



## DIAGNOSIS OF DISEASES USING ARTIFICIAL INTELLIGENCE IN ORTHOPEDIC DENTISTRY

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### Annotation

Artificial intelligence is a rapidly developing technology that is increasingly being implemented in the life of modern people. One of the promising areas of its application is dentistry. Modern technologies allow the use of artificial intelligence to improve the effectiveness of diagnosis, treatment and prevention of oral diseases. The use of artificial intelligence in dentistry allows doctors to work more efficiently and accurately. In addition, the use of modern technologies accelerates the treatment process, makes it more comfortable for patients and improves the quality of the results obtained.

This article discusses the areas of application of artificial intelligence, its advantages and disadvantages. Methods and technologies that contribute to optimizing the processes of diagnosis, treatment and prevention were analyzed. New technologies can dramatically change the healthcare system, improving the quality of services while reducing costs for clinics.

In the future, the use of artificial intelligence will become an integral part of dental practice, which will allow achieving maximum results in the diagnosis, treatment and prevention of oral diseases.

**Keywords:**artificial intelligence, dentistry, diagnostics, treatment, prevention, innovation.

### Introduction

Every day, modern medicine is becoming more technologically advanced and innovative. In this regard, the use of artificial intelligence (hereinafter – AI) is becoming increasingly common in many areas of medical practice. One of these areas



is dentistry, where AI has already found its application. Modern technologies allow the use of AI to improve the effectiveness of diagnosis, treatment and prevention of oral diseases. In this article, we will look at various aspects of using AI in dentistry and analyze its capabilities, advantages, and limitations.

### **The main part**

#### **2.1. Overview of the use of artificial intelligence in dentistry**

Artificial intelligence is one of the most promising areas of development in medicine [1]. In dentistry, AI can be used to improve the diagnosis, treatment, and prevention of oral diseases. Let's take a closer look at how AI can be applied in dentistry.

##### **2.1.1. Diagnostics**

First, let's look at the use of AI in the diagnosis of oral diseases. The most common diseases are caries and periodontal disease. Visual assessment methods and X-ray examinations are used to determine diseases of the oral cavity. However, the visual assessment is not always accurate

it allows you to accurately determine the presence of the disease and its degree, and X-ray examinations can harm the patient's health. This is where AI can be very useful.

One of the methods of using AI in the diagnosis of oral diseases is image analysis. At the same time, AI is used to analyze X-rays and photos of teeth and gums [2], [3]. Neural networks trained on a large amount of data can accurately detect the presence of caries, periodontal disease, and other oral diseases.

One of the projects using AI in dentistry is "Caries Diagnostics" from the company Dental Monitoring. This project uses AI to detect the presence of tooth decay in a photo of teeth. Based on the data obtained from the analysis, patients are provided with accurate diagnosis and treatment recommendations.

##### **2.1.2. Treatment**

In addition to diagnostics, AI can be used to improve the effectiveness of treatment of oral diseases. For example, in the treatment of periodontal disease, AI can be used to determine the optimal course of treatment that will be most effective for each individual patient.

Another example of the use of AI in the treatment of oral diseases is the creation of individual prostheses and implants. Using AI, it is possible to create prostheses and implants that are ideally suited for each patient, taking into account their individual anatomical features and needs [4].

An example of such a technology is the project "3D printing of teeth" from NextDent [5]. In this project, AI is used to create accurate 3D models of the patient's teeth and gums. On the basis of these models, individual prostheses and implants are created that



provide maximum accuracy and comfort for the patient.[2], [4], [6].

### 2.1.3. Prevention

In addition to diagnosis and treatment, AI can be used to prevent oral diseases. For example, AI can be used to develop individual prevention programs for each patient, taking into account their anatomical features, lifestyle and eating habits.

An example of this technology is the Oral-B Smart Toothbrush project. In this project, AI is used to analyze the patient's lifestyle and eating habits, as well as to develop an individual oral care program. Patients are provided with a personal analysis of the oral condition and individual recommendations for its care.

