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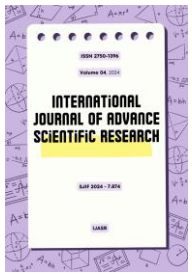

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Research Article

MODERN METHODS OF DIAGNOSTICS IN DENTISTRY

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ABSTRACT

Dentistry is constantly evolving, using the latest technological advances to improve the quality of diagnostics and treatment. The article provides literary data on modern methods of X-ray diagnostics in dentistry.

KEYWORDS

Modern methods, diagnostics, dentistry, treatment, technology, digital imaging, 3D tomography, tooth, intraoral scanner.

INTRODUCTION

The importance of a correct diagnosis in dental treatment is difficult to overestimate. The effectiveness of treatment, its duration, and long-term results directly depend on how correct the doctor's assumption is regarding your clinical picture. It is noted that these methods are a standard, integral part of any comprehensive medical examination and form the basis for planning and conducting surgical treatment for diseases of the maxillofacial region.

3D tomography (CT). Computer tomography is a revolutionary method in diagnostics that allows you to obtain three-dimensional images of the jaw and teeth. This is especially important when planning implantation, since doctors can accurately analyze the condition of bone tissue, determine the best places for implants and avoid

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possible risks. CT significantly increases the success of orthopedic and surgical interventions.

CEREC digital image. CEREC technology allows you to create highly accurate 3D images of teeth in the shortest possible time. This equipment is especially useful in the design of veneers, crowns and other orthopedic structures. With its help, the process of creating dental models is maximally accelerated and becomes error-free, which significantly reduces the waiting time for the patient and increases the comfort of treatment. Intraoral scanner. This device allows you to scan the entire oral cavity in detail and transmit the obtained data to the computer in real time.Using an intraoral scanner, dentists can take precise measurements and create precise implants and other dental appliances without the discomfort for the patient associated with traditional impression methods.

DIAGNOdent laser diagnostics of caries. Before proceeding with implantation, it is necessary to make sure that the adjacent teeth are healthy. DIAGNOdent laser diagnostics of caries allows you to detect hidden caries at an early stage without pain and discomfort for the patient. This method is especially effective, as it is not only highly accurate, but also completely safe. Modern software, such as SimPlant or NobelGuide, helps doctors plan operations with millimeter accuracy. This ensures the optimization of our interventions and reduces the likelihood of complications. Patients can be sure that each stage of the procedure is thought out and controlled to the smallest detail.

X-ray. Classic and modern diagnostic methods are used in dentistry to correctly diagnose. Classic methods include visual inspection and targeted X-ray. X-ray is a painless procedure with a safe dose of radiation for the patient. It is suitable for the need to diagnose one specific tooth. A small plate is placed near the "interested" tooth and held in a given position for several seconds. A targeted image is immediately displayed on the computer monitor, showing the condition of the tissues hidden under the mucous membrane and in the jaw bone.

Panoramic image. An orthopantomogram is a panoramic image that provides the doctor with accurate information about the condition of the patient's teeth, bone tissue, jaw joints and maxillary sinuses. Panoramic images are often taken of children to detect supernumerary teeth or, conversely, the absence of rudiments of permanent teeth. An orthopantomogram shows all restorations, fillings, any pathological formations in the tissues, and at a very early stage. Indications for a panoramic image: Therapeutic treatment - each tooth, carious lesions, destroyed fillings, granulomas and cysts, if any, will be qualitatively visualized in the image. Periodontal treatment - in the image, the periodontist will be able to see the depth of periodontal pockets, the thickness of bone tissue and other details necessary for the treatment of periodontosis. Implantation - an orthopantomogram will allow you to develop an effective implantation plan, determine the most suitable points for implantation. Correction of bite – before choosing a corrective system and putting braces on the

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patient, the orthodontist needs to understand the position and direction of growth of the roots of each tooth.

Computer radiovisiography. Diagnostics is performed using an intraoral video camera. The equipment resembles a small toothbrush in appearance. The image is displayed on the monitor in color with magnification. Allows you to see minor enamel defects, chips or cracks, caries at the spot stage in hard-to-reach places, check the condition of the gums and surrounding mucous tissue.

Tomography. Computer tomography is a three-dimensional scan of the elements of the oral cavity. The doctor prescribes computer tomography to patients for: preparation for the extraction of impacted or dystopic wisdom teeth. Detection of alveolar ridge resorption. Diagnostics of the inflammatory process located in bone tissue. Preparation for the installation of implants or osteoplastic surgeries. Recognition of tumor formations at an early stage.

