CAD SYSTEM FOR MODELING THE PHYSIOGNOMIC SURFACE OF THE SIDE GROUP TEETH

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Abstract: Due to the use of new materials and for increasing the accuracy of dental prosthetic performance the researches has been moved from using traditional methods to the use of CAD / CAM systems. One of the important stages of dental treatment starts with a professional analyzes of the patient's prosthetic field and work out a strategy in accordance with this. For putting into practice this goal, this paper presents a CAD system that was developed to obtain the physiognomic surface of a tooth that is part of the side group teeth. The software system was developed using design and programming environments, AutoCAD and VisualLisp.

Key words: CAD Systems, Dental technique, Dental prosthetics, Computer programming

1. INTRODUCTION

One of the important stages of dental treatment is to analyze the patient's prosthetic professional field and develop a strategy for working collaboratively with him, to achieve an optimum prosthetic works as functionality, aesthetics, durability and cost price.

First will be examined the digital dental record sheet that contains all data on the situation of the patient. This includes the actual situation of the mouth, with existing previous processing, fillings, extractions, pivots, implants and any type of work was made, with each date and location. Sheet contains also information on the disease that would cause allergies to certain fingerprinting substances and also some heart disease cases in which is contraindicated the use of certain products to anaesthesia.

For optimal analysis of the situation from the patient's mouth are used intraoral cameras (Douglas et. al, 2011). The intraoral camera allows viewing and saving the entire teeth structure on computers.

Using a CAD system (Lancea, 2005), the dentist is able to scan certain types of cavities that are previously processed and to correct the respective cavity contour assisted by the computer (Ivan et al., 2004).

After scanning the mouth cavity, all the information regarding the geometry of place in which the implant will be attached is collected. With this information our software is able to generate rapidly the physiognomic surface (Sederberga, 2011) of the molar by using low cost software like AutoCAD.

2. THE STRUCTURE OF PHYST-11 SOFTWARE

The PhyST-11 (*Physiognomic Surface of the Teeth* 2011) software, as mentioned before, is created using AutoCAD and VisualLisp environments. PhyST-11 flow chart is presented in figure 1. A short description of the stages that must be fulfilled through shaping the tooth is presented below:

- After scanning the mouth cavity, the dimensions of missed tooth spaces (length and width) can be determined;
- These dimensions must be filled into the dialog box presented in figure 2.

Fig. 1. PhyST-11 Software flow chart

Fig. 2. Tooth dimensions dialog box

- After closing the dialog box PhyST-11 generates a default molar physiognomic surface in accordance with the indicated length and width.
- This surface was generated by using different tooth views.
- The final surface data is processed by PhyST-11 for generating a smooth surface that is very useful within the manufacturing process for roughing operation (Fig.3).

Fig. 3. The molar physiognomic roughing surface

3. CREATING THE MOLAR PHYSIOGNOMIC SURFACE

The molar physiognomic surface is defined by using five different curves as an interpolated surface between them. The surface geometry can be used with its default shape, which is generated by PhyST-11 software or can be modified by dragging its defining curves with the mouse.

There are, also, other possibilities for defining this surface by modifying its shape with the mouse or by reading the points that defines the curves (Fig. 4) from a text file. After finishing the surface definition the new surface will be displayed on the screen. If the default surface is accepted, it will be displayed (Fig. 5).

The default surface was designed in accordance with four different views of molar tooth. Each curve was generated using the projection on different planes of the molar shape (Fig. 6).

After defining the curves the software improves its geometrical quality with the spline command (Schumakera & Speleersb, 2011) (Fig. 7).

Fig. 4. The curves that defines the surface

Fig. 5. The molar physiognomic surface

Fig. 6. Steps to define the molar physiognomic surface

Fig. 7. The shape improvement with splined curves

Fig. 8. NC milling path generation

It is important to mention that the surface is generated in accordance with CAM principles and can be used in the future for generating the NC Program for a CNC milling machine.

4. FURTHER DEVELOPMENTS

The PhyST-11 software will be developed and in short time will be able to be used within the CAM field. The milling path is realised (Fig. 8) and we are looking forward to extend the program for any kind of teeth.

5. CONCLUSIONS

Due to industrial techniques evolution (reverse engineering, CNC machining etc.) in order to increase the products quality and the firm profitability, dentistry began to implement these modern techniques more and more. Thus, classical methods for processing the prosthetic field, the impression of it and the design of prosthetic treatment plan to achieve prosthetic works have become outdated.

Nowadays, it aims permanently to develop methods of producing prosthetic works using three-dimensional scanning, virtual modelling and using the CAM manufacturing devices.

Companies specialized for solving such kind of problems generally sells their software packages at high prices therefore we tried to develop another type of software at a lower price.

6. ACKNOWLEDGEMENTS

This paper is supported by the Sectoral Operational Programme Human Resources Development (SOP HRD), financed from the European Social Fund and by the Romanian Government under the project number POSDRU/89/1.5/S/59323..

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