ADVANCED CREATING OF 3D DENTAL MODELS IN BLENDER SOFTWARE

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Abstract: *The development of virtual 3D dental models evolves with great pace. This is a stage of construction, which is of great importance in future developments of real manipulation, prosthetics and other activities set for execution. Concept of modeling of 3D dental models is determined on the basis of concrete requirements, factors and opportunities. A good basis for creating virtual dental models provide Blender software combined with specialized applications which improve the process of modeling.*

***Keywords*:** Blender, 3D, dental, tooth, implants, open source

1. Problem discussion

The modeling of 3D virtual models of dental models is particularly relevant. This is done in regardless of, and by means of computer-generated environment to examine the dental specimens for purposes of science. The developed 3D models are used by designers, engineers, medical specialists, etc. Designing 3D virtual dental models is carried out through the use of methodologies for the relevant software systems. The following types of design are possible: by individual design using design tools and/or by generating parametric virtual models.

The aim of this study is to determine the correct approach to develop 3D virtual dental models which have the necessary qualities, using the resources of modern open source program Blender [1, 2].

2. Objective and research methodologies

A standard method for developing 3D virtual dental models of teeth, jaw tissues, dental implants, abutments and dental crowns in Blender software is to use set of tools for modeling, editing, modification and sculpturing (fig. 1) [3 - 13].

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(a)   *(b)*
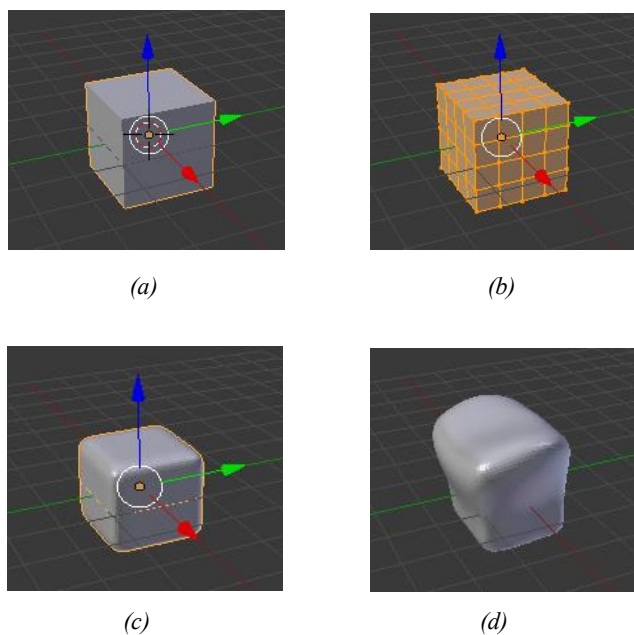

(c)   *(d)*

Fig.1. A standard method for developing 3D virtual dental via toolbox of Blender software (a) object mode; (b) edit mode; (c) modifier; (d) sculpt mode

If necessary the set of tools in Blender software can be used combined with parametric built virtual dental models. The

parametric building of virtual dental models is through specialized applications addons. These are applications that are specifically designed for the needs of 3D modeling of teeth, jaws, tissue and dental implants, abutments and dental crowns. At this stage the applications running on the latest version 2.76 Blender's are: Human teeth addon и Open Dental CAD addon [14, 15].

Human teeth addon enables direct modeling of high-quality 3D models of teeth. The virtual models are accurately modeled and tailored to the geometric characteristics of such real samples. Computer-generated full set of teeth is shown on fig. 2. The green box has covered the location that occupies Human teeth addon in the composition of Blender software.
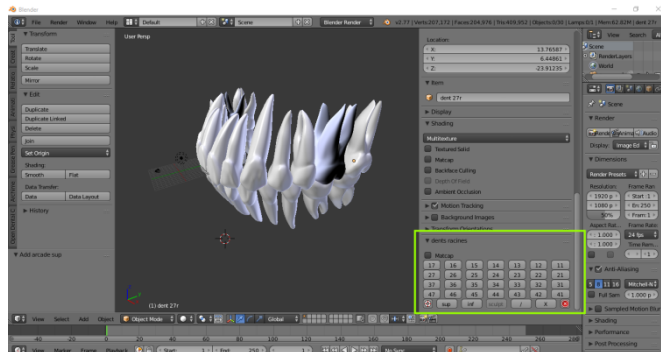

Fig. 2. Interface of Blender software with enabled application Human teeth addon. There is a computer-generated full set of teeth on the desktop

