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# BioCAD Applications in Anatomical Structures

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**Abstract**
The application of the engineering knowledge of biological systems has a great importance in order to obtain solutions that improve the treatment of the systems. The treatment of the image files is inserted in the context so as to generate computational models in the area of the bioengineering, making use of BioCAD that is a model creation protocol of structures anatomical systems. The purpose of this paper is to describe the construction of a three-dimensional model of a biological structure.

***Key words:***
*BioCAD, Bioengineering, Modeling.*

## Introduction

Among the uses of bioengineering, there is the medical practice, which has, as an example, the PROMED, wich is a program for the use of 3D technologies in medicine, created and conducted by the 3D technologies lab, at Renato Archer Information Technology Center (CTI), Campinas, SP, Brazil. The development of three-dimensional computational models of biological structures allows a later observation and analysis of the Biomechanical behavior, with computational simulations that reduce *in vivo* testing requirements.
With the goals of training in CAD software (Rhinoceros), applying the knowledge acquired in the preparation of 3D models of anatomical structures and consolidating the modeling procedures, the scholar worked on BioCAD cases from the CTI linked to the PROMED that represent standardized anatomical structures, but that have a certain degree of interpersonal variability. For this reason, the methodology is based on the production of the model with emphasis on the main anatomical frameworks of the structure, essential to its better virtual representation.

## Results and Discussion

The case studied is a CTI support consisting of the design of the entire dental dental arc of the mandibles (right and left) research development. The methodology will consist of the design of one of the jaws and the teeth that compose it from an STL format base obtained by 3D scanning, after which the reflection will be made with the mirror tool to obtain the complete jaw.
The element produced is the first premolar tooth, formed by only one root that was completely drawn, from root to occlusion. Starting from the scanned base represented on the left of image 1, traces of guide lines are made (in the right of image 1) and finally the surfaces that will form the tooth as a whole are created.
During the preparation, the fact that the tooth doesn't have the same central axis for all its extension imposed a certain difficulty to the job, which was worked out by working with two axes, one for the upper part and one for the lower one. In addition, the design of the occlusion is made difficult by the fact that the scanning of this area is not as high quality as the other extensions of the tooth. The resulting model that was represented on image 2 will be integrated to the other teeth for the composition of the mandible.

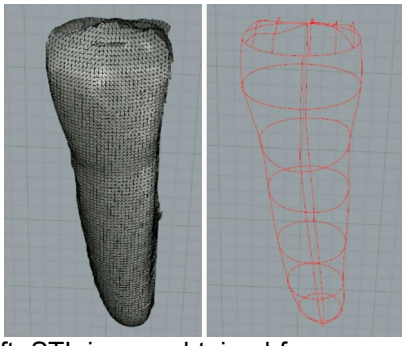

**Image 1.** Left, STL image obtained from scanning and to the right, guide lines drawn in CAD.

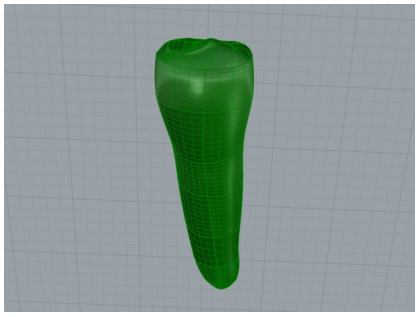

**Image 2.** Three-dimensional model finalized in CAD.

## Conclusions

The design and analysis of facial structures in dentistry are examples of the application of BioCAD in bioengineering problems. Therefore, the importance of the contact between the health area and the engineering in the production of anatomical models is evidenced. The engineer have the important paper to produce a good CAD representation for the correct use from biomedical area of the model as a tool.

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USHIDID, Darpan et al. **Just-in-time design and additive manufacture of patient-specific medical implants.** Disponível em: <http://www.sciencedirect.com>. Acesso em: 30 jun. 2017.