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Modeling of a smile during prosthetics on implants

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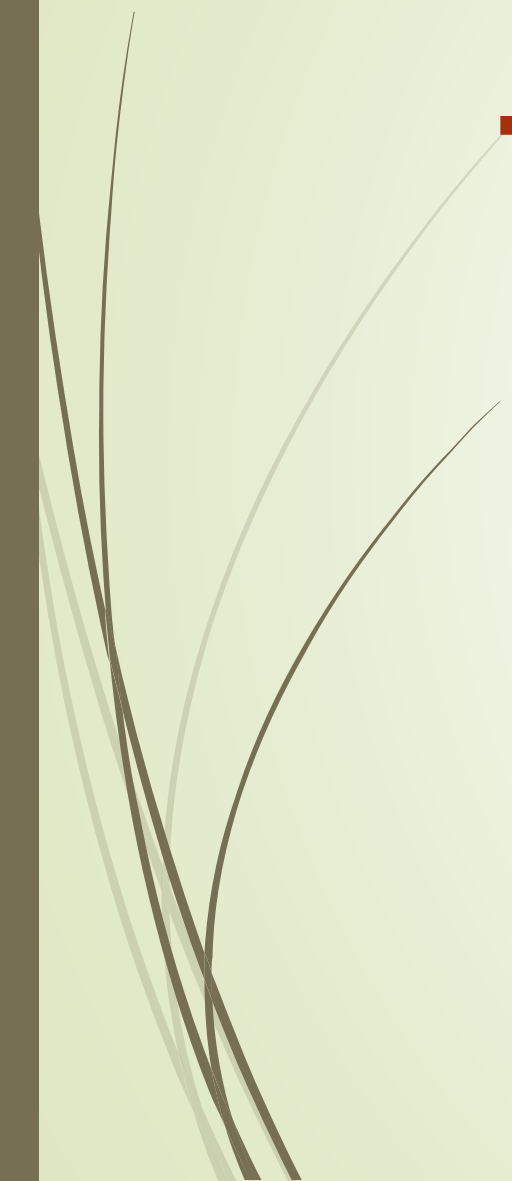


TOPICALITY

Modeling teeth during prosthetics on implants is an innovative technique in dentistry for creating a three-dimensional digital model of the patient's future smile, taking into account his anatomical features:


- ▶ shapes,
- ▶ color
- ▶ location and size of teeth,
- ▶ face contour,
- ▶ gum level, etc.

Recently, regarding the visible parts, patients began to put forward more and more demands in order to get the best smile design, that is, the demand for high aesthetics of both individual teeth, especially if they are in the frontal area of the jaw, and the dentition in general has increased.

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- ▶ Currently, aesthetic dentistry uses digital modeling of teeth and smile design, manufacturing and installation techniques using special DSD (Digital Smile Design) and CAD/CAM (Computer-Aided Design/Computer-Aided Manufacturing) technologies. They are a set of computer programs, using which an orthopedic dentist can choose the desired shape or shade of future teeth together with the patient, virtually simulate a smile, show and discuss its key points, and together with the surgeon determine the place of implant placement, make high-precision templates.



The aim

- ▶ Analysis of the feasibility of using imaging methods during planning of orthopedic treatment on implants.
 - ▶ To evaluate the advantages of using 3D methods in modeling a smile during prosthetics on implants
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MATERIALS AND METHODS

Orthopedic doctor conducts:

- ▶ examination of the patient's oral cavity;
- ▶ appointment of additional examinations;
- ▶ consultations with related specialists;
- ▶ study of collected information;
- ▶ discussion with the patient of possible wishes;
- ▶ development of an optimal treatment plan;
- ▶ scanning of the oral cavity in order to obtain virtual impressions of the teeth. In some cases, it may be necessary to make standard wax impressions, or to use both techniques;
- ▶ photographing the entire maxillofacial system of the patient, its individual elements in order to assess the parameters of the smile, the relationship with other parameters, the quality of articulation, and fixation of the preoperative state.



Clinical stage of computer modeling

Virtual simulation of a smile

- ▶ All received data (photos, prints) are transferred to a computer program, where they are processed and combined to create a three-dimensional image. After that, they are processed and adjusted, several variants of the future smile are created (by shape, shade, etc.), as a result, the dentist and the patient choose the most optimal variant.
- ▶ At this stage, it is possible to combine virtual projection with the results of computer tomography.