Morphological studies. Study of the biomaterial of the lymph node, wound surface, exudate for the purpose of differential diagnostics.

Cytological examination. Study of the structural features of cellular structures, used to assess the effectiveness of therapy in the treatment of destructive diseases.

Histological examination. Conducted to determine the nature of the pathology.

Bacteriological studies. Of particular importance in the treatment of purulent, specific diseases of the mucous membranes. In some cases, testing is carried out for the presence of an allergic reaction to different types of drugs.

The use of modern X-ray diagnostic techniques is a standard, integral part of any comprehensive medical examination and forms the basis for planning and performing surgical treatment for diseases of the maxillofacial region. Currently, the most common method is the production of panoramic X-ray images. This method allows you to obtain very important information about the condition of the area under study, quite accurate with the correct mutual arrangement of the patient, radiation flow and recording sensors. However, despite the obvious advantages, such as a well-developed methodological base, a wide range of equipment and ease of training of service personnel, this method has at least one fundamental drawback: it allows you to obtain only flat two-dimensional images of volumetric objects.

This significantly limits its capabilities, primarily due to shading and overlapping of deeper areas. The invention of X-ray tomography with computer processing of the obtained information revolutionized the field of image acquisition in medicine. The method is based on measuring and complex computer processing of the difference in the attenuation of X-ray radiation by tissues of different densities. It was proposed in 1972 by Godfrey Hounsfield and Allan Cormack, who were awarded the Nobel Prize in Physiology or Medicine in 1979 "for the development of

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computer tomography". The device, manufactured and tested by a group of engineers from the English company "EMI", was called the EMI scanner.It was used only for brain research.

The method, called dental computed tomography (Imhof, 1992), provides metric analysis of cross-sections of jaws in the third dimension. After receiving and processing the data, it is transferred to film or storage media. Over the past time, the intellectual level of X-ray equipment has grown significantly, and the initially very high cost of such equipment and examinations on it has significantly decreased.

In recent years, a new generation of highly informative X-ray equipment for volumetric dental tomography has been developed on the basis of traditional computer tomographs - cone-beam tomographs with an increased level of safety. Due to the directed conical radiation beam, they scan the structure of the examined volume in just one revolution, while in conventional devices, with a fan-shaped radiation flow, several revolutions are needed for this. The dimensions of the examined cylindrical volume are characterized by such a parameter as the "field of view" FOV (Field Of View) (diameter x height) and, depending on the type of device, vary from 4x4 cm to 19x24 cm. Devices with a large field of view and a sufficiently high resolution allow for a complete image of the entire dental system to be obtained in a single examination. The data obtained during primary tomography are transformed by the workstation and displayed on the dentist's computer display using a special program.Computer tomography-based methods that provide a three-dimensional image of cross-sections of the jaws on a scale of 1:1 are more effective than standard examinations with the connection of additional programs.

Additional capabilities, a reduced radiation dose, and higher image quality provide cone-beam devices with an advantage over classic tomographs. The accuracy of determining the size of anatomical structures in both methods is almost identical, and the radiation load on the patient with volumetric tomography is significantly less. Manufacturers of cone-beam tomographs claim that they form a higher-quality image and produce less interference if there are metal objects in the area being examined (for example, fixed restorations). In terms of radiation dose, cone-beam tomography is located between traditional X-ray diagnostics and spiral tomography.

Cone-beam computed tomographs include a movable X-ray tube, which is located exactly opposite the flat sensor and simultaneously rotates around the patient's head. This creates a set of single two-dimensional images in various projections, which are summed up into a three-dimensional image using a computer and special software. Axial tomograms of the facial skull serve as a supplement to conventional two-dimensional intraoral images or orthopantomograms, providing reconstruction in any plane of interest. Computer technologies for processing the received information make it possible to analyze any single two-dimensional image and the resulting three-dimensional image in any projection.

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Thus, the information content of cone-beam computed tomography for diagnostics and planning of dental treatment is many times greater than the potential of conventional digital panoramic radiography. The computed tomogram does not have the summation effects inherent in conventional radiography, since the areas under study are removed by a collimated beam of rays and fan-shaped cut into "layers". These layers can be thought of as layers of minimal volume elements whose dimensions are determined by the selected slice thickness. The structures in these layers attenuate the incoming X-rays depending on the thickness and location of the tissue. Anatomical structures are depicted on an X-ray image in various shades of gray. About 4,000 shades of gray are measured on a CT scan. Since mechanical color sensitivity does not correlate with the gray scale, the task of developing a full-fledged color coding has not yet been solved.

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