

BIOINFORMATICS&BIOMATHEMATICS

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Ziryanov M.A., Epishov V.V., Gladskikh N.A., Sich G.V. Digital transformation of medical processes in orthopedic dentistry by using computer diagnostics and CAD/CAM technologies

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***Abstract.** Digital transformation of processes in healthcare is an important and urgent task today. The use of methods of radiation diagnostics (MSCT, MRI) in the planning of complex rehabilitation of patients is one of the examples of the digital transformation of processes in dental practice. Comprehensive planning of orthopedic treatment using CAD/CAM technologies is widely used in dentistry today. Models obtained by computer prototyping (stereolithography) are actively used to visualize the results.*

Application of methods of radiation diagnostics (MSCT, MRI) in the planning of complex rehabilitation of patients. Comprehensive planning of orthopedic treatment using CAD / CAM technologies. Models obtained by computer prototyping (stereolithography).

***Keywords:** CAD / CAM technologies, orthopedic dentistry, radiation diagnostics (MSCT, MRI), digital transformation, medical processes.*

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Application of methods of radiation diagnostics (MSCT, MRI) in the planning of complex rehabilitation of patients.

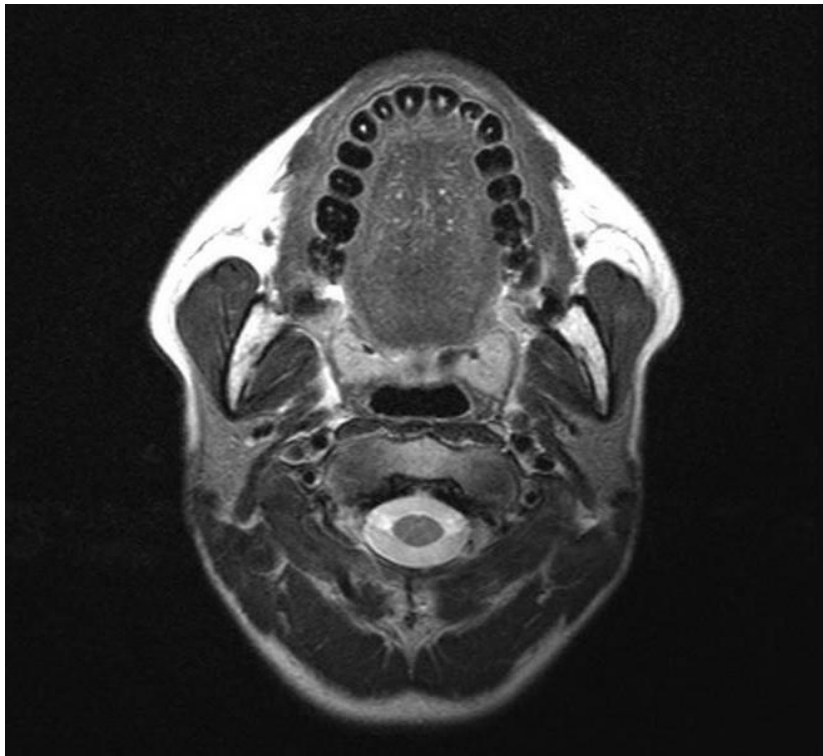
Computed tomography is a method of non-destructive layer-by-layer study of the internal structure of an object. The method is based on measuring and complex computer processing

of the difference in X-ray attenuation by tissues of different density. Currently, X-ray computed tomography is the main tomographic method for studying human tissues using X-rays.

MAGNETIC RESONANCE IMAGING (MRI) is a method of radiation diagnostics based on recording the energy emitted by the protons of the hydrogen nuclei of the human body when they return from an excited state to their original state.