The possibilities for parametric modeling are: individual computer generating of tooth (by number) or multiple computer modeling using "sup" for upper dentition and "inf" for lower dentition. The individual numbering of teeth is shown on fig. 3.
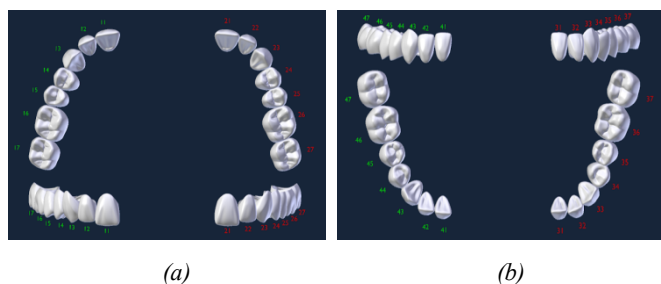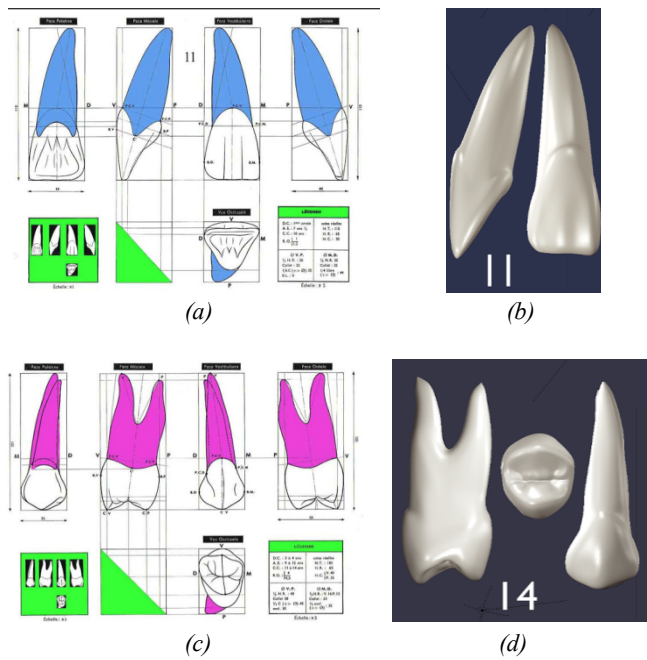

(a)   *(b)*

Fig. 3. Individual numbering of teeth (a) upper dentition (b) a lower dentition

The teeth are modeled with high quality they have complied with all features. Fig. 4 shows part of the models of teeth in schematic options and 3D prepared [14].

(a)   *(b)*

(c)   *(d)*

Fig.4. Dental models (a) scheme of tooth number 11; (b) 3D model of tooth 11; (c) diagram of tooth number 14 (d) model tooth 14

Once the computer-generated model of the respective tooth is done the designer can make individual remodeling (fig.5).

(a)   *(b)*

(c)
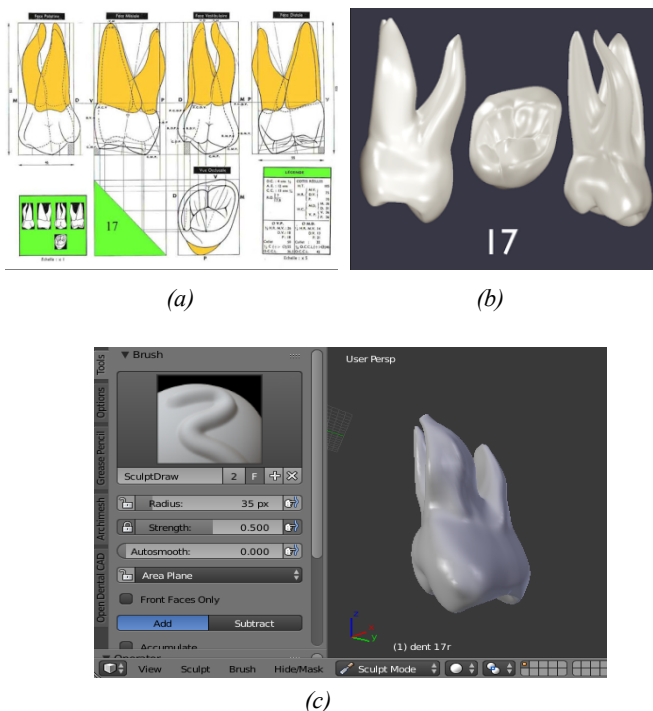
Fig.5. Model of tooth number 17 (a) scheme of tooth No.17; (b) 3D model of tooth 17 by default; (c) 3D model of tooth 17 sculpt modified

Human teeth addon application can be provided by download from the website http://byaapplication3d.blogspot.bg/p/ents-3d.html. When used the Human teeth addon in combination with Open Dental CAD addon the opportunities to build 3D computer models dental are significantly increasing [15]. Fig. 6 shows the

operation panel of the Open Dental CAD addon in Blender's environment.

(a)   *(b)*   *(c)*
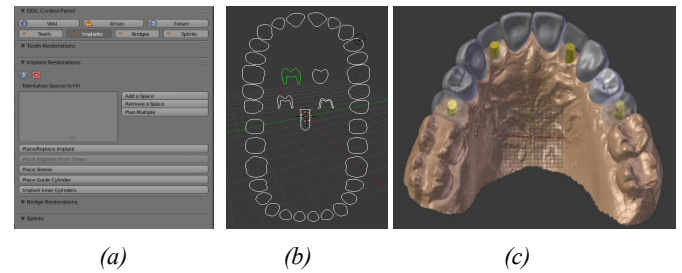
Fig.6. Model of tooth number 17 (a) scheme of tooth No.17; (b) 3D model of tooth 17 by default; (c) 3D model of tooth 17 sculpt modified

The application Open Dental CAD addon can be provided by download from the webpage https://github.com/patmo141/odc_public/wiki.

3. Conclusion

Very well constructed variations of dental and implant 3D computer models not only from a visual standpoint, but also as a foundation on which to build, modify and alter depending on the job that needs to be realized is an opportunity that is successfully implemented in development of projects related to high-quality dental visualizations. Fully-functional applications Human teeth addon and Open Dental CAD addon are freely available for providing and integration into practice. Dental applications integrated into Blender software provide very good perspective in the workflow.

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