Wax modeling and fitting

- ▶ In some situations (for example, the manufacture of veneers, bridges or other removable orthopedic structures) a fitting of the future sample of the product is required. For this, a laboratory technician makes a trial version from silicone or plastic, fixes it on a wax model, and sends it to the clinic for fitting. The doctor tries on the sample of the product on the patient's teeth, adjusts it if necessary and sends it back to the laboratory.
- ▶ The advantages of virtual modeling give the technician the opportunity to see the shortcomings of the created structure, crowns on prostheses, etc. By placing them in a digital articulator, he can evaluate and compare the bite immediately, reducing the correction of the teeth during the fitting. After completion, all data are sent to the dental laboratory.



The technical specialist carries out:

- ▶ The agreed-upon version goes through special manufacturing stages: milling, baking, glazing, polishing. The manufacturing method depends on the type of orthopedic construction, material properties, volume and other features of the treatment. Previously, all these processes were carried out manually, due to which errors were not excluded, but now CAD/CAM technology has significantly accelerated this procedure and made it more accurate.


The variant agreed jointly in the clinic's conditions undergoes special stages of production in the dental laboratory:

- ▶ milling orthopedic construction,
- ▶ baking structures made of ceramics and zirconium,
- ▶ glazing structures,
- ▶ polishing.
- ▶ The manufacturing method depends on the type of orthopedic construction, material properties, volume and other features of the treatment.

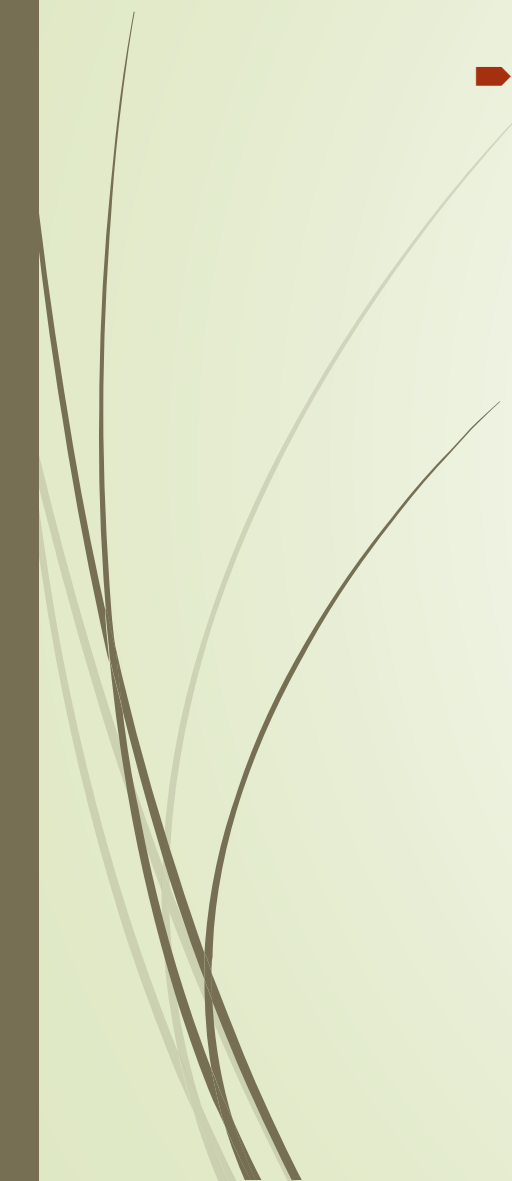


The task of computer simulation of a smile

- ▶ Select and confirm the color, shape, shade of the future teeth;
- ▶ Demonstrate the selected result;
- ▶ Try on the future smile;
- ▶ Assess the performance of the designed structure (articulation, closure, etc.);
- ▶ Make the necessary adjustments according to the patient's wishes;
- ▶ Form and obtain a model of the jaw before implantation for the production of surgical templates;
- ▶ Speed up the treatment procedure;
- ▶ Save the necessary data in the event of a breakdown of the orthopedic structure for its speedy restoration, taking into account the features of the maxillofacial system.