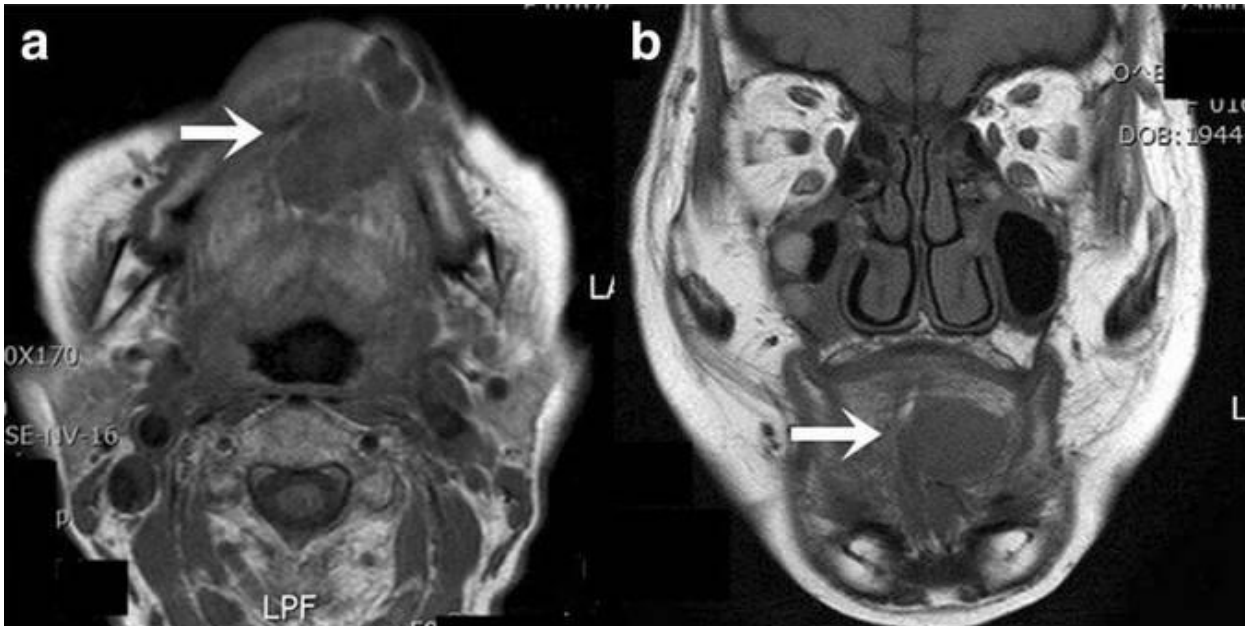
MRI allows you to get an image of the layers of the human body in any plane - frontal, sagittal, axial, etc., which can then be reconstructed into three-dimensional images. With magnetic resonance imaging (MRI), the patient is not exposed to ionizing radiation.

The pictures show changes caused by inflammatory processes: tissue swelling, fluid accumulation, expansion of the periodontal gap. Based on the results of the diagnostic procedure, the doctor determines abscesses, phlegmon of soft tissues in the study area.



Head MRI method

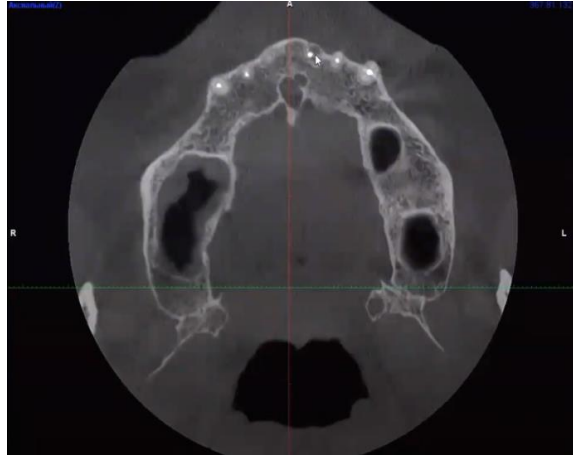
The arrow indicates a neoplasm in the soft tissues of the organ.



Currently, X-ray computed tomography is the main tomographic very informative method for studying human tissues using X-rays.

Orthopedic treatment should begin with a primary examination of the patient, with a detailed survey, study of the anamnesis. You need to decide on the design. For treatment using CAD/CAM technologies, it is necessary to take an impression in the clinic or, if an intraoral scanner is available, to take a scan from the patient's oral cavity, which is much easier compared to the traditional method. Next, the impression (scan) is sent to the laboratory, the model must be cast immediately.

