentin is a key-element in implementing long-term survival of the dental element. Although the coronal factor is widely validated to be an important variable, many authors in the literature remain in doubt about the effective efficacy of a reduced taper shaping instruments on the preservation of periradicular dentin.

The present dissertation aims to compare the correlation between instruments' taper and pericervical dentin preservation of four different shaping techniques, using micro-computed tomography (micro-CT) as the analytical tool, and then comparing the results with Finite Element Analysis (FEA).

Volumes differences between the pre-shaping and post-shaping scans of 48 samples subdivided in 4 different shaping techniques were calculated to evaluate pericervical dentin preservation between the groups. Mesial canals were also isolated and analyzed in coronal, middle and apical points and 4 mm below the furcation roof to evaluate percentage and distribution of dentin removal. Moreover, thickness of the dentine in the distal and mesial side of the mesial canals, also known as “danger zone”, was measured.

Results showed a significant volume difference between G1 (9% taper) and G3 (5% taper) ($p < 0.05$). G3 also showed a significant difference in dentin removal towards the mesial side, compared to G1, G2 (7% taper) and G4 (8%

taper). At the distal level, a greater removal of peri-canal dentin could be observed following shaping with the G1, G2 and G4 group instruments, confirming the less conservative approach of the increased taper instruments. Analyses on centroid line displacement showed no differences among the three groups under study.

In summary, the extent of the endodontic access cavity is the main variable influencing the preservation of residual structures, however, as demonstrated in the present study, lowering the taper of endodontic instruments also positively affects the preservation of pericervical dentin.