So, the use of AI in dentistry can significantly improve the effectiveness of diagnosis, treatment and prevention of oral diseases. With the help of AI, you can create individual prostheses and implants, determine the optimal course of treatment, and develop individual prevention programs.

The conclusion is that the use of AI in dentistry has a huge potential for improving the quality of healthcare. AI can be used to improve the accuracy of diagnosis, determine the optimal course of treatment and prevention of oral diseases [6]. In addition, AI allows you to create individual prostheses and implants, taking into account the anatomical features of patients [2].

Despite the fact that the use of AI in dentistry is still a relatively new direction, there are already many projects and technologies that successfully use AI in dental practice. In the future, it is likely that the use of AI will become an integral part of dental practice, which will allow achieving maximum results in the treatment and prevention of oral diseases.

## 2.2. Features of using artificial intelligence in dentistry

The use of AI in dentistry has its advantages and disadvantages. In this chapter, we will look at the main ones.

Advantages of using AI in dentistry:

- increased diagnostic accuracy: the use of AI makes it possible to achieve high accuracy in the diagnosis of oral diseases. AI can analyze data using machine learning algorithms [7, p. 97] and examine large amounts of information to detect pathologies that can be missed during a normal visual assessment.
- Optimize the course of treatment: AI can help dentists determine the optimal course of treatment for a patient based on medical data and information about the results of previous treatments. This allows you to create an individual approach to treatment that takes into account the individual needs and anatomical features of the patient.



- development of individual prevention programs: the use of AI allows you to develop individual programs for the prevention of oral diseases for each patient. With the help of machine learning algorithms [7, p. 97] and analysis of medical data, AI can determine the risks of diseases and suggest individual prevention measures;
- Creating customized prosthetics and implants: AI can be used to create customized prosthetics and implants. Using 3D modeling and analysis of medical data, AI can create prostheses and implants that accurately match the patient's anatomical features [2].

#### Disadvantages:

- High cost of technology: the limited use of AI in dentistry may be due to the high cost of technology and the need for long and complex training of personnel.
  - Limited access to technology: one of the main limitations of using AI in dentistry is the lack of access to appropriate technology. Artificial intelligence is an expensive technology that requires large financial investments and qualified specialists to develop and implement it. However, with the development of technology and the emergence of new methods of financing, it becomes possible to expand the scope of the project. distribution and use of AI in dentistry. For example, some companies offer solutions that allow dental clinics to use AI technologies without the need to purchase their own computing power and software products.
  - risk of errors: another limitation of the use of AI in dentistry is the risk of errors. Although AI is able to process large amounts of data and make decisions based on the analysis of this data, it is not infallible. In addition, errors may occur due to the fact that the AI works on the basis of algorithms that may not take into account all possible scenarios.
  - Insufficient data: another limitation for the use of AI in dentistry is insufficient data. In order for the AI to work correctly, it needs to have enough data to analyze. However, in some areas of dentistry, there may not be enough data to train AI;
  - the need for qualified specialists: the use of AI in dentistry also requires the availability of qualified specialists who can process data and use the appropriate tools;
  - Ethical and legal issues: the use of AI in dentistry also raises questions of ethics and law. For example, there is a risk that the use of AI may lead to a deterioration in the quality of medical care for people who do not have access to this technology. Privacy and patient data protection issues are also possible.
- In addition, there is a risk that AI can become a substitute for humans. This can lead to a decrease in the importance of dentists and dentists, which can negatively affect their professional growth and development.



In conclusion, we can say that the use of AI in dentistry has many advantages that can help improve the quality of diagnosis, treatment and prevention of oral diseases. This includes automating tasks, reducing data processing time, and reducing the likelihood of errors.

However, there are also limitations in the use of AI technologies in dentistry. One of the main limitations is that AI algorithms (English AI – Artificial Intelligence, AI – artificial intelligence) [8, p. 38] require a large amount of data for training and configuration, which can lead to difficulties when used in small clinics.

Also, AI technologies cannot completely replace the work of specialists and require a certain level of knowledge and training to correctly interpret the results.

