AFFORDABLE 3D MODELS OF REAL TEETH FOR AN INTRODUCTION TO DRILLING TECHNIQUES AND FAMILIARITY WITH DENTAL FILLING MATERIALS IN FIRST-YEAR DENTISTRY BIOPHYSICS PRACTICAL EXERCISE

M. Marešová [1,2], Z. Kubeš [1], J. Beneš [1,2], J. Dejmek [1,2]

[1] Institute of Biophysics, Faculty of Medicine in Pilsen, Charles University, Pilsen, Czech Republic
[2] Biomedical Center, Faculty of Medicine in Pilsen, Charles University, Pilsen, Czech Republic

Introduction

Treatment of dental caries with subsequent installation of a filling using photocomposite filling materials is currently one of the most widespread types of dental care. Students practice this type of treatment by creating a cavity in a tooth model with subsequent photocomposite filling in practical exercises from Biophysics. However, it is not a classic clinical procedure, but we only perform steps where we can assess and see in detail the physical properties of the given material and how it reacts to curing and further processing. CT images of the jaw of an anonymous patient were used to create a practical model of the tooth. These images were processed in the 3D Slicer program. In this program, a computer representation of the spatial geometry of the tooth was created from these CT images based on the contrast of the displayed tissues. In our case, it was the extraction of molars 46, 47 and 16 [1]. Their virtual models were then computerized and printed 1:1 on a 3D printer.

Material and methods

Photocomposite is a filling material used in dentistry, where it is currently one of the most used materials for making white aesthetic dental fillings. The material is applied in a plastic state and hardens through a polymerization reaction. This is most often initiated by illumination with a clearly defined light spectrum of a polymerization LED lamp. The tooth model itself is made on a 3D printer from ASA (Acrylic Styrene Acrylonitrile) material. It is printed completely filled with a layer thickness of 0.2 mm to preserve the details of the crown. Three layers of transparent polish were applied to the crown, which simulates dental enamel on the tooth model. Curing between individual layers took 1.5 minutes and at the end 3 minutes was applied in LED lamp.

A cavity measuring approx. (h x w x d) 2 x 3 x 1.5 mm is created in the prepared tooth model using a suitable rotary tool. The cavity is then filled with a photocomposite material. It is applied in layers, which are individually cured with an LED lamp for 40 seconds. This is followed by smoothing with a rubber disc. The last step is finishing (polishing) with a rotary toothbrush with paste. The students observe the individual steps of the entire process under a stereoscopic microscope and take photos at each step for the final evaluation.

Results and conclusion

The tooth models were pilot-tested on 62 students as part of the Biophysics practical exercises for dentistry students. The new model proved to be functional and the students were satisfied with the new assignment. A very good visual match with the real tooth was achieved. The price of one tooth model was approximately 20 times lower than a commercially available model that would suit the assigned practical exercises. Specifically, the price of one manufactured tooth model was 9.35 CZK (approx. 0.4 €). The price includes all material for production and human activity. The insurmountable advantage of making our own models is that any type of tooth can be extracted from any data and printed in the specific size required.

References

[1] Jansová K., Eber M.: Preklinická stomatologie: I. část - morfologická.2., dopl. vydání. Olomouc: Univerzita Palackého, 1996, ISBN 80-7067-596-9.