When planning orthopedic treatment, the use of X-ray images alone is not enough, because sometimes such images carry unreliable information - an increase in the size of the studied departments is about 30%. CT is used for imaging, with prosthetics on implants. This ensures the accuracy and safety of implant placement. CT allows you to plan orthopedic treatment for disorders in the temporomandibular joint.



CT scan.



X-ray image.

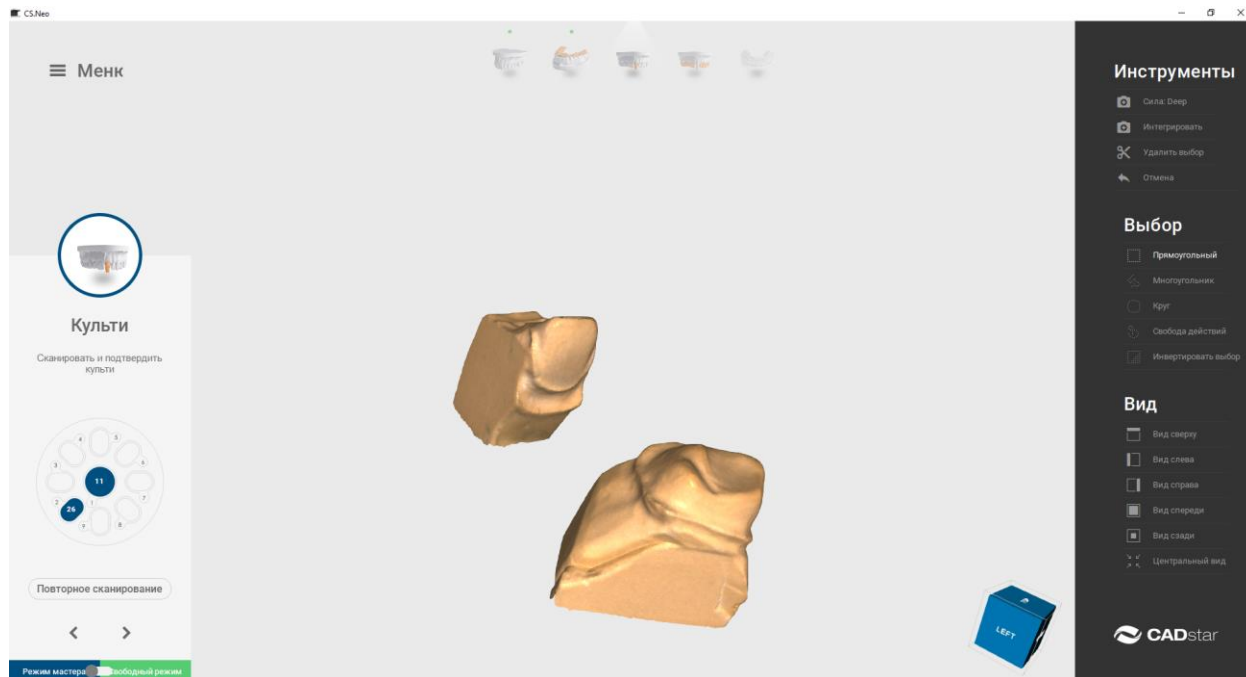
The model is installed on a special platform for further scanning. Next, the outfit is filled in the EXOCAD program.



