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M.R. Reymus* & C.D. Diegritz

Department of Operative Dentistry, University of Munich, Munich, Germany

Self-printed artificial teeth for endodontic education

Aim To assess the feasibility of creating artificial teeth for endodontic training. The workflow was aimed to be simple, time and cost effective as well as transferable to other educational institutions. The final goal was to create an alternative to extracted human teeth and commercial artificial ones.

Methodology Suitable extracted human teeth were selected according to their degree of development and destruction, the volume of the pulp chamber and root canals on radiographs as well as to the estimated difficulty for root canal treatment. A three-dimensional radiograph of the selected tooth was taken using a cone-beam CT with a small field-of-view (Kodak 950). The generated data were processed with several software applications (InVesalius, Brazil; Meshmixer, USA; PreForm, USA) to generate a printable STL file. This file was printed with a stereolithographic printer using a resin mixed with barium sulphate for radiopacity (Print 2, Formlabs, USA).

Results The self-production of artificial teeth for endodontic training was feasible. The workflow was kept as simple as possible thus reducing the number of processing steps to a minimum. The software applications were user-friendly, easy to learn and free for educational purposes. The quality achieved by the cone beam CT was sufficient, thus being transferable to other institutions possessing this equipment. The search and selection of suitable teeth was the most time-consuming step. The process of transferring these real teeth to printed artificial copies takes approximately 7 h for 40 molars. Material costs for one tooth amount to approximately 0.31 €.

Conclusions The use of extracted human teeth has serious drawbacks which have come to the fore in recent years. Commercial artificial teeth have been promoted as a possible alternative, yet they are too expensive to be purchased in large quantities for sufficient training in the preclinical settings. The workflow presented shows a time and cost effective way to produce artificial teeth, which are suitable for endodontic training and exceed commercial ones in various criteria. They are less expensive, can have unlimited variations in anatomy, present radiopacity and are available at the right time in sufficient numbers.