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Research Article

USE OF MULTISPIRAL COMPUTED TOMOGRAPHY WITH 3D RECONSTRUCTION FOR THE DIAGNOSIS OF DENTO-MANDIBULAR-FACIAL ANOMALIES

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ABSTRACT

Maxillofacial anomalies occupy one of the first places among the diseases of the maxillofacial region and are characterized by significant morphological, functional and aesthetic disorders already at the early stages of bite formation. Most often there is a combination of sagittal and vertical anomalies of occlusion. Oral examination plays a major role in the detection of dental pathology, diagnosis, choice of treatment method and is an important part of the general examination of the body.

KEYWORDS

Topographic scanning, stereolithography, symmetrography, photosymmetroscopy, multispiral, three-dimensional diagnostics.

INTRODUCTION

Since 1915, many researchers have attempted to create a volumetric model of a face with teeth standing in an anatomically correct position. This was a complex and labor-intensive process that proved to be unworkable.

In the 1980s, 3D imaging of the maxillofacial region began to develop. This technology included laser and computer topographic scanning, stereolithography, moiré topography, stereophotogrammetry and other methods. Improvement of diagnostic methods in maxillofacial surgery requires introduction of more

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informative and ergonomic methods into practice, which became possible due to computer technologies. The transition from two-dimensional analysis - telerentgenogram of the head in lateral and direct projections, symmetroscopy, symmetrography, photosymmetroscopy and its modification of two-dimensional digitizers - to three-dimensional analysis is necessary, in which the most reliable assessment of the parameters of the dentoalveolar system is possible. Standard measurements with a ruler cannot give a spatial representation of the treatment or diagnostic situation. In recent years, the number of patients requiring plastic surgeries to correct deformities of the maxillofacial region has been increasing. Recently, the requirements of patients to the quality of medical care have increased and continue to increase worldwide.

The aim of this study is to investigate the role of multispiral computed tomography with 3D reconstruction in the diagnosis of maxillofacial deformities.

MATERIAL AND METHODS OF RESEARCH

A special place in the diagnosis of anomalies of the dentoalveolar system is occupied by the creation of a complex three-dimensional model "head - dental rows". However, it is necessary to point out the important tasks of dentistry, for the solution of which a complex model, including the surfaces of the face and jaws, is necessary. The complex model is understood as a triangulated description of the facial and jaw surfaces with precise spatial positioning of them relative to each other.

Figure 1. MSCT with 3D reconstruction of a patient with an acquired defect of the angle and body of the mandible

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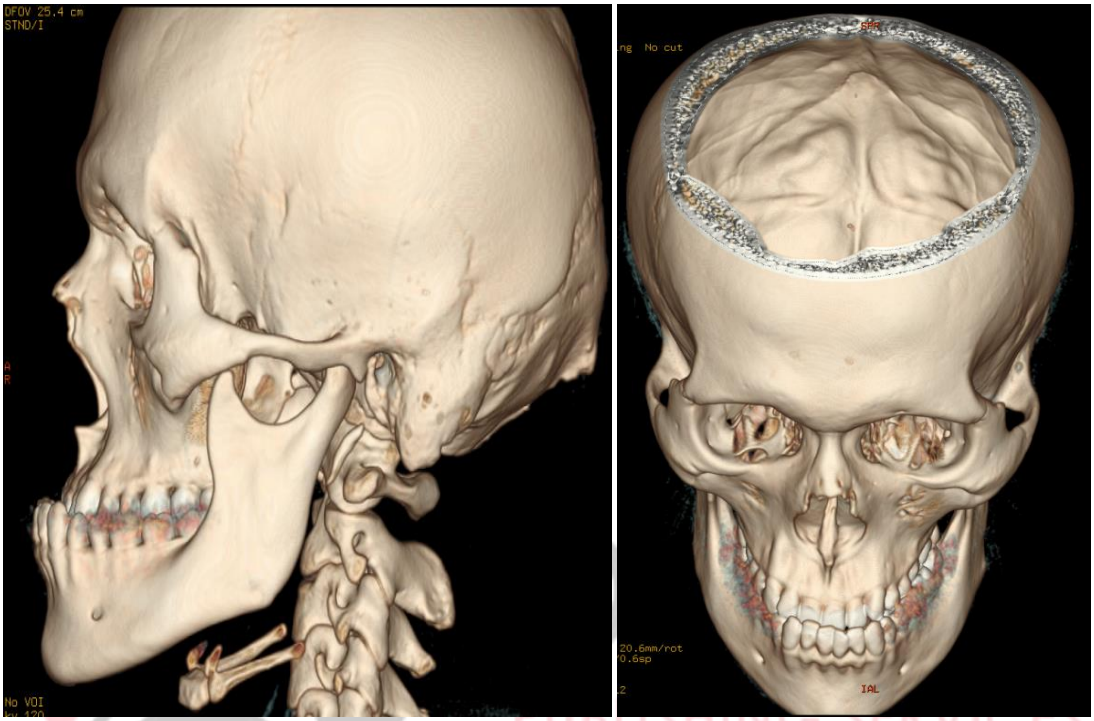
Thanks to the comprehensive application of X-ray MSCT, it is possible to create a three-dimensional spatial representation of facial tissues, which is important for planning complex orthognathic surgeries. 3D MSCT produces digital images, including color representation of the object, which facilitates interactive visualization.