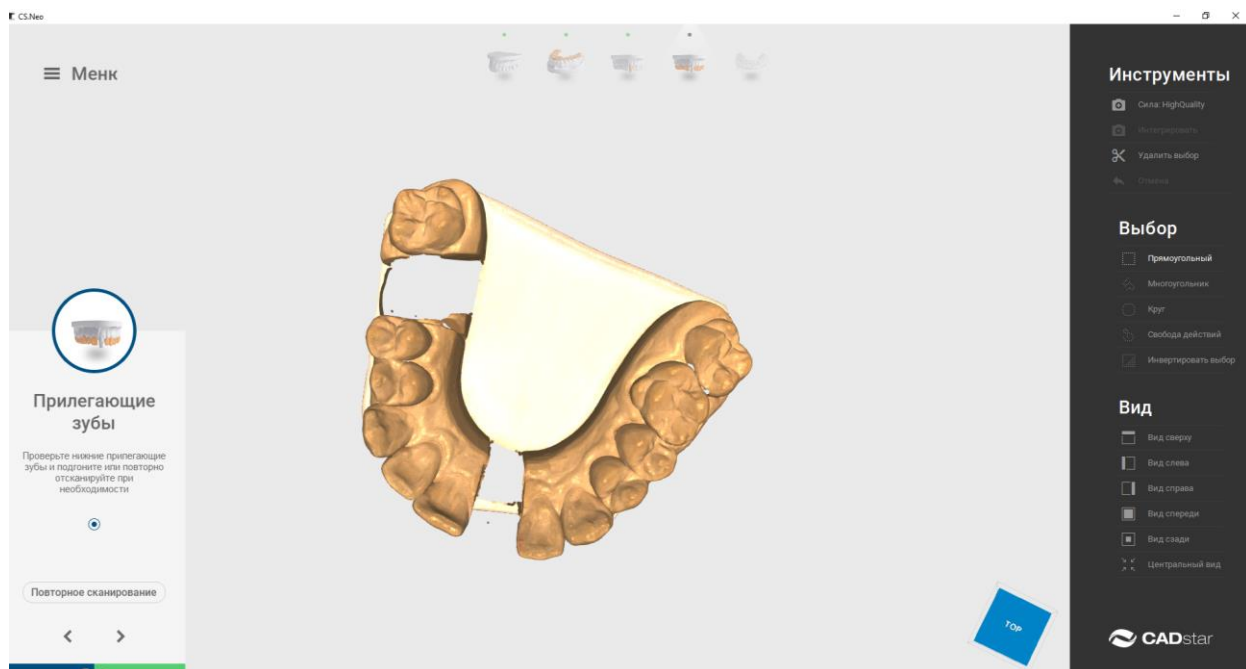
After that, the transition to the laboratory scanner application is carried out, and the model is scanned.



Scanned stumps of teeth.



Scanning adjacent teeth.



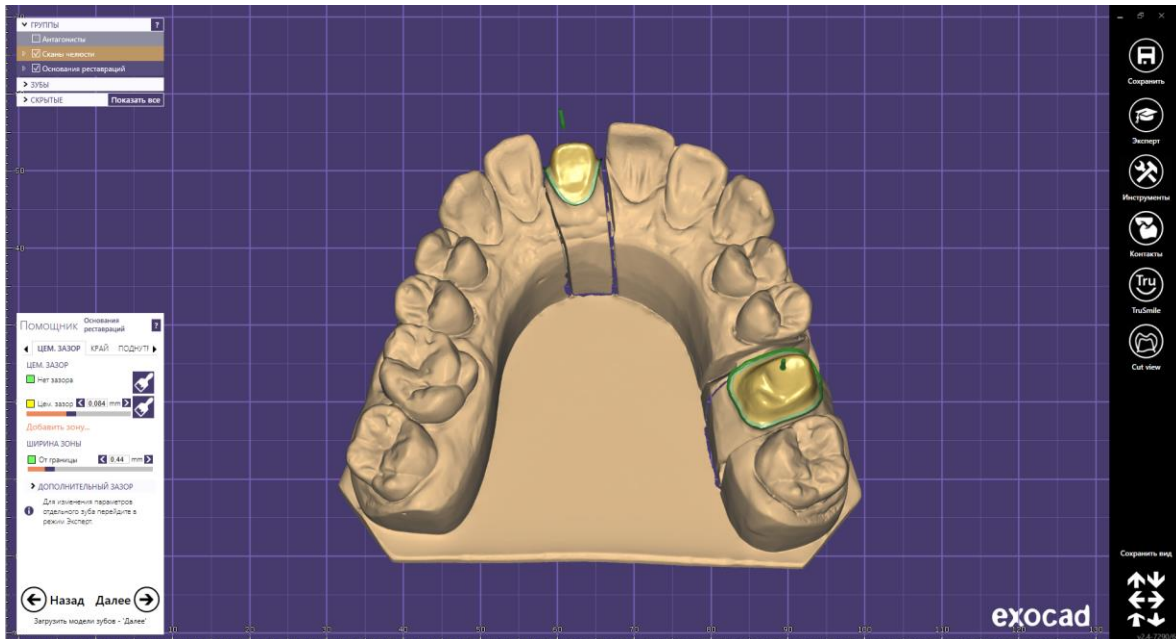
A grid is formed (layering a set of images of the model from different angles). Transition to EXOCAD.



