

**ARTIFICIAL INTELLIGENCE METHODS FOR EARLY DIAGNOSIS OF CARIES  
AND PERIODONTAL DISEASES AND DIGITAL EXAMINATION**

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**Abstract:** In recent years, innovative technologies in the field of medicine have been developing rapidly. In particular, the introduction of artificial intelligence in dentistry and the widespread use of digital diagnostic methods have opened a new stage in this field. As one of the main problems in dentistry, the issue of early diagnosis of actively spreading caries and various periodontal diseases has always been relevant. With the help of artificial intelligence capabilities and modern digital examinations, the possibility of effectively solving this problem and achieving reliable results has significantly expanded.

**Keywords:** artificial intelligence, caries, problems, diseases, dental images, healthcare, treatment, patient, modern technologies.

Maintaining dental health and timely detection of diseases are one of the main foundations for overall health. While traditional diagnostics in dentistry are often a lengthy, highly human-dependent and subjective process, modern artificial intelligence technologies are revolutionizing this. Through in-depth and accurate analysis of data obtained using digital X-rays, 3D scanning, photo analysis or other digital imaging technologies, artificial intelligence programs allow for the early detection of caries and periodontal diseases that may be present in a patient. Different artificial intelligence systems use different approaches in this regard. For example, radiological image recognition programs can detect microscopic changes in dental images. Extensive analysis of digital images allows for the rapid and reliable detection of unclear points such as tooth decay, hidden enamel lesions, periodontal degradation or cracks. Artificial intelligence algorithms have become sophisticated enough to detect even the most subtle changes by studying thousands of medical images.

Artificial intelligence-based systems are seen as assistants to specialists in identifying simple and invisible problems. Such systems also simplify the decision-making process for the dentist, reduce analysis time, and reduce the likelihood of human error. Analyzes created by artificial intelligence based on the results of digital examinations allow the doctor to fully assess the patient's current condition, accurately determine the treatment strategy, and give specific recommendations for disease prevention. The use of artificial intelligence in dentistry today is not limited to diagnosis. These technologies also help in developing preventive measures, long-term patient monitoring, and creating a personalized treatment plan. For example, digital monitoring, telemedicine solutions, and cloud-based data exchange can establish constant communication between the patient and the doctor. This allows the doctor to remotely monitor many patients at the same time.

Caries disease is often not visible to the naked eye in the early stages, but is visible only with special equipment or systems capable of detecting small changes. In traditional systems, it was not easy to detect the disease at this stage. With the help of artificial intelligence, data obtained through X-rays, optical images or intraoral cameras are analyzed with precision. Artificial intelligence algorithms also have great potential for detecting periodontitis and other periodontal diseases in the early to chronic stages. As a result of the introduction of such systems, the quality and efficiency of service in dental institutions are increasing. With the help of digital examinations, it is possible to quickly and accurately diagnose each patient. As a result, patients' time and financial costs are reduced, and dentists can try to use their knowledge and experience more effectively. Algorithms created using artificial intelligence help minimize errors due to the human factor. In addition, digital technologies based on artificial intelligence are taking dentistry to a new level. The use of technology in preventive work, diagnostics and treatment is also having a positive impact on the promotion and education of dentistry. The large amount of medical data collected on digital platforms will become an important source of knowledge for dentists and researchers in the future. This will stimulate the introduction of high-quality, reliable and innovative approaches to the provision of medical services.

Early diagnosis of diseases is an urgent issue for modern medicine. It is in this area that artificial intelligence technologies are yielding results that exceed expectations. Modern algorithms are opening up vast opportunities for both the dentist and the patient. Based on the results of artificial intelligence, it is possible to create an individual treatment strategy, accurately develop and improve diet, hygiene, personal prevention and other instructions. As a result of machine learning and deep learning algorithms, artificial intelligence accepts each new piece of information and expands its knowledge. Digital examination systems, on the other hand, speed up the diagnostic process. Digital images obtained using numerous dental devices, intraoral cameras, laser scanners, 3D tomographic equipment provide detailed information about the condition of the patient's teeth. Artificial intelligence can analyze these images and detect even the smallest changes. Diagnostic efficiency increases significantly as a result of fast and accurate analysis of images and data. In modern dentistry, artificial intelligence and digital technologies play an important role in identifying problems at an early stage before treating a patient, preventing the spread of disease, maintaining long-term healthy teeth, and improving the quality of dental services.

Digital diagnostics has become one of the most convenient and effective methods, especially in the provision of preventive and emergency medical care. With the help of high-resolution imaging equipment, a dental card of each patient is created in digital form. This is of great importance in analyzing the patient's history, assessing the dynamics of treatment, and forming a single database for the future. Thus, the introduction of artificial intelligence and digital technologies has become an integral part of the system for early detection of diseases in dentistry.

### **Conclusion:**

In conclusion, artificial intelligence and digital examination methods are bringing revolutionary changes in the early detection of caries and periodontal diseases in dentistry. With the help of these technologies, it is possible to detect diseases at an early stage, develop effective treatment

strategies, facilitate the work of dentists and ensure that the patient fully benefits from medical services. Systems created on the basis of artificial intelligence are opening a new page in the practical and scientific development of dentistry, and in the future, innovations in this direction are expected to expand even more. As a result, artificial intelligence will become central to maintaining human health and improving the quality of life.

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