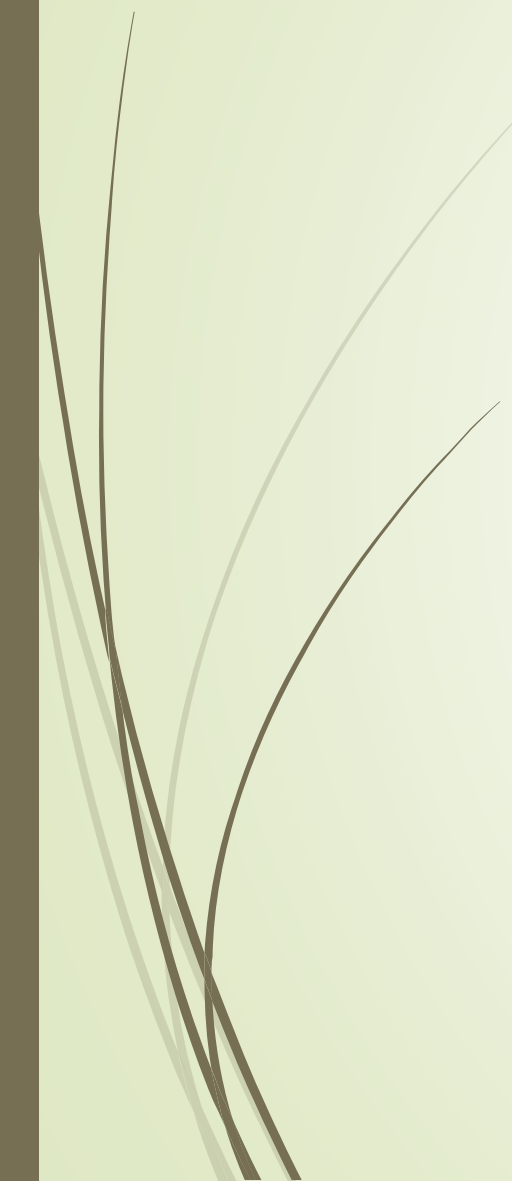




RESULTS

- ▶ With the help of a computer program, the doctor can see the most optimal places for prosthetics, reproduce a prototype of the future dentition and demonstrate the possible result to the patient in order to discuss critical wishes with him. The use of computers and digital programs not only accelerates appropriate treatment, but also eliminates medical errors. In addition, it is worth highlighting the indisputable comfort and involvement of the patient in the process - together with the doctor, he determines the shape and color of the future teeth, sees the result before and after, can adjust some fundamental points in advance.
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ADVANTAGES OF USING COMPUTER PROGRAMS

- ▶ A detailed study of the state of the patient's maxillofacial system, which is much more accurate than, for example, a sight picture or an orthopantomogram;
 - ▶ Accurate measurement of the height, volume and quality of bone tissue, which is important for selecting the optimal implant and excluding bone awakening in the maxillary sinus;
 - ▶ Two-dimensional or three-dimensional visualization of the received data to consider some areas layer by layer;
 - ▶ Modeling the prosthesis itself or its individual elements, the implant installation process, choosing the most accurate place and at the right angle;
 - ▶ Increasing the level of planning, which excludes medical errors or patient dissatisfaction with the aesthetics and shape of dental rows;
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- ▶ Creation of implantation templates that increase the quality of the procedure and the probability of engraftment;
 - ▶ Reducing the subjective human factor, shortening the operation itself and increasing comfort during the procedure;
 - ▶ The likelihood of performing complex surgical operations even in the most difficult cases for patients for whom implantation was previously contraindicated (diabetics, hypertensives, etc.);
 - ▶ Increasing the practicality of orthopedic construction and minimizing the risks of their correction in the future;
 - ▶ More complete information and visual demonstration of the future result.



Conclusions



- 1. The probability of medical errors approached zero.*
- 2. Patients can see their future teeth and smile in advance and try it on.*
- 3. Both sides, the doctor and the patient, get maximum comfort and the opportunity to focus on specific actions that ensure the accuracy of treatment.*
- 4. Prosthetics and related procedures have become more understandable, visualized and fast.*