Assessment of Residual Coronal Tooth Structure Post-Endodontic Cavity Preparation Using Intra-oral Digital Scanner and Micro-CT

Nassr Al-Nuaimi, Rupert Austin, Shanon Patel, Federico Foschi, Francesco Mannocci
Department of Conservative Dentistry, King’s College London Dental Institute, UK

Introduction

The longevity of root canal treated teeth is significantly affected by the reduction in the amount of remaining coronal tooth structure due to the combination of dental caries, restorations, endodontic treatment and fractures. Establishing a reliable method to quantify the amount of remaining coronal hard tooth structure may assist in predicting the survival of endodontically treated teeth and aid in future treatment planning.

The purpose of this *in vitro* study was to evaluate the volumetric scanning accuracy and reliability of digital impressions for 3D measurement of residual coronal tooth structure post-endodontic cavity preparation, with reference to high-resolution micro-computed tomography (µCT).

Materials & Methods

Prior to scanning, quantification of the accuracy and precision of the intra-oral digital scanner was performed using metrology gauge block and a profiometric tooth calibration model. Non-invasive access cavities were cut in 34 human extracted molar teeth. All teeth were scanned with an intra-oral digital scanner (Test Scanner: 3M™True Definition scanner) in high-resolution mode and µCT (Reference scanner: GE Locus SP µCT scanner) in high (REF 1) and low (REF 2) resolution modes (Fig. 1).

Alignment was made by superimposing the intra-oral digital scanner datasets on both µCT (REF 1 & REF 2) datasets using best-fit alignment (Geomagic® Control®). Volume measurements and 3D deviations were performed separately and recorded for each scan modality. 3D deviations between test and reference scanners were expressed as mean (+/-) and maximum (+/-) values (µm) and displayed in a colour-coded image using the Geomagic software (Fig. 2).

Results

The intra-oral digital scanner accuracy was 2 µm, the repeatability was 14.4 µm and the reproducibility was 16.6 µm. Data analysis showed no statistically significant difference in the volumetric measurements obtained from intra-oral scanner, REF 1 and REF 2 µCT scans (*P*>0.05). (Fig. 3)

Volumetric scanning using digital impressions of endodontically accessed teeth was not statistically different to the µCT scanner (*P*>0.05). Intra-oral digital scanner is able to accurately quantify the amount of residual coronal tooth structure following access cavity cutting.

From an endodontic point of view, the volumetric accuracy of the True Definition scanner is adequate to be used to create accurate virtual models that reproduce the residual coronal tooth structure.

Conclusion

Scanning the intra-coronal aspect of the endodontically accessed tooth for reliable assessment of the loss of tooth structure during endodontic treatment can be used to make inferences about the prognosis of the endodontic and restorative treatment, leading to improvement in treatment planning process.

Clinical Relevance

Scanning the intra-coronal aspect of the endodontically accessed tooth can be used to make inferences about the prognosis of the endodontic and restorative treatment.

References