JOURNAL OF MULTIDISCIPLINARY SCIENCES AND INNOVATIONS
VOLUME 04, ISSUE 11
MOPNTHLY JOURNALS
ISSN NUMBER: 2751-4390
IMPACT FACTOR: 9,08

ANALYSIS OF COMPUTER MODELING IN DENTAL IMPLANTS AND COMPARATIVE CHARACTERISTICS DOMESTIC AND FOREIGN EXPERIENCE

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Abstract: The article analyzes the domestic and foreign experience in planning the preparation of the oral cavity for prosthetics. Recently, thanks to the development of computer technology, the possibility of virtual 3D modeling of the prosthesis structure and its further prototyping has appeared. Digital treatment planning based on three-dimensional imaging procedures allows you to plan therapy with absolute precision and makes the result of treatment precisely predictable. An analysis of domestic experience shows that one of the most widespread in the practice of orthopedic dentistry is the Blue Sky Plan program. The templates produced in the program are easily exported to STL files and do not require additional processing. The program contains a wide range of implant systems. Managed surgery from DENTSPLY Implants is very popular in foreign practice. It offers a comprehensive solution for digital treatment planning and implant placement based on SIMPLANT software templates.

Keywords: 3D modeling, computer technologies, prosthetic modeling, preparation for prosthetics, Blue Sky Plan program, orthopedic dentistry, XiVE® S, XiVE® TG implants, guided surgery, DENTSPLY Implants.

Currently, computer-aided design and manufacture of prosthetics using special computer equipment called CAD/CAM is widely used. The development of these systems began back in the 60s of the twentieth century. It was during this period that the foundations of this method were laid, a classification was made, and basic concepts and terms were defined. SAD (English computer-aided design/drafting) is a technology that represents computer–aided design tools, while SAM (English computer-aided manufacturing) means the means intended for the technological preparation of the production of the obtained models. Many authors have repeatedly attempted to make a comparative analysis of the traditional method of prosthetics planning and the computer method. The arguments in favor of both the traditional and the computer method are noted. Along with the advantages, each method has its drawbacks. However, currently, most specialists choose computer modeling as a way to prepare the oral cavity for prosthetics. This is due to a number of reasons: - removing the optical impression becomes less time-consuming; - removing the optical impression is a non-contact technique, which makes the procedure less painful and less traumatic; - removing the impression using computer modeling significantly reduces pressure on the tissues, prevents tension of the tissues of the bed. This leads to an increase in image accuracy.; - the possibility of distortion of the relief of soft tissues is eliminated (when removing traditional prints, the relief is distorted by 1-3 mm). The sequence of the procedure is as follows: First, an optical impression is taken (a 3D model is formed), after which the technician proceeds to model the test design. When comparing modeling using plaster and wax models with computer models, it can be noted that computer modeling has a number of advantages. However, most authors conclude that it is not what method a doctor uses that matters, but how proficient he is at it. After all, it is the skills and ability to work with certain methods that are the leading ones in determining the result of a study. With the help of computer modeling, a dental technician can immediately see the clinical picture, evaluate and analyze it over time. This is done by scanning the entire oral cavity of the patient,

which allows you to focus on the proportions and position of the teeth, the main characteristics of the oral cavity. Taking into account all these parameters, it is possible to build a harmonious prosthesis. The advantages of this technique include the fact that with the help of computer technology it is possible to make prostheses and create a database of patients. This significantly expands the possibilities of orthopedic dentistry. You can use the accumulated 3D models as donor models. This accelerates the preparation of the oral cavity for prosthetics for future patients. The space of the medical organization is also significantly saved, since there is no need to store a large number of plaster models automatically. Another advantage is that with the help of computer modeling, it is possible to re-manufacture the prosthesis without loss of quality and accuracy, which is impossible in the manufacture of plaster models. Computer modeling significantly increases the speed of preparation of the oral cavity for prosthetics. The comparison showed that it takes from several days to a week to manufacture a prosthesis using traditional methods, whereas computer modeling takes no more than 2-3 hours.

The production of a prosthesis using computer modeling methods takes place in 4 stages. At the first stage, it is necessary to obtain 3D information. Then it is processed and the 3D design of the prosthesis is further created. According to the finished design, a prosthesis is made in accordance with the shapes and sizes that were obtained during the modeling process.

The CAD module is represented by a software package that provides a set of functions to provide three–dimensional visualization of the information received. With this module, you can design a virtual prosthesis according to the parameters of the prosthetic field. Anatomical and functional characteristics are also taken into account. The SELF–module is a module focused on the manufacture of a prosthesis. These are mainly milling modules that are aimed at processing standard workpieces and implementing the design of the prosthesis. In this case, machines with numerical control are used. Each of these modules corresponds to a certain stage of preparation of the oral cavity for prosthetics:

• obtaining a digital impression, which is the registration of a set of digital parameters of objects of interest to us. For this purpose, scanners or digitizers are used that use contact and non-contact methods for measuring the surface profile.;

• processing and transformation of the received digital information, reconstruction of the surface of teeth on the monitor, construction of a virtual model of a prosthesis;

• Automated prosthetic manufacturing. The main modules of the computer modeling system correspond to the production stages of the prosthesis.

As practice shows, if computer modeling is correctly applied in the practice of a dentist (orthopedist), it is possible to significantly improve the quality of prosthetics, as well as speed up the process of preparing the oral cavity for prosthetics. The results will be more accurate and predictable. It is possible to reduce risks and reduce the likelihood of complications due to the possibility of predicting treatment results and modeling the clinical situation in dynamics. The installation of the implant body will be more accurate, which significantly reduces the risks and complications. The scan performed before the operation allows you to timely identify the location of bone structures, soft tissues, vital structures, and select the optimal position of the structure. Computer modeling also allows you to assess the situation in advance, in the preoperative period, which reduces the need for emergency decisions during the operation itself, and will help prevent many undesirable consequences.

Conclusions.

Recently, thanks to the development of computer technology, the possibility of virtual 3D modeling of the prosthesis structure and its further prototyping has appeared. We have analyzed various experiences of using computer technology to prepare the oral cavity for prosthetics. The

main stages of preparing the oral cavity for prosthetics using computer technology are: obtaining a digital impression; processing and converting the received digital information; building a virtual model of the prosthesis; automated production of prostheses.

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