However, the benefits of using AI in dentistry are significant. In terms of efficiency and time savings, AI technologies can improve the efficiency of dentists and make treatment more accessible and high-quality for patients. Therefore, despite some limitations, it can be concluded that the use of AI in dentistry has a huge potential to improve the quality of life and health of people.

### **2.3. Prospects for the use of AI in dentistry**

Robotizing a dental practice can help doctors cope with time-consuming and monotonous tasks, such as canal treatment, implant placement, and impression removal. An example is the Yomi robotic dental system, which is used for surgical procedures such as implant placement. Yomi uses AI navigation technology to help dentists accurately determine the position of the implant and carry out its installation. Another potential example of the use of robotics in dentistry is the automation of the root canal treatment process. Root canals are a complex system that can cause difficulties for dentists when processing them. However, robotic systems based on AI can accurately determine the depth and width of the channel and automatically perform processing [2].

Another potential use of AI in dentistry is in the field of teledentistry. Teledentistry is a new way of providing dental care that allows patients to receive consultations and diagnostics remotely, without having to visit a clinic. With the help of AI, you can create teledentistry systems that can analyze the data received from the patient and make diagnostics based on this data.

In general, the future of AI use in dentistry is associated with automating routine processes, optimizing the treatment process, and improving diagnostics. There will be an improvement in the quality of medical care and an increase in the level of accuracy and efficiency of doctors. However, it is necessary to take into account the limitations associated with the lack of accuracy of some algorithms, as well as problems with the





security and confidentiality of patient data.

In addition, the use of robots can help in dental operations that require high precision. For example, robotic systems can be used for dental implantation, planning and performing orthodontic procedures [9], [10]. This can reduce the risk of human error and improve the results of procedures.

However, despite the potential benefits, robotizing a dental practice also has its limitations. For example, the cost of purchasing and maintaining robots can be very high. In addition, in some cases, a human operator may need to be present to properly monitor the procedure, which can lead to increased personnel costs.

Overall, the future of AI and robotics in dentistry is bright. New technologies will allow doctors to more accurately diagnose and treat diseases, reduce the number of errors and improve the results of procedures.

However, restrictions must be taken into account and new technologies must be carefully implemented to minimize risks to patients and comply with legal requirements.

### Conclusion

During the review of the use of AI in dentistry, various studies and practical applications of AI technologies in this field of medicine were analyzed. The following advantages of using AI in dentistry were identified:

- improving the accuracy of diagnostics of diseases of the oral cavity and teeth;
- improving the quality of treatment and preventing mistakes in the treatment process;
- reduce the time and cost of treatment;
- optimization of dental clinics and improvement of patient care;
- reducing the burden on doctors and improving their performance.

However, some limitations of the use of AI in dentistry were also identified, such as limited access to technology, the need for a large amount of data to train algorithms, and the risk of data misinterpretation and misuse of AI in the treatment process.

Despite some limitations, the use of AI in dentistry has great potential to improve the quality of medical care and optimize the operation of dental clinics. Robotization of dental practice, the use of automatic diagnostics and forecasting are key areas of development of AI technologies in dentistry.

However, in order for the use of AI to become more widespread in dental practice, several important issues need to be addressed, such as the development of a unified methodology for data collection and processing, the creation of standards and regulations for the use of AI technologies, as well as improving the availability of these



technologies for small and medium-sized dental clinics. they will help make healthcare more accessible and efficient.

In general, the use of AI in dentistry has great potential to improve the quality of treatment and optimize workflows in dental clinics. However, it is necessary to consider the limitations and risks associated with these technologies, and take appropriate measures to protect patient confidentiality and prevent errors in diagnosis and treatment.

In the future, it is expected that the development of AI and robotics technologies will lead to even more accurate and rapid diagnosis, treatment and rehabilitation of patients, as well as optimization of dental clinic management processes and reduction of healthcare costs [6].

Despite all its advantages, AI will not replace the doctor, but will be used as a tool in the work of specialists. The combined use of technology and human experience and intuition can lead to the best results in treating patients and optimizing the work of dental clinics.

Thus, the use of AI in dentistry is already yielding positive results, and the prospects for its further development in this area remain very promising.

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