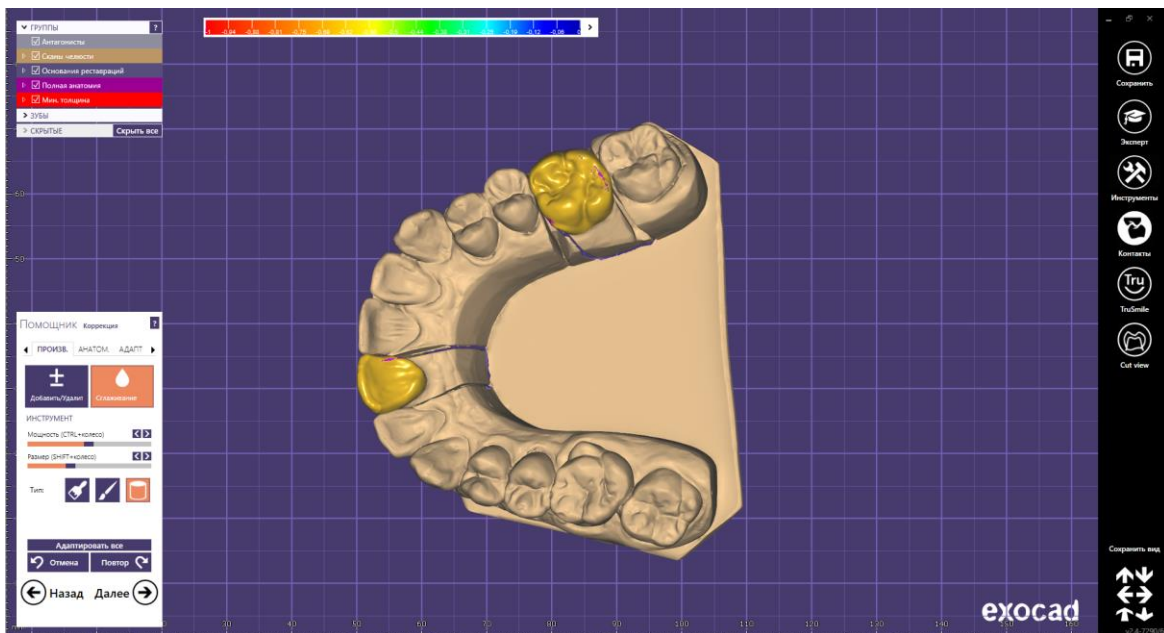
We determine the marginal - the border of the preparation, its value is from 0.2 to 0.3-0.35 mm.



Next step: set the cement gap. We make it 0.08 mm or 8 microns. Marginal from 0.2 to 0.3-0.35 mm.



Full anatomy modeling stage. frontal tooth - reduced zirconium dioxide (modeling of half a crown on a computer, cutting edge manually with enamels). 26 complete anatomy of zirconia multiline (up to 6 layers). In this case 3 layers. differ in layers of colors (the neck is one color, the crown is another, the cutting edge is the third).



The modeled files are sent to the cad/cam milling center. After sawing out on the machine, the zirconium dioxide tooth is removed from the block, the connectors are sawn off, the tooth is placed in the zirconium sintering oven at 1000 degrees from 4 to 7 hours. After that, the full anatomy of the zirconium tooth is glazed, painted, and the reduced one is applied with enamels and chandeliers by hand. We select from the table a form = a library of teeth that suits us (suits the patient) or we finalize it manually.

The process of the milling machine. With proper arrangement, up to 30 units can be made from one disk.



Furnace for zirconium sintering.