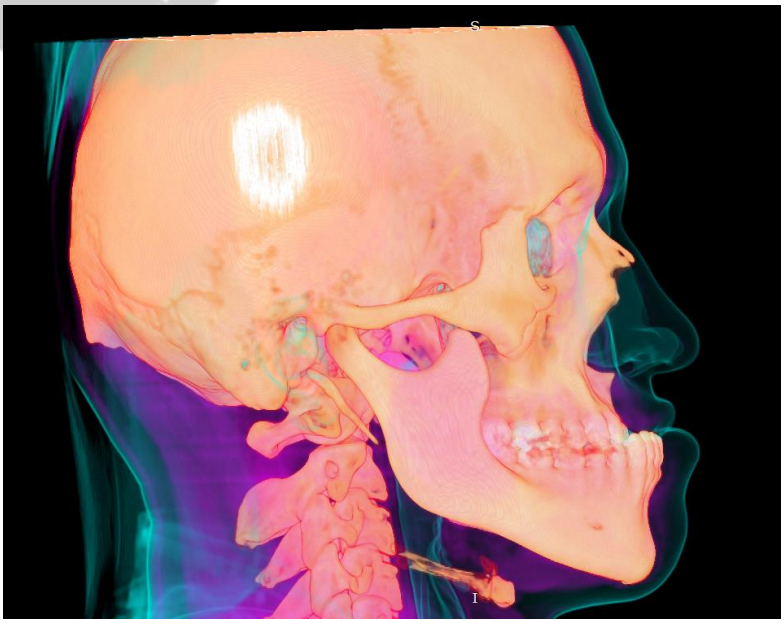


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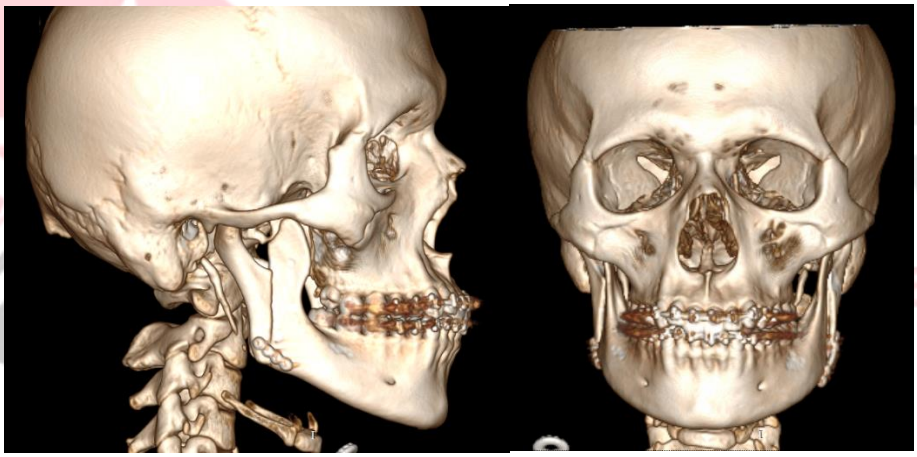
Figure 2. MSCT with 3D reconstruction of a patient with inferior macrognathia preoperatively

Results of the study and their discussion

Construction of three-dimensional graphic models was based on obtaining in minimal time intervals X-ray computed tomograms, which allow to create texture segmentation and three-dimensional reconstruction of organs. This is diagnostically significant due to visualization of the human body in different planes with the possibility to examine internal surfaces of both soft tissue contour and bone structures.

The construction of such a complex model will make it possible to solve the problem of accurate determination of parameters and individual features of occlusion and to plan orthodontic and surgical treatment. Currently, this task is solved using radiographs, which does not provide the required accuracy and involves harmful radiation exposure for the patient.



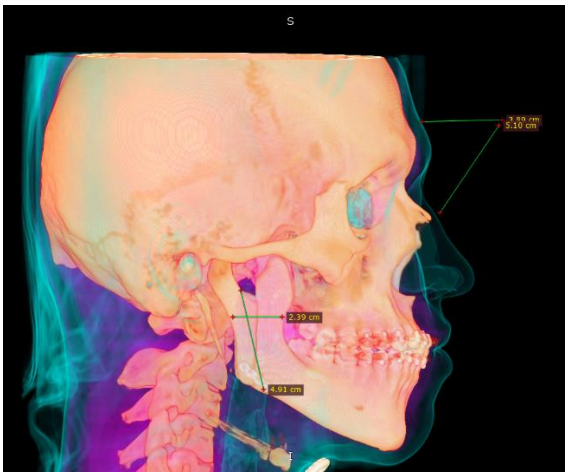


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Figure 3. MSCT with 3D reconstruction of a patient with inferior macrognathia after surgery

CONCLUSION

Thus, the analysis of a number of parameters that are very informative for performing cephalometric analysis in assessing the state of the dentoalveolar system emphasizes the importance of transition to three-dimensional diagnosis.

Physiologic occlusion is not the only criterion of harmonious development of the dentoalveolar system, but is only a part of the triad: "joint - muscles – occlusion", the correct interaction of the components of which is necessary for the normal functioning of the orofacial complex.

The proposed method of three-dimensional diagnostics of the occlusal plane position allows to reveal its asymmetry, which is impossible in any two-dimensional analysis due to the overlapping of the left and right sides.

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